



**PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY**

DASU HYDROPOWER PROJECT

BIDDING DOCUMENT

NCB NO: DASU-RS-02

PROCUREMENT OF SMALL WORKS CONSTRUCTION OF SCHOOLS

**(Construction of GBPS Looter and Rehabilitation of
GBPS Shah Jahanabad)**

Volume 1

Bidding Procedures

- Section I. Instructions to Bidders (ITB)
- Section II. Bid Data Sheet (BDS)
- Section III. Evaluation and Qualification Criteria
- Section IV. Bidding Forms (BF)
- Section V. Eligible Countries
- Section VI. Fraud and Corruption

Conditions of Contract and Contract Forms

- Section VIII. General Conditions (GC)
- Section IX. Particular Conditions (PC)
- Section X. Contract Forms (CF)

**GENERAL MANAGER/PROJECT DIRECTOR
DASU HYDROPOWER PROJECT
DASU, PAKISTAN
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BIDDING DOCUMENTS

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- ❖ **Conditions of Contract and Contract Forms (Section VIII to X)**

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SECTION-I

INSTRUCTIONS TO BIDDERS (ITB)

Section I - Instructions to Bidders

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Section I - Instructions to Bidders

A. General

- 1. Scope of Bid**
- 1.1 In connection with the Specific Procurement Notice - Request for Bids (RFB), specified in the Bid Data Sheet (BDS), the Employer, as specified **in the BDS**, issues this bidding document for the provision of Works as specified in Section VII, Works' Requirements. The name, identification and number of lots (contracts) of this RFB are specified **in the BDS**.
- 1.2 Throughout this bidding document:
- (a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, and fax, including if specified **in the BDS**, distributed or received through the electronic-procurement system used by the Employer) with proof of receipt;
 - (b) if the context so requires, "singular" means "plural" and vice versa;
 - (c) "Day" means calendar day, unless otherwise specified as "Business Day". A Business Day is any day that is an official working day of the Borrower. It excludes the Borrower's official public holidays; and
 - (d) "ESHS" means environmental, social (including sexual exploitation and abuse (SEA) and gender based violence (GBV)), health and safety.
- 2. Source of Funds**
- 2.1 The Borrower or Recipient (hereinafter called "Borrower") specified **in the BDS** has received or has applied for financing (hereinafter called "funds") from the International Bank for Reconstruction and Development or the International Development Association (hereinafter called "the Bank") in an amount specified **in the BDS**, toward 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 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank, and will be subject, in all respects, to the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, equipment, plant, or materials, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).
- 3. Fraud and Corruption**
- 3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Section VI.

3.2 In further pursuance of this policy, bidders shall permit and shall cause their agents (where declared or not), subcontractors, sub-consultants, service providers, suppliers, and their personnel, to permit the Bank to inspect all accounts, records and other documents relating to any initial selection process, prequalification process, bid submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, or a state-owned enterprise or institution, subject to ITB 4.6, or any combination of them in the form of a joint venture (JV), under an existing agreement, or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless specified **in the BDS**, there is no limit on the number of members in a JV.

4.2 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder:

- (a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or
- (b) receives or has received any direct or indirect subsidy from another Bidder; or
- (c) has the same legal representative as another Bidder; or
- (d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
- (e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or
- (f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager for the Contract implementation;
- (g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm;
- (h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or

indirectly involved in the preparation of the bidding document or specifications of the contract, and/or the Bid evaluation process of such contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the procurement process and execution of the contract.

- 4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate in more than one Bid, except for permitted alternative Bids. This includes participation as a Subcontractor in other Bids. Such participation shall result in the disqualification of all Bids in which the firm is involved. A firm that is not a Bidder or a JV member may participate as a subcontractor in more than one Bid.
- 4.4 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or sub-consultants for any part of the Contract including related Services.
- 4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Anti-Corruption Guidelines, in accordance with its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework as described in Section VI paragraph 2.2 d., shall be ineligible to be prequalified for, initially selected for, bid for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the BDS.
- 4.6 Bidders that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Employer.
- 4.7 A Bidder shall not be under suspension from Bidding by the Employer as the result of the operation of a Bid-Securing or Proposal-Securing Declaration.
- 4.8 Firms and individuals may be ineligible if so indicated in Section V and (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) 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 any country, person, or entity in that country. When the Works are implemented across jurisdictional boundaries (and more than one country is a Borrower, and is involved in the procurement), then exclusion of a firm or individual on the basis of ITB 4.8 (a) above by any country may be applied to that procurement across other countries involved, if the Bank and the Borrowers involved in the procurement agree.

4.9 A Bidder shall provide such documentary evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Borrower's request, is satisfied that the debarment;

(a) relates to fraud or corruption, and

(b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment and services to be supplied under the Contract and financed by the Bank may have their origin in any country subject to the restrictions specified in Section V, Eligible Countries, and all expenditures under the Contract will not contravene such restrictions. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The bidding document consists of Parts 1, 2, and 3, which include all the sections specified below, and which should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures

- Section I - Instructions to Bidders (ITB)
- Section II - Bid Data Sheet (BDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Bidding Forms
- Section V - Eligible Countries
- Section VI - Fraud and Corruption

PART 2 Works' Requirements

- Section VII - Works' Requirements

PART 3 Conditions of Contract and Contract Forms

- Section VIII - General Conditions of Contract (GCC)
- Section IX - Particular Conditions of Contract (PCC)

- Section X - Contract Forms

- 6.2 The Specific Procurement Notice - Request for Bids (RFB) issued by the Employer is not part of this bidding document.
- 6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the bidding document, responses to requests for clarification, the minutes of the pre-Bid meeting (if any), or Addenda to the bidding document in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.
- 6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information and documentation as is required by the bidding document.

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

- 7.1 A Bidder requiring any clarification of the bidding document shall contact the Employer in writing at the Employer's address specified **in the BDS** or raise its inquiries during the pre-Bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period specified **in the BDS**. The Employer 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. If so specified **in the BDS**, the Employer shall also promptly publish its response at the web page identified in the BDS. Should the clarification result in changes to the essential elements of the bidding document, the Employer shall amend the bidding document following the procedure under ITB 8 and ITB 22.2.
- 7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
- 7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
- 7.4 If so specified **in the BDS**, the Bidder's designated representative is invited to attend a pre-Bid meeting and/or a Site of Works visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

- 7.5 The Bidder is requested, to submit any questions in writing, to reach the Employer not later than one week before the meeting.
- 7.6 Minutes of the pre-Bid meeting, if applicable, including the text of the questions asked by Bidders, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the bidding document in accordance with ITB 6.3 Any modification to the bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-Bid meeting. Nonattendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

- 8.1 At any time prior to the deadline for submission of bids, the Employer may amend the bidding document by issuing addenda.
- 8.2 Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Employer in accordance with ITB 6. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.
- 8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2.

C. Preparation of Bids

9. Cost of Bidding

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

10. Language of Bid

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

11. Documents Comprising the Bid

- 11.1 The Bid shall comprise the following:
- (a) **Letter of Bid** prepared in accordance with ITB 12;
 - (b) **Bill of Quantities or Activity Schedule**: completed in accordance with ITB 12 and ITB 14, as specified **in the BDS**;
 - (c) **Bid Security or Bid-Securing Declaration**, in accordance with ITB 19.1;

- (d) **Alternative Bid**, if permissible, in accordance with ITB 13;
- (e) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.3;
- (f) **Bidder's Eligibility**: documentary evidence in accordance with ITB 17 establishing the Bidder's eligibility to Bid;
- (g) **Qualifications**: documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the contract if its Bid is accepted;
- (h) **Conformity**: a technical proposal in accordance with ITB 16;
- (i) any other document required **in the BDS**.

11.2 In addition to the requirements under ITB 11.1, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement.

11.3 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.

12. Letter of Bid and Schedules

12.1 The Letter of Bid and Schedules shall be prepared using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 20.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Unless otherwise specified **in the BDS**, alternative Bids shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included **in the BDS** and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification Criteria.

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the bidding document must first price the Employer's design as described in the bidding document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the Bidder with the Most Advantageous Bid conforming to the basic technical requirements shall be considered by the Employer.

13.4 When specified **in the BDS**, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified **in the BDS** and described in Section VII, Works' Requirements. The method for their evaluation will be

stipulated in Section III, Evaluation and Qualification Criteria.

14. Bid Prices and Discounts

- 14.1 The prices and discounts quoted by the Bidder in the Letter of Bid and in the Activity Schedule or Bill of Quantities shall conform to the requirements specified below.
- 14.2 The Bidder shall submit a Bid for the whole of the Works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section IV. Bidding Forms. In case of admeasurement contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.
- 14.3 The price to be quoted in the Letter of Bid, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered.
- 14.4 The Bidder shall quote any discounts and indicate the methodology for their application in the Letter of Bid in accordance with ITB 12.1.
- 14.5 Unless otherwise specified **in the BDS** and the Conditions of Contract, the prices quoted by the Bidder shall be fixed. If the prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data in Section IV- Bidding Forms and the Employer may require the Bidder to justify its proposed indices and weightings.
- 14.6 If so specified in ITB 1.1, Bids are invited for individual lots (contracts) or for any combination of lots (packages). Bidders wishing to offer discounts for the award of more than one Contract shall specify in their Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all lots (contracts) are opened at the same time.
- 14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of Bids, shall be included in the rates and prices¹ and the total Bid price submitted by the Bidder.

15. Currencies of Bid and Payment

- 15.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same and shall be as specified **in the BDS**.
- 15.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data

¹ In lump sum contracts, delete "rates and prices and the."

are reasonable², 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 IV, Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work's requirements and the completion time.
- 17. Documents Establishing the Eligibility and Qualifications of the Bidder**
- 17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, included in Section IV, Bidding Forms.
- 17.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract, the Bidder shall provide the information requested in the corresponding information sheets included in Section IV, Bidding Forms.
- 17.3 If a margin of preference applies as specified in accordance with ITB 33.1, domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITB 33.1.
- 18. Period of Validity of Bids**
- 18.1 Bids shall remain valid for the Bid Validity period specified **in the BDS**. The Bid Validity period starts from the date fixed for the Bid submission deadline (as prescribed by the Employer in accordance with ITB 22.1). A Bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
- 18.2 In exceptional circumstances, prior to the expiration of the Bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 19, it shall also be extended for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 18.3.
- 18.3 If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity period, the Contract price shall be determined as follows:

² For lump sum contracts, delete "unit rates and prices and shown in the Schedule of Adjustment Data are reasonable" and replace with "Lump Sum."

- (a) in the case of **fixed price** contracts, the Contract price shall be the Bid price adjusted by the factor specified **in the BDS**;
- (b) in the case of **adjustable** price contracts, no adjustment shall be made; or
- (c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

19.1 The Bidder shall furnish as part of its Bid, either a Bid-Securing Declaration or a Bid Security as specified **in the BDS**, in original form and, in the case of a Bid Security, in the amount and currency specified **in the BDS**.

19.2 A Bid Securing Declaration shall use the form included in Section IV, Bidding Forms.

19.3 If a Bid Security is specified pursuant to ITB 19.1, the Bid Security shall be a demand guarantee in any of the following forms at the Bidder's option:

- (a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);
- (b) an irrevocable letter of credit;
- (c) a cashier's or certified check; or
- (d) another security specified **in the BDS**,

from a reputable source from an eligible country. If an unconditional guarantee is issued by a non-bank financial institution located outside the Employer's Country, the issuing non-bank financial institution shall have a correspondent financial institution located in the Employer's Country to make it enforceable, unless the Employer has agreed in writing, prior to Bid submission, that a correspondent financial institution is not required. In the case of a bank guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Employer prior to Bid submission. The Bid Security shall be valid for twenty-eight (28) days beyond the original validity period of the Bid, or beyond any period of extension if requested under ITB 18.2.

19.4 If a Bid Security or Bid Securing Declaration is specified pursuant to ITB 19.1, any Bid not accompanied by a substantially responsive Bid Security or Bid-Securing Declaration shall be rejected by the Employer as non-responsive.

19.5 If a Bid Security is specified pursuant to ITB 19.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the Contract and furnishing the Performance Security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security pursuant to

ITB 48.

- 19.6 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security. and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) 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 Letter of Bid, or any extension thereto provided by the Bidder; or
 - (b) if the successful Bidder fails to:
 - (i) sign the Contract in accordance with ITB 47; or
 - (ii) furnish a Performance Security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security in accordance with ITB 48.
- 19.8 The Bid Security or the Bid-Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been constituted into a legally enforceable JV, at the time of Bidding, the Bid Security or the Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent mentioned in ITB 4.1 and ITB 11.2.
- 19.9 If a Bid Security is not required **in the BDS**, pursuant to ITB 19.1, and;
- (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid; or
 - (b) if the successful Bidder fails to: sign the Contract in accordance with ITB 47, or furnish a Performance Security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security in accordance with ITB 48;

the Borrower may, if provided for **in the BDS**, declare the Bidder ineligible to be awarded a contract by the Employer for a period of time stated **in the BDS**.

20. Format and Signing of Bid

- 20.1 The Bidder shall prepare one original of the documents comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL". 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 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive

information.

- 20.3 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified **in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.
- 20.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.
- 20.5 Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

- 21.1 The Bidder shall deliver the Bid in a single, sealed envelope (one-envelope Bidding process). Within the single envelope the Bidder shall place the following separate, sealed envelopes:
- (a) in an envelope marked “ORIGINAL”, all documents comprising the Bid, as described in ITB 11; and
 - (b) in an envelope marked “COPIES”, all required copies of the Bid; and
 - (c) if alternative Bids are permitted in accordance with ITB 13, and if relevant:
 - (i) in an envelope marked “ORIGINAL - ALTERNATIVE BID”, the alternative Bid; and
 - (ii) in the enveloped marked “COPIES – ALTERNATIVE BID” all required copies of the alternative Bid.
- 21.2 The inner and outer envelopes shall:
- (a) bear the name and address of the Bidder;
 - (b) be addressed to the Employer in accordance with ITB 22.1;
 - (c) bear the specific identification of this Bidding process specified in accordance with BDS 1.1; and
 - (d) bear a warning not to open before the time and date for Bid opening.
- 21.3 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

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

permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

- 25.3 Next, envelopes marked “SUBSTITUTION” shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.
- 25.4 Next, envelopes marked “MODIFICATION” shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at bid opening.
- 25.5 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Bidder and whether there is a modification; the total Bid Price, per lot (contract) if applicable, including any discounts and alternative Bids; the presence or absence of a Bid Security, or Bid Securing Declaration, if required; and any other details as the Employer may consider appropriate.
- 25.6 Only Bids, alternative Bids and discounts that are opened and read out at Bid opening shall be considered further for evaluation. The Letter of Bid and the priced Schedules are to be initialed by representatives of the Employer attending Bid opening in the manner specified **in the BDS**.
- 25.7 The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).
- 25.8 The Employer shall prepare a record of the Bid opening that shall include, as a minimum:
- (a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;
 - (b) the Bid Price, per lot (contract) if applicable, including any discounts;
 - (c) the presence or absence of a Bid Security or Bid-Securing Declaration, if one was required; and
 - (d) any alternative Bids.
- 25.9 The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder’s signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

26. Confidentiality

- 26.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other

persons not officially concerned with the Bidding process until information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 43.

- 26.2 Any effort by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.
- 26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract award, if a Bidder wishes to contact the Employer on any matter related to the Bidding process, it shall do so in writing.

27. Clarification of Bids

- 27.1 To assist in the examination, evaluation, and comparison of the Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid given a reasonable time for a response. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 31.
- 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. Determination of Responsiveness

- 29.1 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.
- 29.2 A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:
- (a) if accepted, would:
 - (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or
 - (ii) limit in any substantial way, inconsistent with the bidding document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

- (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

29.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, in particular, to confirm that all requirements of Section VII, Works' Requirements have been met without any material deviation, reservation or omission.

29.4 If a Bid is not substantially responsive to the requirements of the bidding document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

30. Nonmaterial Nonconformities

30.1 Provided that a **Bid** is substantially responsive, the Employer may waive any nonconformities in the Bid.

30.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

30.3 Provided that a Bid is 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, by adding the average price of the item or component quoted by substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate.

31. Correction of Arithmetical Errors

31.1 Provided that the Bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis:

- (a) only for admeasurement contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;
- (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

31.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 31.1, shall

result in the rejection of the Bid.

- 32. Conversion to Single Currency** 32.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified **in the BDS**.
- 33. Margin of Preference** 33.1 Unless otherwise specified **in the BDS**, a margin of preference for domestic Bidders³ shall not apply.
- 34. Subcontractors** 34.1 Unless otherwise stated **in the BDS**, the Employer does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Employer, Financial Parts
- 34.2 The subcontractor’s qualifications shall not be used by the Bidder to qualify for the Works unless their specialized parts of the Works were previously designated by the Employer **in the BDS** as can be met by subcontractors referred to hereafter as ‘Specialized Subcontractors’, in which case, the qualifications of the Specialized Subcontractors proposed by the Bidder may be added to the qualifications.
- 34.3 Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified **in the BDS**. Subcontractors proposed by the Bidder shall be fully qualified for their parts of the Works.
- 35. Evaluation of Bids** 35.1 The Employer shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification criteria. No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies the Employer shall determine the Most Advantageous Bid. This is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be:
- (a) substantially responsive to the bidding document; and
- (b) the lowest evaluated cost.
- 35.2 To evaluate a 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 Quantities⁴ for admeasurement contracts, but including Daywork⁵ items, where priced competitively;

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

⁴ In lump sum contracts, delete “Bill of Quantities” and replace with “Activity Schedule.”

⁵ Daywork is work carried out following instructions of the Project Manager and paid for on the basis of time spent by workers, and the use of materials and the Contractor’s equipment, at the rates quoted in the Bid. For Daywork to be priced competitively for Bid evaluation purposes, the Employer must list

- (b) price adjustment for correction of arithmetic errors in accordance with ITB 31.1;
- (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 32;
- (e) price adjustment for nonconformities in accordance with ITB 30.3; and
- (f) the additional evaluation factors are specified in Section III, Evaluation and Qualification Criteria.

35.3 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.

35.4 If this bidding document allows Bidders to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated cost of the contract combinations, including any discounts offered in the Letter of Bid, is specified in Section III, Evaluation and Qualification Criteria.

36. Comparison of Bids

36.1 The Employer shall compare the evaluated costs of all substantially responsive Bids established in accordance with ITB 35.2 to determine the Bid that has the lowest evaluated cost.

37. Abnormally Low Bids

37.1 An Abnormally Low Bid is one where the Bid price, in combination with other constituent elements of the Bid, appears unreasonably low to the extent that the Bid price raises material concerns as to the capability of the Bidder to perform the Contract for the offered Bid price.

37.2 In the event of identification of a potentially Abnormally Low Bid, the Employer shall seek written clarifications from the Bidder, including detailed price analyses of its Bid price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the bidding document.

37.3 After evaluation of the price analyses, in the event that the Employer determines that the Bidder has failed to demonstrate its capability to perform the Contract for the offered Bid Price, the Employer shall reject the Bid.

38. Unbalanced or Front Loaded Bids

38.1 If the Bid for an admeasurement contract, which results in the lowest evaluated cost is, in the Employer's opinion, seriously unbalanced or, front loaded, the Employer may require the Bidder to provide written clarifications. Clarifications may include detailed price analyses to

tentative quantities for individual items to be costed against Daywork (e.g., a specific number of tractor driver staff-days, or a specific tonnage of Portland cement), to be multiplied by the Bidders' quoted rates and included in the total Bid price.

demonstrate the consistency of the Bid prices with the scope of works, proposed methodology, schedule and any other requirements of the bidding document.

38.2 After the evaluation of the information and detailed price analyses presented by the Bidder, the Employer may as appropriate:

- (a) accept the Bid; or
- (b) require that the amount of the Performance Security be increased at the expense of the Bidder to a level not exceeding 20% of the Contract Price; or
- (c) reject the Bid.

39. Qualification of the Bidder

39.1 The Employer shall determine to its satisfaction whether the eligible Bidder that is selected as having submitted the lowest evaluated cost and substantially responsive Bid meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

39.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the bidding document), or any other firm(s) different from the Bidder.

39.3 An affirmative determination of qualification shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the Bid, in which event the Employer shall proceed to the substantially responsive Bid which offers the next lowest evaluated cost to make a similar determination of that Bidder's qualifications to perform satisfactorily.

40. Most Advantageous Bid

40.1 Having compared the evaluated costs of Bids, the Employer shall determine the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be:

- (a) substantially responsive to the bidding document; and
- (b) the lowest evaluated cost.

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

41.1 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.

42. Standstill Period

42.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless extended in accordance with ITB 46. The Standstill Period commences the day after the date the Employer has transmitted to each Bidder the Notification of Intention to Award the Contract. Where only one Bid is submitted, or if this contract is in

response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

43. Notification of Intention to Award

43.1 The Employer shall send to each Bidder the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information:

- (a) the name and address of the Bidder submitting the successful Bid;
- (b) the Contract price of the successful Bid;
- (c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated;
- (d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful, unless the price information in c) above already reveals the reason;
- (e) the expiry date of the Standstill Period;
- (f) instructions on how to request a debriefing and/or submit a complaint during the standstill period.

F. Award of Contract

44. Award Criteria

44.1 Subject to ITB 41, the Employer shall award the Contract to the successful Bidder. This is the Bidder whose Bid has been determined to be the Most Advantageous Bid as specified in ITB 40.

45. Notification of Award

45.1 Prior to the expiration of the Bid Validity Period and upon expiry of the Standstill Period, specified in ITB 42.1 or any extension thereof, and, upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification of award (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution of the contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

45.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Employer shall publish the Contract Award Notice which shall contain, at a minimum, the following information:

- (a) name and address of the Employer;
- (b) name and reference number of the contract being awarded, and the selection method used;
- (c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;
- (d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;
- (e) the name of the successful Bidder, the final total contract price,

the contract duration and a summary of its scope; and

- (f) successful Bidder's Beneficial Ownership Disclosure Form, if specified in BDS ITB 47.1.

45.3 The Contract Award Notice shall be published on the Employer's website with free access if available, or in at least one newspaper of national circulation in the Employer's Country, or in the official gazette. The Employer shall also publish the contract award notice in UNDB online.

45.4 Until a formal contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract.

46. Debriefing by the Employer

46.1 On receipt of the Employer's Notification of Intention to Award referred to in ITB 43.1, an unsuccessful Bidder has three (3) Business Days to make a written request to the Employer for a debriefing. The Employer shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

46.2 Where a request for debriefing is received within the deadline, the Employer shall provide a debriefing within five (5) Business Days, unless the Employer decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes place. The Employer shall promptly inform, by the quickest means available, all Bidders of the extended standstill period

46.3 Where a request for debriefing is received by the Employer later than the three (3)-Business Day deadline, the Employer should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.

46.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidder shall bear their own costs of attending such a debriefing meeting.

47. Signing of Contract

47.1 The Employer shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and, if specified in the BDS, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be submitted within eight (8) Business Days of receiving this request.

47.2 The successful Bidder shall sign, date and return to the Employer, the Contract Agreement within twenty-eight (28) days of its receipt.

48. Performance

48.1 Within twenty-eight (28) days of the receipt of the Letter of

Security

Acceptance from the Employer, the successful Bidder shall furnish the Performance Security and, if required in the BDS, the Environmental and Social (ES) Performance Security in accordance with the General Conditions of Contract, subject to ITB 38.2 (b), using for that purpose the Performance Security and ES Performance Security Forms included in Section X, Contract Forms, or another form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country, unless the Employer has agreed in writing that a correspondent financial institution is not required.

48.2 Failure of the successful Bidder to submit the above-mentioned Performance Security and, if required in the BDS, the Environmental and Social (ES) Performance Security, or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the Bidder offering the next Most Advantageous Bid.

49. Adjudicator

49.1 The Employer proposes the person named **in the BDS** to be appointed as Adjudicator under the Contract, at the hourly fee specified **in the BDS**, plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in his Bid. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority designated in the Particular Conditions of Contract (PCC) pursuant to Clause 23.1 of the General Conditions of Contract (GCC), to appoint the Adjudicator.

**50. Procurement
Related
Complaint**

50.1 The procedures for making a Procurement-related Complaint are as specified in the BDS.

SECTION-II
BID DATA SHEET (BDS)

Section-II BID DATA SHEET (BDS)

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Section II - Bid Data Sheet (BDS)

The following specific data for the Works to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

ITB Reference	A. General
ITB 1.1	<p>The number of the Invitation for Bids is: DASU-RS-02</p> <p>The Employer is: Water and Power Development Authority (WAPDA) represented by General Manager/Project Director, Dasu Hydropower Project WAPDA, Dasu, District Upper Kohistan, KPK, Pakistan or any other representative authorized by the Employer to represent the Employer from time to time.</p> <p>The reference number of the Request for Bids (RFB) is: DASU-RS-02</p> <p>The name of the RFB is: Construction of GBPS Looter and Rehabilitation of GBPS Shah Jahanabad.</p> <p>The number and identification of lots (contracts) comprising this RFB is: One</p>
ITB 1.2(a)	Electronic Procurement System shall not be Applicable
ITB 2.1	<p>The Borrower is: Government of Islamic Republic of Pakistan</p> <p>Loan or Financing Agreement amount: 588.4 M US\$</p> <p>The name of the Project is: Dasu Hydropower Project, Construction of GBPS Looter and Rehabilitation of GBPS Shah Jahanabad.</p>
ITB 4.1	Maximum number of members in the Joint Venture (JV) shall be: Two (02)
ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr .

B. Contents of Bidding Document	
ITB 6.1	<p>Text of the ITB 6.1 is deleted and in its place, the following is inserted:</p> <p>“The Bidding Document consists of Volumes 1 & 2 which includes all the sections indicated below and should be read in conjunction with any Addenda issued in accordance with ITB 8.</p> <p>Volume 1</p> <ul style="list-style-type: none"> ❖ Bidding Procedures (Section I to VI) <ul style="list-style-type: none"> Section I - Instructions to Bidders (ITB) Section II - Bid Data Sheet (BDS) Section III - Evaluation and Qualification Criteria Section IV - Bidding Forms (BF) Section V - Eligible Countries Section VI - Fraud and Corruption ❖ Conditions of Contracts & Contract Forms (Section VIII to X) <ul style="list-style-type: none"> Section VIII - General Conditions of Contract (GCC) Section IX - Particular Conditions of Contract (PCC) Section X - Contract Forms (CF) <p>Volume 2</p> <ul style="list-style-type: none"> ❖ Works Requirements (Section VII) <ul style="list-style-type: none"> Section VII <ul style="list-style-type: none"> a. General Specifications b. Technical Specifications c. Drawings
ITB 7.1	<p>For <u>Clarification of Bid purposes</u> only, the Employer’s address is:</p> <p>Attention: General Manager/Project Director, Dasu Hydropower Project, Water and Power Development Authority (WAPDA)</p> <p>Address: Dasu Hydropower Project WAPDA, Dasu, District Upper Kohistan, KPK, Pakistan</p> <p>Country: Islamic Republic of Pakistan</p> <p>Telephone: 0092- 0998 - 407007</p> <p>Electronic mail address: dasuhpp@yahoo.com.</p>
ITB 7.1	<p>Requests for clarification should be received by the Employer no later than: 14 days before Bid Submission date</p>
ITB 7.1	<p>Web page: dasuhpp.com</p>
ITB 7.4	<p>A Pre-Bid meeting will take place at the following date, time and place:</p> <p>Date: _____</p>

	<p>Time: _____</p> <p>Place: Office of the General Manager/ Project Director Dasu Hydropower Project WAPDA, Dasu, District Upper Kohistan, Khyber Pakhtunkhwa.</p> <p>A site visit to be conducted by the bidders shall be organized on the same day subsequent to Pre-Bid Meeting.</p> <p>Bidders are strongly encouraged to participate in the Pre-Bid Meeting for the purpose of clarity and better understanding of Bidding Documents.</p>
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C. Preparation of Bids	
ITB 10.1	<p>The language of the bid is: English</p> <p>All correspondence exchange shall be in English language.</p> <p>Language for translation of supporting documents and printed literature is English.</p>
ITB 11.1 (b)	<p>The following schedules shall be submitted with the Bid:</p> <ul style="list-style-type: none"> (i) Bill A – General Items (including Provisional Sums); (ii) Bill B – Relocated School Buildings (02 Nos.); (iii) Bill C – Earthwork (Excavation & Filling) (iv) Bill D – Stone Masonry Walls & Boundary Wall; (v) Bill E – Daywork (Provisional Sum); (vi) Bill F – Specified Provisional Sums.
ITB 11.1 (i)	<p>The Bidder shall submit the following additional documents in its Bid:</p> <p><u>Valid PEC Registration:</u> The Firm(s) and/or JV partner’s valid registration with Pakistan Engineering Council in minimum C-4 Category or above with specialization field of CE10.</p> <p><u>Valid Registration with FBR:</u> The firm(s) and/or JV partner’s valid registration with Federal Board of Revenue for Income Tax and Sales Tax and shall be on the active taxpayer’s list.</p> <p><u>Certificates of Completion and Performance:</u> The Bidder, with regard to information provided in Form EXP-4.2(a), (b) and (c) shall submit documentary evidence such as Taking Over Certificate (TOC) or Defects Liability Certificate (DLC) or Employer’s letter of satisfactory performance.</p> <p><u>Electronic Copies</u> Two (2) electronic copies containing the entire bid document. In the event there is found to any discrepancy between electronic and hard copy, the signed hard copy shall prevail.</p>
ITB 13.1	Alternative Bids shall not be considered.
ITB 13.2	Alternative times for completion shall not be permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the Works: <u>Not Applicable</u> .
ITB 14.5	The prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract.
Add new Clauses ITB 14.8 to 14.10	<p>14.8 Bidders shall be provided with a flash drive/disc containing a copy of the Bills of Quantities in a spreadsheet version (Microsoft Excel files).</p> <p>14.9 The Bidder shall enter the rates, prices and totals on the flash drive/disc and may submit the print out of the flash drive/disc.</p>

	14.10 The Bidder shall not modify the text or change any of the quantities in the CD. The Bidder shall ensure that the rates, prices and totals on the CD correspond exactly with the original Bill of Quantities or no modification or change has been made on the text and quantities in case the print out of the CD is submitted. In the event of any difference or discrepancy between hard copy and CD, the original of Bill of Quantities as issued with the bid shall prevail.
ITB 15.1	The prices shall be quoted by the Bidder, entirely in Pak Rupees (PKR) . Currency of payments is also in Pak Rupees (PKR) .
ITB 18.1	The bid shall remain valid for a period of 120 days from the date of Bid Opening.
ITB 18.3 (a)	The bid price shall be adjusted by the following factor(s): Not Applicable
ITB 19.1	A Bid Security is required in an amount not less than PKR 4,000,000 in the form of Unconditional Bank Guarantee issued by a scheduled Bank in Pakistan. Guarantees from other financial institutions such as insurance, bonding or security companies or Call Deposit Receipt (CDR) shall not be permitted. A Bid Securing Declaration shall not be required.
ITB 19.3 (a)	Unconditional Bank Guarantee in the form specified in ITB 19.1
ITB 19.3 (b)	Not Applicable.
ITB 19.3 (c)	Not Applicable.
ITB 19.3 (d)	Other types of acceptable securities: None
ITB 19.9	This Sub-Clause is not applicable.
ITB 20.1	In addition to the original of the Bid, the number of copies is: Three (3)
ITB 20.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: Power(s) of Attorney given by the Bidder /J.V.

D. Submission and Opening of Bids

ITB 22.1	For <u>Bid submission purposes</u> only, the Employer's address is: Address: Office of the General Manager/ Project Director Dasu Hydropower Project WAPDA, Dasu, District Kohistan, Khyber Pakhtunkhwa. Country: Islamic Republic of Pakistan Telephone: 0092- 0998 - 407007 Electronic mail address: Not Applicable The deadline for bid submission is: Date: _____ Time: _____ Electronic Procurement System shall not be Applicable.
ITB 25.1	The Bid opening shall take place at: Address: WAPDA Auditorium, WAPDA House, Lahore Country: Islamic Republic of Pakistan Date: _____ Time: _____
ITB 25.1	Electronic Procurement System shall not be Applicable
ITB 25.6	The Bid Documents shall be initialed by representatives of the Employer attending Bid opening. The following documents of the Bid shall be initialed of the Bid Opening Committee: <ul style="list-style-type: none">• Letter of Bid with Appendices• Summary page of Bill of Quantities• Substitution and Modification letter referring to changes in bid price (if any).

E. Evaluation and Comparison of Bids	
ITB 32.1	Not Applicable
ITB 33.1	A margin of preference for domestic bidders shall not apply.
ITB 34.1	At this time the Employer does not intend to execute certain specific parts of the Works by subcontractors selected in advance.
ITB 34.2	Not Applicable
ITB 34.3	<p>a) Contractor's proposed subcontracting: Maximum percentage of subcontracting permitted is: 20% of the Accepted Contract Amount.</p> <p>b) Bidders planning to subcontract more than 10% of total volume of work shall specify, in the Letter of Bid, the activity (ies) or parts of the works to be subcontracted along with complete details of the sub-contractors and their qualification and experience.</p>

F. Award of Contract	
ITB 47.1	The successful Bidder shall submit the Beneficial Ownership Disclosure Form.
ITB 48.1 and 48.2	The successful Bidder shall be not be required to submit an Environmental and Social (ES) Performance Security.
ITB 49	The Adjudicator proposed by the Employer including the hourly rate for their services shall be agreed between the parties to the Contract, 28 days after signing of the Contract Agreement.
ITB 50.1	<p>The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)." If a Bidder wishes to make a Procurement-related Complaint, the Bidder shall submit its complaint following these procedures, In Writing (by the quickest means available, such as by email or fax), to:</p> <p style="margin-left: 40px;">For the attention: Mr. Zeshan Ahmad Title/position: Director Contracts, Dasu HPP, Dasu, Kohistan Employer: Water & Power Development Authority (WAPDA) Email address: dhppcms@gmail.com</p> <p>In summary, a Procurement-related Complaint may challenge any of the following:</p> <ol style="list-style-type: none">1. the terms of the Bidding Documents; and2. the Employer's decision to award the contract.

SECTION-III
EVALUATION QUALIFICATION CRITERIA
(EQC)

Section III - Evaluation and Qualification Criteria

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1. Evaluation

In addition to the criteria listed in ITB 35.2 (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 VII, Works' Requirements.

1.2 Multiple Contracts

Pursuant to ITB 35.4 of the Instructions to Bidders, if Works are grouped in multiple contracts, evaluation will be as follows:

This Sub-Clause 1.2 is not used.

1.3 Alternative Completion Times

An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows:

Alternative Completion Time is not permitted.

1.4 Sustainable procurement

[If specific **sustainable procurement technical requirements** have been specified in Section VII- Specification, **either** state that (i) those requirements will be evaluated on a pass/fail (compliance basis) **or** otherwise (ii) in addition to evaluating those requirements on a pass/fail (compliance basis), if applicable, specify the monetary adjustments to be applied to Bid prices for comparison purposes on account of Bids that exceed the specified minimum sustainable procurement technical requirements.]

This Sub-Clause 1.4 is not used.

1.5 Alternative Technical Solutions for specified parts of Works

The acceptability of alternative technical solutions of parts of the Works, if permitted under ITB 13.4, will be determined as follows:

Alternative Technical Solutions for specified parts of Works are not permitted.

1.6 Specialized Subcontractors

If permitted under ITB 34, only the specific experience of Subcontractors for specialized works permitted by the Employer will be considered. The general experience and financial resources of the Specialized Subcontractors shall not be added to those of the Bidder for purposes of qualification of the Bidder.

There are no specialized works considered by the Employer.

2. Qualification

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
1. Eligibility							
1.1	Nationality	Nationality in accordance with ITB 4.4	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1.1 and 1.2, with attachments
1.2	Conflict of Interest	No conflicts of interest in accordance with ITB 4.2	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
1.3	Bank Eligibility	Not having been declared ineligible by the Bank, as described in ITB 4.5.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
1.4	State-owned enterprise or institution of the Borrower country	Meets conditions of ITB 4.6	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1.1 and 1.2, with attachments
1.5	United Nations resolution or Borrower's country law	Not having been excluded as a result of prohibition in the Borrower's country laws or official regulations against commercial relations with the Bidder's country, or by an act of compliance with UN Security Council resolution, both in accordance with ITB 4.8 and Section V.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1.1 and 1.2, with attachments
2. Historical Contract Non-Performance							

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
2.1	History of Non-Performing Contracts	Non-performance of a contract ¹ did not occur as a result of contractor default since 1st January 2019.	Must meet requirement ¹ & ²	Must meet requirements	Must meet requirement ²	N/A	Form CON-2
2.2	Suspension Based on Execution of Bid /Proposal Securing Declaration by the Employer	Not under suspension based on execution of a Bid/Proposal Securing Declaration pursuant to ITB 4.7 or withdrawal of the Bid pursuant ITB 19.9	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.3	Pending Litigation	Bidder's financial position and prospective long term profitability sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement	N/A	Must meet requirement	N/A	Form CON – 2

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

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

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
2.4	Litigation History	No consistent history of court/arbitral award decisions against the Bidder ³ since 1st January 2019.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form CON – 2
2.5	Declaration: Environmental and Social (ES) past performance	Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for breach of environmental or social (including Sexual Exploitation and Abuse) contractual obligations in between 1 st January 2019 and Application submission deadline. ⁴	Must make the declaration. Where there are Specialized Sub-contractor/s, the Specialized Sub-contractor/s must also make the declaration.	N/A	Each must make the declaration. Where there are Specialized Sub-contractor/s, the Specialized Sub-contractor/s must also make the declaration.	N/A	Form CON-3 ES Performance Declaration
2.6	Bank's SEA and/or SH Disqualification	At the time of Contract Award, not subject to disqualification by the Bank for non-compliance	Must meet requirement (including each	N/A	Must meet requirement (including each	N/A	Letter of Bid, Form CON-4

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

⁴ The Employer may use this information to seek further information or clarifications in carrying out its due diligence.

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
		with SEA/ SH obligations	subcontractor proposed by the Bidder)		subcontractor proposed by the Bidder)		
		If the Bidder had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, the Bidder shall either (i) provide evidence of an arbitral award on the disqualification made in its favour; or (ii) demonstrate that it has adequate capacity and commitment to comply with SEA/SH prevention and response obligations; or (iii) provide evidence that it has already demonstrated such capacity and commitment on another Bank financed works contract.	Must meet requirement (including each subcontractor proposed by the Bidder)	N/A	Must meet requirement (including each subcontractor proposed by the Bidder)	N/A	Letter of Bid, Form CON-4
3. Financial Situation and Performance							
3.1	Financial Capabilities	(i) The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and	Must meet requirement	Must meet Requirement	N/A	N/A	Form FIN – 3.1, with attachments

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
		other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as PKR 25 Million for the subject contract(s) net of the Bidder's other commitments.					
		(ii) The Bidders shall also demonstrate, to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.	Must meet requirement	Must meet requirement	N/A	N/A	
		(iii) The audited balance sheets or, if not required by the laws of the Bidder's country, other financial statements acceptable to the Employer, for the last three (3) years shall be submitted and must demonstrate the current soundness of the Bidder's	Must meet requirement	N/A	Must meet requirement	N/A	

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
		financial position and indicate its prospective long-term profitability.					
3.2	Average Annual Construction Turnover	Minimum average annual construction turnover of PKR 145 Million calculated as total certified payments received for contracts in progress and/or completed within the last three (3) years, divided by 3 years	Must meet requirement	Must meet requirement	Must meet twenty five percent (25%), of the requirement	Must meet forty percent (40%), of the requirement	Form FIN – 3.2
4. Experience							
4.1 (a)	General Construction Experience	Experience under construction contracts in the role of prime contractor, JV member, subcontractor, or management contractor for at least the last ten (10) years, starting 1st January 2014.	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP – 4.1

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
4.2 (a)	Specific Construction & Contract Management Experience	(i) A minimum number of One (01) similar contract specified below that have been satisfactorily and substantially ⁵ completed as a prime contractor, joint venture member ⁶ , management contractor or sub-contractor ⁶ between 1st January 2019 and bid submission deadline: Two Contracts each of minimum value of PKR 120 Million or One Contract of minimum value PKR 240 Million .	Must meet requirement	Must meet requirement ⁷	N/A	N/A	Form EXP 4.2(a)
4.2 (b)	Key Activities	For the above and any other contracts [substantially completed and under implementation] as prime contractor, joint venture member, or sub-	Must meet requirements	Must meet requirements	N/A	At least one (01) of the three (03) key activities	Form EXP – 4.2 (b)

⁵ Substantial completion shall be based on 80% or more works completed under the contract.

⁶ For contracts under which the Bidder participated as a joint venture member or sub-contractor, only the Bidder's share, by value, shall be considered to meet this requirement.

⁷ In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
		contractor between 1st January 2019 and Application submission deadline, a minimum construction experience in the following key activities successfully completed ⁸ : (i) Excavation = 6000 m ³ (ii) Brick/Block Masonry in Building Works 500 m ³ (iii) RCC= 500 m ³					
4.2 (c)	Specific Experience in Managing ES aspects	For the contracts [substantially completed and under implementation] as prime contractor, joint venture member, or Subcontractor between 1st January 2019 and Application submission deadline, experience in managing ES risks and impacts in the following aspects: (i) Preparing and	Must meet requirements	Must meet requirements	N/A	N/A	Form EXP – 4.2 (c)

⁸ Volume, number or rate of production of any key activity can be demonstrated in one or more contracts combined if executed during same time period.

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each Member	At least one Member	
		Managing Construction Environmental/Social Management Plans.					

3. Key Personnel

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

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

The Contractor shall require the Employer’s consent to substitute or replace the Key Personnel (refer the General Conditions of Contract Sub-Clause 9.1).

Key Personnel

No.	Position/specialization	Quant ity	Relevant academic qualifications	Minimum years of relevant work experience
		No.		
1	Project Manager	1	B.Sc. (Civil Engineering)	15 Years
2	Civil Engineer	1	B.Sc. (Civil Engineering)	Minimum 10 years’ experience including preparation of detailed drawings
3	Site Engineer	3	DAE (Civil Engineering)	5 Years
4	Survey Engineer	2	DAE (Civil Engineering)	5 Years
Suitable experts in the following specializations				
5	Environmental Officer	01	Bachelor degree in Environmental Sciences/Engineering	Minimum eight (8) years’ experience in environmental management work most preferable in construction
6	OHS Supervisor	01	DAE (Civil Engineering)	Minimum five (5) years’ experience in OHS preferably in construction

4. Equipment

The Bidder must demonstrate that it will have access to the key Contractor's equipment listed hereafter:

No.	Equipment Type and Characteristics	Minimum Number required
1	Excavator	02
2	Tractor/Trolley	02
3	Dumper	04
4	Water Tanker (Bowser type)	02
5	Heavy Duty Tractor with Blade	02
6	Static Roller	02
7	Concrete mixer	05

The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section IV.

SECTION-IV

BIDDING FORMS (BF)

Section IV - Bidding Forms

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Letter of Bid

Date of this Bid submission: _____
RFB No.: DASU-RS-02

To: Water and Power Development Authority through General Manager/ Project Director
Dasu Hydropower Project.

- (a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with ITB 8;
- (b) **Eligibility:** We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;
- (c) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid-Securing Declaration or Proposal-Securing Declaration in the Employer's Country in accordance with ITB 4.7;
- (d) **Exploitation and Abuse (SEA) and/or Sexual Harassment (SH):** *[select the appropriate option from (i) to (v) below and delete the others].*

We *[where JV, insert: "including any of our JV members"]*, and any of our subcontractors:

- i. [have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]
 - ii. [are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]
 - iii. [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor.]
 - iv. [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently provided and demonstrated that we have adequate capacity and commitment to comply with SEA and SH prevention and response obligations.]
 - v. [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached documents demonstrating that we have adequate capacity and commitment to comply with SEA and SH prevention and response obligations.]
- (e) **Conformity:** We offer to execute in conformity with the bidding document the following Works: [insert a brief description of the Works]
- (f) **Bid Price:** The total price of our Bid, excluding any discounts offered in item (f) below is: *[Insert one of the options below as appropriate]*

[Option 1, in case of one lot:] Total price is: [insert the total price of the Bid in words and figures, indicating the various amounts and the respective currencies];

Or

[Option 2, in case of multiple lots:] (a) Total price of each lot [insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies]; and (b) Total price of all lots (sum of all lots) [insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies];

- (g) **Discounts:** The discounts offered and the methodology for their application are:
- (i) The discounts offered are: *[Specify in detail each discount offered.]*
- (ii) The exact method of calculations to determine the net price after application of discounts is shown below: *[Specify in detail the method that shall be used to apply the discounts];*
- (h) **Bid Validity:** Our Bid shall be valid until *[insert day, month and year in accordance with ITB 18.1]*, and it shall remain binding upon us and may be accepted at any time on or before this date;
- (i) **Performance Security:** If our Bid is accepted, we commit to obtain a performance security *[and an Environmental and Social (ES) Performance Security, **Delete if not applicable**]* in accordance with the bidding document;
- (j) **One Bid Per Bidder:** We are not submitting any other Bid(s) as an individual Bidder or as a subcontractor, and we are not participating in any other Bid(s) as a Joint Venture member, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;
- (k) **Suspension and Debarment:** We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Employer’s Country laws or official regulations or pursuant to a decision of the United Nations Security Council;
- (l) **State-owned enterprise or institution:** *[select the appropriate option and delete the other] [We are not a state-owned enterprise or institution] / [We are a state-owned enterprise or institution but meet the requirements of ITB 4.6];*
- (m) **Commissions, gratuities and fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*

Name of Recipient	Address	Reason	Amount

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

- (n) **Binding Contract:** We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;
- (o) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive;
- (p) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption; and
- (q) **Adjudicator:** We accept the appointment of *[insert name proposed in Bid Data Sheet]* as the Adjudicator.

[or]

We do not accept the appointment of *[insert name proposed in Bid Data Sheet]* as the Adjudicator, and propose instead that *[insert name]* be appointed as Adjudicator, whose daily fees and biographical data are attached.

Name of the Bidder: **[insert complete name of the Bidder]*

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

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

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

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

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

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

BILL OF QUANTITIES (BOQ)

BILL OF QUANTITIES (BOQs)

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Particular Conditions of Contract, General and Technical Specifications, and Drawings. The expression of each item of work in this Bill of Quantities shall be deemed only as an abstract of the work, which consists of many kinds of acts as detailed in the relevant Sections and Clauses of these Bid documents.
2. 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 the actual quantities of work ordered and carried out except where otherwise specifically described in the Specifications or instructions or shown on the Drawings as pay line, as measured by the Contractor and verified by the Project Manager and valued at the rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Project Manager may fix within the terms of the Contract.
3. The rates and prices bid in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all Construction Plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.
4. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
5. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
6. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.
7. Provisional Sums 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.
8. The method of measurement of completed work for payment shall be in accordance with the Specifications. Where such payment reference is not indicated the CESMM 4 (UK) April 2012 Edition shall prevail.
9. Any arithmetic errors in computation or summation will be corrected by the Employer as follows:
 - (a) where there is a discrepancy between amounts in figures and in words, the amount in words will govern; and
 - (b) where there is a discrepancy between the unit rate and the total amount derived from the multiplication of the unit price and the quantity, the unit

rate as quoted will govern, unless in the opinion of the Employer, there is an obviously gross misplacement of the decimal point in the unit price, in which event the total amount as quoted will govern and the unit rate will be corrected.

10. Any work which is not executed, in the Project Manager's judgment, in accordance with provisions of the Contract, is not subject to measurement or payment unless such work is reinstated by the Contractor according to the Project Manager's instructions. Any additional labour, construction equipment or materials required to make good defective work or used in repair or maintenance shall be at the expense of the Contractor and shall not be taken into account when determining the sum to be paid for each item.

11. The following abbreviations have been used in the Bill of Quantities:

m	meter
m ²	square meter
m ³	cubic meter
kg	kilogramme
ton	tonne (metric)
nos	number
hr	hour
LS	Lump Sum
PS	Provisional Sum

B. Daywork

General

1. Reference should be made to Clause 55 of the Conditions of Contract. Work shall not be executed on a daywork basis except by written order of the Project Manager. Bidders shall enter basic rates for daywork items in the Bill of Quantities, which rates shall apply to any quantity of daywork ordered by the Project Manager. Nominal quantities have been indicated against each item of daywork, and the extended total for daywork shall be carried forward as a Provisional Sum to the Summary and Grand Summary in the Bill of Quantities. The amounts thus calculated will be used by the Project Manager for the purpose of evaluating Bids. Unless otherwise adjusted, payments for daywork shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.

Daywork Labour

2. In calculating payments due to the Contractor for the execution of daywork, the hours for labour will be reckoned from the time of arrival of the labour at the job site to execute the particular item of daywork to the time of return to the original place of departure, but excluding meal breaks and rest periods. Only the time of classes of labour directly doing work ordered by the Project Manager and for which they are competent to perform will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but not the time of foremen or other supervisory personnel.
3. The Contractor shall be entitled to payment in respect of the total time that labour is employed on daywork, calculated at the basis rates entered by him in the Bill of Daywork Rates: Labour. The rates for labour shall be deemed to cover all costs to the Contractor including (but not limited to) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances, and any sums paid to or on behalf of such labour for social benefits in accordance with Pakistani law, as well as Contractor's profit, overheads, superintendence, liabilities and insurance and allowance to labour, timekeeping and clerical and office work, the use of consumable

stores water, lighting and power; the use and repair of scaffolding workshops and stores portable power tools, manual plant and tools; supervision by the Contractor's staff, foremen and other supervisory personnel; and charges incidental to the foregoing.

Daywork Materials

4. The Contractor shall be entitled to payment in respect of materials used for daywork (except for materials for which the cost is included in the percentage addition to labour costs as detailed heretofore), at the rates entered by him in the Bill of Daywork Rates: Materials and shall be deemed to include overhead charges and profit as follows;
 - (a) The rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc., and shall provide for delivery to store for stockpiling at the Site.
 - (b) The cost of hauling materials for use on work ordered to be carried out as daywork from the store or stockpile on the Site to the place where it is to be used will be paid in accordance with the terms for Labour and Construction in this schedule.

Daywork Contractor's Equipment

5. The Contractor shall be entitled to payments in respect of Contractor's Equipment already on Site and employed on daywork at the basic rental rates entered by him in the Bill of Daywork Rates: Equipment. Said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity, and insurance, repairs, maintenance, supplies, fuel, lubricants, and other consumables, and all overhead, profit, and administrative costs related to the use of such equipment. The cost of drivers, operators, and assistants will be paid for separately as described under the section on Daywork Labour.
6. In calculating the payment due to the Contractor for Contractor's Equipment employed on daywork, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Project Manager, the travelling time from the part of the Site where the Contractor's Equipment was located when ordered by the Project Manager to be employed on daywork and the time for return journey thereto shall be included for payment.

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS**

GRAND SUMMARY

Item No.	Description	Amount PKR (Million)
A	GENERAL ITEMS (INCLUDING PROVISIONAL SUMS)	
B	RELOCATED SCHOOL BUILDINGS (02 Nos.)	
C	DISMANTLING (SHAH JAHANABAD)	
D	EARTHWORK (EXCAVATION & FILLING)	
E	STONE MASONARY WALLS & BOUNDARY WALL.	
E1	SUB-TOTAL OF BILLS (A TO E)	
F	TOTAL FOR DAYWORK (PROVISIONAL SUM)	
G	SPECIFIED PROVISIONAL SUMS INCLUDED IN SUB-TOTAL OF BILLS	
	TOTAL OF BILLS (E1+F)	

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS**

BILL-A: GENERAL ITEMS

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)	Ref. Payment Chapter- Clause
				In Figures	In Words		
1	Provide and Maintain Survey Equipment	P.S.*		1,000,000		1,000,000	14.1.1
2	Environment Officer	PM	18				GS 11.8.2
3	Laboratory testing of drinking water quality	Nos.	12				GS 11.8.3
4	Provision of water quality meters	LS	1				GS 11.8.4
5	Measurements with water quality meters	Nos.	6				GS 11.8.3
6	Provision of noise level meter	LS	1				GS 11.8.4
7	Measurements with noise quality meters	Nos.	15				GS 11.8.3
8	Implementation of Environmental Codes of Practice (ECP)	PM	18				GS 11.8.5
9	Insurance for Loss or Damage to the Works under Sub-Clause 13.1 (a)	L.S					14.1.3
10	Insurance for Loss or Damage to the Equipment Under Sub-Clause 13.1 (b)	L.S					14.1.3
11	Insurance for Loss or Damage to the Property under Sub-Clause 13.1 (c)	L.S					14.1.4
12	Insurance for Personal Injury or Death Under Sub-Clause 13.1 (d)	L.S					14.1.5
13	Provisional Sum for Adjudicator	P.S.*		1,000,000		1,000,000	14.1.7
14	Provisional Sum for Adjustments for Change in cost under clause 49 of COC	P.S.*		5,000,000		5,000,000	14.1.6
15	Provisional Sum for Physical Contingency	P.S.*		3,000,000		3,000,000	14.1.8
	Occupational Health and Safety						
16	i) OHS Supervisor One (1)	PM	18				14.1.2
	ii) Standard First Aid Kit Purchase (5)	LS					
	iii) First Aid Kit Maintenance	PM	18				
	iv) Fire Extinguishers Purchase and installtion 6kg (20)	LS					
	v) Fire Extinguishers Refilling & maintenance	LS					14.1.2
	vi) PPEs Purchase and Use on Actual Basis	LS					
Total of Bill-A =						10,000,000	

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)	Ref. Payment Chapter- Clause	Ref. Tech. Specs. (TS)
				In Figures	In Words			
B-1.1	CIVIL WORKS							
	I) Concrete Works							
1	Plain Cement Concrete (PCC)						14.3.2	3.4
	a) PCC Class D (10 Mpa)	m ³	47					
	b) PCC Class C (15 Mpa)	m ³	3					
	c) PCC Class B (20 Mpa)	m ³	37					
	d) PCC ratio (1:2:4)	m ³	4					
2	Reinforced Cement Concrete Class B (21 Mpa)	m ³	318				14.3.2	3.4
3	Reinforcing steel grade 60, ASTM A615	kg	35,616				14.3.4	3.6
	II) Masonry							
1	Precast cement concrete solid block (10Mpa) masonry with C/S mortar 1:6 including scaffolding & curing. Complete in all respects.	m ³	169				14.3.5	3.7
	III) External & Internal Finishes							
1	Cement sand plaster (1:4) 13 mm thick	m ²	2,800				14.6	7.3
2	Providing and laying approved quality Ziarat Grey marble tiles of 13mm nominal thickness, according to approved pattern, including finishing, grinding and polishing complete in all respects.	m ²	530				14.5.2	6.2
3	Providing and fixing 20mm thick granite with properly ground ends and front edges beveled to desired pattern, on counter top/Stair case as per drawings and or as directed by the Engineer.	m ²	5				14.5.1	6.2
4	Providing and fixing marble 20mm thickness with properly ground ends and front edges beveled to desired pattern, on counter top/stair as per drawings and or as directed by the Engineer.	m ²	62				14.5.2	6.2
5	PCC tiles 25mm thick of approved quality.	m ²	200				14.5.3	6.2
6	Providing and applying three coats of plastic emulsion paint, preparing the surface including one coat of putty and one coat of Primer.	m ²	2,100				14.8.1	9.1
7	Providing and applying three coats of weather shield paint on external surfaces, preparing the surface, including one primer coat.	m ²	85				14.8.1	9.1
8	Providing and fixing Fair Face Brick Cladding (Gutka) with cement surkhi (1:4) finishing complete in all respects..	m ²	1,075				14.6.4	7.7
9	Providing and applying three coats of white wash / color wash, preparing the surfaces including one coat of putty and one coat of Primer.	m ²	37				14.6.2	7.4 & 7.5
10	Precast cement concrete pavers 50 mm thick of approved shape including base and sub base as per specifications.	m ²	16				14.5.4	3.8

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

11	Providing and laying 6mm thick approved quality white / Coloured (Glazed or Matt) ceramic tile in floors, grouting and finishing complete in all respects.	m ²	33				14.5.2	6.2
12	Providing and fixing 6mm thick approved quality white/ Coloured (Glazed or Matt) ceramic tiles on walls including border tiles, grouting & finishing complete in all respects.	m ²	196				14.5.2	6.2
13	Marble dado or skirting, consisting of 13mm nominal thick marble strips of approved shade and quality over 12mm thick (1:3) cement : sand plaster including cement washing, finishing, grinding and polishing complete in all respects.	m ²	57				14.5.5	6.2
14	False ceiling approved design comprising iron L & T section and Gypsum board. Complete in all respects.	m ²	40				14.4.3	11.12
15	Khuprail tiles on slant roof	m ²	45				14.4.5	6.2
16	White board with aluminum frame	m ²	16				14.10.6	11.11
17	Stone Ballast	m ³	20				14.3.1	3.3
	IV) Joinery and Metal Works							
1	Providing and fixing MS windows glazing with plain or color glass as directed by the Engineer.	m ²	75				14.10.3	11.2
2	Providing and fixing MS ventilators glazing with plain or color glass as shown in the drawings.	m ²	4				14.10.3	11.2
3	Providing and erecting steel gate including enamel paint 2 coats and primer.	Each	1				14.10.3(ii)	11.2
4	Providing, fabricating, painting (enamel paint 2 coats, primer) and fixing of MS safety grill (ASTM A36) complete in all respects as per drawings.	m ²	89				14.10.3(ii)	11.2
5	Providing and fixing MS stair railing as per drawings including finishing, painting with enamel including primer as directed by the Engineer.	m	57				14.10.3(iv)	11.2
6	Providing and fixing solid wood panelled doors with metql chowkhat (16 gauge) including best quality brass mongery/Hardware access including french polishing for Wood Works complete in all respects.	m ²	57				14.7.2	8.2
7	Making and fixing steel grated door including frame 50x50x10mm & 20mm square bars at 100mm c/c, wire gauze , two coats Enamel paint and primer. Complete in all respects.	m ²	2				14.10.3(ii)	11.2
8	Providing and fixing kitchen cabinets including french polishing and hardware for Wood Works	m ²	6				14.7.1	11.2
9	Providing and fixing stainless steel railing of gauge 16SWG as per drawings. Complete in all respects.	m	28				14.10.3(iv)	11.5
10	Providing and fixing Almirah including french polishing	m ²	22				14.7.1	8.2
11	Providing & placing aluminum cover for exposed water supply, sewerage pipes, and for roof drainage as shown on drawings. Complete in all respects.	m ²	4				14.10.3(ii)	11.4

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

	V) Roof Drainage Treatment						
1	(i) First Coat of Hot Bitumen @1.70kg/m ²	m ²	250				
2	(ii) Second Coat of Hot Bitumen @1.70kg/m ²	m ²	250				
3	(iii) Polythene sheet 0.2mm thick (800 gauge)	m ²	250				
4	(iv) Extruded polystyrene foam board, 25mm thickness	m ²	250			14.4.1	5.1
5	(v) Polythene Sheet 0.2mm thick (800 gauge)	m ²	250				
6	(vi) Earth filling 100m thick	m ²	250				
7	(vii) PCC tiles laid in 1:6 CS mortar & grouted with 1:4 CS mortar	m ²	250				
8	u-PVC Class-C rain water down-pipe 100 mm dia . Complete in all respects	m	22			14.11.1(A)	12.1&12.3
9	Khuras on Roof	Each	4			14.4.2	5.2
10	Bottom Khuras	Each	4			14.4.2	5.2
	VI) Land Preparation and Installation of Grass						
1	Removal of stones, weeds/undesirable grass, other injurious matters and ploughing, leveling and dressing of lawn (on level or slopes)	m ²	220			14.10.5(i)	11.8
2	Supplying and fixing of approved quality Local grass including watering, rolling, weeding complete in all respect	m ²	220			14.10.5(ii)	11.8
	VII) Miscellaneous						
1	Providing and applying 2-coats of hot bitumen (each coat @ 1.70kg/m ²)	m ²	22			14.11.2(iii)	5.1
2	Providing and Fixing PVC rubber water stopper 225mm including cutting and jointing of approved brand	m	33			14.11.2(iii)	3.5
3	Providing and fixing RCC manhole covers 600mm dia	No.	6			14.11.2(iii)	3.4
4	Providing and fixing galvanized mild steel rungs	No.	20			14.11.2(iii)	3.6
5	Anti termite treatment in foundation and floors with approved chemicals.	m ²	660			14.2.4	1.3
6	Emulsified Bitumen Coating @ 0.60 kg/m ² grade 10/20 on plastered & concrete surfaces for footing, column & other structures in contact with soil or as shown in drawings.	m ²	770			14.2.3	11.9
7	Crush stone / aggregates of size 19 to 25mm	m ³	11			14.2.2(iii)	10.3
8	Supplying and filling compacted sand	m ³	141			14.2.2(ii)	10.2
	Total of B-1.1						

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

B-1.2	PUBLIC HEALTH WORKS							
	I) WATER SUPPLY							
1	Providing, laying, cutting, jointing, testing & disinfecting PPR (PN-20 SDR-6) pipes & specials inside buildings & trenches							12.1
	a) 25 mm dia	m	40				14.11.1(A)	
	b) 32mm dia	m	6					
	c) 40 mm dia	m	66					
2	Providing and fixing wash basin including coupling, bottle trap etc., C.I. brackets, rubber plug with chain, connection pipe, mirror, towel rail, soap dishes, glass shelves complete in all respects	Each	5				14.11.3(ii)	12.3
3	Providing and fixing peet valves complete in all respect.							
	a) 25 mm dia	Each	2				14.11.4(ii)	12.4
	b) 32 mm dia	Each	2					
	d) 40 mm dia	Each	2					
4	Providing and fixing C.P. bib tap: 13 mm i/d	Each	6				14.11.4(ii)	
5	Providing and fixing C.P. Tee stop cocks: 13 mm i/d	Each	6				14.11.3(vi)	12.4
6	Providing and fixing Stainless Steel sink: 51 cm x 101 cm including C. I. brackets	Each	1				14.11.3(iii)	12.4
8	Providing and fixing Chromium plated Basin Mixer 13 mm. Complete set including connections etc	Each	5				14.11.3(iii)	12.4
9	Providing and fixing C.P. Double bib tap: 13 mm i/d with Muslim shower complete set	Each	2				14.11.4(ii)	12.4
10	Tooth brush holder with tooth paste dish complete with screws	Each	6				14.11.3(iv)	
11	Supply, installation, testing and commissioning for electric water heater instant including piping etc. complete in all respects						14.11.3(viii)	12.4
	Electric Water heater instant 20 Lit	No.	1					
12	Providing and installing brass ferrule assembly for connections including drilling & tapping pipe lines and screwing in pipe lines, connection with internal diameter 25mm	No.	3				14.11.1E	
13	Providing and installing of sluice valves/pressure reducing valves/check valves/air vent valves/wash out valves of approved quality by KITZ (star), TEEPU or equivalent including all fittings Complete in all respects, excluding construction of chamber.						14.11.1B	12.1
	40 mm dia	No.	1					
14	Providing and fixing HDPE water tank by DURA, Super TUFF or equivalent including float valve, making connection of riser and supply lines with overhead water tank. 2000 Liter Capacity	No.	1				14.11.1(D)	

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

II) SEWERAGE								
1	Providing, lowering, laying, cutting, jointing & testing uPVC-Class C Sewer pipe 150 mm dia. Complete in all respects.	m	71				14.11.2(ii)	12.2
2	Providing and fixing White glazed earthen ware water closet European style domestic of best quality (with seat cover). complete in all respect	Each	4				14.11.3(iii)	12.3
3	Providing and fixing White glazed earthen ware water closet squatting type Orissa pattern domestic of best quality. complete in all respect	Each	4				14.11.3(iii)	12.3
4	Providing and fixing Floor trap 100 mm x 50 mm (including 50 mm concrete chamber all round): With UPVC grating	Each	9				14.11.3(iv)	12.3
5	Providing and fixing gully trap including 600 mm x 600 mm block masonry chamber, uPVC grating 150mm and P-trap. Complete as per drawings and specifications.	Each	2			0	14.11.3(iv)	12.3
6	Providing and fixing Toilet paper holders:	Each	6			0	14.11.3(iv)	
7	Providing, laying and jointing µPVC soil, waste & vent pipes pipes class C (BS 3505) including specials (Elbows,Bends & Sockets etc) with appropriate adhesive solution.						14.11.3(v)	12.3
	a) 50 mm i/d	m	5					
	b) 75 mm i/d	m	21					
	c) 100 mm i/d	m	13					
8	Supplying & fixing C.I manhole cover with frame (wt. of cover with frame as per BS EN-124),however excluding construction of in-house manhole..						14.11.2(v)	11.2
	a) 300mm dia cover weighing minimum 12.5kg	Each	10					
	b) 450mm dia cover weighing minimum 25kg		1					
Total of B-1.2								
B-1.3 INTERNAL ELECTRIFICATION WORKS								
1	Supply, Installation, wiring, testing and commissioning of complete internal electrical system/electrification, telephone points, TV cable points, Park Lights sytem and complete earthing & lightning protection system for Primary School including all fixtures, fittings, LV cable from energy meter to DB and system .	Block/ Buildi ng	1				14.12.3	13
2	Supply and installation of following sizes of perforated GI cable tray made cut of 2 mm thick GI sheet, suspended from the ceiling or fixed on wall/column etc complete with suspenders, runners and fixing hard ware etc. as required. (W x H)						14.12.2	
	i) 450mm x 50mm	m	9					
	ii) 300mm x 50mm	m	9					
3	Supply and installation of following sizes of PVC Duct having 2 mm thick, fixed on wall/column etc complete with fixing hard ware etc. as required. (W x H)						14.12.2	13
	i) 50mm x 50mm	m	15					
	ii) 100mm x 50mm	m	9					
	iii) 100mm x 100mm	m	7					

DASU HYDROPOWER PROJECT

BILL-B: SCHOOL BUILDINGS

	iv) 150mm x 100mm	m	7				
	Total of B-1.3						
	Total of Bill-B (B-1.1+B-1.2+B-1.3)						

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS
BILL-C: DISMANTLING (SHAH JAHANABAD)**

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)	Ref. Payment Chapter- Clause	Ref. Tech. Specs. (TS)
				In Figures	In Words			
	CIVIL Dismantling WORKS							
	Concrete Works							
1	a) Dismantling cement concrete plain	m ³	25				14.14	11.13
	b) Dismantling cement concrete reinforced separating reinforcement from concrete cleaning and straightening the same.	m ³	15				14.14	11.13
	Roofing Works							
2	a) Dismantling G.I. Sheet roofing.	m ²	120				14.14	11.13
	b) Stripping and stacking (G. I. Sheet roof).	m ²	120				14.14	11.13
	Plaster Works							
3	Removing cement plaster.	m ²	700				14.14	11.13
	Woodwork							
4	a) Removing door, window and frame.	No.	7				14.14	11.13
	b) Removing ventilators and etc.	No.	3				14.14	11.13
	Stone Masonry Works							
5	Dismantling stone masonry in cement mortar.	m ³	10				14.14	11.13
	Block Masonry Works							
6	Dismantling Block masonry in cement mortar.	m ³	11				14.14	11.13
Total of Dismantling C								

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS**

BILL-D: EARTHWORK (EXCAVATION & FILLING)

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)	Ref. Payment Chapter- Clause	Ref. Tech. Specs. (TS)
				In Figures	In Words			
1	Excavation and dressed to designed section, grades & profiles.						14.2.1(i)	1.2
	a) Soft soil, ordinary soil, hard soil and gravel work	m ³	3,500					
	b) Hard rock and large boulders	m ³	300					
2	Excavation of trenches for water supply pipe lines in all kind of soils, hard, average or soft including trimming, dressing sides, levelling the bed of trenches to correct grade and cutting in pits for joints.	m ³	30				14.2.1(i)	1.2
3	Excavation in open cutting for sewer and manholes, dressing to correct section and dimension according to template and levels in all kind of soils, hard, average or rock.	m ³	55				14.2.1(i)	1.2
4	Lead for disposal of surplus/unsuitable material (for above items 1, 2 & 3) :						14.2.1(ii)	1.2
	(a) 0 to 500m	m ³	3,000					
	(b) 500m to 1km	m ³	700					
5	Filling/backfilling in 150mm thick layers, watering, ramming and compacting selected earth under floors of buildings, trenches or else where.	m ³	150				14.2.2(i)	1.2
6	Compaction of natural ground	m ²	600				14.2.2(iv)	1.2
7	Material Shifting to construction site by a) Hand operated hoists or pulleys manual. b) Manual winches of Cranes. c) Rope and pully systems. d) Hand carts or wheelbarrows. f) Manual Conveyor belts. g) lifting, coolie & donky etc as per ruite and site condition.	Lump Sum					14.2.5	1.2
Total of Bill-C								

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS**

BILL-E: STONE MASONRY WALLS & BOUNDARY WALL

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)	Ref. Payment Chapter- Clause	Ref. Tech. Specs. (TS)
				In Figures	In Words			
1	Plain cement concrete (PCC) 10 Mpa (Class D)	m ³	30				14.3.2	3.4
2	Plain cement concrete (PCC) 20 Mpa (Class B)	m ³	60				14.3.2	3.4
3	Reinforced Cement Concrete Class B (21 Mpa)	m ³	42				14.3.2	3.4
4	Reinforcing steel grade 60, ASTM A615	kg	4284				14.3.4	3.6
5	Precast cement concrete solid block (10Mpa) masonry with C/S mortar 1:6 including scaffolding & curing. Complete in all respects.	m ³	33				14.3.5	3.7
6	Cement sand plaster (1:4) 13 mm thick	m ²	352				14.6	7.3
7	Providing and applying three coats of weather shield paint on external surfaces, preparing the surface, including one primer coat.	m ²	352				14.8.1	9.1
8	Stone Masonry Dressed Coursed with Mortar (C/S 1:4)	m ³	410				14.13.1	4.1
9	uPVC Class C Pipe Dia 100 mm	m	140				14.13.4	12.2
10	Filter Layer of Granular Material	m ³	9				14.13.2	4.2
11	Providing and fixing razor wire fencing having 600mm ring at 150mm centre to centre hanging on 10mm dia MS bar with 40x40x5mm angle iron post. Complete in all respect.	m	130				14.10.2	11.1
12	Providing and erecting steel Main gate including enamel paint 2 coats and primer	Each	1				14.10.3(ii)	11.2
13	Sign Boad above Gate	Each	1				14.10.3(vii)	11.2
14	Supply & placing Geotextile cloth size 300mmx300mm, weight 600gram/m ² behind weep holes. Complete in all respects.	m ²	10				14.13.5	4.3
Total of Bill-E								

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS
BILL-F: TOTAL FOR DAYWORK (PROVISIONAL SUM)**

Item No.	Items of Works	Unit	Quantity	Unit Price (PKR)		Total Amount (PKR)
				In Figures	In Words	
E-1	Schedule of Daywork Rates: 1. Labour					
1	Foreman	Hour	8			
2	Skilled Labour	Hour	8			
3	Unskilled Labour	Hour	8			
4	Mason for Block Work	Hour	16			
5	Mason for Stone Masonry	Hour	8			
6	Carpenter	Hour	8			
7	Steel Fixer	Hour	8			
8	Electrician	Hour	8			
9	Welder	Hour	8			
10	Plumber	Hour	8			
11	Operators (Excavator, Dragline, Dozer with Ripper, Loader, Dumper and Paver etc.)	Hour	16			
12	Painter	Hour	8			
13	Driver for Vehicle (10 tons)	Hour	8			
	Sub-Total					
	Contractor's overhead, profit etc.					
	Total of E-1					
E-2	Schedule of Daywork Rates: 2. Materials					
1	Cement, OPC Or Equivalent in Bags	ton	2			
2	Mild Steel Deformed Reinforcing Bar upto 20mm diameter Grade 60	ton	3			
3	Fine Aggregate for Concrete and Asphalt base / Wearing Course	m ³	5			
4	Coarse Aggregate / Crush	m ³	5			
5	Sand	m ³	5			
	Sub-Total					
	Contractor's overhead, profit etc.					
	Total of E-2					
E-3	Schedule of Daywork Rates: 3. Contractor's Equipment					
1	Excavator (Chain Type):					
	(i) Capacity upto 1 m ³	Hour	8			
	(ii) Capacity 2 m ³ or more	Hour	8			
2	Tractor	Hour	8			
3	Tractor with Trolley	Hour	8			
4	Dumper (18 Ton Capacity)	Hour	8			
5	Loader	Hour	8			
6	Welding Plant	Hour	8			
7	Water Tanker	Hour	8			
	Total of E-3					
Total of Bill-E						

**DASU HYDROPOWER PROJECT
CONSTRUCTION OF SCHOOLS**

BILL-G: SPECIFIED PROVISIONAL SUMS INCLUDED IN SUB-TOTAL OF BILLS

Item No.	Items of Works	Total Amount (PKR)	Ref. Payment
1	Provide and Maintain Survey Equipment	1,000,000	Bill-A
2	Provisional Sum for Adjudicator	1,000,000	Bill-A
3	Provisional Sum for Adjustments for Change in cost under clause 49 of COC	5,000,000	Bill-A
4	Provisional Sum for Physical Contingency	3,000,000	Bill-A
Total of Bill-F (Specified Provisional Sums)		10,000,000	

2. Schedule of Payment Currencies (Not Applicable)

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. The Employer should insert the names of each section of the Works.

	A	B	C	D
Name of Payment Currency	Amount of Currency	Rate of Exchange to Local Currency	Local Currency Equivalent $C = A \times B$	Percentage of Total Bid Price (TBP) $\frac{100 \times C}{TBP}$
Local currency _____		1.00		
Foreign Currency #1 _____				
Foreign Currency #2 _____				
Foreign Currency #3 _____				
Total Bid Price				100.00
Provisional Sums Expressed in Local Currency		1.00		
TOTAL BID PRICE (Including provisional sum)				

3. Schedule(s) of Adjustment Data

Table A - Local Currency

Index code*	Index description*	Source of index*	Base value and date*	Contractor's related currency amount	Contractor's proposed weighting
A	Nonadjustable	—	—	—	A: <u>0.30</u> *
B	Local Labour (Unskilled) (UL)	Monthly Statistical Bulletin, Pakistan Bureau of Statics, Government of Pakistan			B: _____ <u>0.10 to 0.12</u> *
C	Local Labour (Skilled) (L)				C: _____ <u>0.06 to 0.09</u> *
D	Cement (C)				D: _____ <u>0.08 to 0.12</u> *
E	Reinforcing Steel (CS)				E: _____ <u>0.08 to 0.12</u> *
F	Miscellaneous Materials (Local) (ML)				F: _____ <u>0.10 to 0.13</u> *
G	Provision & Maintenance of Contractor's Equipment & Plant				G: _____ <u>0.09 to 0.12</u> *
H	High Speed Diesel (HSD)Plant				H: _____ <u>0.08 to 0.12</u> *
					Total		1.00

[*Whereas “A” should a fixed percentage, B, C, D and E should specify a range of values and the Contractor will be required to specify a value within the range such that the total weighting = 1.00]

- (i) The base cost indices or prices shall be those for the month falling 28 days prior to Bid Submission deadline.
- (ii) For local labour (unskilled), the index shall the minimum wage for unskilled labour as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic, under “Urban Inter-City Consumer Prices of Construction and Energy Items”, for the city of Abbottabad.
- (iii) For local labour (skilled), the index shall the minimum wage for skilled labour Mason as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic, under “Urban Inter-City Consumer Prices of Construction and Energy Items”, for the city of Abbottabad.
- (iv) For cement, the index shall be the cost of one bag (50kg) of cement as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic, under “Urban

- Inter-City Consumer Prices of Construction and Energy Items”, for the city of Abbottabad.
- (v) For reinforcing steel, the index shall be the cost of one tonne of MS Reinforcing Steel ½ inch round bars (Grade 40) as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic, under “Urban Inter-City Consumer Prices of Construction and Energy Items”, for the city of Abbottabad.
 - (vi) For Miscellaneous Material (Local), the index shall be the “National Consumer Price Index (N-CPI)” as given under Price Indices (General) as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic.
 - (vii) For Provision & Maintenance of Contractor’s Equipment and Plant, the index shall be the “National Consumer Price Index (N-CPI)” as given under Price Indices (General) as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic.
 - (viii) For High-Speed Diesel, the index shall be the cost of High-Speed Diesel (HSD) per liter as published in the Monthly Statistical Bulletin, issued by Pakistan Bureau of Statistic, under “Urban Inter-City Consumer Prices of Construction and Energy Items”, for the city of Abbottabad.

Table B - Foreign Currency

Not Applicable

Form of Bid Security (Bank Guarantee)

Beneficiary: _____

Request for Bids No: _____

Date: _____

BID GUARANTEE No.: _____

Guarantor: _____

We have been informed that _____ (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of _____ under Request for Bids No. _____ ("the RFB").

Furthermore, we understand that, according to the Beneficiary's conditions, Bids must be supported by a Bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating either that the Applicant:

- (a) has withdrawn its Bid during the period of Bid validity specified by the Applicant in the Letter of Bid ("the Bid Validity Period"), or any extension thereto provided by the Applicant; or
- (b) having been notified of the acceptance of its Bid by the Beneficiary during the period of Bid validity, (i) fails to execute the contract agreement or (ii) fails to furnish the performance security and, if required, the Environmental, Social, Health and Safety (ESHS) Performance Security, in accordance with the Instructions to Bidders ("ITB") of the Beneficiary's bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the contract agreement signed by the Applicant and the performance security and, if required, the Environmental and Social (ES) Performance Security, issued to the Beneficiary in relation to such contract agreement; and (b) if the Applicant is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Bidding process; or (ii) twenty-eight days after the end of the Bid Validity Period.

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

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

[signature(s)]

Technical Proposal

Technical Proposal Forms

- **Key Personnel Schedule**
- **Equipment**
- **Site Organization**
- **Method Statement**
- **Mobilization Schedule**
- **Construction Schedule**
- **ES Management Strategies and Implementation Plans**
- **Code of Conduct (ES)**
- **Others**

Form PER -1 Key Personnel Schedule

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

Key Personnel

1.	Title of position*:	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
2.	Title of position*:	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
3.	Title of position*:	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
4.	Title of position*:	
	Name of candidate:	
	Duration of appointment:	

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	Time commitment: for this position:	
	Expected time schedule for this position:	
5.	Title of position*:	
	Name of candidate	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	

*As listed in Section III.

Form PER-2: Resume and Declaration - Key Personnel

Name of Bidder

Position [#1]:											
Personnel information	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%; padding: 5px;">Name:</td> <td style="width: 60%; padding: 5px;">Date of birth:</td> </tr> <tr> <td style="padding: 5px;">Address:</td> <td style="padding: 5px;">E-mail:</td> </tr> <tr> <td colspan="2" style="padding: 5px;">Professional qualifications:</td> </tr> <tr> <td colspan="2" style="padding: 5px;">Academic qualifications:</td> </tr> <tr> <td colspan="2" style="padding: 5px;">Language proficiency:</td> </tr> </table>	Name:	Date of birth:	Address:	E-mail:	Professional qualifications:		Academic qualifications:		Language proficiency:	
Name:	Date of birth:										
Address:	E-mail:										
Professional qualifications:											
Academic qualifications:											
Language proficiency:											
details	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="padding: 5px;">Address of employer:</td> </tr> <tr> <td style="width: 45%; padding: 5px;">Telephone:</td> <td style="padding: 5px;">Contact (manager / personnel officer):</td> </tr> <tr> <td style="padding: 5px;">Fax:</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">Job title:</td> <td style="padding: 5px;">Years with present employer:</td> </tr> </table>	Address of employer:		Telephone:	Contact (manager / personnel officer):	Fax:		Job title:	Years with present employer:		
Address of employer:											
Telephone:	Contact (manager / personnel officer):										
Fax:											
Job title:	Years with present employer:										

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

Project	Role	Duration of involvement	Relevant experience

Declaration

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

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

Commitment	Details
Commitment to duration of contract:	
Time commitment:	

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

- (a) be taken into consideration during Bid evaluation;
- (b) my disqualification from participating in the Bid;
- (c) my dismissal from the contract.

Name of Key Personnel:

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Bidder:

Signature: _____

Date: (day month year): _____

Form EQU: Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III (Evaluation and Qualification Criteria). A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder. The Bidder shall provide all the information requested below, to the extent possible. Fields with asterisk (*) shall be used for evaluation.

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

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

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

Site Organization (Form TP-1)

[Insert Site Organization Information]

- (a) Bidders should consider submission of Organization Charts and Manning Schedules reflecting a combined site organization chart with supporting functions which should indicate in the head office organization, site organization and all partners and subcontractors.*
- (b) The Manning schedule of Key Personnel shall be based on the individuals indicated in Forms PER-1 and PER-2*

Method Statement (Form TP-2)

[Insert Method Statement]

(a) *Bidders shall prepare the provision of their Methods Statements incorporating inter-alia, the following*

1. *Method Statements for each part of the Works*
2. *Material Procurement*
3. *Project Quality Plan*
4. *Progress Control*
5. *Safety and Security Control Plan*
6. *Environment Protection Policy*
7. *Sequencing of Works*

(b) *Among the above, “Method Statements for each part of the Works” Bidders should consider:*

1. *Clear description of the method that the Bidder proposes to adopt for the execution of all Sections and parts of the Works.*
2. *Demonstration in sufficient detail the Bidder’s understanding of the scope of the Works and all relevant requirements of the Bid Documents.*
3. *Bidder’s should consider, inter-alia, the following*
 - i. *Mobilization; construction of contractors camp accommodation, temporary huts and offices, , , concrete production facilities including aggregates,etc;*
 - ii. *Building Construction; excavation works, concrete work; handling and placing methods, sequences, formwork details, dewatering system etc. Architectural and utility works, general construction details;*

The Bidder shall indicate his proposals for Temporary Facilities and First Aid Stations to be located at individual work site. All proposed activities by the Bidder should complement the Construction Methods and Construction Time Schedule

Mobilization Schedule (Form TP-3)

[Insert Mobilization Schedule]

- (a) *The Bidder should consider submission of a mobilization schedule for Site mobilization; construction of Contractor's temporary facilities and Site Investigations any other enabling facilities or works prior to execution of the Permanent Works.*

Construction Schedule (Form TP-4)

[Insert Construction Schedule]

- (a) *The submitted Construction Schedule should take due account of the Contractor's obligations to coordinate and plan the work: (i) to accommodate the requirements of the Other Contractors engaged by the Employer upon the other Lots under the Project, (ii) to meet the stipulated Time for Completion for the whole of the Works and the Time for Completion of the various parts of the Works, and (iii) to accommodate the requirements of the Contract, with due consideration on relevant information provided in Bid Documents including the Defects Notification Period. The schedule shall include*
- a) Network drawings;*
 - b) Tabular listings of early starts and finishes, late starts and finishes, free and total floats;*
 - c) Computer generated bar charts, defining the Critical Path*
 - d) Periods required for work carried out by other contractors*
 - e) Periods required for work carried out by sub-contractors;*
 - f) Information on shutdown periods, vacation day, and other non-working time periods;
and*
 - g) Schedule of equipment and plant and manpower mobilization schedule.*
- (b) *The Schedule may be computer based using Microsoft Project or equivalent.*

ES Management Strategies and Implementation Plans (ES-MSIP)

The Bidder shall submit comprehensive and concise Environmental and Social Management Strategies and Implementation Plans (ES-MSIP) as required by ITB 11.1 (i) of the Bid Data Sheet. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

In developing these strategies and plans, the Bidder shall have regard to the ES provisions of the contract including those as may be more fully described in the Works Requirements in Section VII.

- These Management Strategies and Implementation Plans shall collectively comprise the Construction Environmental Action Plan (CEAP). The Bidder shall submit CEAP comprising Site specific sediment and erosion control plan for each construction site and quarry;
- Site specific camps management plan for each camp;
- Spoil management and disposal plan for each site;
- Waste management plan for each construction site and quarry;
- Site specific pollution control (water, air, noise) plan for each construction site and quarry;
- Site specific traffic management plan for each construction site and quarry;
- Site specific decommissioning and landscaping plans for quarry sites, spoil disposal sites, temporary roads and other disturbed areas;
- Complaints logging system and response plan;
- Standard Operating Procedures for pollution spills, and management of fuels and hazardous goods; and
- Demobilization plan after completion of works

The above mentioned plans shall address but not limited to the following respective ES implementation strategies/risks:

- Landslide
- Erosion
- Wastewater quality
- Air Quality (dust, smoke)
- Operation of quarry sites
- Emissions from plant and equipment
- Noise
- Waste Management
- Spills from Hydrocarbon and chemical storage
- Local Roads
- Chance Find
- Drinking water
- Sanitation
- Sewerage
- Reinstatement of Work Sites

- Construction yards
- Construction camps

The implementation strategies shall include personnel involve and their roles and responsibilities, monitoring frequency and reporting mechanism.

It shall be mandatory for the Contractor to include these strategies and implementation plans in sub-contracts (if any).

Code of Conduct for Contractor's Personnel (ES) Form (Form TP-6)

Note to the Bidder:

The minimum content of the Code of Conduct form as set out by the Employer shall not be substantially modified. However, the Bidder may add requirements as appropriate, including to take into account Contract-specific issues/risks.

The Bidder shall initial and submit the Code of Conduct form as part of its bid.

CODE OF CONDUCT FOR CONTRACTOR'S PERSONNEL

We are the Contractor, [*enter name of Contractor*]. We have signed a contract with [*enter name of Employer*] for [*enter description of the Works*]. These Works will be carried out at [*enter the Site and other locations where the Works will be carried out*]. Our contract requires us to implement measures to address environmental and social risks related to the Works, including the risks of sexual exploitation, sexual abuse and sexual harassment.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the Works. It applies to all our staff, laborers and other employees at the Works Site or other places where the Works are being carried out. It also applies to the personnel of each subcontractor and any other personnel assisting us in the execution of the Works. All such persons are referred to as "**Contractor's Personnel**" and are subject to this Code of Conduct.

This Code of Conduct identifies the behavior that we require from all Contractor's Personnel.

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
3. maintain a safe working environment including by:
 - a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;

- b. wearing required personal protective equipment;
 - c. using appropriate measures relating to chemical, physical and biological substances and agents; and
 - d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
 5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
 6. not engage in Sexual Harassment, which means unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
 7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;
 8. not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
 9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
 10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH);
 11. report violations of this Code of Conduct; and
 12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert with relevant experience in handling gender-based violence, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters*] in writing at this address [] or by telephone at [] or in person at [];
or
2. Call [] to reach the Contractor's hotline (*if any*) and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be

submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact [*enter name of Contractor's contact person with relevant experience*] requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date: (day month year): _____

ATTACHMENT 1: Behaviors constituting Sexual Exploitation and Abuse (SEA) and behaviors constituting Sexual Harassment (SH)

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

BEHAVIORS CONSTITUTING SEXUAL EXPLOITATION AND ABUSE (SEA) AND BEHAVIORS CONSTITUTING SEXUAL HARASSMENT (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors:

(1) **Examples of sexual exploitation and abuse** include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.
- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favor.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) **Examples of sexual harassment in a work context**

- Contractor's Personnel comment on the appearance of another Contractor's Personnel (either positive or negative) and sexual desirability.
- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's or Employer's Personnel by another Contractor's Personnel.
- A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.

Bidder's Qualification

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

Form ELI -1.1: Bidder Information Form

Date: _____

RFB Title: DASU-RS-02 Construction of GBPS Looter and
Rehabilitation of GBPS Shah Jahanabad

Page _____ of _____ pages

Bidder's name
In case of Joint Venture (JV), name of each member:
Bidder's actual or intended country of registration: <i>[indicate country of Constitution]</i>
Bidder's actual or intended year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4. <input type="checkbox"/> In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1. <input type="checkbox"/> In case of state-owned enterprise or institution, in accordance with ITB 4.6 documents establishing: <ul style="list-style-type: none">• Legal and financial autonomy• Operation under commercial law• Establishing that the Bidder is not under the supervision of the Employer
2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -1.2: Information Form for JV Bidders

(to be completed for each member of Joint Venture)

Date: _____

RFB No. and title: DASU-RS-02 Construction of GBPS Looter and
Rehabilitation of GBPS Shah Jahanabad

Page _____ of _____ pages

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

Form CON – 2: Historical Contract Non-Performance, Pending Litigation and Litigation History

Bidder's Name: _____

Date: _____

Joint Venture Member's Name _____

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Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> Contract non-performance did not occur since 1 st January 2019 <input type="checkbox"/> Contract(s) not performed since 1 st January 2019			
Year	Non-performed portion of contract	Contract Identification	Total Contract Amount PKR
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: Name of Employer: Address of Employer: Reason(s) for nonperformance:	
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No pending litigation <input type="checkbox"/> Pending litigation			

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Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount PKR
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	
Litigation History in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No Litigation History <input type="checkbox"/> Litigation History			
Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (PKR)
<i>[insert year]</i>	<i>[insert percentage]</i>	Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: <i>[indicate "Employer" or "Contractor"]</i> Reason(s) for Litigation and award decision	<i>[insert amount]</i>

Form CON – 3: Environmental and Social Performance Declaration

Bidder's Name: _____

Date: _____

Joint Venture Member's Name: _____

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Environmental and Social Performance Declaration
in accordance with Section III, Qualification Criteria, and Requirements

- No suspension or termination of contract:** An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5.
- Declaration of suspension or termination of contract:** The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental, or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. Details are described below:

Year	Suspended or terminated portion of contract	Contract Identification	Total Contract Amount (PKR),
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: Name of Employer: Address of Employer: Reason(s) for suspension or termination: <i>[indicate main reason(s) e.g. for gender-based violence; sexual exploitation or sexual abuse breaches]</i>	
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: Name of Employer: Address of Employer: Reason(s) for suspension or termination: <i>[indicate main reason(s)]</i>	
...	...	<i>[list all applicable contracts]</i>	

Performance Security called by an employer(s) for reasons related to ESHS performance

Year	Contract Identification	Total Contract Amount (PKR),
<i>[insert year]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i>	

Form CON – 4 Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration

[The following table shall be filled in by the Bidder, each member of a Joint Venture and each subcontractor proposed by the Bidder]

Bidder's Name: *[insert full name]*

Date: *[insert day, month, year]*

Joint Venture Member's or Subcontractor's Name: *[insert full name]*

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SEA and/or SH Declaration in accordance with Section III, Evaluation and Qualification Criteria
<p>We:</p> <ul style="list-style-type: none"><input type="checkbox"/> (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations<input type="checkbox"/> (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations<input type="checkbox"/> (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor.<input type="checkbox"/> (d) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently demonstrated that we have adequate capacity and commitment to comply with SEA/ SH obligations.<input type="checkbox"/> (e) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached evidence demonstrating that we have adequate capacity and commitment to comply with SEA/ SH obligations.
<p><i>[If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]</i></p>
<p><i>[If (d) or (e) above are applicable, provide the following information:]</i></p>
<p>Period of disqualification: From: _____ To: _____</p>
<p>If previously provided on another Bank financed works contract, details of evidence that demonstrated adequate capacity and commitment to comply with SEA/ SH obligations (as per (d) above)</p> <p>Name of Employer: _____</p> <p>Name of Project: _____</p> <p>Contract description: _____</p> <p>Brief summary of evidence provided:</p>

<hr/> <hr/> <hr/> <p>Contact Information: (Tel, email, name of contact person):</p> <hr/> <hr/> <hr/>
<p>As an alternative to the evidence under (d), other evidence demonstrating adequate capacity and commitment to comply with SEA/ SH obligations (as per (e) above) <i>[attach details as appropriate]</i>.</p>

Form CCC: Current Contract Commitments / Works in Progress

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

Name of contract	Employer, contact address/tel/fax	Value of outstanding work PKR	Estimated completion date	Average monthly invoicing over last six months (PKR/month)
1.				
2.				
3.				
4.				
5.				
etc.				

Form FIN – 3.1: Financial Situation and Performance

Bidder's Name: _____

Date: _____

Joint Venture Member's Name _____

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1. Financial data

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

2. Sources of Finance

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

No.	Source of finance	Amount (PKR)
1		
2		
3		

3. Financial documents

The Bidder and its parties shall provide copies of financial statements for **three (03)** years pursuant to Section III, Evaluation and Qualifications Criteria, Sub-factor 3.2. The financial statements shall:

- (a) reflect the financial situation of the Bidder or in case of JV member, and not an affiliated entity (such as parent company or group member).
- (b) be independently audited or certified in accordance with local legislation.
- (c) be complete, including all notes to the financial statements.
- (d) correspond to accounting periods already completed and audited.

Attached are copies of financial statements¹ for the _____ years required above; and complying with the requirements

¹ If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, the reason for this should be justified.

Form FIN - 3.3: Financial Resources

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

Source of financing	Amount (PKR)
1.	
2.	
3.	
4.	

Gross Total = _____

Less Current Commitments = _____

Net Financial Resources = _____

Form EXP - 4.1: General Construction Experience

Bidder's Name: _____

Date: _____

Joint Venture Member's Name: _____

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

Form EXP - 4.2(a): Specific Construction and Contract Management Experience

Bidder's Name: _____

Date: _____

Joint Venture Member's Name: _____

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Similar Contract No.	Information			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor <input type="checkbox"/>	Member in JV <input type="checkbox"/>	Management Contractor <input type="checkbox"/>	Sub- contractor <input type="checkbox"/>
Total Contract Amount in PKR				
If member in a JV or subcontractor, specify participation in total Contract amount				
Employer's Name:				
Address:				
Telephone/fax number				
E-mail:				

Form EXP - 4.2(a) Specific Construction and Contract Management Experience (cont.)

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

Form EXP - 4.2(b): Construction Experience in Key Activities

Bidder's Name: _____

Date: _____

Joint Venture Member's Name _____

Subcontractor's Name² (as per ITB 34.2 and 34.3): _____

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Subcontractor's Name (as per ITB 34.2 and 34.3): _____

All subcontractors for key activities must complete the information in this form as per ITB 34.2 and 34.3 and Section III, Qualification Criteria and Requirements, Sub-Factor 4.2.

1. Key Activity: **Brick/block masonry 800 m³**

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

² If applicable.

Note: Evidence in the form proving 800 m³ brick/block masonry.

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Address: Telephone/fax number E-mail:	
---	--

	Information
Employer's Name:	
Address: Telephone/fax number E-mail:	

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

Form EXP - 4.2(c): Specific Experience in Managing ES aspects

Bidder's Name: _____

Date: _____

Bidder's JV Member Name: _____

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1. Key Requirement no 1 in accordance with 4.2 (c): _____

Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor <input type="checkbox"/>	Member in JV <input type="checkbox"/>	Management Contractor <input type="checkbox"/>	Subcontractor <input type="checkbox"/>
Total Contract Amount				
Details of relevant experience				

SECTION-V

ELIGIBLE COUNTRIES

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Services in Bank-Financed Procurement

In reference to ITB 4.8, and 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process:

Under ITB 4.8 (a) and 5.1 The country with which Government of Islamic Republic of Pakistan prohibits the commercial relations.

Under ITB 4.8 (b) and 5.1 “None”

SECTION-VI

FRAUD AND CORRUPTION

Section VI - Fraud and Corruption

(Section VI shall not be modified)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

- a. Defines, for the purposes of this provision, the terms set forth below as follows:
 - i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
 - ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
 - iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
 - iv. "coercive practice" is 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;
 - v. "obstructive practice" is:
 - (a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or 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
 - (b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

- b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;
- c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring mis-procurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;
- d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;¹ (ii) to be a nominated² sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;
- e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect³ all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

¹ For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

² A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which 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 allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

³ Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

**SECTION VIII –
GENERAL CONDITIONS OF CONTRACT**

General Conditions (GC)

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

PROCUREMENT OF WORKS

CONSTRUCTION OF GBPS LOOTER AND REHABILITATION OF GBPS SHAH JAHANABAD
NCB NO. DASU-RS-02

Section VIII - General Conditions of Contract

These General Conditions of Contract (GCC), read in conjunction with the Particular Conditions of Contract (PCC) and other documents listed therein, should be a complete document expressing fairly the rights and obligations of both parties.

These General Conditions of Contract have been developed on the basis of considerable international experience in the drafting and management of contracts, bearing in mind a trend in the construction industry towards simpler, more straightforward language.

The GCC can be used for both smaller admeasurement contracts and lump sum contracts.

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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 23.
 - (d) **Bank** means the financing institution **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 Clause 42 hereunder.
 - (g) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC Sub-Clause 57.1.
 - (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 Sub-Clause 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 **named in the PCC** pursuant to GCC Sub-Clause 38.1 and calculated from the Completion Date.

- (q) **Drawings** means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract, 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) **"In writing"** or **"written"** means hand-written, type-written, printed or electronically made, and resulting in a permanent record;
- (u) The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.
- (v) 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.
- (w) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.
- (x) **Plant** is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.
- (y) 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.
- (z) **PCC** means Particular Conditions of Contract.
- (aa) The **Site** is the area defined as such in the PCC.
- (bb) **Site Investigation Reports** are those that were included in the bidding document and are factual and interpretative reports about the surface and subsurface conditions at the Site.
- (cc) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.
- (dd) 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.
- (ee) 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.
- (ff) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed

for construction or installation of the Works.

- (gg) A **Variation** is an instruction given by the Project Manager which varies the Works.
- (hh) The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the PCC.
- (ii) “**Contractor’s Personnel**” refers to all personnel whom the Contractor utilizes on the Site or other places where the Works are carried out, including the staff, labor and other employees of each Subcontractor.
- (jj) “**Key Personnel**” means the positions (if any) of the Contractor’s personnel that are stated in the Specification.
- (kk) “**ES**” means Environmental and Social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH));
- (ll) “**Sexual Exploitation and Abuse**” “**(SEA)**” means the following:

Sexual Exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another. In Bank financed operations/projects, sexual exploitation occurs when access to or benefit from a Bank financed Goods, Works, Non-consulting Services or Consulting Services is used to extract sexual gain;

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
- (mm) “**Sexual Harassment**” “**(SH)**” is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor’s Personnel with other Contractor’s or Employer’s Personnel; and
- (nn) “**Employer’s Personnel**” refers to the Project Manager and all other staff, labor and other employees (if any) of the Project Manager and of the Employer engaged in fulfilling the Employer’s obligations under the Contract; and any other personnel identified as Employer’s Personnel, by a notice from the Employer or the Project Manager to the Contractor.

2. Interpretation

- 2.1 In interpreting these GCC, words indicating one gender include all genders. Words indicating the singular also include the plural and words indicating the plural also include the singular. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.
- 2.2 If sectional completion is **specified in the PCC**, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than

references to the Completion Date and Intended Completion Date for the whole of the Works).

- 2.3 The documents forming the Contract shall be interpreted in the following order of priority:
- (a) Agreement,
 - (b) Letter of Acceptance,
 - (c) Contractor's Bid,
 - (d) Particular Conditions of Contract,
 - (e) General Conditions of Contract, including Appendices,
 - (f) Specification,
 - (g) Drawings,
 - (h) Bill of Quantities,¹⁹ and
 - (i) any other document **listed in the PCC** as forming part of the Contract.

3. Language and Law

- 3.1 The language of the Contract and the law governing the Contract are **stated in the PCC**.
- 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
- (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country; or
 - (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's Country prohibits any import of goods from that country or any payments to any country, person, or entity in that country.

4. Project Manager's Decisions

- 4.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. Delegation

- 5.1 Unless otherwise **specified in the PCC**, the Project Manager may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may revoke any delegation after notifying the Contractor.

6. Communications

- 6.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.

7. Subcontracting

- 7.1 The Contractor may subcontract 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. The Contractor shall require that its Subcontractors execute the Works in accordance with the Contract,

¹⁹ In lump-sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule."

including complying with the relevant ES requirements and the obligations set out in Sub-Clause 28.1.

7.2 Submission by the Contractor for approval of the Project Manager, addition of any Subcontractor not named in the Contract, shall also include the Subcontractor's declaration in accordance with Appendix C- Sexual exploitation and Abuse (SEA) and/or Sexual Harassment (SH) Performance Declaration

**8. Other
Contractors**

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as **referred to in the PCC**. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

8.2 The Contractor shall also, as stated in the Specification or as instructed by the Project Manager, cooperate with and allow appropriate opportunities for the Employer's or any other personnel, notified to the Contractor by the Employer or Project Manager, to conduct any environmental and social assessment.

9. Personnel and Equipment

- 9.1 The Contractor shall employ the Key Personnel and use the Equipment identified in its Bid, to carry out the Works or other personnel and Equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of Key Personnel and Equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.
- 9.2 The Project Manager may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Key Personnel (if any), who:
- (a) persists in any misconduct or lack of care;
 - (b) carries out duties incompetently or negligently;
 - (c) fails to comply with any provision of the Contract;
 - (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment;
 - (e) based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution of the Works;
 - (f) has been recruited from the Employer's Personnel;
 - (g) undertakes behavior which breaches the Code of Conduct for Contractor's Personnel (ES).

If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience.

Notwithstanding any requirement from the Project Manager to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Works are being carried out, any Contractor's Personnel who engages in (a), (b), (c), (d), (e) or (g) above or has been recruited as stated in (f) above.

- 9.3 The Contractor shall take all necessary safety measures to avoid the occurrence of incidents and injuries to any third party, associated with the use of, if any, Equipment on public roads or other public infrastructure. The Contractor shall monitor road safety incidents and accidents to identify negative safety issues, and establish and implement necessary measures to resolve them.

9.4 Labor

- 9.4.1 *Engagement of Staff and Labor.* The Contractor shall provide and employ on the Site for the execution of the Works such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor with appropriate qualifications and experience from sources within the Country. Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, transportation, accommodation and welfare facilities in accordance with GCC Sub-Clause 9.4.6, of the Contractor's Personnel, and for all payments in connection therewith.

The Contractor shall provide the Contractor's Personnel information and documentation that are clear and understandable regarding their terms and conditions of employment. The information and documentation shall set out their rights under

- 10. Employer's and Contractor's Risks** 10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.
- 11. Employer's Risks** 11.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Employer's risks:
- (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to
 - (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or
 - (ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.
 - (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.
- 11.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer's risk except loss or damage due to
- (a) a Defect which existed on the Completion Date,
 - (b) an event occurring before the Completion Date, which was not itself an Employer's risk, or
 - (c) the activities of the Contractor on the Site after the Completion Date.
- 12. Contractor's Risks** 12.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.
- 13. Insurance** 13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles **stated in the PCC** for the following events which are due to the Contractor's risks:
- (a) loss of or damage to the Works, Plant, and Materials;
 - (b) loss of or damage to Equipment;
 - (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and
 - (d) personal injury or death.
- 13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for

compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

- 13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may 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.
- 13.4 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager.
- 13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Data

- 14.1 The Contractor shall be deemed to have examined any Site Data **referred to in the PCC**, supplemented by any information available to the Contractor.

15. Contractor to Construct the Works

- 15.1 The Contractor shall construct and install the Works in accordance with the Specification and Drawings.
- 15.2 If the Contract specifies that the Contractor shall design any part of the permanent Works, the Contractor shall take into the Employer's requirements which may include, if stated in the Specification:
- (a) designing structural elements of the Works taking into account climate change considerations;
 - (b) applying the concept of universal access (the concept of universal access means unimpeded access for people of all ages and abilities in different situations and under various circumstances; and
 - (c) considering the incremental risks of the public's potential exposure to operational accidents or natural hazards, including extreme weather events.

16. The Works to Be Completed by the Intended Completion Date

- 16.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.
- 16.2 The Contractor shall not carry out mobilization to the Site unless the Project Manager gives approval, an approval that shall not be unreasonably delayed, to the measures the Contractor proposes to address environmental and social risks and impacts, which at a minimum shall include applying the Management Strategies and Implementation Plans (MSIPs) and Code of Conduct for Contractor's Personnel submitted as part of the Bid and agreed as part of the Contract.

The Contractor shall submit, to the Project Manager for its approval any additional MSIPs as are necessary to manage the ES risks and impacts of ongoing Works. These MSIPs collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP). The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to

ensure that it contains measures appropriate to the Works. The updated C-ESMP shall be submitted to the Project Manager for its approval.

17. Approval by the Project Manager

- 17.1 The Contractor shall submit Specification and Drawings showing the proposed Temporary Works to the Project Manager, for his approval.
- 17.2 The Contractor shall be responsible for design of Temporary Works.
- 17.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.
- 17.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.
- 17.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

18. Health, Safety and Protection of the Environment

- 18.1 The Contractor shall be responsible for the safety of all activities on the Site.
- 18.2 The Contractor shall:
 - (a) comply with all applicable health and safety regulations and Laws;
 - (b) comply with all applicable health and safety obligations specified in the Contract;
 - (c) take care for the health and safety of all persons entitled to be on the Site and other places, if any, where the Works are being executed;
 - (d) keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons;
 - (e) provide fencing, lighting, safe access, guarding and watching of the Works until the issue of the Contract Certificate of Completion;
 - (f) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land;
 - (g) provide health and safety training of Contractor's Personnel as appropriate and maintain training records;
 - (h) actively engage the Contractor's Personnel in promoting understanding, and methods for, implementation of health and safety requirements, as well as in providing information to Contractor's Personnel, training on occupational safety and health, and provision of personal protective equipment without expense to the Contractor's Personnel;
 - (i) put in place workplace processes for Contractor's Personnel to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent

and serious danger to their life or health;

- (j) Contractor's Personnel who remove themselves from such work situations shall not be required to return to work until necessary remedial action to correct the situation has been taken. Contractor's Personnel shall not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal;
- (k) where the Employer's Personnel, any other contractors employed by the Employer, and/or personnel of any legally constituted public authorities and private utility companies are employed in carrying out, on or near the site, of any work not included in the Contract, collaborate in applying the health and safety requirements, without prejudice to the responsibility of the relevant entities for the health and safety of their own personnel; and
- (l) establish and implement a system for regular (not less than six-monthly) review of health and safety performance and the working environment.

Subject to GCC Sub-Clause 16.2, the Contractor shall submit to the Project Manager for its approval a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works.

The health and safety manual shall be in addition to any other similar document required under applicable health and safety regulations and laws.

The health and safety manual shall set out all the health and safety requirements under the Contract,

(a) which shall include at a minimum:

- (i) the procedures to establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the Contractor, including control measures for chemical, physical and biological substances and agents;
- (ii) details of the training to be provided, records to be kept;
- (iii) the procedures for prevention, preparedness and response activities to be implemented in the case of an emergency event (i.e. an unanticipated incident, arising from both natural and man-made hazards, typically in the form of fire, explosions, leaks or spills, which may occur for a variety of different reasons including failure to implement operating procedures that are designed to prevent their occurrence, extreme weather or lack of early warning);
- (iv) remedies for adverse impacts such as occupational injuries, deaths, disability and disease;
- (v) the measures to be taken to avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases,
- (vi) the measures to be implemented to avoid or minimize

the spread of communicable diseases (including transfer of Sexually Transmitted Diseases or Infections (STDs), such as HIV virus) and non-communicable diseases associated with the execution of the Works, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups. This includes taking measures to avoid or minimize the transmission of communicable diseases that may be associated with the influx of temporary or permanent Contract-related labor;

- (vii) the policies and procedures on the management and quality of accommodation and welfare facilities if such accommodation and welfare facilities are provided by the Contractor in accordance with GCC Sub-Clause 9.4.6; and

- (b) any other requirements stated in the Specification.

18.3 Protection of the environment

- (a) The Contractor shall take all necessary measures to: protect the environment (both on and off the Site); and
- (b) limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities.

The Contractor shall ensure that emissions, surface discharges, effluent and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Specification, nor those prescribed by applicable laws.

In the event of damage to the environment, property and/or nuisance to people, on or off Site as a result of the Contractor's operations, the Contractor shall agree with the Project Manager the appropriate actions and time scale to remedy, as practicable, the damaged environment to its former condition. The Contractor shall implement such remedies at its cost to the satisfaction of the Project Manager.

19. Archaeological and Geological Findings

19.1 All fossils, coins, articles of value or antiquity, structures, groups of structures, and other remains or items of geological, archaeological, paleontological, historical, architectural or religious interest found on the Site shall be placed under the care and custody of the Employer. The Contractor shall:

- (a) take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's Personnel or other persons from removing or damaging any of these findings;
- (b) train relevant Contractor's Personnel on appropriate actions to be taken in the event of such findings; and
- (c) implement any other action consistent with the requirements of the Specification and relevant laws.

The Contractor shall, as soon as practicable after discovery of any such finding, notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

20. Possession of

20.1 The Employer shall give possession of all parts of the Site to the

- 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.
- 21. Access to the Site** 21.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager (including the Bank staff or consultants acting on the Bank's behalf, stakeholders and third parties, such as independent experts, local communities, or non-governmental organizations), including to carry out environmental and social audit, as appropriate, access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.
- 22. Instructions, Inspections and Audits** 22.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.
- 22.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub-consultants to keep, accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.
- 22.3 Inspections & Audit by the Bank
- Pursuant to paragraph 2.2 e. of Appendix A to the GCC- Fraud and Corruption, the Contractor shall permit and shall cause its agents (where declared or not), subcontractors, sub-consultants, service providers, suppliers, and personnel, to permit, the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank. The Contractor's and its Subcontractors' and sub-consultants' attention is drawn to GCC Sub-Clause 25.1 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).
- 23. Appointment of the Adjudicator** 23.1 The Adjudicator shall be appointed jointly by the Employer and the Contractor, at the time of the Employer's issuance of the Letter of Acceptance. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority **designated in the PCC**, to appoint the Adjudicator within 14 days of receipt of such request.
- 23.2 Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract, a new Adjudicator shall be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority **designated in the PCC** at the request of either party, within 14 days of receipt of such request.

- 24. Procedure for Disputes**
- 24.1 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.
- 24.2 The Adjudicator shall give a decision in writing within 28 days of receipt of a notification of a dispute.
- 24.3 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 within 28 days of the Adjudicator’s written decision. If neither party refers the dispute to arbitration within the above 28 days, the Adjudicator’s decision shall be final and binding.
- 24.4 The arbitration shall be conducted in accordance with the arbitration procedures published by the institution named and in the place **specified in the PCC**.
- 25. Fraud and Corruption**
- 25.1 The Bank requires compliance with the Bank’s Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG’s Sanctions Framework, as set forth in Appendix A to the GCC.
- 25.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.
- 26. Stakeholder Engagement**
- 26.1 The Contractor shall provide relevant contract-related information, as the Employer and/or Project Manager may reasonably request to conduct Stakeholder engagements. “Stakeholder” refers to individuals or groups who:
- (i) are affected or likely to be affected by the Contract; and
 - (ii) may have an interest in the Contract.
- The Contractor may also directly participate in Stakeholder engagements, as the Employer and/or Project Manager may reasonably request.
- 27. Suppliers (other than Subcontractors)**
- 27.1 **Forced Labor:** The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage forced labor including trafficked persons as described in GCC Sub-Clause 9.4.14. If forced labor/trafficking cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.
- 27.2 **Child Labor:** The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage child

labor as described in GCC Sub-Clause 9.4.15. If child labor cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

27.3 *Serious Safety Issues:* The Contractor, including its Subcontractors, shall comply with all applicable safety obligations, including as stated in GCC Sub-Clause 18.2. The Contractor shall also take measures to require its suppliers (other than Subcontractors) to adopt procedures and mitigation measures adequate to address safety issues related to their personnel. If serious safety issues are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

27.4 *Obtaining natural resource materials in relation to supplier:* The Contractor shall obtain natural resource *materials* from suppliers that can demonstrate, through compliance with the applicable verification and/ or certification requirements, that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats such as unsustainably harvested wood products, gravel or sand extraction from river beds or beaches.

If a supplier cannot continue to demonstrate that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to demonstrate that they are not significantly adversely impacting the habitats.

28. Code of Conduct

28.1 The Contractor shall have a Code of Conduct for the Contractor's Personnel.

The Contractor shall take all necessary measures to ensure that each Contractor's Personnel is made aware of the Code of Conduct including specific behaviors that are prohibited, and understands the consequences of engaging in such prohibited behaviors.

These measures include providing instructions and documentation that can be understood by the Contractor's Personnel and seeking to obtain that person's signature acknowledging receipt of such instructions and/or documentation, as appropriate.

The Contractor shall also ensure that the Code of Conduct is visibly displayed in multiple locations on the Site and any other place where the Works will be carried out, as well as in areas outside the Site accessible to the local community and project affected people. The posted Code of Conduct shall be provided in languages comprehensible to Contractor's Personnel, Employer's Personnel and the local community.

The Contractor's Management Strategy and Implementation Plans shall include appropriate processes for the Contractor to verify compliance with these obligations.

29. Security of the Site

- 29.1 The Contractor shall be responsible for the security of the Site, and:
- (a) for keeping unauthorized persons off the Site;
 - (b) authorized persons shall be limited to the Contractor's Personnel, the Employer's Personnel, and to any other personnel identified as authorized personnel (including the Employer's other contractors on the Site), by a notice from the Employer or the Project Manager to the Contractor.

Subject to GCC Sub-Clause 16.2, the Contractor shall submit for the Project Manager's No-objection a security management plan that sets out the security arrangements for the Site.

The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct towards Contractor's Personnel, Employer's Personnel and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Specification.

The Contractor shall not permit any use of force by security personnel in providing security except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.

In making security arrangements, the Contractor shall also comply with any additional requirements stated in the Specifications

B. Time Control

30. Program and Progress Reports

- 30.1 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. 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.
- 30.2 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.
- 30.3 The Contractor shall monitor progress of the Works and submit to the Project manager progress report and any updated Program showing the actual progress achieved and the effect of the progress achieved on the timing of the remaining Works, including any changes to the sequence of the activities, at intervals no longer than the periods **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 lump-sum Contract, the Contractor shall provide an updated Activity Schedule within 14 days of being instructed to by the Project Manager.

30.4 Unless otherwise stated in the Specification, each progress report shall include the Environmental and Social (ES) metrics set out in Appendix B.

30.5 In addition to the progress reports, the Contractor shall inform the Project Manager immediately of any allegation, incident or accident in the Site, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's Personnel. This includes, but is not limited to, any incident or accident causing fatality or serious injury; significant adverse effects or damage to private property; or any allegation of SEA and/or SH. In case of SEA and/or SH, while maintaining confidentiality as appropriate, the type of allegation (sexual exploitation, sexual abuse or sexual harassment), gender and age of the person who experienced the alleged incident should be included in the information.

The Contractor, upon becoming aware of the allegation, incident or accident, shall also immediately inform the Project Manager of any such incident or accident on the Subcontractors' or suppliers' premises relating to the Works which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel, or Contractor's, its Subcontractors' and suppliers' personnel. The notification shall provide sufficient detail regarding such incidents or accidents. The Contractor shall provide full details of such incidents or accidents to the Project Manager within the timeframe agreed with the Project Manager.

The Contractor shall require its Subcontractors and suppliers (other than Subcontractors) to immediately notify the Contractor of any incidents or accidents referred to in this Sub-clause.

31. Extension of the Intended Completion Date

31.1 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.

31.2 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.

32. Acceleration

32.1 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.

32.2 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.

33. Delays Ordered by the Project Manager

33.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

34. Management Meetings

34.1 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.

34.2 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.

35. Early Warning

35.1 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.

35.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.

C. Quality Control

36. Identifying Defects

36.1 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.

37. Tests

37.1 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.

38. Correction of Defects

38.1 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.

38.2 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.

39. Uncorrected Defects

39.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

D. Cost Control

40. Contract Price²⁰

40.1 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.

41. Changes in the Contract Price²¹

41.1 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. 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.

41.2 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.

42. Variations

42.1 All Variations shall be included in updated Programs²² produced by the Contractor.

42.2 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 Contractor shall also provide information of any ES risks and impacts of the Variation. 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.

42.3 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

²⁰ In lump-sum contracts, replace GCC Sub-Clause 40.1 as follows:

40.1 The Contractor shall provide updated Activity Schedules within 14 days of being instructed to by the Project Manager. 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.

²¹ In lump-sum contracts, replace entire GCC Clause 41 with new GCC Sub-Clause 41.1, as follows:

41.1 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.

²² In lump-sum contracts, add "and Activity Schedules" after "Programs."

effects of the Variation on the Contractor's costs.

- 42.4 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.
- 42.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.
- 42.6 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 Sub-Clause 41.1 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.²³
- 42.7 Value Engineering: The Contractor may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;
- (a) the proposed change(s), and a description of the difference to the existing contract requirements;
 - (b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle cost) the Employer may incur in implementing the value engineering proposal;
 - (c) a description of any effect(s) of the change on performance/functionality; and
 - (d) a description of the proposed work to be performed, a program for its execution and sufficient ES information to enable an evaluation of ES risks and impacts.

The Employer may accept the value engineering proposal if the proposal demonstrates benefits that:

- (a) accelerates the contract completion period; or
 - (b) reduces the Contract Price or the life cycle costs to the Employer; or
 - (c) improves the quality, efficiency, safety or sustainability of the Facilities; or
 - (d) yields any other benefits to the Employer,
- without compromising the functionality of the Works.

If the value engineering proposal is approved by the Employer and results in:

- (a) a reduction of the Contract Price; the amount to be paid to the Contractor shall be the **percentage specified in the PCC** of

²³ In lump-sum contracts, delete this paragraph.

the reduction in the Contract Price; or

- (b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit described in (a) to (d) above, the amount to be paid to the Contractor shall be the full increase in the Contract Price.

43. Cash Flow Forecasts

43.1 When the Program,²⁴ 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.

44. Payment Certificates

44.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.

44.2 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.

44.3 The value of work executed shall be determined by the Project Manager.

44.4 The value of work executed shall comprise the value of the quantities of work in the Bill of Quantities that have been completed.²⁵

44.5 The value of work executed shall include the valuation of Variations and Compensation Events.

44.6 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.

44.7 If the Contractor was, or is, failing to perform any ES obligations or work under the Contract, the value of this work or obligation, as determined by the Project Manager, may be withheld until the work or obligation has been performed, and/or the cost of rectification or replacement, as determined by the Project Manager, may be withheld until rectification or replacement has been completed. Failure to perform includes, but is not limited to the following:

- (a) failure to comply with any ES obligations or work described in the Works' Requirements which may include: working outside site boundaries, excessive dust, failure to keep public roads in a safe usable condition, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion;
- (b) failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ES issues, or anticipated risks or impacts;
- (c) failure to implement the C-ESMP e.g. failure to provide

²⁴ In lump-sum contracts, add "or Activity Schedule" after "Program."

²⁵ In lump-sum contracts, replace this paragraph with the following: "The value of work executed shall comprise the value of completed activities in the Activity Schedule."

required training or sensitization;

- (d) failing to have appropriate consents/permits prior to undertaking Works or related activities;
- (e) failure to submit ES report/s (as described in Appendix B), or failure to submit such reports in a timely manner;
- (f) failure to implement remediation as instructed by the Project Manager within the specified timeframe (e.g. remediation addressing non-compliance/s).

45. Payments

- 45.1 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.
- 45.2 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.
- 45.3 Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.
- 45.4 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.

46. Compensation Events

- 46.1 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 Sub-Clause 20.1.
 - (b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.
 - (c) The Project Manager orders a delay or does not issue Drawings, Specification, 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.

46.2 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.

46.3 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.

46.4 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.

47. Tax

47.1 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 Clause 49.

48. Currencies

48.1 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.

49. Price Adjustment

49.1 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 specified below applies to each Contract currency:

$$P_c = A_c + B_c \text{ Imc/loc}$$

where:

P_c is the adjustment factor for the portion of the Contract Price payable in a specific currency “c.”

A_c and B_c are coefficients²⁶ **specified in the PCC**, representing the nonadjustable and adjustable portions, respectively, of the Contract Price payable in that specific currency “c;” and

I_{mc} is the index prevailing at the end of the month being invoiced and I_{oc} is the index prevailing 28 days before Bid opening for inputs payable; both in the specific currency “c.”

49.2 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.

50. Retention

50.1 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.

50.2 Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC Sub-Clause 57.1, half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected. The Contractor may substitute retention money with an “on demand” Bank guarantee.

51. Liquidated Damages

51.1 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.

51.2 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 Sub-Clause 45.1.

52. Bonus

52.1 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

²⁶ The sum of the two coefficients A_c and B_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, for the nonadjustable portion of the payments, is a very approximate figure (usually 0.15) 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.

due to be complete.

53. Advance Payment

- 53.1 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.
- 53.2 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.
- 53.3 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.

54. Securities

- 54.1 The Performance Security, and if so **specified in the PCC** an environmental and social (ES) 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 or surety 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, and until one year from the date of issue of the Certificate of Completion in the case of a Performance Bond.

55. Dayworks

- 55.1 If applicable, the Dayworks rates in the Contractor's Bid shall be used only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.
- 55.2 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.
- 55.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

56. Cost of Repairs

- 56.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage

arises from the Contractor's acts or omissions.

E. Finishing the Contract

- 57. Completion** 57.1 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 whole of the Works is completed.
- 58. Taking Over** 58.1 The Employer shall take over the Site and the Works within seven days of the Project Manager's issuing a Certificate of Completion.
- 59. Final Account** 59.1 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.
- 60. Operating and Maintenance Manuals** 60.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates **stated in the PCC**.
- 60.2 If the Contractor does not supply the Drawings and/or manuals by the dates **stated in the PCC** pursuant to GCC Sub-Clause 60.1, 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.
- 61. Termination** 61.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.
- 61.2 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 Contractor does not maintain a Security, which is required;
- (g) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as **defined in the PCC**; or
- (h) if the Contractor, in the judgment of the Employer has engaged in Fraud and Corruption, as defined in paragraph 2.2 a of the Appendix A to the GCC, in competing for or in executing the Contract, then the Employer may, after giving fourteen (14) days written notice to the Contractor, terminate the Contract and expel him from the Site.

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

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

61.5 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 Sub-Clause 61.2 above, the Project Manager shall decide whether the breach is fundamental or not.

62. Payment upon Termination

62.1 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 **specified 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.

62.2 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.

63. Property

63.1 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.

64. Release from Performance

64.1 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.

**65. Suspension of
Bank Loan or
Credit**

- 65.1 In the event that the Bank 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 of such suspension within 7 days of having received the Bank's suspension notice.
 - (b) If the Contractor has not received sums due to it within the 28 days for payment provided for in GCC Sub-Clause 45.1, the Contractor may immediately issue a 14-day termination notice.

APPENDIX A TO GENERAL CONDITIONS

Fraud and Corruption

(Text in this Appendix shall not be modified)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

- i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
- ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
- iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
- iv. "coercive practice" is 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;
- v. "obstructive practice" is:
 - (a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or 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
 - (b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

- b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;
- c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;
- d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;¹ (ii) to be a nominated² sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;
- e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders(applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect³ all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

¹ For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

² A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which 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 allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

³ Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

APPENDIX B

Environmental, Social, Health and Safety (ESHS)

Metrics for Progress Reports

Refer General Specifications and Appendix to General Specifications.

APPENDIX C

Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH) Performance Declaration for Subcontractors

[The following table shall be filled in by each subcontractor proposed by the Contractor, that was not named in the Contract]

Subcontractor's Name: *[insert full name]*

Date: *[insert day, month, year]*

Contract reference *[insert contract reference]*

Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration
<p>We:</p> <ul style="list-style-type: none"><input type="checkbox"/> (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.<input type="checkbox"/> (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.<input type="checkbox"/> (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor.<input type="checkbox"/> (d) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently demonstrated that we have adequate capacity and commitment to comply with SEA /SH obligations.<input type="checkbox"/> (e) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached specific evidence demonstrating that we have adequate capacity and commitment to comply with SEA and SH obligations.
<p><i>[If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]</i></p>
<p style="text-align: center;"><i>[If (d) or (e) above are applicable, provide the following information:]</i></p>
<p>Period of disqualification: From: _____ To: _____</p>
<p>If previously provided on another Bank financed works contract, details of evidence that demonstrated adequate capacity and commitment to comply with SEA/SH obligations (as per (d) above)</p> <p style="margin-left: 40px;">Name of Employer: _____</p>

Name of Project: _____
Contract description: _____
Brief summary of evidence provided: _____ _____
Contact Information: (Tel, email, name of contact person): _____ _____
As an alternative to the evidence under (d), other evidence demonstrating adequate capacity and commitment to comply with SEA/SH obligations (as per (e) above) <i>[attach details as appropriate]</i> .

Name of the Subcontractor _____

Name of the person duly authorized to sign on behalf of the Subcontractor _____

Title of the person signing on behalf of the Subcontractor _____

Signature of the person named above _____

Date signed _____ day of _____, _____

Countersignature of authorized representative of the Contractor:

Signature: _____

SECTION IX – PARTICULAR CONDITIONS OF CONTRACT

The following Particular Conditions shall supplement the GC. Whenever there is a conflict, the provisions herein shall prevail over those in the GC

.

Section IX - Particular Conditions of Contract

A. General	
GCC 1.1 (d)	The financing institution is: The World Bank
GCC 1.1 (r)	The Employer is: Pakistan Water and Power Development Authority (WAPDA) represented by General Manager/ Project Director, Dasu Hydropower Project WAPDA, Dasu, District Kohistan, KPK, Pakistan.
GCC 1.1 (v)	The Intended Completion Date for the whole of the Works shall be: 540 Days from Start Date of the Works
GCC 1.1 (y)	The Project Manager is: Dasu Hydropower Consultants - (DHC), DC Road, Tehsil Dasu, District Kohistan, KPK, Pakistan.
GCC 1.1 (aa)	The Site is located at Kohistan District of Khyber Pakhtunkhwa Province of Pakistan .
GCC 1.1 (dd)	The Start Date shall be: the date at which the following precedent conditions have been all fulfilled and the Project Manager's notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor: i. signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of the Country; The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Start Date and shall then proceed with the Works with due expedition and without delay.
GCC 1.1 (hh)	The Works for DASU-RS-02 consist of following; The Scope of Work includes Construction of Government Boys Primary School (GBPS) Looter and Rehabilitation of Government Boys Primary School (GBPS) Shah Jahanabad and allied activities as shown on drawings and mentioned in the Bill of Quantities (BOQ) and Specifications.
GCC 2.2	The are no Sectional Completions:
GCC 3.1	The language of the contract is: English The law that applies to the Contract is the law of Islamic Republic of Pakistan
GCC 5.1	The Project Manager may delegate any of his duties and responsibilities.
GCC 8.1	Schedule of other contractors: Not Applicable

GCC 13.1	<p>The minimum insurance amounts and deductibles shall be:</p> <p>(a) for loss or damage to the Works, Plant and Materials: <i>PKR 662,000,000</i>; Deductibles = <i>PKR 2,000,000</i></p> <p>(b) for loss or damage to Equipment: <i>PKR 264,800,000</i>; Deductibles = <i>PKR 2,000,000</i></p> <p>(c) for loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract: <i>PKR 30,000,000</i> per occurrence with the number of occurrences unlimited; Deductibles = <i>PKR 2,000,000</i></p> <p>(d) for personal injury or death:</p> <p style="padding-left: 20px;">(i) of the Contractor's employees: <i>PKR 2,000,000</i></p> <p style="padding-left: 20px;">(ii) of other people: <i>PKR 500,000/-</i>.</p> <p>Limit of Liability shall not be less than 1.15 times the Contract amount.</p> <p>The Insurance Company shall have at least "A" rating from Pakistan Credit Rating Agency (PACRA).</p>
GCC 14.1	Site Data are: Location Map
GCC 20.1	The Site Possession Date(s) shall be: no later than the Commencement Date
GCC 23.1 & GCC 23.2	Appointing Authority for the Adjudicator: Chairman Pakistan Engineering Council (PEC) .
GCC 24.3	Hourly Rate and types of reimbursable expenses to be paid to the Adjudicator: shall be as agreed with the amount adjusted between the Parties to the Contract.
GCC 24.4	<p>Institution whose arbitration procedures shall be used: Applicable Law of Pakistan and Arbitration Act 1940.</p> <p>The place of arbitration shall be: Lahore</p>
Add New Clause GCC 24.5	<p>The Provisional Sum shall be used for payments to the Contractor of the Employer's share (one-half) of the invoices of the Adjudicator for its fees and expenses. No prior instruction of the Project Manager shall be required with respect to the work of the Adjudicator. The Contractor shall produce the Adjudicator invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those statements submitted under Clause 44 and 45, which contain requests for payment under the Provisional Sum. The Project Manager's certification of such Statements shall be based upon such invoices and such evidence of payment by the Contractor. Contractor's overhead, profit, etc., shall not be included in the Provisional Sum.</p>
B. Time Control	
GCC 30.1	The Contractor shall submit for approval a Program for the Works within

	twenty eight (28) days from the Letter of Acceptance.
GCC 30.3	<p>The period between Program updates is Sixty (60) days.</p> <p>The amount to be withheld for late submission of an updated Program is One percent (1 %) of the payment certificate.</p> <p>The period for submission of progress shall be as mentioned in the General Specifications Sub-Clauses 8.5.1 [Weekly Reports] 8.5.2 [Monthly Progress Reports] and 8.5.3 [Monthly Environmental Progress Reports].</p>
C. Quality Control	
GCC 38.1	The Defects Liability Period is: 365 days .
D. Cost Control	
GCC 42.7	If the value engineering proposal is approved by the Employer the amount to be paid to the Contractor shall be fifty percent (50%) of the reduction in the Contract Price.
GCC 47.1	<p>a) Local Direct Taxes:</p> <p>It is implied that the bidder has taken all the risks into account while submitting the proposed price. The Employer (WAPDA) shall not be responsible for any present or future direct taxes (Income Tax/Corporate Tax. WHT, Turnover Tax, Super Tax etc.) payable by the bidder, his/her experts and other employees.</p> <p>Any increase or decrease in the rates of all local direct taxes or introduction of new tax on the. Income of the Contractor, experts and other employees in connection with the performance of the contract, will be the liability of the Contractor as these taxes are levied on the Income earned by the Contractor from the Contract and the Employer (WAPDA) will not compensate to the Contractor.</p> <p>b) Local Indirect Taxes:</p> <p>All local indirect taxes i.e. sales taxes. Custom duty, VAT. levies, other' charges or similar taxes levied on the Contractor's invoice, shall be borne and reimbursed by the Employer (WAPDA), subject to withholding law, on the basis of actual amount of Indirect taxes paid by the Contractor at the prevailing tax rates supported. by the documentary evidence of such payment of Indirect taxes by the Contractor; These indirect taxes shall be mentioned as a separate line Item on the Contractor's Invoice.</p>
The following Sub-Clause is added after Sub-Clause 47.1	
GCC 47.2	<p><u>Advance Income Tax</u></p> <p>All payments (gross) as payable to the Contractor, Sub-contractors will be subject to Withholding Tax/Advance Tax at the prescribed rate at the time of payment. The deduction of withholding income tax from the gross payable bills shall be made in accordance with prevalent Income Tax laws of the Government of Pakistan. These deductions shall be deposited in the</p>

	<p>Government Treasury by the Employer (WAPDA) to the account of the Contractor within prescribed period.</p> <p><u>Provincial Sales Tax on Services</u></p> <p>Subject to the relevant provisions of the Provincial Sales Tax Act on Services, all payments (gross) as payable to the Contractor/sub-contractors in relation to Works/Services will be subject to withholding sales tax at the prevalent rates, at the time of payments.</p>
GCC 48.1	The currency of the Employer's country is: Pakistani Rupee (PKR)
GCC 49.1	<p>The Contract is subject to price adjustment in accordance with GCC Clause 45, and the following information regarding coefficients shall apply.</p> <p>The coefficients for adjustment of prices are:</p> <p>(a) For Local Currency: Pakistani Rupees (PKR)</p> <p>(i) 30% percent non-adjustable element (coefficient A).</p> <p>(ii) 70% percent adjustable element (coefficient B).</p> <p>(b) For Foreign Currency: Not Applicable</p> <p>The Index I for local currency shall be Monthly Statistical Bulletin, Pakistan Bureau of Statics, and Government of Pakistan.</p>
GCC 50.1	<p>The proportion of payments retained is: 10% from each Payment Certificate issued by the Project Manager pursuant to Sub-Clause 44.2.</p> <p>Maximum Limit of Retention shall be 5% of the Accepted Contract Amount.</p>
GCC 51.1	The liquidated damages for the whole of the Works are 0.1% per day. The maximum amount of liquidated damages for the whole of the Works is 10% of the Final Contract Price.
GCC 52.1	No Bonus shall be paid for the completion earlier than the Intended Completion Date.
GCC 53.1	<p>The Advance Payments shall be: 10 percent of the Accepted Contract Amount less specified Provisional Sums and shall be paid to the Contractor no later than 42 days of the issue of Letter of Acceptance or 21 days after submission of Advance Payment Guarantee, whichever comes later.</p> <p>The Advance Payment Bank Guarantee shall be irrevocable and shall be issued by a Scheduled Bank of Pakistan.</p>
GCC 53.3	<p>The sentence "<i>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</i>" is deleted and substituted with the following:</p> <p><i>The advance payment shall be repaid by deducting</i> at the amortization rate @10% of each Payment Certificate issued by the Project Manager pursuant</p>

	to Sub-Clause 44.2.
GCC 54.1	<p>The Performance Security amount is Ten percent (10%) of the Accepted Contract Amount in Pak Rupees in the form of irrevocable Scheduled Bank Guarantee issued by a Scheduled Bank of Pakistan.</p> <p>The last sentence in GCC Sub-Clause 54.1 is deleted and substituted as follows:</p> <p>“The Performance Security, in the case of a Bank Guarantee, shall remain valid until expiry of the Defects Liability Period.”</p>
E. Finishing the Contract	
GCC 57.1	<p>Following shall be added in the end after the wording “Works is completed”.</p> <p>“to his satisfaction, all specified tests have been satisfactorily performed, As-built drawings and necessary documents have been submitted by the Contractor”.</p>
GCC 60.1	The date by which “as built” drawings are required is: within 42 days of the final completion.
GCC 60.2	The amount to be withheld for failing to produce “as built” drawings and/or operating and maintenance manuals by the date required in GCC 60.1 is: One percent (1%) of the Accepted Contract Amount.
GCC 61.2 (g)	The maximum number of days is: 100.
GCC 62.1	The percentage to apply to the value of the work not completed, representing the Employer’s additional cost for completing the Works, is: Ten percent (10%).

SECTION – X
CONTRACT FORMS

Section X - Contract Forms (CF)

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Notification of Intention to Award

For the attention of Bidder's Authorized Representative

Name: _____

Address: _____

Telephone/Fax numbers: _____

Email Address: _____

DATE OF TRANSMISSION: This Notification is sent by: [*email/fax*] on [*date*] (local time)

Notification of Intention to Award

Employer: _____

Project: _____

Contract title: _____

Country: _____

Loan No. /Credit No. / Grant No.: _____

RFB No: _____

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

- a) request a debriefing in relation to the evaluation of your Bid, and/or
- b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	
Address:	
Contract price:	

2. Other Bidders

Name of Bidder	Bid price	Evaluated Bid price (if applicable)

3. Reason/s why your Bid was unsuccessful

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on _____.

You may request a debriefing in relation to the results of the evaluation of your Bid. If you decide to request a debriefing your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Bidder, contact details; and address the request for debriefing as follows:

Attention: _____

Title/position: _____

Agency: _____

Email address: _____

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, _____.

Provide the contract name, reference number, name of the Bidder, contact details; and address the Procurement-related Complaint as follows:

Attention: _____

Title/position: _____

Agency: _____

Email address: _____

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

Further information:

For more information see the [Procurement Regulations for IPF Borrowers \(Procurement Regulations\)](https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=4005) [<https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=4005>] (Annex III). You should read these provisions before preparing and submitting your complaint. In addition, the World Bank's Guidance "[How to make a Procurement-related Complaint](http://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#framework)" [<http://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#framework>] provides a useful explanation of the process, as well as a sample letter of complaint.

In summary, there are four essential requirements:

1. You must be an 'interested party'. In this case, that means a Bidder who submitted a Bid in this bidding process, and is the recipient of a Notification of Intention to Award.
2. The complaint can only challenge the decision to award the contract.
3. You must submit the complaint within the period stated above.
4. You must include, in your complaint, all of the information required by the Procurement Regulations (as described in Annex III).

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on _____.

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification, please do not hesitate to contact us.

On behalf of the Employer:

Signature: _____

Dasu Hydropower Project – Bidding Documents – DASU-RS-02
Construction of GBPS Looter and Rehabilitation of GBPS Shah Jahanabad
Section-X, Contract Forms

Name: _____

Title/position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form (“Form”) is to be completed by the successful Bidder¹. In case of joint venture, the Bidder must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Bidder is any natural person who ultimately owns or controls the Bidder by meeting one or more of the following conditions:

- *directly or indirectly holding 25% or more of the shares*
- *directly or indirectly holding 25% or more of the voting rights*
- *directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder*

RFB No.: *[insert number of RFB process]*

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

To: *[insert complete name of Employer]*

In response to your request in the Letter of Acceptance dated *[insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding 25% or more of the shares (Yes / No)	Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)	Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Bidder (Yes / No)
<i>[include full name (last, middle, first), nationality, country of residence]</i>			

OR

(ii) *We declare that there is no Beneficial Owner meeting one or more of the following conditions:*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder

OR

(iii) *We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Bidder shall provide explanation on why it is unable to identify any Beneficial Owner]*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder]”

Name of the Bidder: **[insert complete name of the Bidder]*_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder:

***[insert complete name of person duly authorized to sign the Bid]*_____

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

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

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

* In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder. In the event that the Bidder is a joint venture, each reference to “Bidder” in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.

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

Letter of Acceptance

[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]* for execution of the *[name of the contract and identification number, as given in the PCC]* for the Accepted Contract Amount 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 (i) the Performance Security and an Environmental, Social, Health and Safety Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose the Performance Security Form and the ESHS Performance Security Form, included in Section X - Contract Forms, of the bidding document.

[Choose one of the following statements:]

We accept that *[name of Adjudicator proposed by the Bidder]* be appointed as the Adjudicator.

[or]

We do not accept that *[name of the Adjudicator proposed by the Bidder]* be appointed as the Adjudicator, and by sending a copy of this Letter of Acceptance to *[name of the Appointing Authority]*, the Appointing Authority, we are hereby requesting such Authority to appoint the Adjudicator in accordance with ITB 48.1 and GCC 23.1.

Authorized Signature:

Name and Title of Signatory:

Name of Agency:

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made the _____ day of _____,
_____, between _____ of
_____ (hereinafter “the Employer”), of the one part, and
_____ of _____ (hereinafter “the
Contractor”), of the other part:

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

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
 - a) the Letter of Acceptance
 - b) the Letter of Bid
 - c) the addenda Nos _____(if any)
 - d) the Particular Conditions
 - e) the General Conditions of Contract, including appendix;
 - f) the Specification
 - g) the Drawings
 - h) Bill of Quantities; and
 - i) any other document listed in the PCC as forming part of the Contract, but not limited to;
 - i. the ES Management Strategies and Implementation Plans; and
 - ii. Code of Conduct for Contractor’s Personnel (ES).
3. In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

Dasu Hydropower Project – Bidding Documents – DASU-RS-02
Construction of GBPS Looter and Rehabilitation of GBPS Shah Jahanabad
Section-X, Contract Forms

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

Signed by: _____
for and on behalf of the Employer

Signed by: _____
for and on behalf the Contractor

in the
presence of: _____
Witness, Name, Signature, Address, Date

in the
presence of: _____
Witness, Name, Signature, Address, Date

Performance Security

Option 1: Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of Employer]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _ *[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of _ *[insert 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 Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*,¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary 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...², and any demand for payment under it must be received by us at this office indicated above on or before that date.

¹ *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency(ies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

² *Insert the date twenty-eight days after the expected completion date as described in GCC Sub-Clause 57.1. The Employer should note that in the event of an extension of this date for completion of the Contract, the Employer would need to request an extension of this guarantee from the*

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

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

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 Beneficiary’s written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.”

Performance Security

Option 2: Performance Bond

By this Bond [*insert name of Principal*] as Principal (hereinafter called “the Contractor”) and [*insert name of Surety*] as Surety (hereinafter called “the Surety”), are held and firmly bound unto [*insert name of Employer*] as Obligee (hereinafter called “the Employer”) in the amount of [*insert amount in words and figures*], for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Contractor has entered into a written Agreement with the Employer dated the _____ day of __, 20 __, for [*name of contract and brief description of Works*] in accordance with the documents, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, the Condition of this Obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Contractor shall be, and declared by the Employer to be, in default under the Contract, the Employer having performed the Employer’s obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- (1) complete the Contract in accordance with its terms and conditions;
or
- (2) obtain a Bid or Bids from qualified Bidders for submission to the Employer for completing the Contract in accordance with its terms and conditions, and upon determination by the Employer and the Surety of the lowest responsive Bidder, arrange for a Contract between such Bidder and Employer and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term “Balance of the Contract Price,” as used in this paragraph, shall mean the total amount payable by Employer to Contractor under the Contract, less the amount properly paid by Employer to Contractor;
or

- (3) pay the Employer the amount required by Employer to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

Any suit under this Bond must be instituted before the expiration of one year from the date of issue of the Certificate of Completion.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Employer named herein or the heirs, executors, administrators, successors, and assigns of the Employer.

In testimony whereof, the Contractor has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this __ day of _____ 20 _____.

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

Environmental and Social (ES) Performance Security

ES Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of Employer]*

Date: *[Insert date of issue]*

ES PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____ (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 Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its Environmental and/or Social (ES) obligation(s) under the Contract, without the Beneficiary 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...², and any demand for payment under it must be received by us at this office indicated above on or before that date.

¹ The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency (cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.

² Insert the date twenty-eight days after the expected completion date as described in GCC Sub-Clause 57.1. The Employer should note that in the event of an extension of this date 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

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

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

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 Beneficiary’s written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.”

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of Employer]*

Date: *[Insert date of issue]*

ADVANCE PAYMENT GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert 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 *[insert amount in figures]* () *[insert amount in words]* is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*¹ upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

- (a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or
- (b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

¹ *The Guarantor shall insert an amount representing the amount of the advance payment and 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.*

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number *[insert number]* at *[insert name and address of Applicant's bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified 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 ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the *[insert day]* day of *[insert month]*, 2 *[insert year]*,² 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 (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

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

² *Insert the expected completion date as described in GCC Sub- Clause 57.1. The Employer should note that in the event of an extension of the expected completion date 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 Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*



PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY

DASU HYDROPOWER PROJECT

BIDDING DOCUMENT

NCB NO: DASU-RS-02

PROCUREMENT OF SMALL WORKS

CONSTRUCTION OF SCHOOLS

(Construction of GBPS Looter and Rehabilitation of
GBPS Shah Jahanabad)

Volume 2

Section VII

WORKS REQUIREMENTS

Volume 2(a)

- General Specifications
- Technical Specifications

Volume 2(b)

- Drawings

**GENERAL MANAGER/ PROJECT DIRECTOR
DASU HYDROPOWER PROJECT
DASU, PAKISTAN**

October 2024

BIDDING DOCUMENTS

Main Contents

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- ❖ **Bidding Procedures (Section I to VI)**
- ❖ **Conditions of Contract and Contract Forms (Section VIII to X)**

- Section I. – Instructions to Bidders (ITB)
- Section II. – Bid Data Sheet (BDS)
- Section III. – Evaluation and Qualification Criteria (EQC)
- Section IV. – Bidding Forms (BF)
- Section V. – Eligible Countries
- Section VI. – Fraud and Corruption
- Section VIII. – General Conditions (GC)
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- Section X. – Contract Forms (CF)

Volume 2 – Works Requirements	
Volume 2(a)	
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	– Technical Specifications
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Section VII.	– Drawings

VOLUME 2
Works Requirements
(Section VII)

Volume 2(a)

- **General Specifications**
- **Technical Specifications**

Volume 2(b)

- **Drawings**
-

VOLUME 2(a)
GENERAL SPECIFICATIONS

**DASU HYDROPOWER PROJECT
Relocated Schools**

General Specification

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Abbreviations

Wherever in these specifications or in other contract documents the following abbreviations and terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

AASHTO	American Association of State Highway and Transportation officials
ASTM	American Society for Testing of Materials
AWG	American Wire Gauge
AWPA	American Wood Preservers Association
BS	British Standard Code of Practice
ACI	American Concrete Institute
FHWA	Federal Highway Administration
PCA	Portland Cement Association
Wt.	Weight
lb.	Pound
AWS	American Welding Society
Gallon	U.S. Gallon
In.	Inch
JMF	Job Mix Formula
ft.	Foot
Yd.	Yard
L	Liter
mm	Millimeter
cm	Centimeter
m	Meter
km	Kilometer
m ²	Square Meter
cm ²	Square Centimeter
m ³	Cubic Meter
ha	Hectare
kg	Kilogram
Ton	Metric Ton (1000 kg)
°C	Degree Centigrade
°F	Degree Fahrenheit

GENERAL SPECIFICATIONS

1 GENERAL

1.1 REFERENCE TO OTHER SPECIFICATIONS

Throughout the Specifications and Schedules references are occasionally made to other Sections. All such references are intended solely for the convenience of those using the documents, and the absence of a reference in no manner excludes the application of every other part or section in the Specifications which may, in the opinion of the Project Manager, have any bearing upon the point in question. The Contract Documents shall be read and applied as a whole.

1.2 COOPERATION WITH OTHER CONTRACTORS

Pursuant to GC Clause 8, the Contractor shall coordinate his work with other Contractors at the Site to whatever extent may be necessary to implement and complete the Project in accordance with the Drawings, Specifications, instructions, and specific requirements of the Project Manager.

The Contractor shall during the execution of the Works allow the Employer, the Project Manager and the other contractors employed by the Employer in connection with the Works the use of his roads and other temporary works or services. The Contractor shall at every place of working, provide proper drainage, dewatering, lighting and ventilation, and maintain his roads for other contractor's erection work and for the Project Manager's inspection, valuation and/or verification of the Works.

The Contractor shall draw attention to the specific requirement(s) that the other contractors may require to occupy various areas or places for the purpose of carrying out their works. The Contractor shall carry out his Works in such a manner with due diligence that he does not interfere with the operations of other contractors and he shall make due allowance in his working method or methodology for restrictions required by the operation of other contractors.

The Contractor shall be deemed to have allowed in his rates for any additional expenses incurred in cooperating, adjusting to and working with other Contractors on the Site.

2 DESCRIPTION OF THE PROJECT

The Proposed Dam is located at seven (7) km North of Dasu Town in the Kohistan District of Khyber Pakhtunkhwa (KPK) Province, and three hundred fifty (350) km North from Islamabad, Capital City of Pakistan. The dam site is seventy-four (74) km downstream from the proposed Diamer Basha dam site along the Indus River. The Dasu reservoir is extended to just downstream of the proposed Diamer Basha dam works. The project has been formulated as a peaking hydropower scheme with a capacity of four thousand three hundred twenty 4,320 MW providing the Roller Compacted Concrete (RCC) main dam with a height of two hundred forty-two (242) m having an effective storage volume of 0.82 BCM and the underground powerhouse with the related waterway tunnels.

The major elements of construction are described only under Stage-I:

1) Contract No. DASU-MW-01: Main Works –Dam & Hydraulic Steel Structures

Construction of two hundred forty-two (242) m high RCC dam with spillway, low level outlets and the upstream section of flushing tunnels, including two (2) lanes of diversion tunnel with four (4) sets of diversion gate.

Supply and installation of:

- Eight (8) sets of spillway gate and hoist, one (1) set of spillway stoplog and two (2) sets of temporary stoplog with eight (8) guide frames and one (1) spillway gantry crane,
- Nine (9) sets of low level outlet (LLO) maintenance gates and hoists, nine (9) lanes of LLO steel liner, nine (9) sets of LLO guard gate and hoist, nine (9) sets of regulation gate and hoist, and two (2) sets of LLO overhead travelling crane, and

- Two (2) sets of flushing tunnel inlet stoplog with four (4) guide frames, two (2) lanes of flushing tunnel outlet steel liner and four (4) sets of flushing tunnel outlet gate and hoist, and
 - Four (4) sets of diversion gate and hoists with steel hoist tower and deck for two (2) diversion tunnels.
- 2) Contract No.DASU-MW-02: Main Works – Waterway, Underground Complex and Hydraulic Steel Structures
- Construction of four (4) power intakes with intake tunnels and intake gate shafts, two (2) waterway systems, each comprising the upper pressure tunnel, vertical shaft and lower pressure tunnel with one (1) steel manifold for three (3) lanes of penstocks, and one (1) tailrace tunnel with outfall, one (1) underground powerhouse for six (6) generations unit bays & one (1) erection bay, one (1) transformer & GIS cavern for six (6) associated unit transformers and 550kV GIS, two (2) tailrace surge chambers and two (2) complete set of tunnels including a main access tunnel, IPB tunnels, draft tunnels, drain tunnels, Gas Insulated Line (GIL) tunnel, vent tunnel and various service tunnels, and one (1) surface switchyard compound including main control building and take-off switchyard.
- Supply and installation of:
- Twelve (12) sets of power intake trashrack for four (4) intake structures, two (2) sets of power intake maintenance stoplog with four (4) guide frames and two (2) temporary stoplog for four (4) intake gate shafts, two (2) sets of power intake service gate and hoist for two (2) intake gate shafts and one (1) set of gantry crane,
 - Two (2) lanes of steel penstock,
 - Three (3) sets of surge chamber stoplog with six (6) guide frames and one (1) set of surge chamber gantry crane, and
 - Four (4) sets of tailrace outlet gate and hoist
- 3) Contract No.DASU-EM-01: Hydro-mechanical and Electrical Equipment
- Supply and installation of six (6) nos. Francis turbines, generators, main transformers, generator and station service switchgear, two (2) sets of powerhouse cranes, control, auxiliaries, communication and one (1) lot of 550kV GIS for six (6) units and two (2) circuit of GIL and 500kV take-off switchyard equipment.
- 4) Contract No.DASU-PCI-01R: Construction of Staff Colonies, Infrastructure, Provision of Roads & Utility Systems and of Electric Power Supply
- Construction of project offices, residential houses and hostels (Category-2) required for the supervision and management of the construction phase of the Project.
 - Provision and installation of internal systems such as water supply, sewerage, drainage and telephone to and within colony and offices
 - Construction of access roads to and within colonies (No.1, 2 and 4)
 - Design, manufacturing and installation of electric power supply system from a Grid Station in Dasu to and within colony
- 5) Contract No.DASU-PCI-02 Construction of Staff Colonies, Infrastructure, Provision of Roads & Utility Systems and of Electric Power Supply
- Construction of Appurtenant Facilities, such as schools, mosque, market, WAPDA club, information center, post office, parks and play ground. Also, provision of Electric Power Supply for these Appurtenant Facilities.
 - Construction of Jr. Officer's hostels (Category-3), residential houses (Category-5) and sixteen blocks of residential houses (Category -4), with all the internal electrification work
 - Provision and installation of internal systems such as water supply, sewerage, drainage and telephone to and within appurtenant as well as residential facilities
 - Construction of access roads to these infrastructures.
- 6) Contract No.DASU-TL-01: For Procurement, Design, Supply, Installation, Stringing, Testing

- & Commissioning of 132 KV Single Circuit Transmission Line and Grid Station
- 7) Contract No.DASU-KKH-01: Relocation of KKH (Part 1)
 - Construction of KKH Bypass from RD 0+000 to RD 25+200
 - 8) Contract No.DASU-KKH-02: Relocation of KKH (Part 2)
 - Construction of KKH Bypass from RD 25+200 to RD 62+213
 - 9) Contract No.DASU-RAR-01: Construction of Right Bank Access Road (Komila - Seo Road)
 - Construction of Right Bank Access Road from Komila to Dam site (12.73 km)
 - 10) Contract No.DASU-RAR-02: Construction of Right Bank Access Road
 - Construction of Right Bank Access Road from Dam site to Uttargah (~ 42 km)
 - 11) Contract No.DASU-RAR-03: Construction of Right Bank Access Road
 - The Right Bank access road will be extended from Uttargah to Tangir to facilitate the locals of these valleys. The length of this access road RAR-03 will be approximately 27.5 km. from RD 53+796 to RD 81+312
 - 12) Contract No. DASU-RV: Resettlement of Village Choochang & Construction of Shatial Museum
 - Resettlement of Village Choochang (1,2&3) and Construction of Shatial Museum approximately 67 km away from existing Choochang village on Left Bank of Indus River
 - 13) Contract No.DASU-LBRV-11: Resettlement Villages on Left Bank
 - Resettlement of Villages on Left Bank of Indus River namely Khoshe (1&2), Logro (1,2&3) and Uchar (1&2)
 - 14) Contract No. DASU-LBRV-12: Resettlement Villages on Left Bank
 - Resettlement of Villages on Left Bank of Indus River namely Barseen (1), Nasirabad / Gul-e-Bagh (1&2) and Dhaar / Kaigah (1&2)
 - 15) Contract No. DASU-LBRV-13: Resettlement Villages on Left Bank
 - Resettlement of Villages on Left Bank of Indus River namely Sazeen, Looter, Lachi (1&2), Gadeer (1&2), Pani Bah (1&2), Shatial, Chalash
 - 16) Contract No. DASU-RBRV-11: Resettlement Villages on Right Bank
 - Resettlement of Villages on Right Bank of Indus River namely Dhaat (Melar, Barkai & Kuzkai)
 - 17) Contract No. DASU-RBRV-12: Resettlement Villages on Right Bank
 - Resettlement of Villages on Right Bank of Indus River namely Kot Gal, Nut Bail / Warisabad (1&2), Serto / Sluch (1&2), Seer Gayal (1&2), Dhoop Thoothi (1&2)
 - 18) Contract No. DASU-RV-01: Resettlement Villages on Right Bank
 - Resettlement of Villages on Right Bank of Indus River namely Suppat Gummo, Doonder and Cheer Shial.
 - 19) Contract No. DASU-RV-02: Resettlement of Village Sigloo on Right Bank of Indus River
 - 20) Contract No. DASU-VTC-01: For Vocational Training Centers for Men and Women
 - 21) Contract No. DSU-DL-01: For Procurement, Design, Supply and Installation of 11 KV Distribution Line.

3 SCOPE OF WORKS (CONTRACT DASU-RS-02)

The works for construction of Schools comprises inter alia the following:

3.1 COMPLEMENTARY INVESTIGATION WORKS

Any geotechnical explorations that may be required for construction of permanent structures and places or as instructed or required by the Project Manager.

3.2 PERMANENT WORKS

Below tabulated Buildings shall be built inter alia with other following allied works;

1. Water Supply and Sewerage System
2. Internal Electrification Works of Schools
3. Construction of the Stone Masonry Retaining and Breast Walls
4. Construction of the Boundary Walls
5. Earthwork (Excavation and Filling)
6. Construction of the buildings tabulated below-1;

Table-1

Sr. No.	Description	Quantity (Nos.)
1	Government Boys Primary School (GBPS) Looter	01
2	Rehabilitation of Government Boys Primary School (GBPS) Shah Jahanabad	01

4 THE SITE

4.1 LOCATION AND ACCESS TO THE SITE

The Dasu Hydropower Project is located in Kohistan District of Khyber Pakhtunkhwa (KPK) Province of Pakistan. District Kohistan has a population of about half a million persons. The name of the district Kohistan has been derived from the name of area i.e. Kohistan which means mountains. Geographically, the district lies between 34° 54' - 35° 52' North latitude and 72° 43' - 73° 57' East longitudes. It is bounded on the North by Ghizer and Diamir districts of Northern Area (Gilgit Baltistan), on the South East by Mansehra district, on the South by Batagram district and on the West by Shangla and Swat districts. Total area of Kohistan district is 7,492 square kilometers.

The Dasu Hydropower Project is located across the Indus River near Dasu town, upstream of Seo village. Its reservoir area extends seventy-four (74) km upstream up to the toe of the proposed Damer Basha Dam. Most of the project area lies within the KPK province. At El 950 meters, the reservoir will cover 6,439 acres of land.

Presently access to site is by the KKH which links from Hassan Abdal Town (Pakistan) to China Border at Khunjrab.

The permanent access road to the site is mainly accessible through the Karakoram Highway (KKH) which is being maintained by the NHA (National Highway Authority) after completion in 1978. A part of KKH starting from Hassan Abdal to Thakot Bridge over the Indus River is comparatively well maintained. Beyond Thakot Bridge, KKH runs along the right bank of the Indus River up to Dasu Bridge over around one hundred (100) km. This route is frequently crossed by the tributaries of the Indus River. Due to steep slope and deterioration of excavated rocks at the mountain side along KKH, landslide occur every year which most often results in traffic suspension. At these locations, the temporary steel truss bridges are only functioning after washing away of permanent bridges. According to the latest information, the overall rehabilitation works for existing KKH are being continued by NHA. In parallel with rehabilitation works, the temporary truss bridges could be re-constructed with the permanent ones before commencement of the main construction works for Dasu HPP. It is noted that further occurrence of land slides and traffic suspension for the

transportation of construction materials even after the commencement of Dasu HPP may not be avoidable.

Without limiting any of Contractor's obligations or responsibilities expressed or implied under the Contract, the Contractor shall be deemed to have obtained all necessary information pertaining to and to have complied with all regulations and procedures governing the use of national and international facilities such as access, transport, handling and storage facilities, including roads, railroads, harbours, airports, airways, border crossings and the like for the due fulfilment of the Contract.

5 SITE AREAS AND ACTIVITIES

Specific areas or places forming the Site, as shown or envisaged in the Drawings, have not been designated to be used for working areas, quarrying operations, borrow pits, offices, workshops, storage, batch plants, and the like. The Contractor shall be responsible to make all his own arrangements in this regard with due diligence.

Use of additional Site areas or places for such other facilities as may be required by the Contractor in areas not already designated by the Project Manager shall be subject to the prior consent or approval of the Project Manager regarding extent, access, programme and layout.

Unless otherwise specified herein, the Contractor's offices, workshops, stores, explosive magazines, fuel depots and such other sensitive facilities deemed by the Project Manager and/or required under the governing laws and/or regulations shall be surrounded by two (2.0) m high security fencing. The security fencing thereof shall not be measured separately for payment. Flood-lighting of the area shall be provided or furnished to allow safe movement of persons in each area at night at the Contractor's own cost and risk. The type of safe flood lighting shall be proposed by the Contractor and approved by Project Manager in writing.

On completion of the works, unless otherwise instructed or required by the Project Manager, all fencing shall be removed and the Contractor shall reinstate or restore the Site in accordance with the directions or instruction of the Project Manager.

All roads other than the fenced off areas of the Site shall be considered or deemed as public roads whether or not built and/or maintained by the Contractor. The Contractor shall therefore have due attention and regard to the laws and regulations governing public roads as well as the provisions of the Contract. The Employer shall have rights or entitlements to allow any local authorities or duly constituted authorities to enter the fenced areas with a prior notice or notification to the Contractor where appropriate and necessary for executing their duties and obligations under the Contract.

The Contractor shall not use the Site for any purpose other than that of executing the Works or for that intended purpose for which it has been designated and shall confine his operations to within these areas or places unless otherwise consented or approved in writing by the Project Manager.

Earth, stone, gravel and sand, and all other materials excavated or existing on the Site or the access roads, shall not become the property of the Contractor, but will be at his disposal only so far as they are consented or approved for use in the Works. Existing structures on the Site or the access roads shall remain the property of the Employer and, except as and to the extent required elsewhere in the Contract, shall not be interfered with by the Contractor in any way.

The Contractor shall not enter upon land outside the Site or beyond five (5) m outside the road prism and drainage structures of public roads for the purpose of this Contract without written approval or consensus from the Project Manager.

Any existing rights of way, tracks or roads running through the Site shall be diverted around the Site or fenced off in such a way to prevent unauthorised persons from inadvertently entering the Site. Such rights of way, tracks or roads shall be kept open at all times except for short periods when construction activities such as surface blasting shall require closure for safety reasons.

6 FACILITIES PROVIDED BY THE EMPLOYER

(NONE)

7 FACILITIES AND SERVICES PROVIDED BY THE CONTRACTOR

7.1 GENERAL

The Contractor shall provide in a timely manner and maintain the facilities and services specified in this clause for the execution of the Contract in his care, custody, and control of the Contractor.

If a facility is maintained and operated by the Contractor, all of the Contractor's charges for such maintenance and operation thereof shall be deemed to be covered or included in the rates and prices in the Bill of Quantities (BOQ), unless otherwise specifically provided for in the Contract. The Contractor shall at the end of the Contract, dismantle and remove from the Site all buildings and related facilities at his cost and risk.

The Contractor shall then prepare and submit to the Project Manager for consent detailed drawings, programmes and proposals for each of the facilities to be established by the Contractor under this Clause, at least twenty-eight (28) days before each such facility is to be established or provided.

The Contractor shall be responsible for keeping all areas of the Site for which he is responsible, including (without limitation) temporary facilities, buildings, services, and the like., in a neat, clean, sanitary and orderly condition and to the satisfaction of the Project Manager at all times.

After dismantling and removing from the Site all buildings and related facilities provided, which are no longer required as instructed or agreed by the Project Manager, the Contractor shall reinstate or restore the ground to the satisfaction of the Project Manager with due diligence and expedition.

The Contractor shall provide at his own cost and risk all professional, administrative, supervisory and technical staff and all labour, communications, chemicals, test equipment, transport, plant, equipment, materials, furniture, tools, instruments, fuel spare parts and the like required for the proper and efficient operation and maintenance of the services.

7.2 SITE AND ROADS

The Contractor is fully responsible for his own access and when he uses public roads, he shall observe or abide by regulations stipulated by relevant authorities concerned or duly constituted authorities including local authorities.

Any activities, such as obtaining permission or approval for entering for surveying and investigation, land acquisition and compensation for resettlement plan, and construction of the roads which access to the quarries, borrows etc. located outside the Project boundary shall be made at full responsibility, cost and risk of the Contractor.

The Contractor shall be responsible for the construction and maintenance of access roads to all areas or places of the Site, to all Site offices, and for all haulage and other construction roads required for carrying out the Works. These roads shall be treated to avoid any dust nuisance, graded monthly and maintained whenever necessary or as instructed or directed by the Project Manager.

The Contractor shall establish or provide reasonable traffic regulations governing traffic on the roads maintained by him, and shall provide or furnish signs, pavement marking, traffic signals or other control devices and flagmen as may be required to maintain a safe and unimpeded flow of traffic.

When temporary construction roads constructed by the Contractor are no longer required, the Contractor shall, unless otherwise approved or instructed by the Project Manager, plough to break up hardened surfaces, remove all imported material and reinstate or restore the surface to the satisfaction of the Project Manager. Unless otherwise specified, no separate payment shall be made for Access on Site.

The KKH is a major traffic artery and is economically vital to Pakistan. Transportation of goods

and materials by the Dasu Project contractors will impose a considerable additional burden on the capacity of the KKH and management of project traffic is of considerable importance or significance.

The transportation of goods and materials through the Abbottabad Municipality and for all other areas of the KKH, the Contractor shall ensure that large or heavy loads are only transported at night. The Employer intends to establish or provide lay-by areas at two (2) locations before Abbottabad and near Thakot for priority use by the Dasu Project Contractors to allow parking up of vehicles and over-day rest to avoid day time haulage. However, the establishment of these areas is currently ongoing and may not be available for use by the Contractor immediately after Contract Agreement.

The Employer intends to establish or provide a Traffic Management Committee which will include representatives from the NHA, Traffic Police, Security Services and other local and national government authorities or duly constituted authorities. The Traffic Management Committee shall monitor and control traffic volumes generated by the Dasu Project contractors using the KKH for transport of goods and materials to the Site. The Contractor shall forthwith appoint or nominate a representative who will report periodically to the Traffic Management Committee, but not form part of the committee.

The Contractor shall also provide the Project Manager, with a copy to the Traffic Management Committee, a monthly advanced schedule of goods and materials to be transported along the KKH. The Traffic Management Committee may request or require amendment to the Contractor's proposed schedule based on other contractors' schedules, the overall Project completion programme and to avoid excessive disruption to the public and other KKH users. The Contractor shall have no contractual right or entitlement to claim for additional Costs or Extension of Time (EOT) as a result of amendment of his proposed transportation schedule. The determination of the Traffic Management Committee shall be final and conclusive.

The Contractor shall also independently liaise with local traffic authorities or municipalities, including Traffic Police for specific permits or approvals for transport of particular items of goods, materials, oversized or heavy loads which may require special escort or speed restrictions.

7.3 UTILITIES SUPPLY

The Contractor shall be fully liable or responsible for the provision of electricity, water, gas and other services he may require for the performance of the Contract.

7.4 CONTRACTOR'S RESIDENTIAL AREA

The Contractor shall provide and maintain associated facilities such as Power Supply, Water Supply System, Sewerage System with septic tanks, road network, telecommunication, Buildings for his residential area.

The Contractor shall provide a layout plan of the residential area or camps showing all facilities to the Project Manager for review and approval. Construction details shall be to the approval or permission of the Project Manager with materials and workmanship in conformance with the appropriate specifications and/or code of practice.

The Contractor shall be entirely responsible for the design, provision, construction, maintenance and removal of all accommodation and related facilities within the accommodation area so designated for the Contractor. Such facilities shall conform or comply in layout, town planning and construction with the standards and workmanship requirements of modern community developments as appropriate and necessary. The Contractor shall follow locals laws/standards and International guidelines and standards particularly IFC Guidelines on Workers Accommodation Processes and Standards, 2009.

Except for those areas so designated, no other areas shall be provided or furnished for the erection of residential accommodation facilities by the Contractor.

Any generator plant for power supply shall be adequately silenced and located so as to control or keep the noise level at the nearest sensitive receptors within the National Environmental Quality Standards (NEQS). The Contractor shall provide, operate and maintain a potable water supply for the duration of the Contract and shall provide connections and reticulation for potable water to his own facilities. The quality of the potable water shall conform to or comply with the World Health

Organization (WHO) quality criteria and National Environmental Quality Standards (NEQS) for drinking water.

The Contractor shall also make all arrangements necessary for the distribution of potable water for the due fulfilment of the Contract to his various offices, buildings and other Site facilities. For each such facility, this supply shall be maintained for the duration of the work or use of the area.

The Contractor shall provide and maintain sewerage reticulation and treatment facilities including septic tank with adequate capacity and size in the designated areas and outfall facilities as necessary, including all pipework, manholes, specials and fittings and any other equipment as necessary. Sewage treatment facilities shall comply with Clause 10.11 of this Chapter.

All costs shall be deemed to be covered or included in the unit prices and rates and/or lump sum prices of the various items in the Bill of Quantities (BOQ).

7.5 LIGHTING

Whenever the Contractor is engaged in night or underground works or sections, the Contractor shall provide and maintain in working good condition, adequate high powered flood lighting for all portions or sections of the works in which he is occupied or engaged. This shall cover or include the borrow area, quarry or spoil areas if machinery or equipment is operating in any of these areas or places. Provided lighting shall be adequate or sufficient to ensure that at all time:

1. safe working conditions to be provided or furnished for all personnel or workers on the site(s) or premises,
2. the Works to be constructed or executed in strict accordance / compliance with the contract,
3. complete inspections of all works in progress to be made by the Project Manager whenever directed or required,
4. security of the Works areas and public safety measures to be adequate and effective in a proactive manner.

Unless otherwise specifically directed or required by the Project Manager the minimum intensity of illumination on ground on working surface to be provided for the various operators or work areas shall be shown or tabulated as follows:

Illuminance Operation or Area	Design Value (Lux)	Minimum Measured Value (Lux)
Earthworks and excavation	50	20
Access and haul roads where cross traffic or other hazardous conditions exist	20	10
Concrete placing	100	50
Maintenance shop and mechanical and electric works	300	200

All moving plant used during night operations shall be equipped or furnished with sufficient light and reflectors and fluorescent markings so as to secure or ensure safe working conditions.

If, in the opinion of the Project Manager, the resulting illumination is not adequate or sufficient for the safe and efficient execution of the work or section, additional lighting thereof shall be provided or furnished by the Contractor without additional payment or extra payment thereof. Failing this further such work shall be prohibited or suspended unless or until the lighting is provided satisfactory.

7.6 MEDICAL FACILITIES AND PROTECTIVE EQUIPMENT

7.6.1 FIRST AID MATERIAL BOXES

The Contractor shall provide and maintain in ready condition adequate boxes of first aid kit (materials) together with stretchers at prominently marked locations within one hundred meter (100 m) of each working site or as

directed or required by the Project Manager. The minimum contents or requirements of each first aid box shall be:

- (i) Wound cleaner (500 ml)
- (ii) Swabs for cleaning wounds
- (iii) Cotton wool for padding (250g)
- (iv) Sterile gauze (2 packet)
- (v) Two (2) pairs forceps (for splinters)
- (vi) Two (2) pairs scissors (1 00m)
- (vii) Two (2) cards of 6 safety pins
- (viii) Twenty-four (24) triangular bandages
- (ix) Twelve (12) roller bandages (80mm x 5m)
- (x) Twelve (12) roller bandages (100mm x 5m)
- (xi) Two (2) rolls elastic adhesive strip2 (25mm x 3m)
- (xii) Two (2) anti-allergenic adhesive strip2 (25mm)
- (xiii) Two (2) packet2 adhesive dressing strips
- (xiv) Twelve (12) large dressings (75mm x 100mm)
- (xv) Twelve (12) shell dressings (15 m x 200mm)
- (xvi) Four (4) straight splints

The Contractor shall conduct a basic First Aid Training Program as directed or required by the Project Manager so as to ensure that each foreman or work crew leader is trained in first aid and CPR, possesses a certificate to that effect issued by the Rescue 1122, Red Crescent/Cross, or equivalent qualification within three (3) months of his appointment or assignment.

7.6.2 MEDICAL SCREENING AND FOLLOW-UP EXAMINATION OF EMPLOYEES

The Contractor shall institute and operate a medical screening and examination system for prospective employees, personnel or workers. The screening system shall be established and monitored in consultation with the Employer, the Ministry of Health and the Ministry of Labor respectively. The Contractor shall also conduct follow-up medical examination of the employees, personnel, or workers, who are engaged or involved in kitchen/food handling, high-risk construction works, for example, driller and blasters, workers in batching plant, excavation workers, welders, flagman, etc. Follow-up examination shall be conducted at least once a year, for hearing losses, eye sight, breathing etc. Any ailment or deterioration of health condition, shall be followed-up or taken care by the specialist physician visits at the cost and risk of the Contractor.

7.6.3 TRAFFIC SAFETY MEASURES

The Contractor shall provide or furnish traffic signs at strategic locations of the roads conforming to or complying with the schedules of signs contained or stipulated in the Pakistan Traffic Regulations.

7.6.4 PROTECTIVE EQUIPMENT

The Contractor shall provide personal protective equipment (PPE) or protective gears for workers, and site staffs of the Contractor and Project Manager, such as safety shoes, helmets, masks, breathing apparatus, gloves, protective clothing, goggles, full-face eye shields, and ear protection.

The following but not limited is the list of PPEs required for the entire duration of the Project.

S. No.	Items
1	Safety Shoes (with steel toe)

2	Helmet
3	Reflecting Jackets
4	Welding Shields & Welding apron
5	Gloves (Welding)
6	Gloves (Heavy lifting)
7	Full Body Harness
8	Eye Safety & Eye Protection Glasses
9	Ear plug and Muff
10	Life Lines
11	Rope Grabs
12	Safety Cones
13	Other items related to PPEs & Equipment

The Contractor shall request AFI (Availability for Inspection) of the consumable PPEs to the Project Manager which will approve based on level of compliance.

7.7 FIRE CONTROL

The Contractor shall take all and every reasonable precaution or measures against outbreaks of fire or emergency

The Contractor shall provide and maintain at the Site fire extinguishers and a firefighting service. Such firefighting service shall be always available on a 24h/day basis and the Contractor shall install and maintain a proper warning system to ensure that the firefighting teams and equipment shall be concentrated on any fire in the shortest possible time.

No open fires shall be permitted or approved in working areas or elsewhere within the Contractor's control. Grass and other vegetation in the vicinity of all buildings or premises shall be cut at regular intervals to reduce or minimize fire hazards. Adequate fire breaks shall be cut and maintained within the Site.

In the event of a fire or other emergency, the Contractor shall mobilise all nearby personnel, and shall do whatsoever necessary and possible in order to extinguish the outbreak and minimize the loss and damage directly or indirectly therefrom.

7.8 SECURITY

The Contractor shall institute and operate an effective security system on a 24h/day basis at all the areas or premises comprising the Site. The Contractor shall co-operate with the employers' Joint Control Room and comply with the SOP30 of OHSMP: Contractor Security Management requirements on all matters or issues relating to Security of the Works and persons or children entering the Site. Such a system shall cover or include appropriate identification or access control procedures for all persons, vehicles, and the like as and when entering and leaving.

The Contractor shall be entirely responsible for providing and maintaining in proper operation the security system for the duration of the Works or execution of the Contract, including (without limitation) personnel, equipment, access control buildings, guard shelters, turnstiles, barriers, identification systems, administration, management, and the like.

The Contractor shall also institute and manage emergency evacuation procedures at each working area. The Contractor shall also prohibit to bring any firearms onto the Site.

The cost of providing security system shall deemed to be covered or included in other work items.

7.9 FACILITIES FOR POLICE & SECURITY FORCES

The Contractor shall provide or furnish accommodation and living facilities for local police and security forces. The accommodation and facilities shall be of adequate size having all kind of

facilities.

The Contractor shall be responsible for the running and maintenance of accommodation, furnishing and equipment and the like. Necessary material and other routine maintenance items such as utility consumable items shall be provided or furnished by the Contractor as per the requirement instructed or directed by the Project Manager.

7.10 PROGRESS PHOTOGRAPHS

Colour photographs showing the progress of the Works shall be taken by the Contractor at monthly intervals including ones taken from some constant views determined by the Project Manager or selected by the Contractor and agreed by the Project Manager.

Photographs shall not be less than 120 mm x 80 mm and shall be inscribed with the location, taking date, identification number and title with a brief description. Four (4) prints of each photograph shall be required to be submitted to the Project Manager each month as a part of the Monthly Progress Report. All negatives or a disk of CD in the case of digital photograph shall be numbered and kept on Site by the Contractor in his custody and control. On completion of the Works, the negatives or CDs shall be handed over to the Employer. It is recommended that digital camera with facility of time and date imprinted in picture to be used.

Construction scenes and major construction events selected by the Project Manager shall be taken and recorded in digital video system by the Contractor. Videos shall be edited and inscribed with a brief description or title with the location and date by the Contractor, then submitted to the Project Manager at every month in the one (1) set of the digital video recorded in CD(s).

All such photographs, negatives, video in CDs shall be the property of the Employer subsequently.

7.11 ASSISTANCE FOR THE PROJECT MANAGER

The Contractor shall provide or furnish the Project Manager with such assistance as he may require during working hours at all times including weekends.

When so requested by the Project Manager, the Contractor shall supply or provide for the use of the Project Manager with such equipment and facilities as the Contractor may have available, at Daywork rates or other rates to be negotiated as necessary. The Contractor shall also supply or provide skilled labour, semi-skilled labour and unskilled labour for which there are payment items in the Bill of Quantities (BOQ). Semi-skilled labour shall be deemed to cover or include light vehicle drivers, survey assistants, checkers, messengers, cleaners, and the like.

7.12 TRANSPORT OF PERSONNEL

The Contractor, shall be liable or responsible for, and make provision for the safe vehicular transport of all personnel between their residences and their work areas, and vice versa. Pick and drop points shall be proposed by the Contractor and approved by the Project Manager. Personnel shall only be transported on flatbed trucks or similar vehicles if acceptable side restraints and adequate seating is provided. Weather proof covers shall be used or always furnished. The prevention of overloading of vehicles shall be rigidly enforced by the Contractor and suitable crush barriers shall be provided at loading points.

Pedestrian access on road surfaces shall not be permitted nor approved and suitable sidewalks shall be constructed and clearly demarcated.

8 CONSTRUCTION MATTERS

8.1 CONTRACTOR'S METHODS AND MATERIALS

Unless otherwise specifically verified or confirmed in writing, acceptance of the Bid will not signify acceptance of the Contractor's Equipment, proposed methods, construction, Temporary Works or materials, nor will it in any way relieve the Contractor of any of his obligation and responsibilities expressed or implied under the Contract. Further it will not be accepted as a basis for claiming additional compensation where the proposed methods of construction or the proposed materials do not conform to or comply with the Specifications and/or for reasons of inadequacy or of non-viability are not capable of fulfilling the Contract in accordance with the specifications or the

Contract Programme.

The Specifications deal with the quality of materials, workmanship, etc. but the actual methods of construction are not, with some exceptions, generally specified. The construction of the Works shall involve dealing with a number of special Engineering problems. The accuracy of the Works, the high standard of workmanship so demanded under the Specifications, the safety of the workmen employed and the speed of construction shall depend on the correct handling of these problems by the Contractor. Although responsibility for these matters rests with the Contractor, it is essential that there shall be full liaison between the Contractor and the Project Manager with regard to construction methods and materials to be employed or furnished.

Unless otherwise instructed or directed by the Project Manager, the Contractor shall submit to the Project Manager to consent full details concerning the methods, equipment and materials proposed for each section of the work or installation. These shall be referred to as Method Statements and the details as necessary and confirmed to the Project Manager not later than fifty-six (56) day before the programmed commencement of work in the area concerned. Initial activities shall be based on as consented or agreed in writing by the Project Manager.

The Project Manager will consent to or comment on the proposals within twenty-one (21) day of receipt.

The Project Manager's consent shall not be unreasonably withheld provided that the methods, equipment and materials proposed may be expected to produce an acceptable end result, but any approval, consent, acceptance, agreement, etc. by the Project Manager shall not relieve the Contractor of his obligations or responsibilities for safety, adherence to the programme, compliance with the Specifications and Drawing or any other requirements in fulfilment of the Contract.

After operations have been commenced, it is possible that modifications to the construction methods originally agreed upon will be found desirable and such modifications shall be made from time to time by the mutual agreement in writing between the Project Manager and the Contractor, and subject to the approval of the Project Manager and/or the Employer. The Project Manager's approval on the Contractor's method statement and/or the revised method statement during construction stage shall not release the Contractor from his obligation and responsibilities expressed or implied under the terms, provisions and conditions of the Contract.

If, however any equipment, appliances, types or quality of Temporary Works such as scaffolding, forms, safety provisions, and the like., are in the opinion of the Project Manager, either unsafe or unsuitable for accurate and efficient construction, the Project Manager will instruct the Contractor to replace or modify the item or items concerned, whether or not the Contractor is in agreement with such opinion or instruction, and the Contractor shall forthwith make the appropriate and necessary alterations or rectifications without any additional payment or extra cost and claim.

The Contractor shall remedy at his own cost and risk any damages or defects in any part or section of the Works which are attributable to the Contractor's construction method, equipment, materials and workmanship, in accordance with the Contract and the Project Manager's instructions.

The Contractor shall be entirely liable or responsible for all costs associated with locating, establishing and operating his own Quarry Site as a source of all site requirements for stone and aggregates and the like.

Where an alternative design is initiated by the Contractor, he shall be responsible for obtaining any required design criteria from the Project Manager in a timely manner as necessary.

8.2 PROGRAMMING REQUIREMENTS

8.2.1 OUTLINE

The preparation of up-to-date programmes which are realistic, adequately detailed and upon which the requirements for the issue of drawings for the Project Manager's approval or permission shall be based and progress monitored is a primary requirement of this Contract. To achieve this, the Contractor shall employ on his site, an experienced planner with adequate support staff and systems who shall be responsible for the preparation and updating of programmes and progress reports.

During the erection of Plant and equipment while other operations are still in progress, the

Contractor must programme the work in such a manner that the erection operations can be executed in safety and without undue obstruction or hindrance.

8.2.2 BID CONSTRUCTION SCHEDULE

The Bidder shall prepare and submit a programme (Form TP-4) to define the duration of construction of the various parts or sections of the Works and shall take into consideration any non-working days. Such programme shall be designated as the «Bid Construction Schedule».

Any Project Manager's Programme included or envisaged in the Drawings shall be provided for information only and is not warranted in any way. This programme shall illustrate one (1) alternative for the programming of the Works.

The Bid Construction Schedule shall be based on the Contractor's own comprehensive plan, programme and resource usage with appropriate development of method statements or methodology for construction of the Works. The Contractor shall ensure that the Bid Construction Schedule shall meet the specific requirements of the Contract notwithstanding anything that may be indicated in or inferred from the Project Manager's Programme. The Bid Construction Schedule shall be based on network logic relationships between activities. The programme thereof shall be computerised, whereby using Microsoft Project, Primavera or equivalent conventional construction planning computer software suitable for use on a PC.

The entire programme shall be suitable for future expansion by addition of more detailed programme activities for construction of the Works, for monitoring progress and changes therein, planning of critical activities and generation of progress and planning reports during execution of the Works.

8.2.3 CONTRACT PROGRAMME

The detailed programme to be submitted in terms of GC Clause 30, within twenty-eight (28) days of receipt of notice to commence shall be based on updating and expanding the Bid Construction Schedule and shall be designated with the title of «Contract Work Execution Programme» and revision number with date.

The submission shall cover or include as a minimum of:

- the network drawing,
- tabular listings of early starts and finishes, late starts and finishes, free and total floats,
- computer generated bar charts,
- periods required for work carried out by sub-contractors,
- information on shutdown periods, vacation day and other non-working time periods, and
- schedule of equipment and plant and manpower mobilisation schedule.

Until such time as the Contract Programme has been accepted or approved by the Project Manager, all work shall be executed and monitored against the Bid Construction Schedule.

The Contract Programme shall clearly show or demonstrate the interrelationship of all tasks and activities in the programme. In addition, resource statements including labour and equipment types and numbers and planned outputs shall be prepared and submitted to substantiate each activity duration. The Contractor shall also prepare and submit excavation and construction summation graphs for each section of the Works against which progress will be monitored.

The Contractor shall provide or submit, to the Project Manager, an original version of the software, fully documented in English and licensed for use by the Project Manager where necessary.

The format of all outputs and reports from the Contract Programme shall be as agreed and approved by the Project Manager.

During execution of the Contract, the Contractor shall with due diligence monitor the construction activities relative to the Contract Programme (or the Bid Construction Schedule, as applicable) and shall prepare and submit a report detailing the results of the monitor on a monthly basis as a part of the Monthly Progress Report. All variances from said programmes (as applicable) shall be promptly reported and the future impact of such variances shall be determined and analysed by

the Contractor, whereby using network logic, and necessary corrective measures established, subject to the consent or approval of the Project Manager, but it shall not relieve the Contractor from his obligation and responsibility expressed or implied under the terms and conditions of the Contract.

8.2.4 PROGRESS MEETINGS

The Contractor shall be required to attend regular site meetings with the Project Manager where the progress of construction and environmental compliance will be reviewed. Such meetings shall be normally held monthly and may be attended by representatives or agents of the Employer. The Contractor shall prepare and circulate to all parties concerned to attend the meeting progress records and explanatory sheets one (1) day before the meeting.

The Contractor shall also attend weekly meetings with the Project Manager and provide prior to each meeting as instructed or required by the Project Manager detailed programmes showing separately the various activities or tasks of the Contractor anticipated over the forthcoming two (2) week period as well as the progress achieved over the preceding week relative to the programme applicable to that period.

The agenda of each progress meeting shall cover or include the approval or permission of the minutes of the previous meetings, progress of the works with respect to the schedule and analysis of the difficulties encountered in the work.

The minutes of the meetings (MOM) shall be prepared by the Project Manager and shall be deemed, after approval or consensus by the other participants, to be written confirmation of the declarations, instructions and decisions taken during the meeting.

The Contractor shall be required to attend regular coordination meetings basically on a monthly basis, with the Project Manager and the other Contractors for coordination of interface activities.

8.3 QUALITY MANAGEMENT

8.3.1 SYSTEM AND PROCEDURES

The Contractor shall be solely liable or responsible for the quality and testing of materials, workmanship and production processes in the Contract.

To this end the Contractor shall institute and operate a Quality Management plan, in order to satisfy the specifications relevant to each operation pursuant to the Works in terms of the Contract which details:

- quality control procedures
- personnel responsibilities
- procurement procedures
- testing procedures
- equipment and calibration
- frequency testing, calibration, and the like
- hold points in production for inspection
- rejection and rectification procedures
- documentation and communication

8.3.2 APPROVAL OF SYSTEM

Within twenty eight (28) days after the Notice to Commence the Work and based on the general outline and any amendments thereto requested prior to acceptance of the Bid, the Contractor shall prepare and submit comprehensive details of the systems as proposed, making use wherever possible of diagrams, charts, organograms, and the like. in preference to lengthy description, all for the approval or permission of the Project Manager. Such details shall be updated from time to time as appropriate or as directed or instructed by the Project Manager in writing.

The Contractor shall commence or initiate the operation of the Quality Management plan without

undue delay and in accordance with the Project Manager's approval or instruction of the general outline and documentation examples as accepted with the Bid and shall thereafter modify the system, from time to time in accordance with the further details as approved or instructed by the Project Manager.

8.3.3 PROVISION OF MATERIALS AND EQUIPMENT

- All materials and equipment intended to be incorporated or utilized in the Works shall be subject to approval or permission by the Project Manager prior to purchase order by the Contractor.
- No Plant or part thereof shall be shipped or furnished to the work site before it has been approved or permitted by the Project Manager.
- Proprietary Brands:

Where the Specification refers to materials of a particular brand name, the Contractor shall offer an equivalent for the Project Manager's approval or permission but the Project Manager is under no obligation or liability to accept the alternative and no claims will be entertained if the alternative is not accepted or approved by the Project Manager.

- Testing of Materials

Unless otherwise specifically stated in the Specifications or accepted / approved by the Project Manager, all testing thereof shall be carried out and interpreted in strict accordance with the methods or methodology specified in the relevant AASHTO / ASTM Standards or other international or national standards specified in the Technical Specifications or approved by the Project Manager.

8.3.4 COMPETENCE OF WORKMEN

The competence of personnel required to undertake operations involving particular skills and experience, affecting the quality of the Works, shall be demonstrated to the Project Manager. Suitable means of identification of different skills and training levels of workmen by way of badges or such like shall be instituted.

Workman shall only receive their practical training on those parts of the Works as agreed or approved by the Project Manager.

8.3.5 INSPECTION

Whenever the regular period for carrying out or executing work is to be changed, the Project Manager's consent or approval shall be requested or required and the Project Manager shall be given notice or notification by the Contractor in sufficient time, at least twenty-eight (28) days, to rearrange staffing for proper inspection. The Project Manager shall be given notice of any other proposed changes to normal working times at the weekly progress meetings or as necessary to cope with emergencies or urgencies.

The Employer may, if necessary, employ the other independent organisation or personnel to inspect and check the Works performed or executed by the Contractor. The Contractor shall cooperate with and enable them to conduct and fulfil their inspection, but any claim of the Contractor in this regard shall not be entertained nor accepted.

8.4 APPROVAL OF MATERIALS AND EQUIPMENT

8.4.1 SUBMISSION OF SAMPLES AND DATA

The Contractor shall provide or furnish all information as to quality, weight, constituent substances, dimensions, levels, strength and description of the materials, equipment and work, as may be designated or required by the Project Manager and which the Contractor proposes to incorporate in the Works, and shall give the Project Manager such other particulars as may be required.

Before placing any order for materials for incorporation in the Works, the Contractor shall prepare and submit to the Project Manager for information and consent the names of the firms supplying materials giving the origin, manufacturer's specification, quality, weight, strength and description. When requested or instructed, the Contractor shall provide or furnish such samples of the materials together with the manufacturer's test certificates as the Project Manager instructor require. The samples ordered or specified shall be delivered or submitted to the Project Manager on the Site,

allowing sufficient time for the Project Manager to inspect and/or test the samples before the material is procured or required in the Works. The Project Manager may request or instruct the Contractor to conduct such tests on the submitted samples without separate cost or extra cost.

Unless otherwise specified, all proprietary materials shall be used and placed in the care, custody, and control of the Contractor in strict accordance with the relevant manufacturer's instructions or recommendations.

Items submitted thereof shall be properly labelled to indicate the Project Contract number, Contractor's source of supply, manufacturer Contract Item number, and other data specified or required by the Specifications.

The results of the tests shall generally show or demonstrate the following:

- (i) Sample identification numbers.
- (ii) Sample origin.
- (iii) Part of the Works represented by the sample.
- (iv) Sampling date.
- (v) Description of tests with reference to the relevant standards.
- (vi) Test results.
- (vii) Date of tests.
- (viii) Reference of laboratory undertaking the tests.
- (ix) Conclusion (Satisfactory or Unsatisfactory).

8.4.2 INSPECTION AT THE PLACE OF MANUFACTURE

To allow or permit possible inspection of materials and equipment in the course of or on completion of preparation or manufacture, the Contractor shall give the Project Manager written notice or notification of the workshops and places where the materials and equipment are manufactured or stored and advise him of the state of progress, so that the inspection may be conducted at appropriate times and without delaying the dispatch or delivery of materials and equipment to the Site.

The Project Manager will make or request the Contractor to conduct such tests on concrete, concrete aggregates, embankment materials, filter materials and other materials as he may from time to time advise, and the Contractor shall provide or furnish such samples and assistance in sampling materials at the site as the Project Manager may reasonably instruct or require. Testing by the Project Manager shall in no way relieve the Contractor of his obligation or responsibility to test materials to ensure that the same shall meet or satisfy all the specified requirements and to control their quality.

8.4.3 CERTIFICATES OF COMPLIANCE

In the case of standard labelled stock products of standard manufacture material which have a record of satisfactory performance in similar work over a period of not less than two (2) years, the Project Manager may accept or approve a statement from such manufacturer attested by the certified laboratory certifying that the product conforms to or comply with the applicable Specifications.

Unless otherwise specified, all proprietary materials thereof shall be used and placed in the care, custody, and control of the Contractor in strict accordance with the relevant manufacturer's instructions or recommendations.

In the case of materials for which such practice is usual, the Project Manager may accept or approve the manufacturer's certified mill and laboratory certificate.

If a demonstrable satisfactory service record is available for a material, certain specified tests may be waived by the Project Manager.

The Project Manager may accept or approve a certificate from a commercial testing laboratory, satisfactory to him, certifying that the product has been tested within a period acceptable to the Project Manager and that the same conforms to or comply with the requirements of the Specifications.

The Contractor shall provide or furnish the Project Manager with a list of Sub-Contractors and vendors with whom orders are to be placed for materials or equipment which will be incorporated directly into the works.

Copies of material or equipment orders and list of stock material or equipment shall be provided or furnished to the Project Manager. All orders and stock lists thereof shall state or indicate the Standard Specification under which the material shall be furnished, pertinent drawing and part numbers if any, and the required delivery date, and shall state or specify that the material shall be subject to inspection and testing by the Project Manager.

8.4.4 ACCEPTANCE OF MATERIALS

The acceptance or approval by the Project Manager of any material or equipment shall in no way relieve the Contractor of any of his obligations or responsibilities for meeting or satisfying all of the specific requirements of the Specifications and shall not prevent subsequent rejection or refusal if such material or equipment is later found to be defective as latent defects or not conforming to the Specifications.

8.5 CONTRACTOR'S RETURNS

Records and returns thereof shall be reported to the Project Manager with due diligence and expedition in a form or format acceptable to the Project Manager.

8.5.1 WEEKLY REPORT

The Contractor shall keep or maintain accurate records detailing work carried out for the Works and shall submit them as Weekly Report to the Project Manager prior to the weekly progress meeting as required or instructed by the Project Manager or at such other times as the Project Manager may require or instruct. The records shall cover or include the following for each section of the Works separately in sufficient detail to establish the man-hours spent and equipment-hours expended:

- extent of work done,
- the number of each category of workmen and supervising staff,
- the numbers and types of Contractor's Equipment used,
- the duration and cause of any significant delays due to breakdown of any Contractor's Equipment,
- any other events relevant to progress of the Works.

Notwithstanding the foregoing, the Project Manager may appoint or employ members of his own staff to record some or all of the above data in addition to the Contractor's records. The Contractor shall also provide such further information as may be requested or instructed by the Project Manager.

8.5.2 MONTHLY PROGRESS REPORT

The Contractor shall prepare and submit Monthly Progress Report at the beginning of each following month presenting the records and issues with respect to each month in question. The contents of the Report thereof shall cover or include, but not limited to the following items and details:

- Record of major events in the execution of the Works including Temporary Works together with monthly construction progress photographs.
- The Contractor's latest organization and change from previous month, if any.
- Schedule of current number of all staff on Site for each category showing increase and decrease from the previous month.

- List of equipment currently owned on Site showing increase and decrease from the previous month.
- Principal materials consumed, ordered and being stocked on Site.
- Plant operation records.
- Delivery or removal plan of equipment during the following month.
- Record of accident(s) with number and descriptions.

The reporting form or format of each item shall be subject to the prior consensus or agreement of the Project Manager.

8.5.3 MONTHLY ENVIRONMENTAL PROGRESS REPORT

The Contractor shall also submit Monthly Environmental Progress Report at the beginning of each following month with the following minimum contents or otherwise specified by the Project Manager:

1. Methodology for Environmental Monitoring
2. Organizational set-up
3. Environmental officer: days worked, areas inspected and numbers of inspections of each area;
4. Record of site inspections carried out by the Employer and Project Manager;
5. Record of meeting on major environmental issues during the month;
6. Identify major activities undertaken in each area in the reporting period, violations of environmental requirements/ best practices, actions taken to mitigate the impacts like dust, soil erosion, noise, spillage, solid waste management, spoil management etc.;
7. Status of all permits and agreements:
 - i. list areas/facilities for approvals from the Project Manager and concerned government departments, dates submitted to the Project Manager, actions to follow up if not issued;
 - ii. list areas with landowner agreements required (borrow and spoil areas, camp sites, material storage area, disposal area), dates of agreements, dates submitted to the Project Manager;
8. List of Non- Conformance Reports (NCRs)
9. Number of new workers receiving induction training on environment;
10. Number and dates of toolbox talks, number of workers receiving environmental training;
11. Number of environmental incidents e.g, spillages, dust from excavation etc.;
12. Environmental and workers welfare facilities provided in the camp;
13. CEAP compliance status (statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance);
14. Tree cut during the month
15. Effect monitoring; and
16. Other unresolved issues from previous reporting periods.

8.5.4 DAYWORK AND SIMILAR RECORDS

In accordance with GC Sub-Clause 55 therein, records shall be kept or maintained with daily of labour, materials and equipment where there is an agreement to pay by Dayworks. Such records shall be valid only when duly signed by the Contractor and the Project Manager.

In cases where there is any conflict, dispute or uncertainty on payment procedure, sheets of work records shall be prepared by the Contractor and signed daily by both the Contractor and the Project Manager as an agreed record of work substantially completed provided that such records shall not contain or imply any commitment concerning payment. These sheets shall be annotated «For record purposes only.

9 STANDARDS, DRAWINGS, SUBMISSION AND APPROVAL

9.1 STANDARDS

Abbreviations and definitions, standard codes for sampling and testing and frequency of testing has been described or specified in Technical Specifications in sufficient detail.

The Contractor should have copy in English of all applicable Standards and Codes of Practice concerning site works and tests of equipment.

Except as otherwise specified, where such standards and codes are specified, the latest revision or edition on the Reference Date shall apply.

When the Contract Documents contain particular specification or more restrictive specification than required in Standards and Codes listed above, the Contract Documents shall always prevail.

In case of lack of precise requirements in the Specifications and even if no reference to any standard listed in the Technical Specifications, these standards shall be used or applied mutatis mutandis as a reference.

Where requirements are specified by reference to a standard, it is not the intention to restrict the requirements solely to that standard. The Contractor shall propose to the Project Manager an equivalent standard other than that specified, in which case he shall prepare and submit the proposed standard and all other information required, and shall submit written proof or evidence that his proposed standard shall be equivalent in all significant respects to the standard so specified. All preparation and submissions shall be made in English language.

Where a manufacturer is named in the Specifications, other manufacturers' products will also be acceptable or approved by the Project Manager, provided that the designated material or workmanship shall be of equivalent or better.

9.2 DRAWINGS

9.2.1 BID DRAWINGS

The Bid Drawings referred to in the Specifications are those listed in Volume 3(b) "Drawings" of a general nature only, but are considered to be sufficient for the purpose of bidding. Bid Drawings shall not be used for construction or ordering materials.

In general, the structural drawings for the Works shall be of general drawings that will be modified and/or supplemented by additional details.

9.2.2 CONSTRUCTION DRAWINGS

"Drawings" referred to in the Specifications shall mean all drawings, calculations and technical information of a like nature provided by the Employer through the Project Manager to the Contractor for construction of the Works and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature prepared and submitted by the Contractor and approved by the Project Manager.

After award of the Contract, the Bid Drawings shall be replaced with the drawings issued by the Project Manager for construction, with specifications as may be appropriate and necessary. The Project Manager's drawings for construction shall be prepared whereby applying AutoCAD. One (1) set of A3 size prints of drawings with signature of the Project Manager's authorized person(s) shall be issued to the Contractor together with an electronic soft copy from time to time in accordance with the drawing issuance schedule mutually agreed or consented.

The drawings to be issued by the Project Manager for construction shall cover or include Bid Documents reissued, Bid Drawings modified and/or supplemented, additional drawings and technical information as required to develop in greater detail for construction of the Works and shall be referred to hereinafter as the Drawings. The Permanent works shall be executed or carried out in accordance with such Drawings.

The Drawings to be furnished by the Project Manager to the Contractor shall be established for cases of maximum load likely to occur during operation of the Permanent Works, and exceptional

situation which may occur during construction as far as the Project Manager has received in due time the information from the Contractor and has approved or permitted the method of works. Nevertheless, the Contractor shall be fully liable or responsible for assuring the adequacy or insufficiency of all part or section of the Works with respect to loading which might occur during construction and shall supply or furnish calculation notes and drawings for any necessary falsework, support, strengthening as may be instructed or required by the Project Manager.

Where the Contractor's Equipment and Temporary Works may have an effect or impose forces on any part or section of the Permanent Works, the Contractor shall prepare and submit in advance details for approval of such items, including the magnitude and direction of such forces, together with any other special construction requirements.

The revised Construction Drawings (RCD) for the execution of the Works or Sections shall only be prepared and issued if and when the design of the particular Works or Sections is changed or varied altogether. Site adjustment during execution of the Works or Sections shall be described or specified in the Shop Drawings at site duly reviewed and approved by the Project Manager in writing which shall be incorporated into As-build Drawings to be prepared and submitted by the Contractor.

9.2.3 SCHEDULE FOR DRAWINGS FROM THE PROJECT MANAGER

The Project Manager will provide the Contractor with his schedule for issuance to the Contractor of the Drawings to be issued by the Project Manager for construction of the various parts or sections of the Works.

Whenever it becomes necessary for the Contractor to propose revisions to the programme which may influence or affect the Project Manager's programme of production of Drawings, the Contractor shall give adequate advance notice or notification in writing of the revisions to allow the Project Manager to similarly modify or revise the drawing programme.

The Project Manager may change time to time his drawing programme to suit with the actual progress of the Work. In such case, the Drawing issuance schedule thereof shall be newly established with the mutual agreement between the Project Manager and the Contractor.

9.2.4 CHECKING OF DRAWINGS

The Contractor shall check or verify all the Drawings furnished by the Project Manager carefully as soon as reasonably practicable after the receipt thereof, and shall promptly explain the Project Manager of any errors or omissions arose or discovered.

The Contractor shall review and check all or every Drawings furnished by the Project Manager in every / sufficient detail as soon as practicable after receipt of the Drawings and shall forthwith explain or report to the Project Manager of any error, discrepancy or omission whatsoever nature arose or found within twenty-eight (28) days after receipt of the Drawings

9.3 DRAWINGS SUBMISSION

9.3.1 GENERAL

All Drawings to be prepared and submitted by the Contractor (if any) for the Project Manager's approval shall be made in English language, and all dimensions shall be in Metric system. Symbols shall be in accordance with approved Standards and Codes. All Drawings submitted for approval shall conform to or comply with ISO paper sizes A0 to A3. Title block and numbering thereof shall be approved by the Project Manager.

9.3.2 DRAWINGS TO BE SUBMITTED

Where applicable, the Contractor shall prepare and submit to the Project Manager the following Drawings for approval:

1. Drawings including design calculation notes and other information as necessary of such part or section of Permanent Works to be designed by the Contractor pursuant to the Specifications.
2. Drawings of construction facilities as required for the fulfilment of the Contract in accordance with the Specifications.

3. Drawings of Temporary Works for the construction of Permanent Works.
4. Drawings of the performances in the construction of Permanent Works as necessary for showing or demonstrating the construction methods.
5. Detailed construction drawings and calculation sheets.
6. Detailed drawings of concrete reinforcement as well as bar bending and cutting list.
7. Shop drawings of all structural steel and associated metal works.
8. Shop drawings of miscellaneous metal works.
9. As-built drawings of all Permanent Works constructed, with the final quantity calculations for all items in the Bill of Quantities (BOQ).
10. Other drawings necessary for the performance of each part or section of the Works in accordance with the Contract.

9.3.3 APPROVAL OF DRAWINGS AND DOCUMENTS

Detailed procedure for submission of the drawings and documents prepared by the Contractor for the Project Manager's approval and the approval of the Project Manager to those drawings and documents shall be made in accordance with the Conditions of Contract.

All materials ordered, or works performed, prior to the approval or permission of the relevant designs shall be at the Contractor's cost and risk.

The Contractor shall bring to the attention or instruction of the Project Manager any variation in the Contract in the document submitted for approval.

All the drawings, details, bill of materials and any other information or documents furnished by the Contractor shall become the property of the Employer and shall be non-returnable. The Employer will have the right or entitlement to use this property.

All correspondence shall be dated, numbered and distributed in accordance with a procedure agreed and approved by the Project Manager.

The Project Manager will supply or furnish to the Contractor the updated data and information of the other Contractor's Works which may be relevant.

10 HEALTH AND SAFETY

10.1 GENERAL

The Contractor shall take full responsibility for the avoidance or prevention of unhealthy or unsafe conditions and practices and for the promotion of healthy and safe working practices at the Site, as such conditions and practices may influence or affect his employees and any other persons while present at the Site, and nothing specified herein shall relieve the Contractor of any obligation or responsibility under the Contract whatsoever in this regard.

Approved safety helmets shall be worn by all persons, staffs and labours at all the times whilst on the Works or the Site. Suitable protective clothing including uniform overalls, footwear, waterproofs, gloves, safety glasses, ear protectors, hi-viz waistcoats and the like appropriate to the work being undertaken, shall be issued to and worn by all workmen. The Contractor shall conduct such safety awareness programmes and campaigns as may be necessary, including the use of prominent and strategically placed posters, audio-visual methods, and the like.

The Contractor is required to develop an OHS Plan, emphasizing working at height and the installation of temporary structures such as scaffolds or working platforms. The plan to be reviewed and approved by the Project Manager. In addition, the Contractor shall submit Method Statement or Methodology and Risk Assessment for specified task activities to identify the hazards and precautionary measures to avoid or minimize the incident / accidents on the Site or Work places.

The Contractor shall take all reasonable precaution and measure to provide or furnish the personnel, staff(s) and workmen of the Contractor and Sub-Contractor(s) and the Project Manager

(whenever required) with the following Personal Protective Equipment or Protective Gear as preventive measures to be accepted or approved by the Project Manager before commencement of the Works or Sections in order to avoid or minimize the risk and hazard on the Site i.e. construction accidents, injuries or incidents including any disease and epidemic (Corona pandemic infection) as specified hereunder. inter alia

(Safety Equipment)

- (i) safety helmets (with chin strap),
- (ii) safety clear and dark glasses or goggles and earplugs,
- (iii) mask for dust and mask for Corona Infection ,
- (v) safety shoes and/or rubber boots with steel toe,
- (vi) reflected construction vestt,
- (vii) protective gloves,
- (viii) full body double lanyard harness for high place work at height,

(OHS Resources)

- (i) OHS supervisor one (1)
- (i) First Aide Kits in specific work location(s) as required by the Project Manager(4)
- (i) Fire Extinguisher on camp facilities and on Site

Fire Fighting Equipment mentioned above (Fire Extinguishers) shall be in sufficient quantity as required / approved by the Project Manager to handle any accidental situation.

Pursuant to *GC Sub-Clause 18* , the Contractor shall take full responsibility for the avoidance or prevention of unhealthy or unsafe conditions and poor practices and for the promotion or improvement of healthy and safe working practices at the Site, as such conditions and practices may influence or affect his employees or workmen and any other third parties while present at the Site, and nothing specified herein shall relieve the Contractor from / of any obligation or responsibility expressed or implied under the Contract whatsoever in respect thereof or in relation thereto.

The Contractor shall, within fifty-six (56) calendar days after the date of the Letter of Acceptance, prepare and submit to the Project Manager for his approval or permission of the Method statement and risk assessment (MSRA). The MSRA shall be developed with utmost care and vigilance. The construction work shall not commence unless or until the MSRA has been approved or consented by the Project Manager in writing.

10.2 OCCUPATIONAL HEALTH AND SAFETY

10.2.1 GENERAL

Pursuant to *GC Clause 18* of the General Conditions of Contract, the Contractor shall implement an OHS Plan emphasizing working at height and the installation of temporary structures such as scaffolds or working platforms upon getting consent of the Project Manager

The Contractor's OHS Supervisor shall be responsible for preparing the monthly OHS monitoring report in accordance with the OHS Key Performance Indicators (KPIs) or guidelines provided by the Project Manager.

10.2.2 GUIDELINES AND STANDARDS TO BE FOLLOWED BY THE CONTRACTOR

The Contractor shall comply with the following applicable or relevant Laws, Rules, Regulations, Guidelines and Standards:

- Labor Policy 2010, Government of Pakistan;
- Hazardous Substances Rules, 2003, Government of Pakistan;
- The Explosive Rules, 2010, Government of Pakistan;
- Factories Act 1934, Government of Pakistan
- National Highways Safety Ordinance, 2000, Government of Pakistan
- The Khyber Pakhtunkhwa Occupational Safety & Health Act, 2022;
- The Khyber Pakhtunkhwa Payment of Wages Act, 2013, KPK;

- The Khyber Pakhtunkhwa Factories Act, 2013, KPK;
- The Khyber Pakhtunkhwa Workers' Compensation Act, 2013, KPK.
- Building code of Pakistan, Fire Safety provision 2016
- Power Safety Codes for Licenses, National Electric Power Regulatory Authority, June 2021
- World Bank General Environmental Health and Safety Guidelines, Chapter 2: Occupational Health and Safety, 2007;
- International Labor Organization Code of Practice in Health and Safety in Construction, 1992.
- American National Standard Institute (ANSI) for Personal Protective Equipment's (PPE). As for example, Eye and Face Protection (ANSI Z87.1-1989), Head Protection (ANSI Z89.1-1986), Foot Protection (ANSI Z41.1-1991) or equivalent or PPEs items acceptable to the Project Manager.
- Good International Industry Practices, as for example, OSHA etc.

Wherever there is a conflict, contradiction, or discrepancy in guidance of the above, the more stringent safety requirement shall be applied and complied by the Contractor.

In this document 'Shall' and 'must' shall signify or mean a mandatory requirement whereas 'Should' will be used to mention a recommended practice that the Contractor management will strive to accomplish.

10.2.3 CONTRACTOR'S TARGETS FOR KEY PERFORMANCE INDICATORS

The Contractor shall define his corporate objectives for health and safety, such as, safe operation with "Zero harm" to community members and his staffs and workers and meet or exceed the contractual safety obligations.

The Contractor shall also establish project specific measurable targets to achieve above mentioned objectives. The determination of these targets shall be based entirely upon Contractor's continual improvement philosophy, external peer group benchmarking and stakeholders' input. The Contractor shall also establish project level targets in the OHSMP for the following parameters:

- Total Recordable Injury Rate
- Medical Treatment Cases Frequency Rate
- Lost Time Injury Frequency Rate

Contractor Senior Leadership, e.g., Project Manager, Deputy Project Manager, Construction Manager and Technical Director shall commit performing the following leading indicators and maintain records of identified hazards and their controls:

- All Project Managers and Project Directors complete 1 Walk-through Inspection per month and maintain records of identified hazards and their controls.
- All Construction Managers complete 2 Walk-through Inspections per month with their assigned Occupational Supervisor.

10.2.4 OHS SUPERVISOR

The Contractor shall appoint one (1) OHS supervisor who shall be responsible for ensuring that the health and Safety Management is adhered to the approved MSRA. The OHS supervisor shall be a graduate with at least a Bachelor Degree in OHS/Project Managing/Environmental Management and have experiences of more than five (5) years in health and safety works in major infrastructure construction. He or she shall be suitably qualified and experienced persons acceptably fluent in the English language. He or she shall have obtained a vocational certification issued by NEBOSH (National Examination Board in Occupational Safety and Health), Board of Canadian Registered Safety Professional or an equivalent certification. The OHS supervisor shall be available at Site. Roles and responsibilities of OHS Officer shall include but not limited to the following:

- (i) Preparation of monthly OHS monitoring report in line with OHS KPIs and submission to the Project Manager.
- (ii) Attend Monthly Progress Review Meeting and respond to questions raised by the Project Manager.
- (iii) Responsible to prepare incident report.

- (iv) Provide training and awareness concerning the implementation of MSRA
- (v) Responsible for preparing closeout of daily/weekly or any other OHS observations raise by the Project Manager
- (vi) Discuss Job Risk and conduct effective Tool Box Talk with all workers. Ask questions to ensure that they have a good understanding.
- (vii) To be familiar with all local, national, and international laws that are applicable to the Operations.
- (viii) Raise concern in the monthly OHS Progress Review meeting regarding implementation of MSAR.
- (ix) Shall accompany the Project Manager on monthly safety inspections of the Works and shall take due account of his requirements concerning matters of safety.
- (x) To ensure that visit induction is given to all visitors before they are allowed to visit the site.
- (xi) Provide guidance for the purchase of personal protective equipment
- (xii) Conduct Regular Work Observation Process with the workers
- (xiii) Conduct emergency drill and guidance to employees concerning their emergency response responsibilities.
- (xiv) Develop a culture where it is safe to speak up and provide the time, people and resources to respond to OHS concerns identified by their workers.

10.2.5 OHS IN METHOD STATEMENT

The Contractor shall include an OHS Chapter in each Method Statement or Methodology. This OHS Chapter shall be based on Job Hazard Analysis of the site and specific to construction methods to be followed by the Contractor. This section shall be reviewed or revised by the OHS Specialists of the Project Manager and confer approval along with other technical parameters to be reviewed or revised by the technical team of the Project Manager. Each revision of the method statement or methodology shall also be reviewed or revised by the OHS Specialists and their concurrence shall be required to get them approved.

10.2.6 REQUEST FOR INSPECTION

Temporary structures such as scaffold, stairs, and ladders are one (1) of the major causes of the accidents in construction industry. For technical verifications of the temporary structures, specifications in the bidding documents define the material, stability, strength and deflections of each temporary structure. The Contractor shall ensure that Request for Inspection (RFI) for all temporary structures is initiated prior to actual construction work. The RFI shall cover or include along with the technical requirements (e.g., complete drawings, calculations relating to stability, strength, and deflections), health and safety parameters for all temporary structures. During the RFI submission and approval process, both technical and OHS personnel of the Project Manager shall inspect the requirements and certify the technical quality and safety standards and the readiness of the site to commence the work.

10.3 EPIDEMICS, PANDEMICS, AND HAZARDOUS SUBSTANCES

In the event of any outbreak of illness of a highly contagious (such as Pandemic COVID19) or epidemic nature, the Contractor shall comply with the requirements as may be made by the Government of Pakistan, or the local medical or sanitation authorities or guidance provided by WHO for the purpose of dealing with and overcoming the same.

The Contractor shall identify and keep inventories of all hazardous equipment, materials, or other substances and any other health hazards in his undertaking of the Contract. Newly created hazards or new hazardous equipment, materials or other substances brought on to Site shall be added to the inventory and maintain SDS (Safety Data Sheet) and updated records of all hazardous substances. The Contractor shall draft new, or adapt and modify existing SOPs appropriate to the said hazards.

The Project Manager shall be granted to always inspect or access to such records.

The Contractor shall conduct and document at least weekly inspections of the storage areas for equipment, transport vehicles and hazardous materials and substances, especially for spillages and leaks. The Contractor

shall take adequate precautions and make adequate provisions, to the satisfaction of the Project Manager, to avoid or prevent such spillages of toxic materials and substances from entering natural stream or areas outside the Site.

10.3.1 LIGHTING and Power Leakage

All power and electrical circuits shall be fitted with earth leakage system. Such systems shall be tested monthly and any circuit where the earth leakage system is malfunctioning shall be repaired or reinstated immediately or removed and replaced with a satisfactory unit.

10.3.2 WORKERS WELFARE

Transport of Workers

The Contractor shall be responsible for, and make provision for the safe vehicular transport of all staff and workers between their residences and their work areas, and vice versa. Transportation of workers shall be by passenger vehicles such as buses, vans or others approved or permitted by the Project Manager.

Overloading of passengers on the vehicles shall be avoided or prevented. Transportation of workers by trucks with no fixed seats and hard roof shall be prohibited.

Pedestrian access on road surfaces shall not be approved nor permitted and suitable sidewalks shall be constructed and clearly demarcated.

Site Facilities

The Contractor shall provide or furnish the following facilities for the workers at all Construction sites:

- (i) Provision of safe drinking water conforming to or complying with Pakistan National Environmental Quality standards (NEQS);
- (ii) Resting areas with appropriate shades during work breaks and extreme weather conditions;
- (iii) Appropriate lunch and dinner area with seating arrangements; and
- (iv) Dedicated change rooms other construction sites.
- (v) Portable toilets at the construction sites, if about twenty-five (25) people are working the whole day for a month. Location of portable facilities shall be at least six meter (6 m) away from storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment.

10.4 SAFETY OF PUBLIC

Where the Public could be exposed to danger or hazard by any of the Site activities, the Contractor shall as appropriate install a boundary fence and provide suitable flagmen, barriers and/or warning signs in English, Pashto, Shina, Kohistan and all to the approval or permission of the Project Manager.

10.5 PROHIBITION ON BLASTING

Blasting at all locations is strictly prohibited. The Contractor is permitted to use a jackhammer for breaking rocks in necessary areas where normal excavation is impossible. Environmental considerations must be taken into account.

11 ENVIRONMENTAL CONSIDERATIONS

11.1 GENERAL

Needless disfigurement of the natural beauty and amenities of the area as well as needless adverse effect or negative impact on the environment during construction must be avoided or prevented and special care shall be taken by the Contractor to avoid or prevent permanent damage

or defect therein. The Contractor shall take adequate steps, which may comprise lectures and audio-visual presentations, to educate or orient all members of his workforce on the environmental laws and protection requirements of Pakistan and aimed at encouraging environmental conservation. The Contractor shall supplement these steps by prominently displayed notices and signs in strategic locations to remind personnel of environmental concerns.

The Contractor shall conduct or carry out all operation in accordance with his measures and procedures and Contract Conditions and with the utmost regard to eliminating damage or defect to and disturbance of the environment. To this end, the Contractor shall provide or furnish all necessary control measures including boundary fences in each area before commencement of the Work in care, custody, and control of the Contractor. The positions of the boundary fencing shall be subject to the Project Manager's approval or permission.

Temporary pipelines, power lines, telephone lines and other temporary services shall be located in a manner which will cause the least disturbance and disfigurement to the surrounding environment. Power lines thereof shall be suspended below insulators and be of such design as to avoid or prevent the electrocution of birds to the greatest extent possible. The route of such temporary pipelines, power lines and telephone lines shall be subject to the Project Manager's approval or permission.

All rivers and streams shall be environmentally protected from direct or indirect spills of pollutants or pollution such as garbage, sewage, cement, oils, fuel, chemicals, aggregate tailings, wash and waste water or organic material resulting from the Contractor's activities. In the event of a spill, prompt action or protective measures thereof shall be taken to clear polluted or affected areas.

The Contractor shall construct and operate the necessary collection facilities such as diversion mounds, ditches, drains, dams, oil separation sumps, sedimentation ponds and the like. to avoid or prevent such contamination and to settle out suspended matter and shall dispose of collected materials as approved or permitted by the Project Manager.

Failure by any employee(s) or staff(s) of the Contractor to comply with the instructions with respect to environmental protection shall be sufficient cause for the Project Manager to order the removal of the offending person from the Site, in terms of the Contract.

The quality of waste water and effluent discharged back to any water course shall conform to or comply with the requirements of Sub-Clause 12.3 below.

The Contractor shall be liable or responsible for any compensation due or reinstatement in respect of any damage or defect caused by the Contractor to areas off / outside the Site and no separate payment will be made in this regard.

The Project Manager will notify the Contractor in writing of any observed noncompliance with relevant laws, regulations, permits and other elements of Contract. The Contractor shall, after receipt of such notice or notification, inform the Project Manager of proposed corrective actions and take such actions, at his own cost or risk, immediately when approved. If the Contractor fails to comply promptly, the Project Manager may issue a suspension notice or order stopping all or part of the work until satisfactory corrective action has been taken. No time for extension shall be granted to the Contractor for any such suspensions.

The Contractor shall provide and maintain at his own cost and risk the personnel, equipment and facilities necessary for a fulfilment of the specific requirements of the Environment Protection.

11.2 ENVIRONMENTAL CODES OF PRACTICE

11.2.1 GENERAL

The objective of the Environmental Codes of Practice (ECPs) is to address all potential and general construction related influence or impacts during implementation of the Project. The ECPs will provide or furnish guidelines for best operating practices and environmental management guidelines to be followed or adhered to by the contractors for sustainable management of all environmental issues or matters.

Referring to Clause 11 Environmental Considerations specifies the Contractor's particular environmental obligations.

11.2.2 RELEVANT STATUTES OR GUIDELINES

The Contractor shall at all times comply with or abide by all existing statutes in Pakistan concerning environmental protection, pollution control and abatement that are applicable to his construction operations. Such statutes shall cover or include, but are not limited to, the following:

- National Environmental Quality Standards (NEQS 2000, 2009, 2010 and other revisions issued by competent authority of Government of Pakistan)
- Pakistan Environmental Protection Department Regulations, 2000
- World Bank Group/IFC Environmental Health and Safety Guidelines, 2007
- World Bank Group/IFC Guidelines on Workers Accommodation Processes and Standards, 2009
- Environmental Management Action Plan of Dasu Hydropower Project, (June 2013, WAPDA), Volume 8 Environmental Management Plan (where applicable)
- Environmental and Social Assessment of Dasu Hydropower Project (April 2014, WAPDA)

11.2.3 STAFF

The Contractor shall have suitably qualified and experienced environmental officer acceptably fluent in the English language.

The environmental officer shall graduate at least a bachelor course of environmental sciences / Engineering and have experiences of more than eight (8) years in environmental management work most preferable in construction.

11.2.4 LIST OF ENVIRONMENTAL CODES OF PRACTICE

The list of ECPs prepared for the Project is given below:

1. ECP 1: Waste Management
2. ECP 2: Fuels and Hazardous Goods Management
3. ECP 3: Water Resources Management
4. ECP 4: Drainage Management
5. ECP 5: Soil Quality Management
6. ECP 6: Erosion and Sediment Control
7. ECP 7: Top Soil Management
8. ECP 8: Topography and Landscaping
9. ECP 9: Borrow Areas Development & Operation
10. ECP 10: Air Quality Management
11. ECP 11: Noise and Vibration Management
12. ECP 12: Protection of Flora
13. ECP 13: Protection of Fauna
14. ECP 14: Protection of Fisheries
15. ECP 15: Road Transport and Road Traffic Management
16. ECP 16: Construction Camp Management
17. ECP 17: Cultural and Religious Issues
18. ECP 18 COVID-19 and other Pandemic Management

The ECPs shall form the part of the contract documents and will be used as monitoring tool for compliance requirement. It is mandatory for the Contractor procured directly by the project to include these ECPs in their subcontracts. Violation or contravention of the compliance requirements shall be treated as non-compliance leading to the corrections or rectifications. The

Contractor(s) and subcontractors are requested or required to refer to the Environmental Management Plan (EMP) given in the EIA report of the DHPP for further information on corrective actions, mediation measures, performance indicators, monitoring and auditing protocols wherever applicable as the Project Manager interpretation or determination shall be final and conclusive in any matters and issues in respect thereof or in relation thereto.

11.2.5 ENVIRONMENTAL CODES OF PRACTICE

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Develop a waste management plan for treatment and disposal of various specific waste streams of solid waste (e.g., organic kitchen waste, reusable waste, and refuse), construction waste and hazardous waste (e.g. chemical or flammable waste) prior to commencing of construction and submit to supervision consultant for approval. • Deploy adequate containers (of size and capacity) for the collection of various streams described above. • Treat the organic food waste through the use of composting technologies, such as rapid composters or in-vessel composters. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Handover the recyclable waste to the vendors identified by the Contractor and approved by the Project Manager. All the waste should be stored at the site in closed containers at the site and should be removed frequently from the site and transported to the vendors. • Identify and develop a disposal area or dumping area to dispose of other solid wastes such as refuse (which is not organic waste or recyclable waste) and construction waste. The site should be approved by the Project Manager. • Vehicles transporting solid waste shall be covered with tarpaulin or nets to prevent spilling waste along the route. • Fill the dumping areas with the spoils after completion of the works • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Spoils	Dust and water pollution from improper transport and disposal of spoils	The Contractor <ul style="list-style-type: none"> • Transport all the spoil to the sites identified by the contractor and approved by the Project Manager • Protection of spoil banks from sliding through geotechnical measures. • Compaction of spoils to prevent erosion
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall <ul style="list-style-type: none"> • Collect chemical wastes in 200 litre double-lined drums (or similar sealed container), appropriately labelled for safe transport to an approved or licensed chemical waste facility. Return the empty chemical containers to the suppliers. • Store, transport and handle all chemicals, avoiding potential environmental pollution. • Store all hazardous wastes appropriately in closed containers in bunded areas away from water courses. • Identify and procure the services of licensed vendors to manage hazardous waste and safely transport the hazardous waste to their facilities. Provide the details of the Vendors in the 'Waste Management Plan' for the approval of the Project Manager. • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or other impermeable floorings to prevent seepage in case of spills. • Place the spill cleaning kits at the site and immediately clean any oil spills, remove the contaminated soil from the site, and replace it with fresh soil.

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have the potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health	The Contractor shall <ul style="list-style-type: none"> • Prepare spill control procedures and submit the plan for supervision consultant approval. • Train the relevant construction personnel to handle fuels and spill control procedures. • Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses. • Re-fuelling shall occur only within bunded areas. • Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous materials

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	of construction workers.	<p>are used and stored; and ensure personnel are trained in the correct use.</p> <ul style="list-style-type: none"> • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labelled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Store hazardous materials above flood level. • Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. • Return the gas cylinders to the supplier. However, if they are not empty prior to their return, they must be labelled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Follow the management guidelines proposed in ECPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems.
Discharge from construction sites	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography changing	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials. There should be no water stagnation at the worksites. • Install temporary sediment basins (concrete lined), where appropriate, to capture sediment-laden runoff from site. The deposited sediment should be

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, and effect habitat of fish and other aquatic biology.	<p>removed clearly and disposed of at the spoil disposal area.</p> <ul style="list-style-type: none"> • Divert runoff from undisturbed areas around the construction site. • Stockpile materials away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot. • Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Wastewater discharges	<p>Wastewaters from the septic tanks contain high BOD</p> <p>Wastewater discharges from batching plants and contain high pH values</p>	<ul style="list-style-type: none"> • Shall not discharge wastewater from the septic tanks to the natural drains or streams without prior treatment. • Shall construct wastewater treatment facilities to treat wastewater from the septic tanks. The designs of the treatment facilities shall be approved by the Project Manager. All wastewater from septic tanks will be collected and transported to these treatment facilities. • Construct sedimentation ponds of adequate size and capacity for collecting and treating wastewater discharges from the batching and crushing plants. • Control high pH in wastewater discharges of batching plants through the addition of diluted acids (HCl or other approved by The Project Manager) • Control high turbidity in wastewater through the addition of alum • Regularly clean and remove the deposited sediments from the sedimentation ponds.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).
Construction activities in water bodies	Construction works in the water bodies will increase sediment and	The Contractor Shall

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	contaminant loading, and affect habitat of fish and other aquatic biology.	<ul style="list-style-type: none"> • Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site. • Monitor the water quality in the runoff from the site or areas affected by dredge/excavation plumes, and improve work practices as necessary. • Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Untreated surface water is not suitable for drinking purposes due to presence of suspended solids and E.coli.	<p>The Contractor Shall</p> <ul style="list-style-type: none"> • Provide the drinking water that meets National Environmental Quality Standards (NEQS) for drinking water.

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth works, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare a program for prevent/avoid standing waters, which supervision consultant will verify in advance and confirm during implementation. • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line. • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to NEQS, before it is being discharged into the recipient water bodies. • Ensure that there will be no water stagnation at the construction sites and camps. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Protect natural slopes of drainage channels to ensure adequate storm water drains. Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. Periodic (or as instructed by The Project Manager) insecticide shall be sprayed inside the camp to control insects and spread of disease.
Ponding of water	Health hazards due to mosquito breeding	<p>The Contractor shall</p> <ul style="list-style-type: none"> Do not allow ponding of water especially near the waste storage areas and construction camps. Discard all the storage containers that are capable of storing of water, after use or store them in inverted position.

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	<p>The Contractor shall</p> <ul style="list-style-type: none"> Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2. Construct appropriate spill contaminant facilities for all fuel storage areas. Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage and use of disposals. Train personnel and implement safe work practices for minimizing the risk of spillage. Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site. Remediate the contaminated land using the most appropriate available method.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	<p>The Contractor shall</p> <ul style="list-style-type: none"> Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, which affects the growth	<p>The Contractor shall</p> <ul style="list-style-type: none"> Reinstate and protect cleared areas as soon as possible.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	of vegetation and causes ecological imbalance.	<ul style="list-style-type: none"> Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turfings/tree plantations.
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, and (ii) destruction of aquatic environment by erosion and/or deposition of sediment damaging the spawning grounds of fish	<p>The Contractor shall</p> <ul style="list-style-type: none"> Locate stockpiles away from drainage lines. Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds. Remove debris from drainage paths and sediment control structures. Cover the loose sediments of construction material and water them if required. Divert natural runoff around construction areas prior to any site disturbance. Install protective measures on site prior to construction, for example, sediment traps. Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion. Observe the performance of drainage structures and erosion controls during rain and modify as required.

ECP 7: Top Soil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. Remove unwanted materials from top soil like grass, roots of trees and similar others. The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. Locate topsoil stockpiles in areas outside drainage lines and protect them from erosion. Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. Spread the topsoil to maintain the physio-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed areas and along the proposed plantation sites. Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and re-vegetation
Transport	Vehicular movement outside ROW or temporary access roads will affect the soil fertility of the agricultural lands	<p>The Contractor shall</p> <ul style="list-style-type: none"> Limit equipment and vehicular movements to within the approved construction zone. Plan construction access to make use, if possible, of the final road alignment.

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as will change the local landscape.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Ensure the topography of the final surface of all raised lands (construction yards, approach roads and rails, access roads, and the like) are conducive to enhance natural draining of rainwater/flood water. • Keep the final or finished surface of all the raised lands free from any kind of depression that causes water logging. • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping. • Reinstate the natural landscape of the ancillary construction sites after completion of works.

ECP 9: Borrow Areas Development & Operation

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of borrow areas	Borrow areas will have impacts on local topography, landscaping and natural drainage.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Use only approved quarry and borrow sites • Identify new borrow and quarry areas in consultation with WAPDA, if required. • Reuse excavated or disposed material available in the project to the maximum extent possible. • Store top soil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms, re-vegetation and the like.) and retaining walls and gabions where required. • Control dust by application of watering. • Noise control, installation of mufflers on equipment, daytime works.

ECP 10: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel efficient manner. • Cover haul vehicles carrying dusty materials moving outside the construction site.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Impose speed limits (<20 km/hr) on all vehicle movement at the worksite to reduce dust emissions. • Control the movement of construction traffic. • Water construction materials prior to loading and transport. • Service all vehicles regularly to minimize emissions. • Limit the idling time of vehicles not more than 2 minutes.
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors. • Focus special attention on containing the emissions from generators. • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites. • Service all equipment regularly to minimize emissions. • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations.
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. • Minimize the extent and period of exposure of the bare surfaces. • Restore disturbed areas as soon as practicable by vegetation/grass-turfing. • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations. • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems. • Deploy dedicated water tankers with sprinkling arrangement (minimum 2 water tankers) for dust control. Watering shall be carried out at least twice a day and the frequency of watering shall be

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>increased based on dust generation and weather conditions (e.g. summer)</p> <ul style="list-style-type: none"> • The spoils generated from the newly excavated sites should be wetted before the transport (haulage) to the disposal areas

ECP 11: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures. • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, and the like. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Appropriately site all noise generating activities to avoid noise pollution to local residents. • Use the quietest available plant and equipment. • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Avoid the unnecessary use of alarms, horns and sirens.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Notify adjacent landholders prior any typical noise events outside of daylight hours. • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers where appropriate. • Notify affected people if major noisy activities will be undertaken, e.g. blasting. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyse noise and vibration results and adjust construction practices as required.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Record all trees to be cut by the contractor Minimize disturbance to surrounding vegetation. Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. Get approval from supervision consultant for clearance of vegetation. Make selective and careful pruning of trees where possible to reduce need of tree removal. Control noxious weeds by disposing of at designated dump site or burn on site. Clear only the vegetation that needs to be cleared in accordance with the Engineering plans and designs. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill, and the like. Not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. Ensure excavation works occur progressively and re-vegetation done at the earliest Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction Supply appropriate fuel (LPG) in the work camps to prevent fuel wood collection.

ECP 13: Protection of Fauna

**Dasu Hydropower Project – Bidding Documents – DASU-RS-02
Construction of GBPS Looter and Rehabilitation of GBPS Shah jahanabad
General Specifications**

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality.	The Contractor shall <ul style="list-style-type: none"> • Limit the construction works within the designated sites allocated to the contractors. • Check the site for animals trapped in, or in danger from site works and use a qualified person to relocate the animal.
	Impact on migratory birds, its habitat and its active nests	The Contractor shall <ul style="list-style-type: none"> • Not be permitted to destruct active nests or eggs of migratory birds. • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and locate active nests. • If bird nests are located/ detected within the ledges and roadside embankments then those areas should be avoided. • Petroleum products should not come in contact with the natural and sensitive ecosystems. Contractor shall minimize the release of oil, oil wastes or any other substances harmful to migratory birds' habitats, to any waters, wetlands or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall <ul style="list-style-type: none"> • Restrict the tree removal to the minimum numbers required. • Relocate hollows, where appropriate. • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Night time lighting	Lighting from construction sites and construction camps may affect the visibility of night time migratory birds that use the moon and stars for navigation during their migrations	The Contractor shall <ul style="list-style-type: none"> • Use lower wattage flat lens fixtures that direct light down and reduce glare, thus reducing light pollution, • Avoid flood lights unless they are absolutely required. • Use motion sensitive lighting to minimize unneeded lighting. • Use, if possible, green lights that are considered as bird's friendly lighting instead of white or red colored lights.
Construction camps	Illegal poaching	The Contractor shall <ul style="list-style-type: none"> • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Ensure that staff and Subcontractors are trained and empowered to identify, address and report potential environmental problems.

ECP 14: Protection of Fisheries

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	<p>The Contractor shall</p> <ul style="list-style-type: none"> Ensure the construction equipment used in the river are well maintained and do not have oil leakage to contaminate river water. Contain oil immediately on river in case of accidental spillage from equipment; make an emergency oil spill containment plan to be supported with enough equipment, materials and human resources. Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	<p>The Contractor shall</p> <ul style="list-style-type: none"> Follow mitigation measures proposed in ECP 3: Water Resources Management and ECP 4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Provide the material transport schedule (month wise) to the Project Manager Strictly follow or comply with the Project's 'Traffic Management Plan' and work in close coordination with the Traffic Management Unit. Prepare own traffic management plan compliance with the TMP (considering future traffic for Dasu and Basha construction) Prepare and submit additional traffic plan, if any of his traffic routes are not covered or included in the Project's Traffic Management Plan, and requires traffic diversion and management. Include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>temporary diversions, necessary barricades, warning signs / lights, road signs and the like.</p> <ul style="list-style-type: none"> • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistan Traffic Regulations.
	Accidents and spillage of fuels and chemicals	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit. • Submit Environmental Incident reports in case of spillage of fuels and chemicals

ECP 16: Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Locate the construction camps within the designated sites or at areas which are acceptable from environmental, cultural or social point of view; and approved or permitted by the supervision consultant. • After finalization of site for camp, the preconstruction conditions of the site should be pictographically recorded and shared with The Project Manager. • Consider the location of construction camps away from communities in order to avoid or prevent social conflict in using the natural resources such as water or to avoid or prevent the possible adverse impacts or negative effect of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval or permission a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water	Contractor shall provide the following facilities in the campsites

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	<ul style="list-style-type: none"> • Adequate housing for all workers. • Safe and reliable water supply, which should meet NEQS. • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water shall be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. The minimum number of toilet facilities required is one (1) toilet for every twenty five (25) persons working for a whole day for a month. • Treatment facilities for sewerage of toilet and domestic wastes capable of discharging treated waste water as per NEQS. • Storm water drainage facilities. • Paved internal roads. • Provide child crèches for women working construction site. The crèche shall have facilities for dormitory, kitchen, indoor and outdoor play area. Schools shall be attached to these crèches so that children shall not be deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Ensure proper collection and disposal of solid wastes within the construction camps. • Insist waste separation by source; organic wastes in one (1) container and inorganic wastes in another container at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on a daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste shall be collected and removed from the work camps and disposed in approval waste disposal sites as approved by The Project Manager.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Not use fuel wood for cooking • Provide fuel (LPG) to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to avoid or prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Provide HIV awareness programming, including STI (Sexually Transmitted Infections) and HIV information, education and communication for all workers on a regular basis. • Complement educational interventions with easy access to condoms at campsites as well as voluntary counselling and testing. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices.
Safety	Inadequate safety facilities to the construction camps may create security problems and fire hazards	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide appropriate security personnel (police or private security guards) and enclosures to avoid or prevent unauthorized entry into the camp area. • Maintain or register to keep a track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. • Provide appropriate type of fire fighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles, tasks and responsibilities of laborers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Dismantle and remove from the site all facilities established within the construction camp including

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	requires demolition of construction camps.	<p>the perimeter fence and lockable gates at the completion of the construction work.</p> <ul style="list-style-type: none"> • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed. • Give prior notice or notification to the labourers before demolishing their camps/units. • Maintain the noise levels within the national standards during demolition activities. • Different contractors shall be hired to demolish different structures to promote recycling or reuse of demolished material. • Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if agreement between both parties (contractor and land-owner) has been reached or made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

ECP 17: Cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Communicate to the public through community consultation regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Do not block access to cultural and religious sites, wherever possible or necessary. • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce air and noise pollution (particularly during prayer time) should there be any mosque/religious/educational institutions close to the construction sites and users make objections. • Take due attention and special care and use appropriate and necessary equipment when working next to a cultural/religious institution in its vicinity. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval or permission to continue or resume the Works is given. • Provide separate prayer facilities to the construction workers.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Show appropriate or necessary behaviour with all construction workers especially women and elderly people. • Allow the workers to participate in praying or prayer during construction time. • Resolve cultural or religious issues in consultation with local leaders and supervision consultants. • Establish a resolution mechanism that allows local people to raise grievances or complaints arising from the consequences of construction process. • Inform the duly constituted public authorities and local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters.

ECP 18: COVID-19 and other Pandemic Management

Activity	Environmental Impacts	Good Practices
Awareness materials	Lack of awareness increase the risk of spreading	<ul style="list-style-type: none"> • Preparation of awareness materials on emerging disease outbreaks such as COVID-19 e.g., signs, posters • Installation of awareness signs at work sites, for visibility to workers and the general public
Detection Measures	Risks of spreading the disease	<ul style="list-style-type: none"> • All workers must be vaccinated against COVID-19 as per government instructions; failing this the person should not be allowed to work. • Control and document the entry/exit to the work site for both workers and other parties. • Prevent sick workers from entering the site through checking temperatures of workers and other people entering the site. Require self-reporting prior to entering the site. • All workers to self-monitor their health, possibly with the use of questionnaires, and take their body temperature regularly. • Thermal screening at the workplace to be considered only in the context of a combination of measures for prevention and control of COVID-19 at the workplace and along with risk communication.
Physical Distancing measures	Risks of spreading the disease	<ul style="list-style-type: none"> • Keep a distance of at least 1 meter between workers and minimize physical contact, ensure strict control over external access, and queue management (marking on the floor, barriers). • Reduce density of people in the building (no more than 1 person per every 10 square metres), physical spacing at least 1 meter apart for work stations and common spaces, such as entrances/exits, lifts, pantries/canteens, stairs, where congregation or queuing of employees or visitors/clients might occur.

Activity	Environmental Impacts	Good Practices
		<ul style="list-style-type: none"> • Avoid crowding by staggering working hours to reduce the congregation of employees at common spaces such as entrances or exits. • Implement or enhance shift or split-team arrangements, or teleworking. • Minimise the movement of local workers in and out of the site (e.g., avoid workers returning home to affected areas, or returning to site from affected areas). • Minimise the workers' contact with local community.
Respiratory measures	Health risks to affected works	<ul style="list-style-type: none"> • All workers should wear a face mask. • Provide adequate ventilation in indoor spaces • If a worker is sick, they should not come to work if a member of staff or a worker feels unwell while at work, provide a medical mask so that they may get home safely. • Where masks are used, whether in line with government policy or by personal choice, it is very important to ensure safe and proper use, care and disposal
Hand Hygiene measures:	Risks of spreading the disease	<ul style="list-style-type: none"> • Regular and thorough hand washing with soap and water or hand hygiene with alcohol-based hand-rub (a) before starting work, before eating (if possible, workers should eat outdoors, in a well-ventilated indoor space, or at different times), frequently during the work shift, especially after contact with co-workers or customers, (b) after going to the bathroom, after contact with secretions, excretions and body fluids, after contact with potentially contaminated objects (gloves, clothing, masks, used tissues, waste), and immediately after removing gloves and other protective equipment but before touching eyes, nose, or mouth. • Hand hygiene stations, such as hand washing and hand rub dispensers, should be put in prominent places around the workplace and be made accessible to all staff, contractors, clients or customers, and visitors along with communication materials to promote hand hygiene
Cleaning and Disinfection	Risks of spreading the disease	<ul style="list-style-type: none"> • Cleaning and Disinfection off all site facilities, including offices, accommodation, canteens and common spaces: • Cleaning (soap, water, and mechanical action) to remove dirt, debris, and other materials from surfaces. Disinfection of dirty surfaces and objects only after cleaning. • Most common disinfectants – sodium hypochlorite (bleach) of surface at concentration 0.1% or alcohol at least 70% concentration for surfaces which can be damaged by sodium hypochlorite.

Activity	Environmental Impacts	Good Practices
		<ul style="list-style-type: none"> • Priority disinfection of high-touch surfaces - commonly used areas, door and window handles, light switches, kitchen and food preparation areas, bathroom surfaces, toilets and taps, touchscreen personal devices, personal computer keyboards, and work surfaces. • Disinfectant solutions must always be prepared and used according to the manufacturer's instructions, including instructions to protect the safety and health of disinfection workers, use of personal protective equipment, and avoiding mixing different chemical disinfectants. Provide appropriate PPEs to the cleaners. • Manage the waste as the medical waste, and dispose of it in accordance with local regulations.
Response measures if workers found with COVID-19 symptoms	Health risks to affected workers	<ul style="list-style-type: none"> • Workers who are unwell or who develop symptoms consistent with COVID-19 to stay at home, self-isolate, and contact a medical professional or the local COVID-19 information line for advice on testing and referral (consider telemedicine and flexible sick leave policy). • Standard operating procedures to be prepared to manage a person who becomes sick at the workplace and is suspected of having COVID-19, including isolation, contact tracing and disinfection. • People who were in close contact at the workplace with persons with laboratory-confirmed COVID-19 should be quarantined for 14 days from the last time of the contact in accordance with WHO recommendations. • Set out differentiated procedures for the treatment of sick persons, based on the case severity. Pay workers throughout periods of illness, isolation or quarantine. • Set aside a part of worker accommodation for precautionary self-quarantine. • Establish communications with local medical services and refer sick workers to there.
Adjusting Work Practices and Manage Work Related Travels	Risks of spreading the disease	<ul style="list-style-type: none"> • Consider changes to work processes and timings to minimize contact between workers (e.g., decreasing the size of work team, changing to a 24-hour work rotation). • Cancel or postpone non-essential travel to areas with community transmission of COVID-19. • Provide hand sanitizer to workers who must travel, advice workers to comply with instructions from local authorities where they are travelling, as well as information on whom to contact if they feel ill while travelling. • Workers returning from an area where COVID-19 transmission is occurring should monitor themselves for symptoms for 14 days and take

Activity	Environmental Impacts	Good Practices
		their temperature twice a day; if they are feeling unwell, they should stay at home, self-isolate, and contact a medical professional.
Communication and Contact With the Community	Risks of spreading the disease	<ul style="list-style-type: none"> • Carefully manage the relations with the community with clear and regular communication. • Made aware of the procedures put in place at the site to address issues related to COVID-19. • Practice social distancing with the local community.
Risk communication, training, and education	Risks of spreading the disease	<ul style="list-style-type: none"> • Provide posters, videos, and electronic message boards to increase awareness of COVID-19 among workers and promote safe individual practices at the workplace, engage workers in providing feedback on the preventive measures and their effectiveness. • Provide regular information about the risk of COVID-19 using official sources, such as government agencies and WHO, and emphasize the effectiveness of adopting protective measures and counteracting rumours and misinformation. • Special attention should be given to reaching out to and engaging vulnerable and marginalized groups of workers, such as those in the informal economy and migrant workers, domestic workers, subcontracted and self-employed workers, and those working under digital labour platforms. • Train the workers on procedures in place by the project, and their own responsibilities in implementing them.

11.3 SOCIAL SAFEGUARD ISSUES

11.3.1 EMPLOYMENT

- The Contractor (or agent) shall give preference for employment to local workers, particularly those affected by the project (with ID number), and willing to work in the project construction work.
- The Contractor shall not discriminate with regard to wages between local and non-locals, and between men and women for the same work performed.
- The Contractor/s shall keep accurate record of employed labor including the category, names, ages, gender, hours worked or spent and wages paid. The records thereof shall be summarized monthly basis on an approved sheet issued by the Project Manager and, shall be available for review and inspection by the EA, external reviewers, and panel of experts.
- The Contractor shall not employ any child labor to work on the Project Site in accordance with the applicable labor law in Pakistan.
- Local college/university graduates shall be hired or employed to work in office setting – for example, in secretarial and support staff positions, and where required shall be trained on the job by the Contractor.

11.3.2 CODES OF CONDUCT

Keeping in view the local customs, traditions and considerations, a set of “Rules” have been identified through stakeholder meetings that provide guidelines for “code of conduct” for the

workers both local and outsiders. These codes of conduct must be respected by the Contractor and his personnel, Project Manager and his personnel engaged for project construction (see Table 1). The 18-point codes of conduct shall be enforced to help facilitate a “positive” environment in the project area and thus build a “community” of mutual trust and respect for project construction.

Table 1 Codes of Conduct for construction workers and immigrants

Sr. no	Codes of Conduct
1.	Local religious beliefs, moral and ethical codes must be respected.
2.	Full respect to local norms, customs, and values of the society
3.	Local populations are legally recognized as landowners and therefore, shall be respected all times
4.	DCO, District Officer (Revenue and Estate), village committee members and affected community <i>maleks</i> are the civil authorities recognized by the local District Government and shall be acknowledged and honored.
5.	All workers are strictly forbidden to establish any kind of relationship with local women bring any un-related women to the project site.
6.	All workers are forbidden to possess or consume alcohol. The use of drugs or medicines shall be prescribed by the designated Doctor on site
7.	All workers shall be forbidden to carry guns or any other types of weapon.
8.	All workers shall be forbidden to casually stay or visit any local community or village located along the route to or from the project while the construction is in development or in progress.
9.	All workers shall not leave the camps or work sites unless a written authorization is issued by the respective supervisor(s).
10.	If a local inhabitant approaches any worker on a construction site or camp, the worker shall refer him respectfully to the Supervisor at site.
11.	All workers shall be forbidden to collect, purchase forestry products from the surrounding area of the corridor, other camps or work sites.
12.	The Contractors shall advise and prohibit the local population and its authorities or representatives not to enter the project operation areas (camp sites, colonies, and the like) in order to avoid or minimize the potential risk or adverse effect of incidents related to the operations.
13.	All workers shall be forbidden to purchase goods from any indigenous community. If any local purchase is required, the same will only be done through a representative appointed or hired by the Company or its contractors
14.	In the event of any payment being made to a local community for the purchase of any goods or services by its contractor, such payments shall be fully documented
15.	All workers shall be forbidden to hunt, purchase or possess wild animals; or interfere in one or the other way in their normal life
16.	All workers shall be prohibited to fishing or disturb the aquatic flora and fauna.
17.	All workers shall dispose of or remove adequately all residuals/waste produces at site, whether temporary or permanent nature.
18.	On their days off, the workers of the project may visit or stay around Dasu/Komila Bazaars by wearing local dresses like Shalwar and Kamiz and a local cap on their head.

11.3.3 ENFORCEMENT

The Contractors shall be responsible to enforce the codes of conduct and build awareness among his workforce of the local cultural practices and sensitivities. The Contractor shall be required to meet the local leaders through *jirga* meetings following mobilization to the site in order to build rapport or trust with local community leaders. Other important tips for the contractors/workers to remember include:

- never to be involved in discussion on issues that are not relevant to the project;
- make no promises that cannot be kept;
- always dress covering full bodies;
- never indulge in any romantic contacts with locals.

11.4 ENVIRONMENTAL MONITORING

The Contractor shall perform environmental monitoring for the duration of this contract and submit results to the Project Manager. The items, frequency and number of locations of sampling or measurement shall be as below or otherwise directed by the Project Manager.

11.4.1 GENERAL

The Contractor shall conduct or perform environmental monitoring for the duration of this contract and submit results to the Project Manager. Monitoring activities shall cover or include the following;

- 1) spot monitoring of Wastewater discharges quality
- 2) Spot monitoring of noise
- 3) drinking water quality

The drinking water quality monitoring shall be conducted or carried out only by EPA approved accredited laboratories approved or permitted by the Project Manager in conformity / compliance with the relevant laws, regulations and/or international standards and equivalent standards and codes in Pakistan (if any).

If any of the monitored results including laboratory test results of drinking water and spot monitoring results of wastewater and noise showed or demonstrated excessive or long-term deterioration in comparison with the NEQS, the Contractor shall take immediate counter- measures necessary to recover the acceptable environmental conditions.

If the Contractor's countermeasures are not acceptable or satisfactory in the opinion of the Project Manager, then the Project Manager may order suspension or stoppage of the work(s) or section until the newly monitored results become acceptable or satisfactory to the Project Manager. No additional payment or time extension thereof shall be approved or granted for the work delay caused by this work suspension.

Should the Contractor fail to conform to or comply with the specific requirements of the listed statutes as well as effect and maintain monitoring operations, the Employer may directly undertake the required mediation measure or remedial countermeasures and/or monitoring activities. The consequential costs which the Employer incurs shall be deducted from the payment to the Contractor. Any deduction shall be all subject to the Project Manager's determination.

11.4.2 FREQUENCY, LOCATIONS AND STANDARDS

The items, frequency and number of locations of sampling or measurement shall be as follows or as otherwise directed or required by the Project Manager.

Parameter	Location	Means of Monitoring	Frequency
Landslides	At landslide prone areas	Visual Inspection on stability of landslides	Daily
Erosion	Earthwork areas and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	Daily

Parameter	Location	Means of Monitoring	Frequency
Wastewater quality	Septic Tank and Sedimentation Tank	Spot measurements of pH Conductivity, turbidity, DO, PH, Temperature and Visual inspection on presence of petroleum products (in presence of the Project Manager and Employer.	Monthly as determined by the Project Manager
Air Quality (dust, smoke)	Construction sites, access roads, quarry areas and blasting areas	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Daily
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Daily
Operation of quarry sites	At quarry and borrow sites	Visual inspection	Weekly
Emissions from plant and equipment	At all the construction sites and camps	Visual Inspection	Daily
Noise	Near the sensitive receptors. The locations of sampling can be same locations of baseline air quality or new locations recommended by the Engieer	Spot monitoring	Monthly as determined by the Project Manager weekly
Waste Management	At designated spoil/rock disposal area	Visual inspection on spoil transportation and disposal	During disposal activities
	Construction camps and construction sites	Visual inspection that solid waste is disposed at designated sites and sold to the vendors	Weekly
Spills from Hydrocarbon and chemical storage	Material storage sites, construction yards and camps	Visual Inspection for leaks and spills	Daily
Local Roads	Approach Roads	Visual inspection to ensure local roads are not damaged	Weekly
Chance Find	construction sites	Visual observation on chance finds	Daily during excavation processes

Parameter	Location	Means of Monitoring	Frequency
Drinking water	Nullah/Spring for the workers in the camps and construction sites	Sampling and analysis of water quality as per NEQS	1 st monitoring will be carried out before the start of works for baseline During the construction period, quarterly monitoring will be considered.
Sanitation	At construction sites and construction camps	Visual inspection to ensure cleanliness of sanitation facilities	Weekly
Sewerage	At construction sites and construction camps	Visual inspection on availability of sewerage system including septic tanks and their cleanliness	Weekly
Reinstatement of Work Sites	All Work Sites	Visual Inspection	After completion of all works
Construction yards	Construction work areas and contractor yards	Visual inspection to ensure removal of all buildings and equipment from the site. The site is clean and was restored to original condition	Before contractor demobilization
Construction camps	Construction camps	Visual inspection to ensure removal of all buildings and equipment from the site. The site is clean and was restored to original condition	Before contractor demobilization

11.4.3 ENVIRONMENTAL MONITORING EQUIPMENT

The Contractor shall provide one (01) number water quality meter and one (1) noise level meter. Following parameters shall be monitored for water quality and noise

For water quality monitoring

1. Turbidity
2. Conductivity
3. pH
4. Temperature
5. DO
6. TDS

For noise level monitoring

1. Noise Meters

The equipment and their associated cabling, read-out units, installation consumables, appurtenances, etc. shall be procured from manufacturers having a worldwide reputation and proven track-record in the field of environmental monitoring instrumentation. Specifications and technical data of the equipment proposed by the Contractor shall be submitted to the Project Manager for approval before placing the purchasing orders.

Factory calibration shall be undertaken by the relevant manufacturers and calibration certificate for the instrument shall be submitted to the Project Manager. Regular calibration at approved laboratories shall be undertaken in accordance with the equipment manufacturer's recommendations.

11.4.4 CONSTRUCTION ENVIRONMENTAL ACTION PLAN (CEAP)

Based on the requirements mentioned above, the Contractor shall prepare and submit a 'Construction Environmental Action Plan' (CEAP) indicating or demonstrating the manner in which he will conform to or comply with the specific requirements. The Contractor shall prepare or submit the CEAP to the Project Manager for approval within fifty-six (56) calendar days after the date of the Letter of Acceptance. Any construction operation shall not commence until the CEAP has been approved or granted by the Project Manager. The Contractor shall indicate the breakdown cost of CEAP implementation for contract management within one month of commencement of the contract.

The plan shall cover or include a series of management plans:

- Site specific sediment and erosion control plan for each construction site and quarry;
- Site specific camps management plan for each camp;
- Spoil management and disposal plan for each site;
- Waste management plan for each construction site and quarry;
- Site specific pollution control (water, air, noise) plan for each construction site and quarry;
- Site specific traffic management plan for each construction site and quarry;
- Site specific decommissioning and landscaping plans for quarry sites, spoil disposal sites, temporary roads and other disturbed areas;
- Complaints logging system and response plan;
- Standard Operating Procedures for pollution spills, and management of fuels and hazardous goods; and
- Demobilization plan after completion of works

The Contractor shall prepare and submit the monitoring report periodically depending on the site conditions. The monthly monitoring report shall contain or include in addition to the contents mentioned under sub-clause 8.5.3, to the following items:

- 1) Summary
- 2) Introduction
 - Objectives
 - Methodology
 - Reporting Period
- 3) Project Progress
 - Excavations
 - Disposal
 - Construction of works (roads, bridges, culverts, revetment, etc.)
 - Others, according to Project Phase
- 4) Environment
 - Water
 - Air
 - Noise and Vibrations
 - Soils
 - Flora and Fauna
 - Management of Wastes and Materials
 - Spoil Sites
 - Environmental Indicators

- Environmental Training and Education Indicators
- New Noncompliance
- Noncompliance Resolution
- Pending Noncompliance
- Recommendations and Corrective Actions
-
- 5) Social Aspects
 - Local Employment and Contracting Indicators
 - Cultural Resources and Paleontology
 - Communications and Consultations
 - Grievances and Concerns
 - Resolutions of Grievances Received
 - Pending Grievances
 - Violations to the Code of Conduct
 - Recommendations and Corrective Actions

11.4.5 DISPOSAL OF SURPLUS MATERIAL

Surplus materials authorized for disposal shall be transported to designated waste disposal sites. The Contractor shall be responsible for arranging and covering the costs of transportation for these materials. Any facilities provided for the on-site storage of surplus materials must be removed and the site reinstated as per the Project Manager's approval at the conclusion of the works.

The boundaries of disposal areas/sites must be clearly marked on the ground by the Contractor and require approval from the Engineer prior to the initiation of disposal operations. Surplus material should be evenly distributed in layers, compacted as much as is practicable, and graded to prevent water accumulation. Appropriate measures, such as the construction of retaining walls and gabion walls, must be implemented to maintain the stability of slopes and to protect against erosion from surface runoff and watercourses during the deposition of surplus material in disposal sites. The final surface and side slopes composed of this material must be contoured to ensure proper drainage.

Disposal of surplus materials must be executed in a manner that does not interfere with the operation of any facilities. No surplus material must be disposed of in a way that obstructs any watercourse, jeopardizes partially completed structures, diminishes the efficiency or aesthetic of any structure, or adversely affects the integrity of the completed work in any manner.

No separate measurement and payment will be made for the storage, transportation and disposal of surplus materials and reinstatement works as they are included in the excavation costs of the BOQs

11.5 REFUSE COLLECTION AND DISPOSAL

Metal dust bins or equivalent plastic refuse bins with lids shall be provided by the Contractor for all buildings and construction sites and refuse shall be collected and removed from all facilities on the Site at least twice per week or determined by the Project Manager. Refuse from food preparation and eating areas shall be collected and removed daily. Refuse shall be transported to the refuse dumps in covered contained or covered trucks.

Refuse dumps only for organic waste, shall be identified and established by the Contractor. These locations shall be reviewed and approved by the Project Manager. The location of refuse dumps shall be away from the settlements, drainage lines and water resources. In case of adopting incineration method, the ashes and all unburned material shall be deposited in layers not more than 1 m thick in trenches and each layer shall be covered with a layer of soil not less than 250mm thick. It is noted that always medical waste must be incinerated. The refuse shall not be left uncovered for more than twenty-four (24) hours and shall eventually be covered with a further 500mm thickness of soil to the final ground level. The refuse sites shall be fenced by the Contractor as agreed with the Project Manager in order that windblown refuse is contained within the refuse site. The inorganic waste shall be stored on-site in covered storage areas and shall not be mixed with the organic waste. The inorganic waste shall not be disposed of in refuse dumps and vendor be engaged for removal, transportation and disposal of the waste.

The payment shall be the part of the ECP implementation cost as specified in the Bill of Quantities.

11.6 ENVIRONMENTAL REQUIEMENTS IN METHOD STATEMENT

The contractor shall include an environmental chapter in each method statement or methodology. This chapter must detail the contractor's environmental responsibilities and specific measures relating to the particular construction activity and construction methods to be employed by the contractor. This section shall be reviewed by the environmental staff of the Project Manager and confer approval along with other technical parameters to be reviewed or revised by the technical team of the Project Manager. Every revision of the method statement or methodology will also be reviewed by the Project Manager's environmental staff and their consent will be required for approval.

11.7 REQUEST FOR INSPECTION/ AVAILABILITY FOR INSPECTION

The Contractor shall ensure that Request for Inspection (RFI)/Availability for Inspection (AFI) is initiated prior to actual construction work. The RFI shall cover or include environmental requirements/measures along with the technical requirements. During the RFI/AFI submission and approval process, both technical and environmental staff of the Project Manager shall inspect the requirements and certify the technical quality and environmental requirements are in place prior to the commencement of works.

11.8 MEASUREMENT AND PAYMENT

11.8.1 GENERAL

No separate payment shall be made for fulfilling the requirements of Environment Protection except as otherwise specified below. All costs shall be deemed to be covered or included in the unit prices and rates and/or lump sum prices of the various items in the Bill of Quantities (BOQ).

11.8.2 ASSIGNMENT OF ENVIRONMENTAL OFFICER AND SUBMISSION OF MONTHLY REPORTS INCLUDING CEAP

The cost for the assignment of a dedicated Environmental Officer shall be paid on man-month basis for the period when he/she is actually working at the site for the fulfilment of tasks specified in GC Sub-Clause 18 in the General Conditions of Contract and environmental considerations in general specifications. The monthly rate may cover the presence of the environmental officer at site throughout the construction phase and providing and maintaining the specified environmental obligations including, but not limited to, daily/weekly inspection of the sites, submission of monthly environmental progress reports and proper implementation of ECPs, CEAP and Code of Conduct.

The Contractor shall provide or furnish proof or evidence of his attendance at site to be approved by the Project Manager.

The first payment for the assignment of Environmental Officer shall be paid after the CEAP is approved or permitted by the Project Manager and each monthly payment shall be invoiced after submission of the monthly environmental progress report.

Provided that if, in the opinion of the Project Manager, the environmental obligations are not being implemented, the Project Manager may withhold the payment until a satisfactory level of implementation is provided by the Contractor.

11.8.3 ENVIRONMENTAL MONITORING, SAMPLING AND TESTING

Measurement and payment shall be made at the unit price and rate quoted in the Bill of Quantities (BOQ). The unit price thereof shall cover or include entire cost for performing the regular monitoring works, sampling, delivery to the laboratory and testing of water and noise and preparation and submission of the monitoring report, including all labor, technicians and specialists. The requirement for spot measurements shall be determined by the Project Manager.

The costs for undertaking visual inspection and reporting of such visual monitoring shall be covered or included within the unit prices and rates for fulfilling the general requirements of environmental protection. The Contractor shall indicate the cost of environmental monitoring and list its

breakdown for contract management within one month of commencement of the contract.

Payment will be made when the monitoring work has been substantially completed and any necessary reports have been approved or permitted by the Project Manager.

Provided that if, in the opinion of the Project Manager, some or all tested parameters do not comply with the national/international standards, then the Project Manager may deduct the payment of that individual parameter/as determined by the Project Manager until a satisfactory level of compliance is ensured by the Contractor.

11.8.4 ENVIRONMENTAL MONITORING EQUIPMENTS

Measurement and payment for environmental monitoring equipments listed in Sub-Clause 11.4.3 of General Specifications shall be as stated in Bill-A of Bill of Quantities (BOQ) for the provision of the specified equipments. The payment shall be inclusive of all cost for the provision, delivery regular calibration and safe storage of the equipment at site.

Payment will be made when the monitoring equipment has been delivered to the site to the satisfaction and approval of the Project Manager.

11.8.5 IMPLEMENTATION OF ENVIRONMENTAL CODES OF PRACTICE (ECP) IMPLEMENTATION

Measurement and payment shall be made at the unit price and rate quoted in the Bill of Quantities (BOQ). Contractor shall provide a break up of this amount, which shall be reviewed and approved by the Project Manager.

Payment will be made when the actual work has been done by the Contractor and verified on site by the Project Manager and the Contractor has submitted the record and cost breakup and any necessary report has been approved by the Project Manager.

Provided that, in the opinion of the Project Manager, the Contractor has not ensured the necessary arrangements for the implementation of the ECPs, not provided records, reports and cost breakup, the Project Manager may withhold payment until a satisfactory level of compliance is ensured by the Contractor.

12 DEALING WITH WATER

12.1 GENERAL

Except as otherwise specified, the Contractor shall bear all risks from water, whether from the main river, a local water course, an underground spring or any other source or cause.

The Contractor shall properly deal with and dispose of all water to ensure the Works are kept sufficiently dry at all times for their proper execution. For this purpose, the Contractor shall make necessary arrangements to avoid or minimise damage, defect, inconvenience or interference due to water. He shall also provide, operate and maintain in sufficient quantity such pumping equipment, well points, pipes and other equipment as may be necessary. He shall also provide any sumps, and other temporary works as may be necessary to minimise damage, erosion, inconvenience or interference. Such operations shall continue for the duration of the Contract and shall at all times be subject to the agreement or approval of the Project Manager with regard to sufficiency of measures taken and environmental protection. All discharges of water to streams and river shall follow or abide by NEQS Pakistan.

12.2 SURFACE WORKS

12.2.1 SURFACE EXCAVATIONS

The Contractor shall take all necessary steps to ensure that water entering any surface excavation does not endanger the stability of the surface excavation at any time. Fill and cut slopes shall be promptly repaired or restored whenever damaged by surface water.

The Contractor shall ensure at his cost and risk that no concentrations or accumulations of water occur either within or around or above the area of any open excavation which may affect the safety

of the excavation.

If permanent slopes on which permanent or temporary protections are designated in the Drawings or instructed or required by the Project Manager and the Contractor fails to provide such protections before the first rainy season after excavation of the slopes, any damages or defects to the slopes by surface water shall be rectified and repaired by the Contractor at his own cost and risk.

The Contractor shall maintain excavations such that ponding of rain water is prevented by suitably sloping surfaces where possible and the construction of channel and sumps. Where excavations are not self-draining, sufficient pumps shall be installed to keep the water level in such sump 0.5 m below the lowest excavated surfaces for as long as required for construction of the Works.

12.2.2 BORROW PITS AND QUARRIES

Borrow pits and quarries shall be continuously protected against the ingress of surface water and the Contractor shall construct such temporary banks as may be required to divert surface water, and as far as possible, shall plan operations in such a way that the borrow pits and quarries are self-draining. Where this is not possible, borrow pits and quarries shall be dewatered by pumping. The Contractor shall be solely responsible for keeping borrow and quarry areas dry and for ensuring that borrow and quarry material shall be sufficiently dry when required for use. The Contractor shall also instate or restore the borrow area slopes and stabilize them by method or methodology approved or permitted by the Project Manager,

12.3 WATER DISCHARGED FROM WORKING AREAS

All water discharged from the working areas shall be discharged into settlement ponds as specified in Sub-Clause 12.5 below before release the water into natural waterways unless clean water is piped separately to waste.

All water discharged from the working areas and living areas into natural waterways from settlement ponds or treatment facilities shall be chemically tested from source to a distance not exceeding a radius of 500 m from source, at monthly intervals or as otherwise instructed or determined by the Project Manager. The results thereof shall be reported to the Project Manager promptly. These water quality results shall conform to the NEQS

12.4 WATER CONTROL DURING CONCRETING

All water which would flow into an area to be concreted shall be diverted clear of the area. Water arising within the area to be concreted shall be dealt with and piped clear of the area as directed or instructed by the Project Manager.

12.5 SETTLEMENT PONDS

The Contractor shall construct, operate and maintain settlement ponds with sufficient capacity for their purpose, with suitable oil traps at each point where contaminated water is discharged from the Works.

Unless otherwise directed or instructed by the Project Manager, all water emanating from excavation shall be discharged into these settlement ponds, to remove oil, sand, silt, cementations materials and other suspended matter. The outflow from each settlement pond shall be so arranged as to avoid or prevent any floating oil from leaving the pond irrespective of the volume of water entering the pond.

Ponds shall be constructed using any suitable materials and shall be watertight. They shall be subdivided to enable sections to be cleaned while other sections are in operation.

To ensure, the continuing satisfactory operation of the system, accumulations of silt and oil shall be removed and disposed of by the Contractor at intervals and in areas approved or permitted by the Project Manager.

Natural ground water and storm-water from areas outside the immediate area or the Contractor's activities shall be avoided or prevented from flowing into the ponds. In this regard, it is particularly important to ensure that any diversion berms or drains protecting ponds constructed below ground

are adequately maintained.

Where necessary separate settlement ponds shall be constructed to collect surface water runoff from spoil areas.

If the Project Manager is not satisfied that the provisions in this regard are adequate, he may order the Contractor to carry out such additional work in so far as is necessary without any additional payment. PROVISIONS of Survey Teams and Instruments

13 PROVISION OF SURVEY TEAMS AND EQUIPMENTS

The Contractor shall provide and maintain the following surveying equipment for the exclusive use of the Project Manager.

Sr No.	Description of Item	No.
1	Electronic Total Station 1" Reading, 6" Accuracy, Memory 10,000 Point numeric Key Pad complete in all respect with tripod and aluminum levelling staff with graduations in metric units	1
2	Single Prism Target Set (with single prism, Tilting Mount with Target Plate, graduated pole 2m telescope	1
3	Aluminum Heavy Duty Tripod for Total Station)	1
4	Data Download Cable from Total Station to PC	1
5	Software for Data Downloading	1
6	Automatic Level, Magnification 22X with all Stand standard Accessories	1
7	Pill Bubble for Levelling Staff	1
8	Steel measuring tape 100 m long	1
9	Club Hammer 2 kg.	1
10	Sledge Hammer 4 kg	1
11	Traffic Cones	6
12	Hand tapes 3 m. (lockable in pocket)	2
13	Survey Umbrella	2
14	GNS Receiver	1

The Contractor shall make available qualified Surveyors and helpers as and when required by the Project Manager. The Contractor shall provide adequate supplies of expendable materials, i.e. pencils, erasers and inks, drawing papers, pegs, brushes and paints as required or instructed by the Project Manager.

All surveying equipment shall be new and shall be maintained throughout the Contract Period and replaced by the Contractor free of charge in case of damage or loss. The survey equipment shall be provided or supplied to the Project Manager within seven (7) days from the Project Manager's order to commence the Works.

Upon completion of the Contract, the surveying instruments and equipment shall become the property of the Employer.

VOLUME 2(a)
TECHNICAL SPECIFICATIONS

DASU HYDROPOWER PROJECT
Relocated Schools

Technical Specifications

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CHAPTER-1
EARTH WORK
(EXCAVATION & FILLING)

Chapter-1: EARTHWORK (EXCAVATION & FILLING)

1.1 SCOPE

Earthwork (Bulk Excavation & filling benching) shall cover or include furnishing of all labor material, tools, plants, equipment instruments and services necessary for the following:-

- i) Carrying out or executing excavation works in all types of soil and lifting and transporting excavated material. Suitable material intended for use as backfill shall be placed in temporary stockpiles. All other excavated material shall be placed in spoil banks. All excavations and earthwork thereof shall be performed and executed in accordance with provisions and stipulations of Specifications and specific requirements set forth herein which shall apply except when they are specifically amended or modified in writing by the Project Manager for any particular item of work or section. The location of the temporary stockpiles shall be subject to the approval or permission of the Project Manager.
- ii) Fill and backfill using selected excavated material or imported material procured or supplied from approved sources or by blending the excavated and imported material.
- iii) Any material surplus to these requirement or unsuitable shall be disposed of and leveled in thin layers and compacted. The Contractor is responsible for location and land of the dumping site for surplus material. For surplus material, the Contractor will submit the method statement, detailed disposal plan clearly explaining the quantity of material, transportation mechanism, land area plan & profile drawings, any other required and approval of the Project Manager. However, the Contractor will be paid lead of the surplus / unsuitable material as provided in BOQ (Bill: Earthwork (Excavation and Filling).
- iv) All distances shall be measured over the shortest practical route and the route other than shortest practical route may be considered in cases of unavoidable circumstances and as approved by the Project Manager. Lead is the shortest possible horizontal route between the centre of gravity of the material excavated and centre of gravity of the material finally placed.

1.2 GENERAL

1.2.1 CLASS NATURE OR CONDITION OF SOIL

The Contractor shall acquaint himself or well versed in the class, Conditions, origin or nature of the ground, existing structures, foundations and subsoil which might be encountered during excavation or earthworks. The Employer shall not guarantee or warrant in any way that the materials to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated or envisaged on the Drawings or in any other Contract Document or to material procured or supplied from boring or trial holes. The Contractor shall be deemed to have made local and independent inquiries and shall take the whole risk of, the nature of the ground, subsoil or material to be excavated and he shall not be entitled to receive any extra or additional payment nor to be relieved of any of his obligations and responsibilities expressed or implied under the Contract by reasons of nature of such ground, subsoil or material. Payment shall be made based on the prices and rates for types of earthwork as classified in Bill of Quantities (BOQ).

1.2.2 AUTHORIZED OUTLINES

Unless otherwise specified or directed / instructed by the Project Manager in writing, all earthwork viz. excavations, holes, trenches for foundations, filling, embankments and the like, shall be executed to the widths, lengths; depths, alignment, grades and levels shown or envisaged on the approved drawings. If they are not indicated on the drawing, the same shall be carried out or

executed to the profile agreed to by the Project Manager in writing before the commencement of work or section.

1.2.3 SITE CLEARANCE

SITE CLEARANCE

The surface area of the ground to be occupied by all banks, spoils, borrow-pits and excavations shall be cleared off or removed of all roots, grass, shrubs, brush, trees, fences, walls, buildings, roads, ruins and such other structures as may either cause hindrance or impediment in the execution of work or may decay and form dangerous pockets.

STRIPPING of grass, uprooting bush stumps having girth and root less than 0.90 meters and diameter less than 15 cm and their number not exceeding 200 per acre. The cost of this item is covered or included in the unit rate of earthwork.

JUNGLE CLEARANCE

In so far as removal of roots, bush stumps, shrubs, trees and jungle, The Project Manager shall forthwith decide or determine, on the basis of the actual sizes and concentration of such material, whether rate for ordinary jungle clearance or heavy jungle clearance is to be paid. His decision or determination shall be final or conclusive shall be final.

DEMOLITION offences, walls buildings, roads, ruins and other structures. The rates for these works shall deemed to be included of other work items:

In so far as the disposal of materials procured or supplied during the operations of site clearance,

Whether or not, it shall be a "set off" against the cost of site clearance. In the absence of such clarifications, the materials thereof shall be the property of the Government or the Employer, that any damage or defect to the works and public or private property caused by the Contractor's execution or operation in clearing shall be repaired, rectified or replaced at his cost and risk.

1.2.4 BENCH MARKS OR DATUM

Any bench mark, which is to be used for the work, shall be correctly related to the datum specified on the approved drawing or fixed by the Project Manager and the Contractor shall make and maintain at his own cost and risk all such permanent bench marks required for the proper execution of work in the vicinity thereof, in perfect order to the satisfaction of the Project Manager.

1.2.5 SETTING OUT

Before commencing actual execution of the work, the central line of the embankment or excavation shall be distinctly marked with a deep furrow (dagbel) at least 22.50 cm wide and 15 cm deep and pegs shall be fixed at every thirty (30) meters. Top and bottom edges of the excavation and toes of all embankments shall be clearly lock-spitted. All curves in the alignment shall also be properly laid and half-breadth carefully set out.

In the case of the excavation of foundation, the center, longitudinal or face line and at least one (1) main cross line, shall be marked by means of masonry pillars built clear of the point to which the slopes of the excavation shall extend. On each pillar, there shall be an accurate mark to enable theodolite to be set up over it for setting out purposes.

The Contractor shall conduct or carry out a joint survey with the Project Manager's representative, of the area where earthwork is required, plot the ground levels on the Drawings and obtain approval or permission from the Project Manager before starting the earthwork.

All these operations involved in setting out shall be covered under Building Works.

1.2.6 EXCAVATION

All excavation operations manually or by mechanical means shall be done in accordance with the Specifications and to the lines and grades shown on the approved shop drawings or as directed in writing by the Project Manager. A working space of generally 0.5m shall be added on all four sides of structural foundation or as directed by the Project Manager. During the progress of work, if it is considered necessary or desirable by the Project Manager to vary the slopes or the dimensions of the excavations from those shown on the drawings or envisaged, he shall get the slopes or the dimensions revised by the competent authority and communicate the change in writing to the contractor. The contractor shall perform the work and make excavation according to the revised slopes and dimensions as communicated by the Project Manager.

Generally, in hard soil, the sides of the excavations shall be kept vertical up to a depth of 1.5 meters from the bottom. For greater depths, the excavation profiles shall be widened by allowing slope of 1:0.5 (1 V: 0.5H). Where the soil is soft, loose or slushy, unsupported vertical cut shall not be allowed and side slope of the foundation shall be kept with slope 1:1.5 or as directed by the Project Manager. In Hard Rock, the sides of the excavations may be kept vertical or as directed by the Project Manager.

The side slopes shall be clearly marked in the shop drawings. No additional cost shall be paid for excavation beyond the aforesaid limits unless approved by the Project Manager.

However, in case of building isolated foundation excavation, the Project Manager may instruct the whole area excavation up to the bottom of the footing keeping in view the site conditions. The Contractor will get approval before excavating the whole area isolated footing for buildings.

Notwithstanding the above, excavation shall be measured as per actual at site duly approved by the Project Manager and payment shall be made accordingly.

1.2.7 EXCAVATION IN FOUNDATION

- i) The bottom and side slopes of excavation, upon or against which structures or other required constructions are to be placed, shall be completed or finished accurately to the required grades and dimensions, and if instructed or required by the Project Manager, shall be moistened with water and tamped or rolled with suitable tools or equipment for the purpose of forming a firm foundation. Whenever the natural foundation material is disturbed or loosened or excavated beyond the approved lines and grades, the loose material shall be removed and the extra excavation made good or restored at Contractors cost and risk with selected materials which shall be thoroughly compacted by tamping or rolling in layers not exceeding fifteen (15) cm. If at any point in the excavation, material unsuitable for foundation is encountered, as determined or required by the Project Manager, he shall direct or instruct in writing its removal and excavation shall be filled with selected materials thoroughly compacted by tamping or rolling in layers not exceeding fifteen (15) cm. The cost of this replacement with selected materials shall be paid under the rate for earthwork compacted.
- ii) When a safe and solid foundation cannot be obtained at the depth shown or envisaged on the approved drawings, special measures (to be determined in all cases by the Project Manager) may be taken under a special or mutual agreement reached beforehand.
- iii) No excavated earth shall be heaped within six (6) meters of the top edge of any foundation.
- iv) Foundation trench shall be inspected and approved by the Project Manager before foundation is laid.
- v) All excavations shall be kept free from water from whatever source it may come, at all times to the full satisfaction of the Project Manager except where otherwise specified or permitted in writing by him. No extra payment or extra cost thereof shall be made for bailing, pumping or dewatering by any means. All Swamps, drainage channel, and the like, when no longer required, shall be filled with concrete or other suitable material to the satisfaction of the Project Manager.

1.2.8 SLIDE MATERIALS

Materials which do not stand on the slopes on the drawings or established by the Project Manager and the material which are a part of slides extending beyond the established lines of excavation but are left into excavated areas shall be removed by the Contractor in an approved manner, and slopes shall be re-finished to lines and grades required or instructed by the Project Manager. The Contractor may be required to excavate potential slide areas beyond the limits of the originally staked excavation, if, in the opinion of the Project Manager, such excavation is necessary to avoid or prevent damage or defect to the work.

1.2.9 SHORING FOR FOUNDATION

- i) The Contractor shall provide or furnish all timbering, steel sheet piles, or other approved supports, and shore the side of excavation, trenches/drains, pits and wall, in such a manner as will be sufficient to secure them from falling and prevent any movement.
- ii) Shoring shall consist of frames of vertical and walling pieces supported by struts. These shall hold the lagging in position against the sides of the excavation. Lagging shall be further secured by wedges driven firmly down between the frame and the lagging. Scantling shall vary according to the foundation and their sizes shall be fixed by the Project Manager. Struts and frame shall be secured together by iron dogs and bolts, where necessary. In the case of deep foundation, additional vertical uprights shall be attached to the walling by iron dogs.

1.2.10 EXCAVATED MATERIAL

- i) If cutting and filling are being done simultaneously all suitable materials obtained from excavation shall be used or provided in filling. Wherever practicable, all materials shall be placed in the designated final location direct from excavation, except that the backfill material, when so directed by the Project Manager, shall be placed in temporary stock piles and later placed in the designated locations. As far as practicable and as determined by the Project Manager, all materials designated for use in compacted embankment shall have the proper water content either by sprinkling or other suitable means before and during excavation or after placing.
- ii) Excavated materials containing stumps, roots, vegetable matter and other objectionable material that are otherwise unsuitable or not required for backfill, compacted backfill; canals, channel, canal road, rail track, road ways, level crossing or in any other permanent construction required under these specifications, shall be placed in designated spoil banks, adjacent to the canal or road. All spoil banks shall be leveled, compacted and sloped to drain and trimmed to reasonably regular lines as shown or envisaged on the approved drawings or as directed or instructed by the Project Manager at the Contractor's cost.
- iii) Materials of any kind such as shingle or hard good quality stone, obtained from excavation, as also any find made on the site as antique, relics, coins, fossils, and the like, shall remain the property of the government. The rate shall include the separation, of the aforementioned materials and finds from each other and their depositing, as directed or instructed by the Project Manager. Any of these materials, if ordered or instructed by the Project Manager to be used by the Contractor on the works, shall be charged to him at the "Material supplied only Rates" as in this schedule subject to the Contractors percentage, and if these rates are not available in this schedule, at the rates to be agreed upon between Project Manager and the Contractor before the materials are used.

1.2.11 FILLING IN PLINTH, UNDER FLOOR, AROUND FOUNDATION AND TRENCHES/PIPES ETC.

Earth Filling:

Earth used for filling shall be free from shrubs, rank, vegetation, grass, brushwood, stone shingle and boulders (larger than 63mm in any direction), organic or any other foreign matter. Earth containing deleterious materials, saltpeter earth etc. shall not be used for filling. Fill material taken

from excavation or brought from a source designated by the Project Manager, the rate includes all lead and lift.

The space around the foundations and drains shall be cleared of all debris. The filling unless otherwise specified shall be done in layers not exceeding 15 cm in depth. Each layer shall be watered, rammed and consolidated. Compaction shall be done with any means (mechanically or manually). Special care shall be taken to ensure that no damage is caused to the pipes, drains and masonry or concrete in the trenches. In case of filling under floor, the finished level of filling shall be kept to the slope intended to be given to the floor.

Compaction of the fill material shall be 90 percent with the standard proctor or modified proctor depending upon the soil condition or as directed by the Project Manager. Moreover, material for soil shall meet AASHTO classification A-1 to A-5 shall be used for backfill, or as approved by the Project Manager.

Sand Filing:

Sand shall be clean and free from dust, organic and foreign matter and shall be approved by the Project Manager. Sand filling shall be done in a manner similar to earth filling in plinth and also for trenches specified above except that consolidation shall be done by flooding with water. Sand filling of medium to coarse sand (passing less than 4% through BS sieve No.200) or fine sand (passing 4 to 10% through BS sieve No.200) shall be done in layers not more than 225 mm thick and shall be rammed after flooding with water. The surface of the consolidated sand filling shall be dressed to the required level or slope.

1.2.12 SLOPE PROTECTIONS

- i) Slope protection shall be constructed according to the approved profiles to make a smooth cut/fill slope. Earth shall be taken from an approved source, borrow-pits or spoils, and shall be free from roots, grass, shrubs or other organic matter liable to decay.
- ii) Face of slope protection shall be built in horizontal layers approximately five (5) cm thick. These layers shall extend to the full width to the required side slopes and shall not be widened with loose material dumped from the top.
- iii) All clods and lumps of earth shall be broken up in the borrow-pits to a diameter of not more than five (5) cm. Any clods or lumps thrown on to the bank shall be broken up and spread before compaction begins.
- iv) The top of the bank and the slopes shall be carefully dressed according to the approved profiles. No hollows or humps shall be allowed in the slopes.

1.2.13 DEALING WITH BAD SOIL ETC.

Any vegetation mound or other soil that in the opinion of Site Engineer objectionable, shall be removed and replaced as per directions or instructions of the Project Manager. This earth shall be disposed of as directed by the Project Manager. All holes and hollows on the site, shall be dug out and filled with good earth, duly approved by the Project Manager, properly laid and rammed.

1.2.14 CLASSIFICATION OF EXCAVATED MATERIAL

Excavation shall be classified under the following heads for recording measurement and making payment:

a) Soft Soil

It includes all cutting in sand, silt and those soils which offer no resistance to excavation and sometime requires shoring when foundation of exact dimension is required to be excavated since they have small angle of repose.

b) Ordinary Soil

It includes all cutting in earth which can be ploughed, irrespective of the fact whether picks or "phawarahs" have been used in the actual excavation. Usually the same includes:-

- i) Spoil or rubbish of every description,
- ii) Earth and sandy loam.
- iii) Any other formation in to which a spade can be entered and can be easily excavated by the application of kassi, pick or shovel.

c) Hard Soil

There are the following two types of hard soil.

- i) It includes a stiff and heavy clay soil having specific gravity of 1.5 and above, which can be dug with repeated blows of kasi or pick axe.
- ii) Soil having small percentage, say up to fifteen (15), of kankar or boulder which can be easily dug and removed along with the soil.

d) Gravel work and Rock Not Requiring Blasting

This includes:-

Gravel formation; cement concrete, brickwork/block work in cement mortar

Large boulders above 20 percent which can be individually lifted by hand,

Soft varieties of limestone, sandstone or fissured stone or any other formation which can be excavated by use of picks, jumpers, shovels, wedges, hammers, etc., and do not require blasting.

e) Rock Requiring Blasting but Blasting Prohibited

This includes all as No. (d) above, where blasting is prohibited by the Project Manager. Blasting is prohibited as it is apprehended that it may cause harm to important buildings or other works located nearby. In that case other methods such as cutting out by means of chisel or wedges, pneumatic concrete breakers, sledge hammers and heavy point are normally adopted.

1.2.15 EARTHWORK FOR REPAIRS

1.2.15.1 *Repair to Banks (Holes and Ravines)*

- i) All holes (gharas) and ravines, wherever possible shall be, first fully opened out to the bottom.
- ii) All lumps of fallen earth shall be removed and the sides excavated down in steps not more than 0.50 meters deep.
- iii) All jungle, grass, roots, or other rubbish shall be thoroughly cleared, and the work when ready for filling shall be inspected and passed by the Project Manager before filling begins.
- iv) Filling shall be completed in accordance with the Specifications No. 1.2.7 indicated for foundation excavation.
- v) At the end of day's work, top layer shall be flooded with water to attain consolidation.
- vi) During the work in progress rammers of approved type shall be employed for ramming, as directed by the Project Manager.
- vii) In all other respects the same shall conform to Specifications No. 1.2, unless otherwise specified or directed in writing by the Project Manager.

1.2.15.2 Repairing of Banks by Earth from Berms

- i) Where a silt berm exists, earth for filling and repairs shall be accomplished, as far as possible, by cutting away such berms.
- ii) Care shall be taken that a layer of at least 15 cm thick of silt adjacent to the bank is left intact except under special orders of the Project Manager and that cross dowels are left at close intervals in the silt berm so that borrow-pits may silt up quickly.
- iii) Any bank which is to be widened or raised shall be ploughed or cut into steps.
- iv) Raising of driving banks shall not be done with sandy earth or silt.

1.2.15.3 Repairing of Banks by Earth from Spoil Banks

- i) In case there is no berm, earth shall be obtained from the spoil bank if there is one or from outside excavation.
- ii) In getting earth from the spoil bank, borrow-pits on top shall be strictly prohibited, since in wet weather they form tanks and lead to damage by breaching.
- iii) Earth shall preferably be obtained from the back of the spoil, or by widening the drainage gaps in the spoil banks.

1.2.15.4 Repairing of Banks by Earth from Borrow Pits

- i) Where there is no spoil, earth shall be obtained by leveling down any high lumps, and last of all from borrow-pits.
- ii) Where borrow-pits are unavoidable, they shall be dug as far from the toe of the bank as possible and shall not be more than 30cm deep unless otherwise specified.
- iii) Borrow-pits shall be neatly set out parallel to the banks, if there were no old borrow-pits.
- iv) The dimensions and distinctive marks in the new borrow-pits shall be fixed by the Project Manager to avoid any mixing with the old borrow-pits.
- v) All old borrow-pits shall be measured and measurement duly recorded and checked before new borrow-pits are put in.
- vi) A bar, at least three (3) meters wide, shall be left after every chain to eliminate all chances of a regular rain water drain running along the bank.

1.2.16 COMPACTION OF NATURAL GROUND

The natural ground or surface ready for construction purposes after clearing from the jungle, roots, shrubs, grass, brushes, trees etc will be considered as Natural Ground for the purpose of this item..

Up to a depth of twenty (20) cm below the natural ground, all sods and vegetable matters shall be removed and clear surface shall be broken up by ploughing and scarifying to compact to the degree as defined below

For height of Embankment below sub grade level	Percent of Maximum Dry Density as determined by AASHTO T-180
0 to 30 cm	95
30 to 75 cm	93
Over 75 cm	90
Below the foundation of	95

structures	
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No payment will be made for the works of clearing from the jungle, roots, shrubs, grass, brushes, trees, ploughing and scarifying the site.

1.3 ANTI-TERMITE

1.3.1 MATERIALS

Chemicals: Termiticide made from any one of the following chemicals or as per manufacturer's recommendations and approved by the Project Manager may be used:

- a) Bifenthrin
- b) Imidacloprid
- c) Fipronil

1.3.2 SAFETY PRECAUTIONS

Chemical used for anti-termite treatment are insecticides with a persistent action and are highly poisonous. This chemical can have an adverse effect upon health when absorbed through the skin, inhaled as vapors or spray mists or swallowed.

Persons using these chemical shall be warned that absorption through skin is the most likely source of accidental poisoning. Particular care shall be taken to prevent skin contact with the chemicals. After handling the chemicals, workers shall wash themselves with soap and water and wear clean clothing, especially before eating. In the event of severe contamination, clothing shall be removed at once and the skin washed with soap and water. If chemical has splashed into the eyes, they shall be flushed with plenty of water and immediate medical attention shall be sought.

Care should be taken in the application of chemicals to see that they are not allowed to contaminate wells or springs which serve as source of drinking water.

CHAPTER-2

MORTAR

Chapter-2: MORTAR

2.1 SCOPE

Mortar to be used in works of masonry and plasters shall consist of materials herein described below and ingredients shall be mixed, formed and handled in accordance with the herein stated specifications and requirements, except, when such stipulations and requirements are specially modified by the Project Manager for any particular item of work.

2.2 CEMENT MORTAR

2.2.1 COMPOSITION

Cement mortar shall consist of one part Portland cement to specified number of parts of dry loose sand (Fine aggregate) by volume and sufficient water to produce proper consistency for intended use. Waterproofing agent; and hydrated lime putty not exceeding twenty-five percent (25%) by volume of dry cement shall be added when specially required or directed by the Project Manager.

2.2.2 MATERIALS

i) **Portland cement**

Portland Land cement shall conform to ASTM C 150M-17 Type I or B.S.S.12 and meet the requirements and stipulations specified for Portland cement in Chapter- Cement, Sand, Aggregate and Revetment Material.

ii) **Sand**

Sand shall conform to specifications, requirements and stipulations specified, for sand in Chapter- Cement, Sand, Aggregate and Revetment Materials.

iii) **Water**

Only fresh and clean water free from earth, vegetables, organic impurities and any other substances likely to cause efflorescence or otherwise prove harmful to the work shall be used. Water containing injurious amounts of oils, acids, alkalis, salts, sulphides, chlorides, carbon dioxide shall not be used. The pH value of water shall range between 6 & 8. Broadly speaking water which does not show or demonstrate an intensive odour or brackish taste shall be acceptable.

2.2.3 Mix

Unless otherwise specified or directed by the Project Manager, the ingredients for cement mortar shall be proportioned by volume.

2.2.4 PREPARATION

- i) Methods and equipment used for mixing mortar ingredients including their mixing in dry state shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Project Manager. Normally cement and sand is thoroughly mixed in a dry state on a pucca platform or in troughs as directed by the Project Manager. It shall be gauged with a quantity of water sufficient to make the mortar workable. Normally the quantity of water to be added shall be

twenty-eight percent (28%) of weight of cement plus four percent (4%) of total dry aggregate
28% of weight of cement plus 4% of total dry aggregate.

Water shall be added with a fine rose. Only such quantity of mortar shall be prepared as can be used before the initial setting time.

- ii) If a mixer is used, it shall be of the approved design. The mixing time after all the ingredients are in the mixer, except for the full amount of water, shall be not less than two minutes. Water shall be added at a uniform rate during the mixing time.
- iii) Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within thirty (30) minutes after addition of the water to the mix shall be wasted. Re-tempering of mortar shall not be allowed. Mixing troughs and pans shall be thoroughly cleaned and washed at the end of each day's work. When color for face work is specified to be mixed in, it shall be of approved quality and brand and shall be added in such quantity to obtain the required shade; water proofing material shall be added only when specifically directed or instructed by the Project Manager.

CHAPTER-3
CONCRETE

Chapter-3: CONCRETE

3.1 SCOPE

The work shall cover or include furnishing of all labor, materials, plant, equipment accessories and services as required for completing the concrete items as shown on the drawings, specified herein and/ or as directed by the Project Manager. The materials herein specified shall be proportioned, mixed, formed and placed in accordance with the herein stated requirements. The stipulations and requirements herein set forth herein shall apply except when such stipulations and requirements are specifically modified by the Project Manager for any particular item of work or section.

3.2 MATERIALS

(i) Cement

Portland cement shall conform to ASTM C 150M-17 Type 1 or B.S.S - 12 and meet the specific requirements and stipulations specified for cement in Chapter- 'Cement, Sand, Aggregates & Revetment Materials'.

(ii) Steel Reinforcement

Bar steel reinforcement wherever required shall be of mild steel and shall comply with ASTM Designation A 615-16 or B.S.S. 4449 or equivalent. The provision of steel reinforcement, its bending, binding and placement as shown on the drawings or specified or directed by the Project Manager shall, however, be separately payable since, it is not covered or included in the rate of concrete.

(iii) Sand and Aggregates

All sand aggregates, required under these specifications shall be provided or furnished by the Contractor in accordance with the provisions of and in the complete conformity or compliance with the stipulations and requirements for Sand and Aggregates specified in the Chapter-, "Cement, Sand, Aggregate and Revetment Materials".

(iv) Water

Water for washing aggregates and in all concrete or grout and curing concrete and the like shall be fresh, clean and free from objectionable quantities of silt, injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious substances as determined or defined by ASTM D 596 – 01(2011) and BS 3148 or equivalent.

The water for curing concrete shall have a PH value between 6 to 8 and shall not contain impurities which cause discoloration of concrete.

The water to be used in all concrete and grout and the like will be tested or verified by the Project Manager to determine conformity or compliance with these requirements.

3.3 STONE BALLAST

Whenever dry ramming of stone ballast ranging from 38 mm to 51 mm size is specified or directed/instructed by the Project Manager for the foundation of the building to provide a firm base the ballast from pre-approved stacks shall be placed evenly in layers, not exceeding fifteen (15) cm in thickness in the foundation trench and thoroughly consolidated by means of small compactor (may be hand operated) or square rammer If required or directed by the Project Manager small quantity of water may be sprinkled on the ballast by means of can fitted with rose. The quantity of water will be just enough to facilitate the consolidation and the same shall should not make the foundation muddy.

Size of the stone to be used under floor as ballast in the 1st and subsequent floors shall be 19mm to 25mm or as directed by the Project Manager.

3.4 CEMENT CONCRETE (PLAIN, REINFORCED)

3.4.1 COMPOSITION

Plain cement concrete (PCC) shall be made from cement, sand, coarse aggregates and water as specified in Para 4.2 (iv). No other ingredient shall be mixed with the concrete or mortar without the Project Manager's approval. In reinforced cement concrete, reinforcement steel as specified or directed by the Project Manager shall also be added. However, its cost is payable separately.

If the use of admixtures, including air entraining admixtures, foaming chemicals, water reducing admixtures and/or retarding or workability agents is approved by the Project Manager, this use shall be subject to the following conditions:

- i) No reduction of strength compared with additive free concrete of the same class.
- ii) No reduction of cement content prescribed;
- iii) No corrosive effect on reinforcement steel;
- iv) No Alkali-aggregate reaction promoted;
- v) Dosage and admixtures strictly in accordance with the manufacturer's instructions or recommendations in respect of the specific conditions to be achieved.

The Contractor shall use a retarder to facilitate the preparation of construction joints, subject to the approval of the Project Manager, to the composition of the retarder and its method of application.

3.4.2 FORM WORK

Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. Generally these forms shall be made of metal, tempered pressed wood lining, or of smooth planed boards in good condition as required to produce the surface finish specified herein. Also the same shall be so designed and constructed that the concrete can be properly placed and thoroughly compacted.

When concrete is to be vibrated, due and special care shall be taken to ensure that the formwork will remain stable and the joints tight. The contractor shall make allowance for any settlement or deflection of formwork that is likely to arise during construction.

- i) These Forms shall conform to the various shapes lines, grades and dimensions of the concrete as shown on the drawings or as established by the Project Manager. The material to be used and the design of the forms shall be subject to approval by the Project Manager before construction of forms is started; however, in any case the approval will not relieve the contractor of any obligation or responsibility for the adequacy of the forms nor from the necessity for remedying any damages or defects which may develop or become apparent with use. The Project Manager may at any time condemn any sections of form found deficient in any respect and the contractor shall promptly remove the condemned forms from the work and replace them at his own cost and risk.
- ii) Rough formwork for unexposed faces or where otherwise specified may have irregularities in its surface provided that the shuttering nowhere intrudes into the limits of the concrete structure shown on the drawings and provided it is adequately grouted tight.
- iii) For exposed faces of concrete or elsewhere where specified as 'fair faced', the formwork is to be of steel or timber perfectly smooth and set up true to the required lines and dimensions shown on the Drawings with an allowance for deflection where required. The surface of concrete shall be rubbed smooth wherever required with a carborundum immediately after removal of the shuttering and when the concrete is green, and all small holes shall be stopped with cement mortar of such mix that the stopping shall be invisible.

- iv) All joints in the formwork shall have close fitting to prevent leakage of grout from the concrete.

At construction joints, formwork shall be tightly secured or ensured against previously cast or hardened concrete to prevent the formation of stepping or ridges in the concrete. Formwork shall be constructed to provide straight and true angles arises or edges. Where chamfers are to be formed the fillets shall be accurately cut to size to provide a smooth and continuous chamfer. Chamfer strips shall be placed in the corners of forms so as to produce beveled edges on permanently exposed concrete surfaces Interior angles on such surfaces and edges at formed joints will not require beveling unless requirement for beveling is so indicated on the Drawings.

- v) A smooth finished surface of the concrete shall be required wherever it is a part of a waterway. The form work for such surfaces shall be made of either wood or metal and shall be true in every respect to the required shape and size, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided or furnished in the construction of all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete.
- vi) All forms when erected shall be tight, firmly supported and adequately strutted, braced or tied and sufficiently strong to resist without excessive distortion the pressure of concrete during its placing and compaction. When concrete is to be vibrated, special care shall be taken to ensure that the formwork will remain stable and the joint tight. The contractor shall make allowance for any settlement or deflection of formwork that is likely to arise during construction.
- vii) All forms shall be properly secured in position so as to prevent floating, or other movement during the placing of concrete. Form supports shall be carried to firm foundation so that no settlement of. The forms will be possible during construction.
- viii) Suitable means for removing the forms without injury to the surface of the finished concrete shall be provided. Before concrete is placed all rubbish, chipping, shavings saw dust and dirt shall be removed. The surface of the forms shall be oiled with commercial form oil that will effectively prevent sticking of the concrete to the forms and will not stain the concrete. The oil shall be kept out of any reinforcement or with concrete at any construction joint. All bond breaking materials or processes shall be used only after approval by the Project Manager. Care shall be taken in applying form oil to avoid contact with reinforcement steel and resulting loss of bond.
- ix) The material and position of any ties, passing through the concrete shall be to the Project Manager's approval. Any metal ties and securing devices used to hold the formwork must be of such a type that any metal parts left permanently in the concrete are not nearer than fifty (50) mm from any finished face. The holes left by removing other parts must be completely filled with mortar, all to the satisfaction of the Project Manager.
- x) No Concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms and preparation of surfaces involved in the placing have been approved or permitted by the Project Manager. Except for concrete placed in well foundations, the Contractor chooses to use this method; payment shall be made as if shuttering had been used.

All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed.

In case of Concrete surfaces of previous pours which have set / hardened, the surfaces should be roughened by the process called nicking with sharp tools like chisels and the like. and the surfaces cleared off the detached material by suitable means approved by the Project Manager.

- a) The surfaces of absorptive materials against or upon which Concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from freshly placed concrete. Also, where necessary, to facilitate placing and vibrating concrete in paving

and base slabs as determined by the Project Manager or before concrete for reinforced concrete work is deposited on a foundation of soft ground, the Contractor shall place a fifteen (15) mm thick course of "Blinding Concrete", which shall be placed over the ground below the underside level of the reinforced concrete to form a hard even surface on which to construct the latter. The blinding course shall be spread uniformly over the foundation to be protected and allowed for twenty four (24) hours prior to placement of fresh concrete.

- b) Where shown on the Drawings or directed by the Project Manager, concrete placed against rock shall be doweled by means of steel reinforcing bars anchored into the rock. The contractor shall drill holes of the necessary diameter into the rock to receive the anchors. Each hole shall be flushed out with water, filled with 1:1 sand-cement mortar and the anchor bar inserted to the full depth of the hole immediately before depositing concrete on or against a surface of rock, masonry, brickwork/block work & old concrete.

3.4.3 MIXING CONCRETE

- i) The concrete shall be mixed in machines of the batch mixing type with drums revolving not faster than twelve (12) times per minute and capable of discharging their contents whilst running. The machines are to revolve not less than fifteen (15) times after all materials including water have been deposited in the drums and before any portion of the batch is discharged.

The capacity of the plant shall be such that the proposed arrangement will produce adequate quantity of concrete to meet with all the other specific requirements of these Specifications and the construction schedule. The batched materials shall be thoroughly combined into a uniform mixture before the addition of water and admixtures. The water shall be added gradually and the mixer operated for specified duration of time so as to obtain a thoroughly mixed concrete of uniform color and quality.

A simple and convenient system of varying the water released into each batch must be installed with graduated gauges fixed to the supply tanks which can be set by the Project Manager. The method of releasing the water into the mixer shall be such that the full measured quantity is discharged in one (1) operation and the flow stopped off by an automatic valve or siphon arrangement only when the full quantity of water has been released. No arrangement which permits the discharge of partial quantities of water at the discretion of the mixer driver will be allowed.

- ii) Where it is not possible to employ machine mixing and approval has been obtained from the Project Manager, concrete may be mixed by hand as near as practicable to the site where it is to be deposited. Clean mixing bankers or platforms of sufficient area for the proper execution of the work shall be provided. These platforms, if constructed of timber, shall consist of planks closely jointed so as to avoid the loss of any grout or liquid from the wet concrete. The whole of the aggregate and cement shall be turned over on the banker in a dry state at least twice. The water shall then be added gradually, after which the materials shall again be entirely turned over in a wet state at least three (3) times before leaving the banker.

3.4.4 BATCHING

- i) The aggregates and cement shall be proportioned by means of efficient weigh batching machines except when concrete is mixed by hand or when particular approval has been granted by the Project Manager, when volume batching may be used. The machines shall be carefully maintained and cleaned and they shall be provided with simple and convenient means of checking the accuracy of the weighing mechanism which shall be checked regularly and when required by the Project Manager.
- ii) For volume batching suitable gauge boxes shall be used. Cement shall be taken as weighing fifty (50) kg per standard bag of 0.035 cum or such other amount as may be determined by the Project Manager as a result of tests. The bulking effect of aggregates shall be taken into consideration.

3.4.5 CONSISTENCY OF CONCRETE

The consistency of the concrete shall be such that, taking into consideration the nature of the work, it shall be sufficiently workable to provide a dense and homogeneous concrete of the specified strength. The degree of workability shall be altered if so required by the Project Manager who may order slump or other tests to be carried out in order to control or monitor the consistency in care, Custody, and control of the Contractor.

3.4.6 WATER CEMENT RATIO

In general, the mix design shall provide for water - cement ratios by weight with aggregate at saturated surface dry condition, which will be determined on the basis of producing concrete having suitable workability, density, impermeability, durability and the required strength without the use of excessive amount of cement.

It is expected that water - cement ratio by weight will vary from 0.45 for concrete in thin sections to 0.65 for mass concrete in adverse or severe weather conditions. Maximum permissible water - cement ratio will also vary from 0.67 for low grade concrete to 0.38 for concrete of grade 30 and above.

A simple and convenient system of accurately measuring and varying the water supply to the concrete mixers must be installed with gauges marked in griffons and tenths or Kilogram or equivalent units in order that the amount fed into the machine can easily be ascertained or verified.

3.4.7 CONCRETE STRENGTH

Various grades of Concrete shall have twenty eight (28) day compressive strength of 15 x 30 cm test cylinders at least equal to the values given in the table 3.1 below except as otherwise indicated on the Drawings or directed by the Project Manager. The placing of concrete shall not begin until trial batches of the mix design to be used have been produced by the Contractor and tested and approved by the Project Manager as per ACI 211 method and relevant ASTM standards.

The corresponding minimum compressive strengths of 15 x 15 x 15 cm test cubes are also embodied therein.

Table 3.1 Classes of Concrete

Class concrete	Cylinder 15x30 cm		Cube 15 x 15 cm		Ratio of Cylinder/ Cube.
	Mpa	Psi	Mpa	Psi	
Class A	28	4,060	31.0	4,500	0.90
Class B	20	2,900	24.7	3,580	0.81
Class C	15	2,180	19.5	2,830	0.77
Class D	10	1,450	13.0	1,890	0.77

3.4.8 SLUMP

In general, the slump of the concrete, after concrete has been deposited but before it has been consolidated, shall not exceed the values specified below for the structures and/ or parts thereof unless otherwise directed by the Project Manager. Check slumps shall be taken at the mixer and at locations of placement and or as directed by the Project Manager. The Project Manager may order the placement of concrete having lesser slump, wherever concrete of such lesser slumps can be consolidated readily into place by means of the specified vibrations. The use of buckets,

chutes, hoppers or other equipment of types that will not readily handle and place concrete of such lesser slumps will not be permitted. The slump will be determined in accordance with ASTM C 143M-15 a

The minimum slump shall be twenty (20) mm in all cases, except when plasticizers are used with the Project Manager's approval. The maximum slump shall not exceed the under mentioned limits:

- | | |
|---------------------------------|--------|
| ○ Mass Concrete | 50 mm |
| ○ Slabs, floors and foundations | 50 mm |
| ○ Columns, beams, walls, piers, | |
| ○ Parapets & curbs. | 100 mm |
| ○ Other parts | 75 mm |

3.4.9 TEMPERATURE

The temperature of concrete when it is being placed shall be not more than 32.2 degrees centigrade and not less than 4.5 degrees centigrade except that the temperature of the concrete placed in large slabs having a thickness of 1.52 meter or more shall not exceed 27 degree Centigrade. When the temperature of the concrete, as placed, will be between 27 degrees centigrade and 32.2 degrees centigrade, the concrete shall be mixed at the job site and discharged into the work immediately after mixing. If Concrete is placed when the weather is such that the temperature of the concrete would exceed 32.2 degrees centigrade, as verified and determined by the Project Manager, the Contractor shall employ effective means, such as pre-cooling of aggregates and mixing cool water and placing at night, as necessary, to maintain the temperature of the concrete, as it is placed, below the maximum limits specified herein.

3.4.10 CONVEYING

Concrete shall be conveyed or transported from mixer to the place of final deposit as rapidly as practicable, by methods which will prevent segregation or loss of ingredients and in accordance with ACI 304. Any wet batch hopper through which the concrete passes shall be conical in shape. There shall be no vertical drop greater than one meter except where the use of such equipment is approved in writing by the Project Manager in advance of any use. Each type or class of concrete shall be visually identified by placing a colored tag or marker on the bucket as it leaves the mixing plant so that the concrete may be positively identified and placed in the structure forms in the desired position.

Concrete mixed in stationary mixers and transported by non-agitating equipment shall be placed within thirty (30) minutes after the same has been mixed, unless otherwise approved by the Project Manager. When a truck mixer or an agitator is used for transporting concrete, the concrete shall be conveyed or delivered to the site of the work and discharge shall be completed within one and half (1.5) hours after introduction of the cement to the aggregates. The concrete shall be placed within thirty (30) minutes after the same has been discharged. In all cases, concrete shall be placed and compacted well within the initial setting time.

3.4.11 PLACING

- i) No concrete shall be placed until all the preparatory works have been satisfactorily completed and the reinforcement and embedded items have been checked and approved by the Project Manager. Concrete placing shall follow the practice specified in ACI 304.
- ii) Concrete shall be placed only in the presence of the Project Manager or his authorized representative in care, custody, and control of the Contractor. After the surfaces have been prepared satisfactorily, surfaces of construction joints upon which new concrete is to be placed shall be covered with a layer of mortar approximately eight (8) mm thick. Likewise, in placing concrete through reinforcement, due care and diligence shall be taken that no segregation of the coarse aggregate occurs. In certain cases, like the bottom of beams and slabs, the congestion of steel near the forms may make placing difficult. In such cases, as

determined or required by the Project Manager, a layer of mortar of a composition compatible with the required concrete strength shall be first deposited to cover the surface to a depth of fifteen (15) mm.

The mortar shall have the same proportions of cement and sand as the regular concrete mixture, unless otherwise directed or instructed by the Project Manager. The water-cement ratio of the mortar shall be suitable for placing and working in the manner hereinafter specified. The mortar shall be spread uniformly and shall be worked thoroughly into all irregularities of the surface. Concrete shall be placed immediately upon the fresh mortar. In placing concrete against formed construction joints, special precautions shall be taken to ensure that the new concrete is brought into intimate contact with the surface of the joint, by careful puddling and spading with the aid of suitable tools.

- iii) Re-tempering of concrete will not be permitted nor approved by the Project Manager. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted and no payment will be made to the Contractor for such wasted concrete, including contained cement. Concrete shall be deposited in all cases as nearly as practicable directly in its final position and shall not flow in a manner to permit or cause segregation. Excessive separation of coarse aggregate in concrete, caused by allowing the concrete to fall freely from too great a height (maximum 2 m), or at too great an angle from the vertical, or to strike the forms or reinforcement steel, shall not be permitted nor approved by the Project Manager, and where such separation would otherwise occur, the Contractor shall provide or furnish suitable drop chutes and baffles to confine and control the falling concrete. In case of concrete under water, special arrangements shall be made to place the same by means of a termite, bottom dump buckets, or other approved means or methods which will preclude any free fall of the concrete in the water.
- iv) Except as intercepted by joints, all formed concrete in walls, piers and other restricted areas shall be placed in continuous approximately horizontal layers, the depths of which generally shall not exceed fifty-one (51) cm. The Project Manager reserves the right to require lesser depths of layers where concrete in fifty (50) cm layers cannot be placed in accordance with the requirements of these Specifications. All intersections of construction joints with concrete surfaces shall be made straight and level or plumb.
- v) In placing concrete in large thick slabs and similar exposed areas, the contractor shall maintain the exposed area of fresh concrete at the practical minimum, by first building up the concrete in successive approximately horizontal layers about fifty (50) cm in thickness to the full width of the structure and to the full height of the lift over a restricted area at one end of the structure and then continuing in similar progressive stages to the full area of the structure.

The slope formed by the unconfined upstream edges of the successive layers of concrete shall be kept as steep as practicable in order to keep its area to a minimum. Concrete along these edges shall not be vibrated until adjacent concrete in the layer is placed except that the same shall be vibrated immediately when conditions are such that the concrete will harden to the extent that later vibration will not fully consolidate and integrate the same with more recently placed adjacent concrete. Clusters of large aggregate shall be scattered before new concrete is placed over them. Each deposit of concrete shall be vibrated completely before another deposit of concrete is placed over it.

- vi) Concrete shall not be placed during rains sufficiently heavy or prolonged to wash mortar from coarse aggregate on the slopes of the placement. During such rains mortar shall not be spread on construction joints and diluted mortar already spread shall be removed and replaced before continuing with the work. Once placement of concrete has commenced in a structure, placement shall not be interrupted.
- vii) Concrete buckets where used shall be capable of promptly discharging the low- slump, concrete mixes specified and the dumping mechanism shall be designed to permit or approve the discharge of as little as 0.30 cubic meter (m³) portion of the load in one (1) place. Buckets shall be suitable for attachment of and use of drop chutes where required in confined locations.
- viii) Construction joints shall be approximately horizontal unless otherwise shown on the Drawings or required or instructed by the Project Manager. All intersections of construction

joints with concrete surfaces which will be exposed to view shall be made straight and level or plumb.

- ix) Each layer of concrete shall be consolidated to the maximum practicable density, so that it is free from pockets of aggregates, and closes snugly against all surfaces of forms and embedded materials. In consolidating each layer of concrete the vibrating head of the vibrator shall be allowed to penetrate and vibrate the concrete in the upper portion of the underlying layer. All concrete shall be consolidated with electric or pneumatic, power driven immersion type vibrators, operating at speeds of at least seven thousand (7,000) revolutions per minute when immersed in the concrete. Additional layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified herein.

3.4.12 TIME BETWEEN ADJACENT POURS

The time between adjacent pours shall be defined as the time elapsing from the end of the striking off of one' pour to the start of placing the next pour. The minimum time elapsing between adjacent pours shall be five (5) days for thin and moderate sections and fourteen (14) days for mass sections.

3.4.13 VIBRATION OF CONCRETE

Recommended practice specified in ACI 309 shall be followed for concrete consolidation. Concrete shall be compacted with mechanical vibrating equipment supplemented by hand spacing and tamping. In no case shall vibrators used to transport concrete inside the forms. The vibrating equipment shall be of internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all the concrete. Form or surface vibrators shall not be used unless specifically approved or permitted by the Project Manager. The intensity (amplitude) of vibration shall be sufficient (frequently not less than six thousand (6,000) impulses per minute) to produce satisfactory consolidation. The duration of vibrations shall be limited to that necessary to produce satisfactory consolidation. Excessive surface working shall not be approved nor permitted.

3.4.14 CONCRETE PLACING IN SURFACES WITHOUT FORMWORK

- i) Where, on an upward facing horizontal or near horizontal surface which does not require formwork, no particular finish is called for, the surface shall be that produced by the proper placing and compaction operations without further labors.
- ii) Where a "fair surface" is specified, it shall be obtained by screening. This shall be done, immediately after compaction of the concrete, by the slicing and tamping action of a screed board running on the top edges of the formwork, or on accurately set screening guides, to give a dense concrete skin, true to line and level.
- iii) Where a "fine surface" is specified it shall be obtained by first screening the concrete as expressly described or specified in the preceding sub-clause then leaving it until the concrete has stiffened and the film of moisture has disappeared. Floating shall then be applied with a steel or wooden float to produce a "glossy" surface or a "sand paper" surface as required. Working should be kept to a minimum compatible with a good finish. The surface shall be true to the required profile to fine tolerance. Whenever necessary a properly constructed overhead cover shall be erected before the work is commenced to prevent the finished surface from being marred by raindrops or dripping water.

3.4.15 SEPARATORS

Where the design calls for two (2) different classes of concrete for the facings and the hearing, the two (2) classes shall be placed at the same time so that the same can be thoroughly incorporated with each other. To do this, the Contractor may either use a separator which is gradually withdrawn as the two (2) classes are placed on either side of the same or he may place batches of one (1) class then the other alternately without separator, due care and diligence

being taken that, if any irregularity of the division plane occurs, the specified thickness of the richer class shall be everywhere maintained.

3.4.16 REMOVAL OF FORMS

- i) Forms for various parts of the structure thereof shall not be removed before the number of days specified have elapsed after placing the concrete. Consideration shall be provided to the weather and other climate conditions influencing the setting of concrete, curing, and materials in the mix. The exact number of days shall be determined or required by the Project Manager.
- ii) The time and method of removal and moving of forms shall be as directed by the Project Manager, and this work shall be completed with due care and diligence so as to avoid or prevent any injury and damage to the concrete. No loading on green concrete shall be permitted or approved by the Project Manager. As soon as the forms are removed, the surface of the concrete thereof shall be carefully examined or verified, and any irregularities in the surface shall be immediately repaired or restored to the satisfaction of the Project Manager.
- iii) In general, the minimum elapsed time before removal of forms shall be two (2) days for unloaded walls and conduits and fourteen (14) days for bridge decks. During a moderate weather (about 16 degree C, the form work for slabs and beams shall be removed after seven (7) days and sixteen (16) days respectively, in case ordinary Portland cement is used.

3.4.17 CURING

i) General

All concrete including concrete repair work shall be cured by an approved method or combination of methods in accordance with ACI 308. The Contractor shall have all equipment and materials needed for adequate curing and protection of the concrete on hand and ready to use before actual concrete placement begins. The means or methods thereof shall be provided or furnished for the protection of concrete from the sun, drying winds and traffic until the specified curing has been completed.

The curing medium shall be applied so as to prevent loss of moisture from the concrete. Concrete shall be protected from heavy rains for 24 hours. All concrete shall be adequately protected from damage. No fire or excessive heat, including the heat resulting from welding, shall be permitted near or in direct contact with the concrete at any time. All galleries, conduits and other formed openings through the concrete shall be closed during the curing period.

If during the specified minimum period of curing, the surface temperature of the concrete falls below ten (10) degree C, the period of curing shall be extended to allow the concrete to reach sufficient maturity. The period of extension thereof shall be as approved or permitted by the Project Manager in writing.

ii) Moist Curing

- a) Unless otherwise specified or approved by the Project Manager, all concrete shall be cured by water curing or by membrane curing, as hereinafter specified, except that construction joints shall be cured only by water curing. The Project Manager shall have the right or entitlement to specify which type of curing shall be used in the different portions of the work.
- b) Concrete cured with water shall be kept wet for at least fourteen (14) consecutive days immediately following placement of the concrete, by covering with water saturated material, or by a system of perforated pipes, mechanical sprinklers, or porous hose, or by any other approved method or methodology which will keep all surfaces to be cured continuously (not periodically) wet. Water used for curing shall meet or satisfy the requirements of these Specifications for water used for mixing concrete.

iii) Membrane Curing

- a) Membrane curing shall contain or consist of the application of a white pigmented sealing compound which forms a water retaining membrane on the surface of the concrete. The sealing compound thereof shall conform to or comply with the United States Bureau of Reclamation "Specifications for Sealing Compound for curing Concrete. "Effective June 1, 1961. At the time of use, the sealing compound shall be in a thoroughly stirred condition such that the pigment is uniformly dispersed throughout the vehicle. Stirring shall be accomplished by an effective power operated mechanical stirrer, or by agitation with compressed air introduced at the bottom of the drum through a length of pipe, or by other approved effective means or method. Compressed air lines shall be provided or furnished with effective traps so as to avoid or prevent oil or moisture from getting into the compound. The sealing compound thereof shall not be diluted or altered in any manner. Any sealing compound that cannot be satisfactorily stirred or applied shall be heated by steam or hot water or by other approved means or methods until or unless the compound has proper fluidity, but in no case shall the compound be heated to a temperature higher than thirty-eight (38) degrees. Heating of sealing compounds by direct exposure of the container to fire shall not be permitted nor approved.
- b) The sealing compound shall be applied to the concrete surfaces by spraying and shall be applied in one (1) coat at coverage of three (3) sq. meters (m²) per liter. Spraying equipment shall be of the pressure tank type, which provides for continual agitation of sealing compound during spraying operations. The use of ordinary orchard type land sprayers shall not be permitted nor approved by the Project Manager. In order to ensure thorough and complete coverage of the concrete surfaces, approximately one and half (1/2) of the required thickness of coating shall be applied by moving the spray gun back and forth in one (1) direction with the remainder of the coating applied immediately thereafter by moving the gun at right angles to the direction of the first application.
- c) When a sealing compound is used on unformed concrete surfaces, application of the compound shall commence immediately after finishing operations are substantially completed. When a sealing compound is to be used on formed concrete surfaces the surfaces shall be moistened with a light spray of water immediately after the forms are removed and shall be kept wet until or unless the surfaces will not absorb more moisture. As soon as the surface film of moisture disappears and there is an approach to surface dryness, the sealing compound shall be applied. In the event that application of the sealing compound is delayed, the concrete surfaces shall be kept continually moist until or unless the sealing compound is applied or until the specified period of water curing has elapsed. Due care and diligence shall be taken so as to ensure coverage with the compound at edges, corners, and rough spots of formed surfaces,
- d) After the application of the sealing compound has been completed and the coating is dry to touch, any required patching of concrete surfaces shall be carried out or performed. Each patch, after being finished, shall be moistened and coated with sealing compound in accordance with the foregoing requirements. Traffic and other operations by the Contractor shall be such as to avoid or prevent any damage and defect to coatings of sealing compound for a period of not less than twenty-eight (28) days. Where it is impossible, the membrane shall be protected by a covering of sand or earth not less than 2.5 cm in thickness or by other effective means or methods. The protective covering shall not be placed until or unless the sealing membrane is completely dry. Before final acceptance of the work, the Contractor shall remove or clear away all sand or earth covering in a manner acceptable to the Project Manager and dispose of the same as directed or instructed by the Project Manager. Any damage or defect to the sealing membrane within twenty-eight (28) days after application shall be repaired or reinstated without undue delay and in a manner acceptable to the Project Manager.
- e) The sealing compound proposed by the Contractor to use shall be made available for sampling prior to use, and no sealing compound shall be used until or unless the same has been approved or permitted by the Project Manager. The Contractor shall provide or furnish facilities and assistance as required for procuring representative test samples. A sample consisting of 1.1 liters shall be taken from each separate shipment of the compound.

3.4.18 PROTECTION

The Contractor shall protect all concrete against any damage or injury until or unless final acceptance or approval by the Project Manager. Exposed surfaces of all concrete, except surface of concrete coated with white pigmented sealing compound shall be protected from the direct rays of the sun for at least the first three (3) days after placing. Such protection shall be made effective or efficient as soon as reasonably practicable after the placing of unformed concrete or after the removal of forms from formed concrete.

3.4.19 FINISHES AND FINISHING

Finishing of concrete surfaces shall be conducted or performed only by skilled workmen and in the presence of the Project Manager. Concrete surfaces thereof shall be examined or tested by the Project Manager where necessary to determine whether surface irregularities are within the limits hereinafter specified.

- i) Surface irregularities are classified as 'abrupt or 'gradual'. Offsets caused by displaced or misplaced form sheathing, or lining, or form sections, or by loose knots in forms, or otherwise defective form lumber, shall be considered as abrupt irregularities, and shall be examined or tested by direct measurement. All other irregularities shall be considered as gradual irregularities, and shall be tested by use of a template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template shall be 1.52 m for testing of formed surfaces and 3.04 m for testing of unformed surfaces. Before acceptance of the work, the Contractor shall clean all exposed surfaces, unless otherwise specified, of unsightly encrustations and stains.
- ii) Unless otherwise specified herein, the classes of finish for formed surfaces shall be as follows:
 - a) Formed surfaces upon or against which back fill or concrete is to be placed shall require no treatment after form removal except for the removal and repair of defective concrete and for the specified curing. Correction of surface irregularities shall be required for depressions only, and only for those which, when measured as specified in sub-clause (a) exceed 2.5 cm.
 - b) The surface of all waterway passages, including the interior surfaces of culverts, conduits, aqueducts, drainage inlets, regulators and all other formed surfaces subject to the action of flowing water, shall have surface irregularities measured as specified in sub-clause (a) not exceeding three (3) mm for abrupt irregularities and six (6) mm for gradual irregularities.
- iii) Interior unformed surfaces shall be sloped for drainage where shown or envisaged on the Drawings or as directed or instructed by the Project Manager. Surfaces which will be exposed to the weather and which would normally be level shall be sloped for drainage. Unless the use of other slopes or level surfaces is indicated or envisaged on the Drawings or directed / instructed by the Project Manager, narrow surfaces, such as tops of walls and curbs, shall be sloped approximately 6 mm per 30 cm of width; broader surfaces, such as platforms and decks, shall be sloped approximately 3 mm per 30 cm.

3.4.20 REPAIRING CONCRETE SURFACES

- i) If, after stripping of forms, any concrete is found to be not formed as shown or envisaged on the Drawings, or is out of alignment of level, or shows a defective surface the same shall be considered as not conforming with or complying with the intent of these Specifications and shall be removed and replaced by the Contractor at his cost and risk unless the Project Manager grants permission to patch the defective area, in which case patching shall be executed or performed as specified in the following sub - clauses.
- ii) Damage and defects that require replacement or repair are those that consist of honeycomb, damage due to stripping of forms, loose pieces of concrete, blowholes, tie-rod holes, ridges at form joints and bulges due to movement of the forms. Ridges and bulges shall be removed by chipping or tooling followed by rubbing with a grinding stone. Honey comb and other defective concrete shall be chipped out, the chipped openings being sharp edged and

shaped so that the filling will be keyed in place. All holes shall be thoroughly moistened for twenty-four (24) hours before the filling is placed. The surface of the filling shall be finished flush with the surrounding wall, and shall have the same texture. All patches shall be cured.

- iii) When, in the opinion of the Project Manager, the extent of the imperfections in structures exposed to view are such that patching alone would not produce satisfactory appearance, the Contractor shall be required to give, a sack rubbed mortar finish in accordance with the Project Manager's instructions.
- iv) Imperfections, bolt and tie-rod holes and the chipped out honeycomb areas to be repaired or reinstated, shall be filled with dry patching mortar composed of one (1) part of Portland Cement to two (2) parts of regular concrete sand (Volume measurement) together with a non-shrink patching compound, approved or permitted by the Project Manager, in the amount specified or recommended by the manufacturer, and just adequate water so that, after the ingredients are thoroughly mixed, the mortar will stick together on being molded into a ball by slight pressure of the hands and will not extrude free water. Mortar repairs shall be placed in thin layers and thoroughly compacted by suitable tools. Due attention and care shall be taken in filling rod, bolt and pipe holes so that the entire depth of the holes shall be completely filled with compacted mortar.
- v) Where concrete will be exposed to view, the mortar shall be made to match or meet the color of the Concrete by substituting white Portland cement in the required amount for a portion of the regular cement.

3.4.21 CONSTRUCTION JOINTS

The location of all construction joints shall be subject to the approval or permission of the Project Manager, and the joints thereof shall be constructed in conformity / accordance with the provisions of these Specifications.

i) Construction and Expansion Joints.

Construction and expansion joints of the types shown or envisaged on the Drawings shall be constructed where shown or specified on the Drawings. The joints shall be made by forming the concrete on one (1) side of the joint and allowing it to set before concrete is placed on the other side of the joint. The surface of the concrete first placed at construction joints shall be coated with curing sealing compound before the concrete on the other side of the joint is placed.

ii) Expansion Joint Filler

- a) Expansion joint filler shall be placed in all expansion joints of concrete structures. The expansion joint filler shall be either sponge rubber or self-expanding cork conforming to the requirements of ASTM Designation Type I or III, respectively.
- b) The expansion joint filler shall not be coated or painted prior to installation, and the concrete surface of the expansion joint shall be free of all coatings, dirt, laitance and other foreign materials. The expansion joint filler shall be studded with copper nails and positioned against the concrete previously placed before the additional concrete is placed, due attention and care shall be exercised in storing and handling self-expanding cork type expansion joint filler so that the wrapping shall not be disturbed or broken so as to permit hydration, and in no case shall self-expanding cork type expansion joint filler be unwrapped and placed in the joint more than four (4) hours before placing the final section of concrete.
- c) After concrete placement is completed, all exposed edges of expansion joint filler shall be sealed, At the top of all horizontal expansion joints and at the surface of all vertical expansion joints that will be in contact with flowing water, including but not limited to the vertical surfaces of the expansion joints in regulator structures and the interior vertical surfaces of expansion joints in concrete aqueducts and box culverts, the expansion joint filler shall have been set back 2.54 cm from the base of the chamfer, and the remaining 2.54 cm depth shall be filled with a hot-poured type elastic joint sealer conforming to or complying with the specific requirements of ASTM Designation: D1190. At the option of the

Contractor, and when approved or permitted by the Project Manager, a cold applied type joint sealer conforming to the requirements of ASTM Designation: D1850 shall be used in lieu of the hot-poured type. All other exposed surfaces of the expansion joint filler shall be sealed with two (2) coats of clear vinyl-resin paint conforming to or complying with the specific requirements specified in the section-"Painting Metalwork". The completed expansion joints shall be well-sealed and neat in appearance to the satisfaction of the Project Manager.

3.4.22 TESTING OF CONCRETE

Strength tests of the concrete placed during the course of the work shall be made by the Project Manager in an approved laboratory at the Contractor's cost and risk. The Contractor shall assist or support the Project Manager in obtaining, for control purposes, such number of cylinders or cubes as the Project Manager may direct or instruct, but in general, three (3) sets of three (3) cylinders and/or three (3) sets of three (3) beams, taken from each 8.5 cubic meters of concrete or fraction thereof, or from each days pour, whichever is less, of each class of concrete placed, shall govern. Test specimens shall be made and cured by the Project Manager in conformity / accordance with the specific requirements of ASTM Designation C39M-17b, "Standard Method of making and curing Concrete Compressive and Flexural Test Specimen in the Field."

Cylinders, cubes and beams shall be tested by the Project Manager in conformity / accordance with the specific requirements of ASTM Designation C 78-16, "Standard Method of Test for compressive strength of Cylindrical Concrete Specimens" and ASTM Designation C78- 16, "Standard Method of test for Flexural Strength of Concrete (Using simple beam with third point loading)". The test result thereof shall be based on the average of the strength of the test specimens in a set of three (3). If one (1) specimen shows or demonstrates manifest evidence of improper sampling, molding, on testing, the test result shall be based on the average of the remaining two (2) specimens. If two (2) specimens out of a set of three (3) show or demonstrate such defects, the results of the set shall be discarded and average strength shall be determined from test results of other sets. The standard age of test shall be twenty-eight (28) days, but seven (7) days tests shall be used at the discretion of the Project Manager, based on the relation between the seven (7) days and twenty-eight (28) days strengths of the concrete as established by tests for the materials and proportions used. If the average on the strength tests of the specimens cured under laboratory controls, for any portion of the work, falls below the minimum allowable compressive or flexural strength at twenty-eight (28) days required for the class of concrete used in that portion, the Project Manager may change the proportions of the constituents of the concrete, as necessary to secure or ensure the required strength for the-remaining portions of the work. If the average strength of the specimens cured under actual field conditions as specified herein before, fails below the minimum allowable strength, the Project Manager shall make such changes in the conditions for temperature and moisture under which the concrete work is being placed and cured as may be necessary to secure or ensure the required strength. The Contractor shall also be required to bear any additional expense due to sub-strength concrete.

Where the results of the strength tests of the control specimens indicate or specify that the concrete in so far as placed does not meet specifications requirements or where there is other evidence that the quality of the concrete is below specifications requirements, core-boring tests shall be made by the Project Manager in accordance with the applicable or specific requirements of ASTM Designation C1396M-17, "Standard Method of obtaining and testing Drilled cores and sawed beams of Concrete". If the concrete in the structure will be more than superficially wet under service conditions, the cores thereof shall be immersed in water for at least forty-eight (48) hours and tested wet. In the event that the core-boring test indicates or specifies that the concrete placed does not conform to or comply with the Drawings and Specifications, measures as instructed or required by the Project Manager shall be taken to correct or rectify the deficiency. However, the Project Manager shall have the authority or entitlement to prescribe such corrective measures and the Contractor shall take such corrective or remedial measures if in the opinion of the Project Manager, the results of the test specimens, without coring, warrant

such action, If a strength deficiency or defect are found and is due to the Contractor's fault or negligence, the entire cost of replacing faulty concrete shall be borne by the Contractor.

3.5 SUPPLYING AND FIXING WATER STOP

PVC (polyvinylchloride) water stops shall comply with CRD C-572 standards and shall be extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinylchloride. The compound shall contain such additional resins, plasticizers, stabilizers or other materials needed to ensure that when the material is compounded and extruded to the shapes and dimensions shown and tested it shall have the physical characteristics as shown in the Table.

Physical Characteristics	Test Method	Typical Values
Ultimate Elongation	ASTM D 638 (CRD C 573)	350 % min
Tensile Strength	ASTM D 638 (CRD C 573)	1750 psi (12.07 Mpa) min
Low Temperature Brittleness	ASTM D 746 (CRD C 570)	No Failure @ - 35 F (-37 C)
Stiffness in Flexure	ASTM D 747 (CRD C 571)	400 psi (2.76Mpa) min
Specific gravity	ASTM D 792	1.37 max
Hardness, Shore A	ASTM D 2240	70 - 80

Sample of Water Stop shall be approved by the Project Manager prior to installation at site and it shall be 3-bulb or as directed by the Project Manager.

- i) The item shall cover or include supplying and fixing of water stops in all reinforced concrete in conformity / accordance with the Drawing & Specifications laid down herein or as directed or instructed by the Project Manager.

If specified, non - corrosive metal, rubber or polyvinyl chloride water stop shall be placed in joints of structures as shown or envisaged on the Drawings. The Contractor shall fabricate a special intersection spoils and joints and make bends at corners as shown or envisaged on the Drawings. The Contractor shall provide or furnish all water stops, including (without limitation) rubber plugs, gum rubber, rubber cement, bolts, nuts, washers and other joint material. The Contractor shall make all splices, joints and bends, bolt the water stop in (cluding (without limitation) steel sheet piling) at expansion joints when required, and fabricate special intersections in conformity / accordance with the Drawings or as directed / instructed by the Project Manager. All joints, splices, bends and intersections shall be made in strict accordance with the manufacturer's printed instructions or recommendations using materials approved or permitted by the manufacturers and shall be formed to produce a strong, sound and watertight joint. Water stop shall be of approved quality, type & size as specified in the contract, shown or envisaged on the Drawings or as directed or instructed by the Project Manager.

- ii) The gum rubber for making field splices of rubber water stops shall be of uncured rubber and exposure at temperatures above thirty-eight (38) degrees C will make it unfit for use. All rubber shall be stored in as cool a place as practicable, preferably at twenty-one (21) degrees C or less, and in no case shall the rubber be stored in the open or exposed to the direct rays of the sun. All rubber shall be stored so as to allow or permit free circulation of air about the rubber.
- iii) The Contractor shall take suitable or protective precautions so as to support and protect the water stop during the progress of the work or section.

3.6 STEEL REINFORCEMENT

3.6.1 SCOPE

The work shall cover or include supplying, cutting, bending, fabricating, assembling and placing of all concrete reinforcement including (without limitation) welding & fastening and cost of binding wire, spacer, chairs & Labor charges for binding and removal of rust for all steel reinforcement and binding wire and the like. in accordance with Drawings, Specifications and Standards or as directed or instructed by the Project Manager.

3.6.2 MATERIALS AND SIZE OF BARS

All concrete reinforcement shall be new and approved by the Project Manager, and shall conform to or comply with the following standards:-

- i) Reinforcement shall be as specified either plain mild steel conforming to BSS 449 or deformed bars of intermediate grade billet steel in accordance with ASTM Designation: A 615-16 & shall have a minimum yield strength of 60,000 psi (420 MPa).
- ii) Deformations of bars shall be in accordance with ASTM Designation: A 615-16
- iii) Welded wire fabric shall be in accordance with ASTM Designation: A 1064M or BS 4482 and 4483.
- iv) Wire for spiral pile reinforcement shall be in accordance with ASTM Designation: A1064.
- v) Binding wire shall be 1.6 mm dia (16 gauges) soft iron wire.
- vi) Steel reinforcement shall be stored clear of the ground and supported to avoid or prevent distortion or deflection.

3.6.3 SUBMITTALS

The Contractor shall prepare and submit the following to the Project Manager for his approval and record before execution of the work or section:

- i) Shop Drawings for fabrication, bending and placement of concrete reinforcement. ACI 315 shall be conformed to or complied with showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and special reinforcement required for openings through concrete structures.
- ii) Samples of materials as specified and as otherwise may be requested or required by the Project Manager including names, sources and descriptions as instructed or required by the Project Manager.
- iii) The Contractor shall provide or furnish with certificates of manufacturer, issued in conformity / accordance with applicable B.S.S mill test of all reinforcement furnished, which tests (including rebind test) shall be made in accordance with the stipulations and requirements in the afford -stated ASTM Standard Specifications.

3.6.4 CLEANING

Concrete reinforcement, before being positioned, shall be free from loose mill and rust scale, oil, grease and from coatings that destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.

3.6.5 CUTTING

(i) General

Steel reinforcement shall be mill or field cut and bent. All bending shall be in conformity / accordance with ACI 315 and by approved machine or manual methods. When bending is required, the same shall be performed prior to embedding the bars in the concrete'. In all such

cases, the bars shall be of cold bent. Except the dowels, bending or straightening of bars partially embedded in set concrete shall be carried out after the approval or permission of the Project Manager.

(ii) Tolerances

Cutting for all bars shall be within ± 25 mm.

Bending and placement tolerances for overall or an internal dimension of a bent bar shall be as specified or demonstrated given in the Table 3.2.

Table 3.2: Tolerances

<u>Description</u>	<u>Tolerances</u>	
	Plus	Minus
o Bending		
Bars up to 1.00 meters long	5 mm	5 mm
Bars up to 2.00 meters long	5 mm	10 mm
Bars over 2 meters long	5 mm	25 mm
o Placement		
- Concrete cover to formed surfaces	5 mm	5 mm
- Minimum spacing between bars	5 mm	5 mm
- Top bars in slabs and beams	12 mm	12 mm
- Members 200 mm deep or less	5 mm	5 mm
- Member more than 200 mm but Not over 600 mm deep	10 mm	10 mm
- Member more than 600 mm deep	25 mm	25 mm

(iii) Fabrication

- a) All bends, cranks or other labors on reinforcement bars shall be carefully formed in accordance with the Drawings. The bars shall be bent cold and the Contractor shall secure or ensure that the bars do not get cracked or damaged during bending and fabrication.
- b) Reinforcement shall be accurately formed to the dimensions specified or envisaged on the construction drawings to be provided or furnished to the Contractor. Bends for bars shall be made around a pin having a diameter equal to two and half (2.5) cm less than eight (8) times the thickness of the bar for bars less than two and half (2.5) cm and a pin diameter of eight (8) times the thickness of the bar (to nearest whole cm) when the bar thickness is two and half (2.5) cm or greater. Bars having stirrup bends are to be bent around a pin having a diameter of 2.54 cm when the thickness of the bar is 9 mm to 12 mm, and a pin diameter of five (5) cm where the thickness of the bar 16 mm or 18 mm. All bars shall be bent cold.
- c) Reinforcement shall not be straightened or re-bent in a manner that will injure or damage the material. Bars with kinks, or bends not shown or envisaged on the Drawings, shall not be used. Heating of the reinforcement shall be permitted or approved only when the entire operation is approved or permitted by the Project Manager.

(iv) Placing

- a) The number, size, form and position of all steel reinforcement bars, ties, links, stirrups and other parts of reinforcement shall be in exact accordance with the Drawing and they shall be kept accurately positioned with the required cover and secured against displacement during the process of compacting the concrete by using best black annealed iron wire ties made from soft iron wire No 16 SWG and the binding shall be twisted tight with pliers (The free ends of binding wire shall be bent inward) or suitable clips at intersections as approved or permitted by the Project Manager. The reinforcement shall also be supported as required by concrete or metal supports, spacers or metal hangers. Use of timber blocks for wedging, the steel off the formwork shall not be allowed or permitted. Any ties, links or stirrups connecting the bars shall be bent so that the bars are properly braced and the inside of bends and hooks shall be in actual contact with the bars around which they are intended to fit. In all cases sufficient supports for horizontal reinforcement shall be used so

that there will be no sagging of the bars or mesh. Where portions of the supports will be exposed on concrete surfaces designated to receive a smooth finish, the supports shall be made of non-corrodible metal.

- b) Reinforcement in slabs on the ground shall be supported by means of pre-cast concrete blocks. The concrete blocks shall have a horizontal surface approximately 7.5 cm by 10 cm. The reinforcement in all other slabs and in beams shall be supported by means of metal chairs.
- c) The minimum center-to-center distance between parallel bars shall be two (2) and one-half (1.5) times the diameter of the bars, but in no case clear spacing between the bars shall be less than one (1) and one-half (1.5) times the maximum size of the coarse aggregate.
- d) At those surfaces of footings, slabs, walls and other principal structural members in which concrete is deposited directly against the foundation, reinforcement shall have a minimum covering of seven and half (7.5) cm of concrete. At other surfaces of concrete, reinforcement shall be protected by a concrete cover of not less than five (5) cm unless otherwise shown or envisaged on the Drawings.
- e) When it is necessary to splice reinforcement points other than shown or envisaged on the Drawings, the character of the splice shall be determined or required by the Project Manager. Tie overlap in splices in vertical wall and column steel shall be twenty (20) bar diameters and for all other splices twenty-four (24) bar diameters, except where otherwise specified on the Drawings.

3.7 CONCRETE BLOCK MASONRY

3.7.1 DESCRIPTION

The work covered by this section of the Specifications consists of furnishing all plant, labour, equipment, tools and appliances, and materials and in performing all the operations in connection with block masonry work, complete in strict accordance with the specifications here in and the applicable drawings.

3.7.2 MATERIAL REQUIREMENTS

3.7.2.1 Cement

Cement shall be of ordinary Portland cement as specified or required in respective section.

3.7.2.2 Aggregates

Aggregates used shall meet the requirements specified under respective concrete section. All the aggregates dry and properly screened from approved source shall be acceptable for block making.

3.7.2.3 Concrete Masonry Units

- i) Concrete masonry blocks shall be made on the site and shall be of the sizes 200(w)x150(d)x300(L) in mm or as directed by the Project Manager and shall generally conform to the requirements of ASTM Standard C 90-16a or BS Standard 2028, 1346: 1968 "Pre-cast Concrete Blocks" unless specified otherwise. For partition walls size of the blocks shall be 100(w)x150 (d)x300(L) in mm or as directed by the Project Manager.
- ii) The blocks shall be solid or hollow as required and shall be carefully made so that they are true in line and face with square corners and free from all damages and defects therein. The ends of the blocks, which will form the vertical joints in the masonry, shall be double grooved or as directed or instructed by the Project Manager. In the case of hollow blocks, the cavities thereof shall be true to the shapes and sizes specified and shall have uniform wall thickness on the outside of the cavities. The cavities in hollow blocks shall not be more than twenty-five percent (25%) of the total volume.

- iii) The concrete for the blocks shall be mixed in a concrete mixer in the proportion of one (1) part of cement, four (4) parts of sand and eight (8) parts of well graded coarse aggregate not exceeding ten (10) mm in size or one (1) part of cement and nine (9) parts of well grade all in aggregates not exceeding ten (10) mm size.
- iv) All the aggregates, when used shall be split in coarse and fine aggregates for checking the proportions of fine to coarse aggregates and their grading.
- v) Concrete blocks shall be machine moulded. The concrete shall be well worked into the moulds, vibrated, tamped and -pressed to secure or ensure that the blocks are dense and free from voids.
- vi) The blocks shall be cured by keeping moist continuously for a period of at least ten (10) days and then shall be allowed or permitted to dry in shade for at least twenty (20) days before use in masonry.
- vii) All blocks shall have clean cut straight and true edges, smooth dense faces of uniform appearance without voids, honeycombs, projections and shall be free from cracks, chips, chipped edges or other damages and defects detrimental to their use.
- viii) Where blocks are to be plastered or rendered, the block surface thereof shall have a coarse texture suitable for bonding the plaster as approved or permitted by the Project Manager..
- ix) The average compressive strength of any ten (10) blocks picked at random, after curing and drying shall not be less than one thousand and five hundred (1,500) lbs/sq. inch when tested in conformity / accordance with B.S. 2028,1364: 1968; Pre-cast concrete blocks
- x) The average moisture content of all the concrete masonry units shall not exceed thirty (30) percent of the total water absorption of units. The shrinkage of cement concrete blocks shall be much greater at the time the same dries for the first time after moulding and subsequent curing. It is, therefore, essential that Contractor shall take full care to see that blocks are sufficiently and thoroughly dried so that their initial shrinkages are completed before the blocks are laid in the wall. Not only well dried blocks shall be used, but the blocks shall also be laid dry without wetting except with slightly moistened surfaces on which mortar is to be applied to obviate absorption of water from the mortar and even during curing of the mortar joints. The walls shall be slightly moistened and shall not be allowed nor permitted to be excessively wet till they receive any plaster or render.
- xi) The blocks shall be stored in such a manner as to avoid or prevent any contact with moisture on the site of works. The blocks shall be stock piled on platforms or other supports free from contact with the ground. If necessary, cover for protection against wetting shall be provided or furnished. The blocks right from casting to curing drying, stock piling and their subsequent placing in masonry walls shall be handled with care.

3.7.3 CONSTRUCTION REQUIREMENT OF BLOCK MASONRY

3.7.3.1 Cement Mortar for Masonry Work

Cement Mortar shall be composed of one (1) part of ordinary port land cement to six (6) parts of sand for all concrete block walls or as specified or particularized in the Bill of Quantities (BOQ). Hand mixing, when permitted or approved by the Project Manager, shall be completed on clean hard platform as much as required for immediate use with only just sufficient water, to produce mortar of a proper consistency. The mixing thereof shall be completed by mechanical mixers, the Sand shall be of an approved quality and shall pass one hundred percent (100%) through 3/16" (5mm) sieve

3.7.3.2 Gauging

The ingredients for mortar shall be measured in boxes. No re-tempering of mortar shall be allowed or approved, nor shall mixing of any anti-freezing ingredients in mortar be permitted or approved by the Project Manager.

3.7.3.3 *Mixing*

The dry materials shall be dry mixed for approximately two (2) minutes and for three (3) minutes after addition of water making total minimum time of five (5) minutes in a mortar mixer. When hand mixing is permitted or approved, water shall not be added, until the same attains uniform color or mixed materials indicate cementations material to have been thoroughly distributed throughout the mass. After dry maxing is complete, water shall be added until thoroughly mixed mortar of the required plasticity is obtained. If mixing is not satisfactorily done, then the Contractor shall take such steps as directed or instructed by the Project Manager. Mortar shall be used within half an hour of mixing. Mortar lying for more than half an hour (0.5h) shall not be used.

3.7.3.4 *Masonry and Jointing*

- i) All masonry shall be laid in plumb, true to line and level in accurately spaced courses with each breaking joints with the course below. Corners and reveals shall be in plumb and true, Chases, Grooves, regret blocks and raked out joints shall be kept free from mortar and other debris or wreckages.
- ii) The thickness and length of various walls shall be as indicated or envisaged on the drawings
- iii) Unless otherwise specified on the drawings or specified, the spaces around frames and other built-in-items shall be solidly filled with mortar, except the joints that are to be caulked shall be raked out 3/4" (19mm) deep.
- iv) Work required to be built in with masonry including anchors wall plugs and accessories shall be provided or built in, as the work progresses. Wood plugs and blocking shall not be built into masonry.
- v) All horizontal and vertical joints shall be completely and solidly filled with mortar as the blocks are laid. In horizontal bedding joints, mortar shall be spread over the entire top surface of the block to a uniform layer of 3/8" (10mm) thick. For vertical joints, mortar shall be applied to a block unit, when it is standing vertically and then placing it horizontally on the horizontal bedding mortar and pressing the same against the previously laid unit in that course, making a vertical joint of 3/8"(10mm) thickness. In horizontal bedding, joints mortar shall not be spread so much ahead of the actual laying of unit that the same tends to stiffen and lose its plasticity, resulting in poor bond. If the same happens the stiffened mortar shall be removed and fresh mortar laid by the Contractor at his own cost and risk. When the mortar has stiffened somewhat, the same shall be firmly compacted with a jointing tool, to guard against its tendency.
- vi) The thickness of joints shall not exceed 3/8" (10mm) and the joints shall be raked 'h" (r3mm) deep when the mortar remains fresh so as to provide or furnish for proper bond for the plaster. Any mortar which falls on the floor from the joints or removed due to raking of joints shall not be reused.
- vii) No masonry to be erected when temperature of outside air is below 05°C unless suitable means as approved are provided to that the better face shall be on the side of pointing
- viii) When the masonry is to receive plaster on one (1) side and pointing on the other, the block shall be placed in such a way that the better face shall be on the side of pointing.
- ix) Where masonry work abuts columns, the same shall be anchored by means of anchor steel bars or any other type of anchors as approved or permitted at a vertical spacing or approx. 12"(300mm) for walls up to 6"(150mm) .thick and approximately 24"(600mm) for walls more than 6"(150mm) thick unless otherwise directed or instructed by the Project Manager. Alternatively the masonry may be built-up first, leaving the dovetail type ends the columns and the columns then be cast so that the concrete of the columns and the masonry make a dovetail type of joints.
- x) Erection of partition and panel walls shall be delayed, wherever possible, until the frame of the structure has taken up, as much as possible to preclude deformation or deflection occurring due to structural loads. Otherwise the top course of partitions under slabs and beams shall not be laid until the form has been removed and the roof slab placed.

- xi) In damp soils, to avoid or prevent the rise of moisture from the ground due to capillary action, the foundation and basement masonry when, so directed or instructed by the Project Manager, shall be laid in richer mortar than specified in which case the contractor shall be paid for the extra cost or additional cost. In addition, a damp proof course shall be provided or furnished consisting of 1" (25mm) to 2" (50mm) thick layer 1:2:4 cement pudlo mortar or an approved type of bituminous course.

3.7.3.5 Bonding

- i) All masonry work and portions shall be bonded together as follows unless otherwise directed or instructed by the Project Manager.
- ii) Masonry Bond by extending alternate course of masonry units of an intersecting wall or partition through the very thickness of the intersected wall of partition.

3.7.3.6 Coordination

- i) Provide chases, and openings required under other sections to sizes and locations shown or envisaged on the drawings.
- ii) Cooperate with other trades in setting build-in-items, take due and special care in cutting, fittings, setting units so that built in members are in their true respective positions, flush voids full.
- iii) For items provided in other sections such as door, frames, hold fasts, miscellaneous metal work occurring in the masonry, sleeves, anchors, supports, nailing strips, braces jambs, and the like are to be built-in the masonry.
- iv) Due attention and special care shall be taken in building block at door frames .Contractor shall check or verify that frames are square and plumb. Check frames before building work around or against them. The Contractor shall check or verify that full electric conduits are not housed into frames so as to avoid or prevent extension of frame anchor.
- v) The Contractor shall be liable or responsible for any damage or defect to his own work, as well as work of other sections.

3.7.3.7 Protection and Cleaning

- i) Surfaces of masonry, not being worked on, shall be properly protected at all times during the construction operations. When rain is expected and the work is discontinued, the top of exposed masonry walls shall be covered with a strong water proof membrane, well secured in place.
- ii) Exposed masonry surfaces shall be cleaned with water and fiber brushes or as directed or instructed by the Project Manager.
- iii) Protect adjacent work during cleaning operations. Make good or reinstate any damages or defects from neglect or negligence of this precaution.

3.7.3.8 Samples

Samples of all kinds of materials, to be used on the job, shall be submitted for approval.

3.7.3.9 Testing

All the materials and completed masonry work shall be tested for required standard and, if found below the recognized standard specifications such as BSS, ASTM or equivalent shall be rejected. Such material and work shall be removed from the site immediately. All testing shall be conducted at Contractor's cost and risk.

3.7.3.10 Curing

Curing shall be completed as per specifications specified under heading "Concrete Work ".

3.7.3.11 Construction Plants

The Contractor shall prepare and submit location plans, layout drawings, flow-diagrams and equipment list for the aggregate plant(s), refrigeration plant(s) and concrete batching and mixing plant(s) prior to ordering or erecting these plants. The submittal for each plant shall be accompanied by the Contractor's detailed written proposal for quality control of the product at the Site. The proposals for the plant and quality control shall be reviewed and commented on by the Project Manager in respect of compliance with Specification requirements and the Contractor shall modify or amend his proposals to the satisfaction of the Project Manager. The Project Manager will require one (1) month for review of the proposals.

3.8 CONCRETE PAVERS

Concrete pavers of approved shapes shall be installed over Parking Areas, Roads and Footpaths and the like.

For Parking and Roads

Following undermentioned items shall include in preparing the base and sub base for concrete pavers:

- i. PCC class B, 100mm thick
- ii. Stone Ballast 100mm thick of size 19 to 25mm
- iii. Sub base 150mm

Provided in design, the area under the pavers shall be prepared to the required level by compacting the earth to at least 95% modified AASHTO max. Dry density. The compacted earth shall be tested and approved. The specified pavers shall be laid closely packed tamped in place and filled with sand.

For Walkways

Following undermentioned items shall include in preparing the base and sub base for concrete pavers:

- i. Sand cushion 100mm thick

Provided in design, the area under the pavers shall be prepared to the required level by compacting the earth to at least 90% modified AASHTO max. Dry density. The compacted earth shall be tested and approved. The specified pavers shall be laid closely packed tamped in place and filled with sand.

Compressive Strength:

The compressive strength of paving blocks roads and parking areas sampled in accordance with clause 21.4.5(ii) and tested in accordance with BS EN 1338, shall not be less than 49 Mpa (7,100 psi) and the crushing strength of any individual block shall not be less than 40 Mpa (5,800 psi)

However, if the average crushing strength of the first four blocks tested is not less than 54 Mpa (7,800 psi) and if none of these four blocks has a crushing strength of less than 40 Mpa (5,800 psi), the consignment shall be considered to comply with this standard.

The strength required will be 35Mpa for foot path and walkways.

CHAPTER-4
STONE MASONRY

Chapter-4: STONE MASONRY

4.1 DRESSED COURSED STONE MASONRY

4.1.1 SCOPE

It shall cover or include all stone masonry for use in foundation and plinth, superstructures, Retaining walls, Breast walls, stone masonry walls between houses, road side drain, cascade as shown or envisaged on the drawings and such other uses as may be specified or directed / instructed by the Project Manager. This item shall contain or consist of dressed coursed stone masonry with mortar. Dimensions of such masonry may vary in accordance with drawings or as directed or instructed by the Project Manager.

4.1.2 MATERIAL REQUIREMENTS

4.1.2.1 Stone Size

The individual stones shall be large and well proportioned. They shall not be less than twenty centimeter (20 cm) nor more than fifty centimeter (50 cm) in thickness. The thickness of courses, if varied, shall diminish regularly from bottom to top of wall. The size of ring stones in arches shall be as shown or envisaged on the plans.

4.1.2.2 Mortar

Mortar for laying stone and pointing shall be composed of one part of Portland cement and four parts of sand unless otherwise shown on the drawings or BOQ. Portland cement shall meet the requirements of AASHTO M-85 and sand shall meet the requirements of AASHTO M-45. Water used in preparation of mortar shall conform to the requirement set forth under Chapter-3 of Concrete.

4.1.3 CONSTRUCTION REQUIREMENT

4.1.3.1 Surface Finishes of Stone

For the purpose of this specification, the surface finishes of stone shall be defined as follows:

Smooth finished: Having a surface in which the variations from the pitch line do not exceed 0.15 cm.

Rough finished: Having a surface in which the variations from the pitch line do not exceed 1.25 cm.

Scrabbled: Having a surface in which the variations from the pitch line do not exceed two (2) cm.

Rock faced: Having an irregular projecting face without indication of tool marks. The projections beyond the pitch line shall not exceed seven and half (7.5) cm and no part of the face shall recede back of the pitch line.

4.1.3.2 Dressing Stone

Stones shall be dressed to exact sizes and shapes before being laid and shall be cut to lie on their natural beds with top and bottom truly parallel. Hollow beds shall not be permitted. The bottom bed shall be the full size of the stone and no stone shall have an overhanging top. In rock face construction the face side of any stone shall not present an undercut contour adjacent to its bottom axis giving a top heavy, unstable appearance when laid. Beds of face stone shall be fine finished for a depth of not less than thirty centimeter (30 cm).

Vertical joints of face stone shall be fine finished and full to the square for a depth of not less than fifteen centimeter (15 cm).

Exposed surfaces of the face stone shall be provided with the surface finish indicated on the plans, with edges pitched to true lines and exact batter, Chisel drafts four centimeter (4 cm) wide shall be cut at all exterior corners. Face stone forming the starting or nosing of piers shall be rough finished unless otherwise specifically provided herein. Holes for stone hooks shall not be allowed or permitted to show in exposed surfaces.

4.1.3.3 *Stretchers*

Stretchers shall have a width of bed of not less than one and half (1½) times their thickness. They shall have a length of bed not less than twice nor more than three and half (3½) times their thickness, and not less than ninety centimeter (90 cm).

4.1.3.4 *Headers*

Headers shall be placed in each course and shall have a width of not less than one and half (1½) times their thickness. In walls having a thickness of 1.2 meters or less, the headers shall extend entirely through the wall. In walls of greater thickness, the length of headers shall be not less than two and half (2½) times their thickness when the course is forty-five centimeter (45 cm) or less in height, and not less than 1.2 meters in courses of greater height. Headers shall bond with the core or backing not less than thirty centimeter (30 cm). Headers shall hold in the heart of the wall the same size shown in the face and shall be spaced not further apart than 2.5 meters center to center.

4.1.3.5 *Cores and Backing*

Cores and backing shall contain or consist either of roughly bedded and jointed headers and stretchers, as specified hereinbefore, or concrete, as may be specified herein. When stone is used for cores or backing, at least one half (½) of the stone shall be of the same size and character as the face stone, and with parallel ends. No course shall be less than twenty centimeter (20 cm) thick.

Concrete used for cores and backing shall conform to or comply with the requirements specified in Item 16.19.

The headers and stretchers in walls having a thickness of one (1) meter or less shall have a width or length equal to the full thickness of the wall. No backing shall be allowed or permitted.

4.1.3.6 *Mixing Mortar*

The mortar shall be hand or machine mixed, as may be instructed or required by the Project Manager. In the preparation of hand mixed mortar, the sand and cement shall be thoroughly mixed together in a clean tight mortar box until the mixture is of uniform color, after which clean water shall be added in such quantity so as to form a stiff plastic mass. Machine mixed mortar shall be prepared in an approved mixer and shall be mixed not less than one and half (1½) minutes. Mortar shall be used within forty five (45) minutes after mixing re-tempering of mortar shall not be allowed nor permitted.

4.1.3.7 *Laying Stone*

a) General

Stone masonry shall not be constructed in freezing weather or when the stone contains frost, except by written permission of the Project Manager and subject to such conditions as he may require or instruct. Stone Masonry in Cement mortar shall be cured for a minimum period of seven (7) days.

b) Face Stone

Stone shall not be dropped upon, or slid over the wall, nor will hammering, rolling, or turning of stones on the wall be allowed or permitted. The same shall be carefully set without jarring the stone already laid and the same shall be handled with a Lewis or other appliance that will not cause disfigurement.

Each stone shall be cleaned and thoroughly saturated with water before being set and the bed, which is to receive the same, shall be cleaned and well moistened. All stones shall be well bedded in freshly made mortar and settled in place with a suitable wooden maul before the setting of the mortar. Whenever possible, the face joints which cannot be so pointed shall be prepared for pointing by raking them out to a depth of five (5) cm before the mortar has set. The face surfaces of stones shall not be smeared with the mortar forced out of the joints or that used in pointing. No pinning up of stones with sprawls shall be allowed or permitted in beds.

Joints and beds shall be not less than one (1) cm, or more than one and quarter (1¼) cm in thickness and the thickness of the joint or bed shall be uniform throughout.

The stone in any one course shall be placed so as to form bonds of not less than thirty (30) cm. with the stones of adjoining courses. Headers shall be placed over stretchers and, in general, the headers of each course shall equally divide the spaces between the headers of adjoining courses, but no headers shall be placed over a joint and no joint shall be made over a header.

c) Stone Backing and Cores

Stone backing shall be laid in the same manner as specified herein before for face stone, with headers interlocking with face headers when the thickness of the wall will permit. Backing shall be laid to break joints with the face stone. Stone cores thereof shall be laid in full mortar beds so as to bond not less than thirty (30) cm with face and backing stone with each other. Bed joints in cores and backing shall not exceed four and half centime (4.5 cm) and vertical joints shall not exceed ten (10) cm in thickness.

d) Concrete Cores and Backing

The operations involved in the handling and placing of concrete used in cores and backing shall conform to or comply with the requirements specified under relevant specification of concrete. However the puddling and compacting of concrete adjacent to the ashlar masonry facing shall be done in a manner that will ensure the filling of all spaces around the stones and secure full contact and efficient bond with all stone surfaces.

4.1.3.8 Leveling Courses

Stone cores and backing shall be carried up to the approximate level of the face course before the succeeding course is started.

The construction joints produced in concrete cores or backing by the intermittent placing of concrete shall be located, in general, not less than fifteen centimeters (15 cm) below the top bed of any course of masonry.

4.1.3.9 Resetting

In case any stone is moved or the joint broken, the stone shall be taken up, the mortar thoroughly cleaned from bed and joints, and the stone reset in fresh mortar.

4.1.3.10 Copings

Stones for copings of wall, pier, and Abutment Bridge seats shall be carefully selected and fully dimensioned stones: On piers, not more than two (2) stones shall be used to make up the entire width of coping. The copings of abutment badge seats shall be sufficient width to extend at least ten (10) cm under the back wall. Each step forming the coping of wing wall shall be formed by a single stone, which shall overlap the stone forming the step immediately below it at least thirty (30) cm.

Tops of copings shall be given a level cut at least five centimeter (5 cm) wide and beds, bevel cuts, and tops shall be fine finished. The vertical joints shall be smooth finished and the coping

shall be laid with joints not more than 0.6 cm in thickness. The undersides of projecting copings preferably shall have a drip bead.

Joints in copings shall be located so as to provide or furnish not less than a thirty (30) cm. bond with the stones of the under course and so that no joint shall come directly under the superstructure masonry plates.

4.1.3.11 Pointing

Pointing shall not be done in freezing weather or when the stone contains frost.

Joints not pointed at the time the stone is laid shall be thoroughly wet with clean water and filled with mortar after proper raking. The mortar shall be well driven into the joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done and in hot or dry weather, the pointed masonry shall be protected or safeguarded from the sun and kept wet for the period of at least three (3) days after completion.

After the pointing is completed and the mortar set, the wall shall be thoroughly cleaned and left in a neat and workmanlike condition.

4.2 FILTER MATERIAL

The grading of the filter material shall be as specified or envisaged on the drawings or in the Special Provisions. If not otherwise specified herein, the same shall be required that D15 of the filter shall be at least four (4) times as large as D15 for the underlying embankment materials and not more than four (4) times the D85 for the embankment material.

Where: D 15 and D85 are the particle diameters corresponding to fifteen (15) percent and eighty five percent (85%) respectively, passing (by weight) in a grain size analysis

4.3 GEOTEXTILE

Where indicated on the Drawings or directed by the Project Manager, Geotextile cloth shall be placed behind the weep holes. Cloth shall be placed in a proper manner with nailing and fixing with the wall.

Density of the geotextile cloth shall be approximately 600gram/m².

CHAPTER-5
ROOFING

Chapter-5: ROOFING

5.1 ROOFING

5.1.1 SCOPE

The work shall cover or include furnishing all materials, tools and plant, labor, equipment and supports and the like, as well as performing all operations to complete the work in workman like manner in accordance with the approved drawings or as directed / instructed by the Project Manager, the said specifications, provisions and requirements shall also apply except when such provisions and requirements shall be specially modified or rectified by the Project Manager for a particular item of work in connection therewith.

5.1.2 MATERIALS

- i) Tiles used shall be plain Cement Concrete 1:2:4 of thickness 40mm manufactured from the plant of approved manufacturer or as approved by the Project Manager. Aggregates to be used in the tiles shall be not more than 13mm size.
- ii) Approved clean soil in an average thickness of 100mm shall be laid and compacted or as directed by the Project Manager
- iii) Cement - Cement shall be in accordance with specifications laid in Chapter - 10 - "Cement, and, Aggregate & Revetment Materials."
- iv) Sand - Sand shall conform to Specifications laid in Chapter-10 - "Cement, Sand, Aggregates & Revetment Materials."
- v) Bitumen shall be refined cut – back bitumen having viscosity (standard Tar Viscometer) of 110 to 150 seconds at 40 degrees C.
- vi) Polythene sheet 0.2mm (gauge 800) thickness shall confirm the requirements of ASTM D2103.
- vii) Extruded Polystyrene (XPS) foam board in rigid insulation with density 32-35 kg/m³ confirming to ASTM C-578

5.1.3 COMPOSITION

The tile roofing shall consist of the following:-

- i) PCC tiles laid in 1:6 cement sand mortar and shall be grouted with 1:4 c/s mortar.
- ii) 100 mm earth filling.
- iii) Polythene sheet 0.2mm thick (800 gauge)
- iv) Extruded Polystyrene foam board, 25mm thickness.
- v) Polythene sheet 0.2mm thick (800 gauge).
- vi) 2nd coat of hot bitumen @1.70kg/m²
- vii) First coat of hot bitumen @1.70kg/m².

5.1.4 ROOF SLOPE

The necessary main slope in the roof shall be formed by sloping with the cement mortar (1:6) before laying the tiles. Minimum slope shall be as per drawings and shall be cured as directed by

the Project Manager. The payment of cement mortar to be used in adjusting slope shall be deemed to be included in the item of roof treatment.

5.1.5 BONDING OF TILES WITH PARAPET WALL

Tile resting on wall shall have bearing of preferably one hundred and fifteen (115) mm and in no case less than seventy-five (75) mm. These tiles shall butt closely against the brick/block work the parapet wall leaving no voids; wherever possible, the ends of the tiles shall be bonded into with specified mortar.

5.1.6 CEMENT PLASTER TO PARAPET

The portion of the parapet wall between the tiles and drip course shall be plastered with thirteen (13) mm thick cement sand plaster of 1:3 ratios, unless otherwise specified herein.

5.1.7 CURING OF BED

The bed shall be cured for seven (7) days, and the surface shall then be allowed to dry thoroughly before bitumen is laid.

5.1.8 EARTH FILLING

100 mm thick good earth shall then be put and shall be thoroughly rammed and watered. This shall be done before laying the drip to ensure a close joint with the wall.

5.1.9 BITUMEN LAYER

The bitumen coat shall be applied uniformly in such a manner as to cover pores completely and to thoroughly bond with the surface, using not less than 1.70 Kg per square meter for each coat. The coat of bitumen shall be continued along with the parapet wall up to a drip course. In order to safeguard against sticking of bitumen, if directed by the Project Manager, sand shall be sprinkled over the bituminous coating at the rate of one cubic foot per 100 square feet (0.0283m³/10m²) of surface area.

5.1.10 POLYTHENE SHEET

Specified Polyethylene (first layer) sheet shall be laid over bitumen with 300mm overlap and shall be jointed with bitumen or as directed by the Project Manager. The polythene Sheet shall be placed in such a way as to ensure proper bond between polythene sheet and bitumen.

Specified Polyethylene sheet 2nd layer laid over Extruded polystyrene foam board sheet shall be overlapped 300mm and shall be jointed with bitumen or as directed by the Project Manager.

5.1.11 KHURRAS

Khurras shall be made before the earth is laid and shall be in accordance with the Specifications 6.3.

5.1.12 PONDING TEST

Ponding test shall be carried out at a depth of 50mm for twenty four (24hrs) after application of modified bitumen membrane or as directed by the Project Manager to check the water tightness of the roof. The waterproofing shall be considered satisfactory, if no leaks or damp shown on the soffit or any other places. Necessary remedial actions should be taken by the Contractor if

any leakage or seepage occurs. No extra payment will be made for leakage testing of the roof and remedy if required.

5.2 “KHURRAS”, “PARNALAS” AND SPOUTS

5.2.1 TOP KHURRAS

Unless otherwise specified herein, top khurras shall be 600 X 600 mm and shall be made of 1:2:4 cement concrete 80 mm thick. Concrete shall have a slope 1:1 at the sides so as to be overlapped by earth. Cement shall be continued into the outlet so as to ensure a watertight joint.

5.2.2 BOTTOM KHURRAS ON ROOF

Unless otherwise specified bottom khurras on top of verandah or similar roofs shall be 600 x 600 mm and will consist of a 80 mm layer of 1:2:4 cement concrete.

5.2.3 BOTTOM KHURRAS ON GROUND

Unless otherwise specified, bottom khurras when used on the ground, in conjunction with spouts shall be > 1.20 x 0.60 x 0.115 m and shall consist of blocks on edge laid in cement, laid on 76 mm of 1:4:8 cement concrete.

5.2.4 SPOUTS

Unless otherwise specified, spouts shall be made of reinforced cement concrete and shall have an open channel 80 x 98 mm with a semicircular bottom. They shall project at least 380 mm from the face of the wall and shall be built into the wall for depth of at least 340 mm, the part built into the wall shall be sufficiently thickened to provide adequate support for the overhanging portion. Spout shall be fixed at a slope not flatter than 1 in 6 and shall have a lip at the lower edge to allow water to drip clear. Plain corrugated sheet iron spouts can also be used.

CHAPTER-6 FLOORING

Chapter-6: FLOORING

6.1 BASE FOR FLOORING

6.1.1 SCOPE

Unless otherwise specified herein, the base of all ground floors shall be constructed in accordance with the following specifications.

6.1.2 MATERIALS

- i) Sand shall conform to or comply with in all respects to the Specifications for sand, Chapter-10 "Cement, Sand, Aggregates & Revetment Materials" except for its grading, i.e. it shall fulfill the requirements of fine sand as per specifications provided under Chapter-1, sub section 1.2.11.
- ii) Concrete shall be cement concrete conforming to Specifications No. 3.4.
- iii) Stone Ballast (for 1st and subsequent floors) shall fulfil the requirements of chapter-3.

6.1.3 PREPARATION OF SUB BASE

Earth conforming to Specifications for earth shall be used for the sub-base. Earth filling shall be done up to the specified level in a layer of fifteen 15 cm and shall be properly watered and consolidated. The sub-base shall be properly leveled before sand filling.

6.1.4 SAND FILLING

Sand filling (for ground floor) shall be done in layers not more than 7.5 cm thick and shall be rammed after saturation to such an extent that a 7.5 cm layer is reduced to about 5 cm after compaction.

6.1.5 CONCRETE LAYING

Concrete shall be laid in one (1) operation in a uniform layer of specified thickness, absolutely true and parallel to the required level of the finished surface and to the entire satisfaction of the Project Manager.

6.1.6 SURFACING TO BOND WITH CONCRETE

Concrete shall be cured for at least seven (7) days before any topping is laid the surface shall be kept wet and protected from earth, dirt or other foreign matter. Before laying the topping, the surface shall be washed and scrubbed with wire brushes so that the concrete and the topping are well bonded.

6.1.7 LEVELS & SLOPES

Unless otherwise specified herein, the base shall be perfectly level A slope of 1:64 shall, however, be provided or furnished in verandah and bath rooms.

6.2 TILE FLOORING

6.2.1 SCOPE

The work shall cover or include furnishing all labour, material, equipment and performing all services to provide and complete the tile flooring including sand filling (ground floor), plain cement concrete base and finishing with the tiles as shown on the Drawings or as directed by the Project Manager.

6.2.2 MATERIALS

(i) Mortar

Mortar shall conform to Specifications for mortars as actually specified in Chapter-2 "Mortars".

(ii) Base

For ground floor the base shall be laid in conformity with Specifications 6.1. For first or subsequent floors, the top surface of roof slabs shall be roughened with wire brushes while it is still green.

Some of the most common types of tiles used are:-

- a) Cement Concrete/ Mosaic/Terrazzo Tiles - These are precast tiles and are made generally, unless otherwise specified herein, in sizes,
- 15 cm x 15 cm.
 - 20 cm x 20 cm
 - 22.50 cm x 22.50 cm
 - 30 cm x 30 cm

Tiles of sizes 22.50 cm x 22.50 cm and 30 cm x 30 cm are usually used in large floor areas such as hostels, club lobbies and store rooms. Smaller sizes are used in bath rooms, kitchen floors and walls.

Unless otherwise specified herein, Terrazzo tiles shall be first grade, mechanically compressed type, conforming to B.S 531. Tiles shall be 300 x 300 x 32 mm, with a 10 mm thick topping composed of 1:2 cement and marble chips, the base being 1:3 cement sand screed. The colour, quality and size of chips and color of cement shall be as per Drawings and Project Manager's directions.

- b) Glazed/Unglazed Ceramic Tiles. These are made of ball clay, china clay, china stone and flint. These are of two kinds:-
- Earthen Ware glazed.
 - Colour Enamels, and are available in different colours and sizes.

Glazed ceramic tiles shall conform to or comply with B.S. 1281. Tiles shall be of standard grade. Unglazed ceramic tiles shall conform to or comply with BS 1286.

The tiles shall be free from cracks or crazing, free from twisting and uniform in colour. Tiles shall be obtained to the size and thickness indicated on the Drawings. China verona tiles shall be of thickness 13mm.

(iii) Marble Tiles

Marble shall be compact, dense, metamorphic rock of limestone origin from quarries in Pakistan, It shall have specific gravity of about 2.7 and hardness number on Mohr's scale shall range from 3 to 4. Unconfined compressive strength of marble normally shall be greater than 100Mpa.

Generally marble tiles shall be of 300 mm x 300 mm size and 10 mm to 25 mm thick, or as shown on the Drawings or as directed by the Project Manager. The color of the marble shall be as indicated on the Drawings or as directed by the Project Manager.

The Contractor shall produce samples of marble tiles to be used for this item of work for selection, testing and approval. The tests for marble shall be as per ASTM Standards for the determination of:

Weight %age Absorption	ASTM C-97
Modulus of Rupture	ASTM C-99
Compressive Strength	ASTM C-170

(iv) PVC Tiles

PVC tiles of approved size, color and thickness shall conform to or comply with BS 3260 and shall be of approved origin and manufacture. The tiles shall have uniform wearing surface and shall be color fast to day light. The material shall be resistant to or free from mild acids, alkali, oil and grease.

(v) Adhesives

Adhesives for ceramic tiles shall conform to or comply with the requirements of B.S. 5385. Adhesive for fixing PVC tiles shall be as required or recommended by the manufacturer supplying the tiles.

(vi) Joint Filler

Joint filler shall be white Portland cement grout which shall bond to dry tile, shall be non-shrinking, stain resistant, and permanent in color and shall not inhibit fungus and bacterial growth. The same shall be odorless and non-toxic, of smooth consistency for early preparation and neat rapid installation and shall contain or consist of non-metallic material. Grout shall be water resistant and shall not be washed out under water.

(vii) Cleaning Compound

The compound used for cleaning of all terrazzo shall be an approved or permitted neutral chemical cleaner free from acid and alkali or any material that will directly or indirectly influence or affect the color or otherwise damage or injure the terrazzo and shall not adversely influence or affect the conductivity of terrazzo floors.

6.2.3 BASE

The base in cement concrete and if required the sub-base in ballast plus sand or lean concrete shall be prepared as provided in Specifications 7.1 'Base for Flooring.' The thickness of sub base if any and base shall be as shown in the Drawings or as directed by the Project Manager the surface of concrete base shall be rough finished. The curing period of base shall be at least seventy-two (72) hours before laying the tile work.

6.2.4 TILE FLOORING (TILES LAID FLAT)

(i) Pattern

The laying of Tiles shall be plain, diagonal, herring-bone or any other specified pattern.

(ii) Joints

Where pointing is not to be finished, the joints shall not exceed 4.5 mm in thickness. The mortar oozing out of the joints shall be struck off with trowel or wiped off with damp cloth.

- a) Where pointing is to be done, the joints shall not exceed 9 mm in thickness. The mortar in the joint shall be raked out 25 mm deep, while it is still green.

(iii) Pointing

Unless otherwise specified herein, the joints shall be flush pointed with specified mortar.

(iv) Preparation of Base

Before laying tiles the surface of the base shall be washed and scrubbed with wire brushes. Where tiles are to be laid directly on roof slabs the surface of the slabs shall be roughened with wire brushes while it is still green.

(v) Thickness of Bedding Mortar

The floor shall be laid on 19 mm thick bed of specified bedding mortar spread evenly on the base.

(vi) Laying of Tiles

Tiles shall be laid with specified mortar in position on the bedding mortar, which shall be cement mortar of specified mix proportions, or as directed by the Project Manager.

(vii) Protection

Flooring shall be allowed or permitted to mature undisturbed, and protected from the effects of weather or climate. The same shall be kept wet for at least seven (7) days after completion. If pointing is to be finished, the same shall be kept wet for at least fourteen (14) days after the completion of pointing.

(viii) Surface

Surface shall be finished to specify levels all joints shall be uniform, true and parallel and square tiles shall be rubbed to ensure this where it is very necessary, without extra cost.

(ix) Finishing Off Edges

No damaged or defective tiles shall be used. Bats shall not be used except to close any course of tiles. Unless otherwise specified, the overhanging edge of the paving shall be finished off by special bull-nosed bricks/blocks.

6.2.5 FLOORS FINISHED WITH SPECIALLY MANUFACTURED DECORATIVE TILES

(i) Terrazzo or Mosaic Marble Chips Tiles

- a) Surfaces to receive the tiles shall be thoroughly cleaned of or free from all dirt, dust oil, foreign matters and/or other objectionable matters or substances. Tiles shall be laid out from the center line of each space in an outward direction and pattern shall be made symmetrical with minimum number of cut lines.
- b) Joints between the tiles shall be of uniform width. Tiles shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Tiles shall be laid to straight edges.
- c) Tiles shall be laid to the required lines, levels and grades over a setting bed of cement mortar, comprising of specified mix proportions or as directed by the Project Manager, in case mix proportion of cement mortar is not specified, one (1) part of cement and three (3) parts of sand by volume is generally adopted with thickness of about 19mm. The thickness of cement concrete bed shall be as per the Drawings the joints shall be filled with neat cement (white or grey in color) including vertical and horizontal covers.
- d) After seven (7) days, the terrazzo tiles shall be machine-ground to a true, even surface using various grades of abrasive stones as required and directed / instructed by the Project Manager. After the first grinding, the floor shall be grouted with the same color composition as used for its manufacture. The grout shall be of the consistency of thick cream and shall be brushed over the floor to fill in joints and after seventy-two (72) hours, the grouting coat shall be removed by grinding till smooth and even surface is obtained or secured. Areas and positions of the floor inaccessible for the grinding machine shall be ground and rubbed by hand. The final gloss shall be provided or finished by polishing the surface to be prepared to the satisfaction of the Project Manager.
- e) Preservative Treatment

Preservative treatment for terrazzo floor shall produce a water proof finish which will not be impaired by immersion in water at room temperature for a period of 2.5 hours, approximately 18 hours after the floor is finished by buffing, as specified herein. The

preservative material shall not discolor the terrazzo nor leave a tacky or sticky finished film on the surface after buffing.

(ii) Marble Tiles

a) General

The Contractor shall provide or employ skilled and trained marble workers for undertaking and performing this task. The Contractor may be allowed or permitted to employ or appoint a specialist or sub-contractor for this item of work with the approval or permission of the Project Manager. The surface, over which marble tiles are required to be fixed, shall be remove or clean of all dirt and dust and shall be properly hacked so that the mortar sticks well to the surface. The edge of the marble tiles shall be dressed true and square by rubbing them with carborundum stone or any other approved means or methods. The marble tiles shall be laid in cement sand bedding mortar of specified mix proportions or as directed or instructed by the Project Manager. In case mix proportion of cements and mortar is not specified, 1:3 ratio and 19mm thickness over a specified base as shown on the drawings is generally adopted. Marble tile work shall be allowed to season for at least three days during which it shall be kept moist and free of traffic.

b) Jointing

All marble tiles shall be jointed flush or with a V groove as directed or instructed by the Project Manager or as shown or envisaged on the Drawings. Pattern and moulding, if any, shall be accurately framed. Joints shall be filled with white or colored cement mortar as specified or envisaged on Drawings to match or meet the marble.

Allowance shall be made for movement of the structure and backing by including construction and expansion joints in the marble work. The same shall be properly filled with approved mastic compound. Expansion joints shall be formed to meet or coincide with the expansion joints in the building.

c) Protection and Maintenance

The Contractor shall be liable or responsible for protection and maintenance of all tile work during the process of completion. The completed works or parts thereof shall be protected by the Contractor against any damage or defect therein. The works shall be handed over to the Employer in good or perfect condition. If any damage or defect is incurred then the Contractor shall remove and/or replace the same as directed or instructed by the Project Manager at no additional cost or extra cost to the Employer. The Contractor shall exercise all due attention and care to protect the works executed by personnel of other trades that are not covered or contained by his contract. Any damage or defect therefrom shall be made good or reinstated and the works restored to the full satisfaction of the Project Manager.

d) Finishing and Polishing

The Contractor shall make suitable arrangements for giving final finish to the marble tile work such as cleaning, washing and polishing as specified or as directed by the Project Manager.

(iii) Glazed / Unglazed Ceramic Tiles / Porcelain Tiles

a) Cement, Sand, Screed Base

Unless otherwise specified herein or directed by the Project Manager, the glazed/unglazed ceramic/porcelain tiles shall be laid to the required levels and grades over a setting bed of cement sand screed comprising generally of one part cement to 3 parts of sand by volume. The thickness of the screed shall be as specified, generally be not less than 13 mm at any place or as shown on the Drawings.

b) Curing

The curing period of the setting bed shall be as directed or instructed by the Project Manager. The tiled floor shall be kept wet for about seventy-two (72) hours and no traffic shall be allowed or permitted during this period.

c) Cleaning

Floors to receive the tiles shall be thoroughly cleaned of or free from all dirt, dust, oil, foreign material and other objectionable matter.

d) Laying

Tiles shall be laid out from the center line of each space in an outward direction, and pattern shall be made symmetrical with minimum number of cut tiles and shall be laid to straight edges. Tiles shall be cut with approved cutting tool and rough edges shall be rubbed smooth.

e) Joints

Joints between tiles shall be of uniform width and shall be grouted with a plastic mix of neat white cement immediately after a suitable area of tile has been set.

f) Placement

Before placing ceramic tiles on green wet screed bed, a slurry bond coat shall be applied to the mortar bed using a flat trowel, or a slurry bond coat shall be applied to the back of each tile just prior to placing on bed.

- Ceramic tiles shall be placed in the wet slurry coat before the surface dries out. Uniformity of joints shall be maintained thoroughly.
- After each piece is laid, the same shall be firmly pressed into place so as to the same embed it and to even the surface before the mortar takes its initiated.
- Excess mortar shall be cleaned from the surface with water and damp sponge as and when the work progresses, while mortar is fresh and before it hardens.

(iv) Cement Concrete Tiles/Cement Tiles/ Coloured Cement Tiles

Scope

Unless otherwise specified herein, the work of cement concrete tiles/cement tile colored cement tiles, flooring shall be done in accordance with the specifications 7.2 (4) for Tile flooring in all respects except the following modifications:-

- a) Cement Concrete Tiles/Cement Tiles/Colored Cement Tiles shall be of an approved quality having strength 15Mpa and mix ratio approved by the Project Manager.
- b) The tiles shall be laid in cement sand bedding mortar of specified mix proportions or as directed by the Project Manager. In case mix proportion of cements and mortar is not specified, 1:3 ratio and 19mm thickness over a specified base as shown on the drawings.
- c) All tiles shall be laid in water for thirty-six (36) hours before they are laid
- d) The joints shall not be more than two (2) mm which shall be grouted with cement.
- e) As and when necessary, the tiles shall be cut with wire saw to the exact size having a clean sharp edge so as to have fine joints.
- f) Thickness of PCC tiles for roof treatment shall be 40mm and for plinth protection and others it shall be 25mm.

(v) PVC Tiles

a) General

The base shall be prepared as shown or envisaged on the Drawings and/ or as directed or instructed by the Project Manager.

Tiles shall be laid to the required lines, levels and grades over, prepared sub-floor.

Surface to receive the tiles shall be thoroughly cleaned of or free from all dirt, dust, oil, foreign material and other objectionable matter. Tiles shall be laid out from the center line of each space in an outward direction and the pattern shall be made symmetrical with a minimum number of cut tiles.

Joints between the tiles shall be of uniform width. Tiles shall be cut with suitable cutting tool and rough edges shall be rubbed smooth. Tiles shall be laid to straight edges, as per approved patterns.

b) Laying

An area not exceeding about 2.5 sq. m shall be coated with approved adhesive material and left for airing for 10-15 minutes. The tiles shall be laid starting from center line of the room and shall be so pressed that complete adhesion takes place.

c) Finishing

Full uniform contact with base material shall be ensured and surfaces shall be prepared or finished smooth, even in true planes, free of buckets, waves and other imperfections.

d) Cleaning

Not sooner than 5 days after installation, surfaces shall be cleaned with cleaner recommended by flooring manufacturer followed by rinsing with clear water

e) Protection

Surfaces shall be protected by covering with undyed, untreated building paper or as directed by the Project Manager.

f) Tiles Skirting / Dado

Unless otherwise specified herein or directed by the Project Manager, the tiles ~ white glazed, glazed in pigment, and shall be laid to the required dimensions on the portion of the wall to be provided or furnished with skirting or dado over a setting bed of cement sand screed comprising generally of one (1) part cement to three (3) parts of sand by volume. The thickness of the screed shall be as specified and generally be not less than thirteen (13) mm at any place or as shown on the Drawings or envisaged. The curing period of the setting bed shall be as directed by the Project Manager; Joints between tiles shall be of uniform width and shall be grouted full with a plastic mix of neat white cement or having color matching with the tiles, immediately after a suitable area of the tile has been set.

g) Precautions

The following are the due attention and precautions to be observed for the placement of the tiles;-

Before placing tiles on green or wet screed bed, a slurry bond coat shall be applied to the mortar bed using a flat trowel, or a slurry bond coat shall be applied to the back of each tile just prior to placing on bed.

- Tiles- White glazed, glazed in pigment shall be placed in the wet slurry coat before the surface dries out. Uniformity of joints shall be maintained thoroughly.
- After each piece is laid, the same shall be firmly pressed into place so as to embed the same and to even the surface before the mortar takes its initial set.
- Excess mortar shall be cleaned from the surface with water and damp sponge as and when the work progresses, while mortar is fresh and before the same hardens.

6.3 CEMENT CONCRETE FLOORING

6.3.1 SCOPE

The work shall include furnishing all labour, material and equipment and performing all operations as required to lay the cement concrete floors which includes but is not limited to the following: inter alia:

- i) Base in sand and stone ballast or in lean concrete.
- ii) Division Strips.
- iii) Cement Concrete wearing course panels or topping of cement concrete.
- iv) Skirting or dado in cement sand mortar.
- v) In conformity /accordance with the Drawings schedule of floor finish and or instructions of the Project Manager.

6.3.2 MATERIALS

i) Stone Ballast

Stone ballast to be used in the base of floors shall be hard, durable and strong. Stone ballast shall be free from impurities, quarry sap, dust, dirt, solubility characteristics and other foreign materials. The size of stone ballast shall be specified or as directed by the Project Manager.

ii) Aggregates and Cement

Fine aggregate, coarse aggregate, cement and water shall conform to the requirements specified in Chapter-3, Concrete.

iii) Division Strips

Division strips shall be cut from five (5) mm thick plate glass in widths as specified or envisaged in the Drawings or as directed / instructed by the Project Manager.

6.3.3 EXECUTION

(i) Preparation

The ground surface shall be cleared and scrubbed of top soil and all grass, roots and loose material removed or cleared of. Surface thereof shall be dry, leveled and cleared of any fill or backfill.

(ii) Base

The floor base shall be either sand and stone ballast or lean concrete.

a) Sand and Stone Ballast

The sand and stone ballast used as base shall conform to specifications 6.1 mentioned above. The Stone ballast shall be mixed with sand as specified and laid in position. It shall be properly watered and rammed to get the required thickness.

b) Lean Concrete

Lean concrete shall be class D (10Mpa) and shall conform to Chapter-3 Concrete of these Specifications. It will be screened in position to required depth and/or surface elevations.

The surface of the base concrete shall be brushed with a stiff broom just before it hardens to remove all laitance and loose aggregate and at the same time to roughen the surface to improve the bond. The hardened base shall be thoroughly cleaned, wetted preferably overnight, the surplus water removed and a grout of cement and water brushed into the surface just ahead of the application of the topping.

c) Concrete

Concrete shall be (1:2:4) and shall conform to Chapter-3 Concrete of these Specifications. It will be screened in position to required depth and/or surface elevations.

(iii) Panels

Before laying the cement concrete flooring, the surface of the base shall be divided into panels of required size as shown or envisaged on the Drawings, panels shall be made of plate glass, division strips or as specified herein. The top of the division strips shall conform to or comply with the specified level of the finished floor surface.

(iv) Floor

Mixing and placing of concrete of 20 MPa strength shall be in accordance with Chapter-3 "Concrete". Concrete may be conveyed in any suitable manner from the place of mixing provided there is no segregation or loss of any ingredients and provided it is placed in its final position before initial setting takes place that is within 30 minutes of addition of water to the mix. The concrete will be laid in a manner so as not to cause the aggregate to separate from the mortar. The floor concrete panels shall have the thickness, top levels and grades as shown on the Drawings. The concrete shall be rammed and thoroughly consolidated until the mortar creams up to the surface.

The concrete shall be laid in alternate panels, each panel not exceeding the area, as directed or instructed by the Project Manager. Dividing strips shall be provided or furnished wherever shown or envisaged on the Drawings.

(v) Finishing

Immediately after consolidation, the surface shall be leveled with a wooden trowel. Excessive trowelling in the early stage shall be avoided or prevented. The surface shall be tested with a straight edge to detect undulations, which, if found, shall be eliminated or removed. The finer components in the concrete which come to the surface with the stroking shall be quickly but carefully smoothed with the steel trowel. When the concrete has hardened sufficiently, troweling shall be finished with steel trowels. No dry cement or a mixture of dry cement with sand shall be sprinkled on the surface for hardening the surface.

(vi) Dado / Skirting

The plaster on the portion of the wall to be provided with skirting or dado shall be left in a rough state by brooming or by using wire brushes of approved type so as to provide a bond between this base plaster and the dado or skirting. The surface of the wall shall be cleaned of all foreign matter or substance and shall be thoroughly wetted to avoid or prevent the absorption of water in the plaster by the masonry. Only so much mix shall be mixed with water that could be utilized within thirty (30) minutes. This mix proportion of cement and coarse sand shall be as specified or as directed / instructed by the Project Manager. If not specified herein or directed / instructed by the Project Manager, generally a mix proportion of 1:2 shall be applied to the wall in a thickness as specified herein and trowelled hard to a smooth surface, proper in line both vertical and horizontal.

(vii) Curing

Curing shall be earned out in conformity / accordance with the Specifications specified under Chapter- 3 "Concrete".

CHAPTER-7
SURFACE RENDERING

Chapter-7: SURFACE RENDERING

7.1 SCOPE

The work shall cover or include furnishing all materials, tools & plant, labor, equipment, instruments, scaffolding, shuttering, staging and supports and the like as well as performing all operations to complete the work in workman like manner in accordance with the approved drawings or as directed or instructed by the Project Manager; the said specifications, provisions and requirements shall also apply except when such provisions and requirements are specially modified or rectified by the Project Manager for a particular work or portion of work in connection therewith.

7.2 GENERAL

i) Plastering or pointing shall not commence until or unless all electric conduits, drainage and sanitary pipes, inlets to tanks, brackets, clamps, doors and window frames and all sorts of inserts and embedded items are fixed in position. The same shall be the responsibility of the Contractor to make sure or ensure that all such work is carried out or executed by other contractors before starting of plaster or pointing work, chiseling and repairing of cement plaster or pointing shall not be permitted without the approval or instruction of the Project Manager.

ii) Sample of materials shall be prepared and submitted to the Project Manager for his approval or permission prior to use in the works.

iii) Tolerances

Surfaces of plaster work shall be finished with a true plane to correct line and level with all angle and corners to a right angle unless otherwise specified herein and with walls and reveals plumb and square.

The maximum permitted tolerances thereof shall not exceed three (3) mm in two (2) m variation from plumb or level in any exposed line or surface and 1.5 mm variation between planes of abutting edges or ends.

iv) Cleaning and Protection

Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed or instructed by the Project Manager. As each room or space is completed, all rubbish, debris, scaffolding and tools shall be removed or cleared away so as to leave the room clean.

Prior to plastering and pointing all windows, finished wood and metals shall be covered or included by sheet of plastic or tarpaulin to protect the same from damage or defect therein.

Finished plaster shall be protected from injury or damage by any source. Contractor shall also protect walls, floors and work of other trades from plaster materials.

v) Precautions in Plastering

The following precautions shall be strictly observed or adhered to.

a) General

Unless otherwise specified herein or directed / instructed by the Project Manager, the following measures shall be adopted to remedy or make good any damage, defects and faults incidental to plaster work - mud, cement - lime or lime.

- o Fine aggregate (Sand) shall be clean and free from all impurities. The same shall be washed before use.
- o Lime shall be properly slaked before use.

- A proper key shall be provided or furnished between the plaster and the surface to be plastered.
 - The background shall be kept moist, but excessive moisture shall be avoided or prevented.
 - Proper curing shall be provided to eliminate or remove excessive and rapid thermal changes.
 - Each coat shall be allowed or permitted to dry before the next is applied.
- b) Scaffoldings
- The scaffolding for plaster shall always be double.
- c) Inspection of Plastering
- Plastering shall be inspected or examined by the Project Manager or his authorized or delegated representatives when the work is in progress and after its completion. The following points shall be kept in view while making the inspection.
 - If wood skirting is specified herein, the plastering has been finished right onto them.
 - The surface checked or verified by means of straight edge to ensure perfect evenness.
 - All intricate places like softies, cupboards and their recesses, specified to be plastered, have been properly plastered.
 - The work has been properly finished or completed at the junction with other materials such as woodwork at window and door openings, fireplaces and similar other places.
 - If wood angle-beads are specified herein, they are of proper section, under cut for key, securely fixed, and the plaster has been finished up to them in an appropriate or proper manner.
 - Due attention and special care has been taken of cornices and moulding sections. The templates shall be thoroughly checked and compared with the approved Drawing.
 - All ornamental work is true to design and securely fixed and bonded.
 - If hard plaster angles are specified herein, they have been duly executed.
 - In external stucco, rough cast, or pebble-dashing, the coats are of even & thickness and are uniformly laid.
 - The plastered surface struck with the knuckles shall not give hollow sound. If it rings hollow, it is an indication of insufficient adhesion between various coats of plaster.
- d) Remedies of Defects
- Hair-cracks on fresh plaster normally disappear after whitewashing. But wide cracks shall be filled in by forcing down mortar consisting of plaster of paris, cement and sand in the proportion of 1:2:7, unless otherwise specified herein or directed / instructed by the Project Manager.
 - Surface areas showing pitting, blowing, popping and blister shall be remedied by cutting out patches in rectangular shape, under cutting the edges to form a dovetail key and making good on a Portland cement ground.
 - All these remedial measures shall be carried out or executed by the Contractor at his own cost and risk.
- e) Plastering
- Unless otherwise specified herein or directed or instructed by the Project Manager or his authorized subordinate in writing, wooden screeds eight (8) cm wide and having a thickness equal to the plaster shall be fixed vertically two and half (2.5) meter to three (3) meter apart to act as gauges and guides in applying the plaster.

- The arises shall then be plastered for a space of ten (10) cm on each side and up to the ceiling, except in case of openings where the same shall run around them. This plaster shall also serve as a guide for thickness and the like. Unless otherwise specified herein or directed / instructed by the Project Manager all corners and arises shall be rounded off to a radius of twenty (20) mm only and no more. This work shall be covered or included in the unit price and rate of plastering.
 - The mortar shall be laid on the wall between the screeds, using a plasterer's float for the purpose and pressing 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 an upward and sideways motion, 5.5 cm or 7.5 cm at a time. Finally the surface shall be finished off with a plasterer's wooden float. Meta! Floats shall not be used.
 - The plaster shall be laid to a true and plumb surface and tested frequently with a straight - edge and plumb-bob. The straight edge shall not be less than three (3) meters in length. As the work proceeds or progressed, all horizontal lines and surfaces shall be tested with a level, and ail jambs and corners with a plumb bob.
 - All mouldings and decorations shall be worked true to template and shall be neat, clean, level, and parallel, or truly plumb, as the case may be.
 - Unless otherwise specified herein, plaster shall not exceed twelve (12) mm in thickness and shall not be less than six (6) mm at the thinner part.
- f) Protection During Curing
- After completion, plaster shall be kept wet for ten (10) days and shall be protected during that period from extreme fluctuations of temperature and weather conditions.
- g) Defects
- All damages and defects detected shall be treated at the Contractor's cost and risk.

7.3 CEMENT PLASTER

7.3.1 PROPORTIONING & MIXING

Cement mortar to be used in work of cement plastering and pointing shall be proportioned, mixed and formed in accordance with the specifications, provisions and requirements set forth in Chapter-2 "Mortars."

7.3.2 PREPARATION OF SURFACE

- i) Concrete surface to be plastered shall be cleaned to eliminate or remove all grease, oil, foreign materials and other surface impurities which will otherwise adversely or materially influence or affect the adhesion of plaster to the surface concerned. The surface of all concrete ft. ceilings, beams and columns shall be lightly hacked by approved means or method to give the required key for plastering.
- ii) All masonry surfaces to be plastered or pointed shall be cleaned to clear and remove all matters and substances which will otherwise adversely or materially influence or affect the adhesion of plaster or pointing to the surface concerned. Block masonry surface shall be washed with clean water and kept damp for twenty-four (24) hours before further treatment.
- iii) For plaster, the surface thus prepared shall be treated uniformly with cement and sand slurry. The slurry to be used shall be one (1) part cement to one (1) part sand by volume with water added to make a stiff creamy mix or as specified herein or as directed or instructed by the Project Manager. The slurry shall be applied with a stiff brush on the surface which has previously been well wetted. The surface so treated shall be cured for three (3) days.
- iv) For pointing, all joints shall be raked to make a groove of about twenty (20) mm deep or as specified herein or as directed or instructed by the Project Manager and the surface cleared with a wire brush.

7.3.3 APPLICATION OF PLASTER

The plaster having thickness less than the specified thickness shall be rejected. If the plaster is to be more than 13 mm thick, it shall be done in two coats. The surface of first coat shall be made rough before the second coat is applied. The plaster shall not have wavy surface and shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet continuously for at least ten (10) days. The plaster work is to cover all conduits, pipes, etc., fixed in the walls and ceiling. The plastered surface shall be tested frequently with a 3 meter straight edge and plumb bob

Metal lath shall be nailed firmly before plastering is commenced. Metal lath shall be GI expandable wire of gauge 18SWG and mesh of 10mmx10mm. Metal lath shall be applied at the horizontal and vertical joints where the Concrete/RCC surface abuts with masonry surface. Metal lathing minimum 150mm wide extending 75mm on each side of junction of RCC elements and block work fixed by galvanized nails with washers at 150mm centers. The metal lath shall be applied at the internal and external faces of the walls. The payment for this item shall deemed to be included in the item of plastering.

The plaster containing cracks, blisters, pits, discoloration or any damages and defects therein shall not be acceptable nor permissible. Any such plaster or loose plaster shall be removed and replaced with plaster in conformity / compliance with these Specifications and as additionally directed or instructed by the Project Manager.

The Contractor shall cut out and patch all damaged and defective work or section therein. All damaged plaster shall be patched as directed or instructed by the Project Manager. Patching plaster shall match or meet appearance of and shall be finished level with adjoining plaster.

7.4 WHITE WASHING

7.4.1 SCOPE

The work to be completed under white washing covers or includes preparation of surface, supplying of material required for the work and completing the same in conformity / compliance with specifications hereunder contained or as directed or instructed by the Project Manager

7.4.2 PREPARATION OF SURFACE

The following procedure shall be followed or complied for the preparation of the surface to be white washed.

- i) The surface shall be clean, smooth and completely dry before whitewash is applied.
- ii) New plaster to be whitewashed shall not be trowelled to a glazed surface, because whitewash would not adhere to it. The surface to be white wash / color wash should also fulfill the requirements of the specifications.
- iii) The old loose whitewash shall be removed from walls previously whitewashed, and the surface thoroughly cleaned.
- iv) If the old whitewash is not loose, but is discolored by smoke, it shall be treated by a wash of wood ashes and water before whitewashing.
- v) When the whitewash and plaster are in a deteriorated or defective condition of repair, the same shall be either pulled down completely or cut in squares and new patches put in as directed or instructed by the Project Manager or his authorized or delegated subordinate. As soon as these patches dry up, two (2) extra coats of whitewash shall be provided prior to the regular coat. The work of scraping deteriorated white wash / plaster and of repairing the plaster in whole or in patches shall be covered or included in the unit price and rate.

7.4.3 PREPARATION OF WHITE WASH

Whitewash shall be prepared from pure fat lime brought to the site of work in an unslaked condition and in order to slake the lime water shall be added to it in a tub till the mixture attains the consistency of cream, and shall be allowed or permitted to rest for twenty-four (24) to forty-eight (48) hours. The same shall then be strained through coarse cloth and four (4) ounces of gum or rice dissolved in hot water shall be added to each cubic meter of it.

7.4.4 APPLICATION

- i) Whitewash shall be applied with a brush each coat shall contain or consist of four (4) strokes, one (1) in each direction.
- ii) Each coat of whitewash shall be allowed or permitted to dry and inspected by the Project Manager or his authorized or delegated subordinate. The next coat shall not be applied unless the previous one has been approved or permitted by either of them. A dry coat shall not show any sign of cracking, nor shall whitewash come off readily on fingers when rubbed.
- iii) Whitewash, when completed, shall form an opaque coat of uniform white color, through which the old work does not show and shall present a smooth regular surface free from powdery matter.

7.5 COLOUR WASHING

7.5.1 SCOPE

The work to be completed under color washing covers or includes preparation of surface, supplying of material required for the work and completing the same in conformity / compliance with Specifications hereunder laid down or as directed or instructed by the Project Manager.

7.5.2 SURFACE PREPARATION

The surface to be colored washed shall be prepared in conformity / compliance with the Specifications No.8.4.2 for Whitewashing.

7.5.3 PREPARATION OF COLOR WASH

The color wash shall be prepared by adding the necessary coloring pigment to the whitewash which has been strained. The mixture shall be stirred thoroughly and passed through a clean, fine cloth. Only such quantity of wash shall be prepared as can be consumed in clay's work.

7.5.4 APPLICATION

- i) New or scraped surface shall be provided with a coat of whitewash, prior to color wash.
- ii) Old surface, when the color wash is satisfactory, shall be provided with only one (1) new coat of color-wash.
- iii) When replacing one (1) color with another of a lighter shade, the old color shall be thoroughly scraped and a coat of whitewash given before the new color is applied.
- iv) Each coat of color wash shall be allowed or permitted to dry and shall be inspected or examined by the Project Manager or his authorized or delegated subordinate. The next coat shall not be applied unless the previous one has been approved or permitted by either of them.
- v) The completed wall shall be of a uniform color, free from blots, lines or cut shades, and shall present a smooth regular surface which shall neither crack nor come off readily on fingers when rubbed.

- vi) Each room shall be finished in one operation and work shall not start in a room so late that the same shall not be finished the same day.

7.5.5 OTHER RESPECTS

In all other respects not specified herein, the same shall strictly conform to or comply with Specifications No. 8.4 for whitewashing.

7.6 DISTEMPERING

7.6.1 GENERAL

- i) Unless otherwise specified herein or directed / instructed by the Project Manager in writing, a newly plastered wall shall not be distempered earlier than 45 days after the plastering. If distempered earlier, the plaster shall be treated with damp proof compounds at the Contractor's cost.
- ii) Distempering shall not be finished in damp weather or when the weather is excessively hot and dry as extraordinary weather.

7.6.2 PREPARATION OF SURFACE

- i) Newly-plastered surface, when absolutely dry, shall be sand-papered to eliminate or remove all irregularities, making good inequalities and holes with gypsum, which shall be allowed or permitted to set hard. Unless the surface is perfectly clean and smooth, no pleasing effect shall result in from distemper.
- ii) Old plastered surfaces shall be thoroughly cleaned. If the same is whitewashed or color washed, the same shall be rubbed off with sand paper or coconut fiber in case that the same is loose and then stopped and sized.
- iii) After rubbing and cleaning, all plastered surface, old or new, shall be sized with a coat of equal parts of size and alum dissolved in hot water. Decomposed size shall not be used under any circumstances. Where the makers of the distemper recommend a special priming coat, only that coat shall be applied.
- iv) If the existing surface is cleanly distempered, all the distemper shall not necessarily be removed nor eliminated. The surface shall be smoothed down with glass paper and any firm distemper that remains on the wall after such rubbing shall be left.
- v) A priming coat of chalk shall be applied on the surface to be distempered.

7.6.3 PREPARATION OF DISTEMPER

- i) Unless otherwise specified herein, readymade distempers shall be obtained or provided from the market as the same are easily available.
- ii) Distempers shall be mixed strictly in accordance with the maker's instructions or recommendations or as directed / instructed by the Project Manager, and the quantity shall be just sufficient for the day's work.

7.6.4 APPLICATION

- i) Distemper shall be applied only with proper brushes as supplied or recommended by the maker or manufacturer. The brushes shall be washed in hot water after work each day and hung up to dry. Old brushes caked with dry distemper shall not be allowed nor permitted to be used on the work.
- ii) Distemper shall be applied quickly and boldly leaving no dry edges. The brush shall be dipped in distemper and stroked cross wise on the wall then immediately stroked up and down and stopped.
- iii) Unless otherwise specified herein or directed / instructed two (2) men shall work on a wall together, one working from the ceiling downwards as far as he can reach and the other

following him applying the distemper from below. No patchy overlap shall be allowed or permitted under any circumstances.

- iv) Unless otherwise specified herein, the following number of coats of distempers shall be applied:-
 - a. On newly plastered walls two (2) coats over one (1) coat of priming.
 - b. On old-plastered walls covered with one or two coats of hard dry whitewash free from efflorescence or kalar one (1) coat without priming coat.

7.7 FAIR FACE BRICK CLADDING (GUTKA)

7.7.1 GENERAL

The work under this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with furnishing and installing fair face Brick cladding (Gutka) of specified size in position complete in strict accordance with this section of the specifications and applicable drawings and or as established by the Engineer.

7.7.1 STANDARDS

ACI 530	Building code requirements for masonry structures
ACI 530.1	Specifications for masonry structures
ASTM C 67	Standard method for sampling and testing brick and structural clay tile
UBC 2405	Quality control

7.7.1 INSPECTION AND TESTING

Regular inspections shall be carried out to control the quality of the works and to ensure that materials, construction and workmanship are in compliance with the plans and Specifications. Inspection and test records shall be maintained and made available to the Engineer as a routine, on each working day.

All work shall be erected true to line, plumb and level and the variation from plumb in any length of wall shall not exceed 1/12" (2mm) in 3 feet (one meter) or 3/8" (10mm) in a storey height or 1 inch.(25mm) in the entire height.

It shall be of uniform Color, finish and free from cracks, warpage, exposed stones, pebbles or particles of lime. The size of the bricks shall be in accordance with that shown on the Drawings. The testing of bricks shall comply with ASTM C 67. Physical requirements of the gutka shall be as given as follows:

Description	Minimum Compressive Strength (flat wise)	Maximum water Absorption in 5 hour	Maximum Saturation Coefficient
Individual	8 MPa	25%	0.90
Average of 5	10 MPa	22%	0.88

The mortar for all fair face brick (gutka) masonry cladding shall consists of cement, surkhi and sufficient water to produce proper consistency in the following composition:

Cement: Surkhi 1: 4 or Swan pozzolana in the ratio as recommended by the manufacturer.

CHAPTER-8
WOOD WORK

Chapter-8: WOOD WORK

8.1 GENERAL

8.1.1 SCOPE

The work shall cover or include” providing and supplying as required all labor, materials, plants, equipment, instruments, accessories and services to complete the fabrication and erection of wood work. The work shall cover or include (without limitation) all woodwork, whether Carpenter's or joiners work, mill work, construction assembly, surface finish treatment and installation of finish hardware as shown or envisaged on the Drawings, specified herein and/ or as directed / instructed by the Project Manager.

8.1.2 APPROVAL OF MATERIALS & DESIGN

Prior to execution of work and sufficiently in advance, the Contractor shall prepare or submit the following to the Project Manager for approval or permission.

- i) Samples of all the materials and components.
- ii) Shop Drawings showing design, details and locations, reference to the type and hardware group if specified herein or shown on the schedules.
- iii) Sample of face veneers for selection of color and Pattern.

8.1.3 MATERIALS

i) Timber

a) General Characteristics

The timber shall be provided or furnished in accordance with the specific requirements of BS: 1186 or BS EN 942. Best quality timber shall be from the heart of a sound tree, the sap wood shall be entirely removed, the wood shall be uniform in substance, straight in fiber, free from large or dead knots, flaws, shakes or blemishes of any kind. The color of timber shall be uniform throughout and among colored timbers; darkness of color shall be an apparent indication of strength and durability.

For best quality teak wood, the size of the knot shall not be more than thirteen (13) mm and there should not be more than one (1) knot in every sq. meter of timber.

For best quality deodar wood, the size of the knot shall not be more than twenty-five (25) mm and there shall not be more than one (1) knot in every 0.4 sq. meter of timber.

b) Seasoning

Timber shall be properly seasoned. The same shall be kiln or air dried so as to reduce the moisture content to a maximum of fifteen percent (15%) of its natural weight.

c) Hard & Soft Wood - Scope of Use

Unless otherwise specified herein or allowed or permitted by the Project Manager, only deodar wood shall be used for doors, windows, frames, glazed, semi glazed & panel shutters and core of flush doors. For joinery work, unless otherwise specified herein, deodar, kail, chir or teak shall be used or employed. Hardwood which shall contain or consist of shisham, iroko walnut, mahogany, beach or oak whichever is specified herein shall also be used for the above.

d) Preservation of Wood

Prior to installation of finished woodworks in their respective positions into or against or close to masonry or concrete, and all junctions or rafters, purlins, beams and wall plates; preservatives shall be applied to protect or safeguard the woodwork against fungus, termite and borers.

The preservatives shall be of the best available quality as approved or permitted by the Project Manager. The method of application shall be strictly in accordance with the manufacturer's instructions or recommendations.

8.1.4 PLYWOOD AND VENEER

i) Plywood

Plywood shall be an assembled product made up of plies and adhesives, the chief characteristic being the crossed plies which distribute the longitudinal wood strength. The term plywood in general sense shall cover or include similar products such as laminated board, block board and batten board. Plywood shall conform to or comply with B.S. 1455 whereas laminated, block and batten boards to B.S. 3444.

- a) Three (3) ply constructions shall cover or include a 'face a 'back' and a core or inner ply. Multi-ply shall cover or include a face, a back and a core of three (3) or more inner plies. With very few exceptions, the grain of each veneer in the core shall run at right angles to that of the veneers on either side of it.
- b) The construction of plywood shall be balanced with an odd number of veneers arranged symmetrically or unbalanced. The tendency of the finished board to distort or deflect shall be reduced by adopting a balanced construction.
- c) Plywood in conformity / compliance with BS: 1455 shall be classified into two (2) main types, viz interior and resin bonded.
- d) Interior type plywood shall be suitable for most interior work including (without limitation) wall paneling, balustrades, subflooring, kitchen filaments, and any location where resistance to Moisture is not required. Adhesive used shall cover or include casein, soya, blood albumen and animal glues as well as synthetic resin extended with other substances.
- e) Synthetic resin bonded plywood shall have a much greater resistance to moisture. The more resistant types shall be suitable for external wall sheathing, shop front fascia's, sign boards, shuttering and form work for concrete and for any purpose where it may be exposed to moisture. Adhesives used shall cover or include urea, melamine phenol and resorcinol formaldehyde (arranged in order of increasing moisture resistance).

ii) Veneers

- a) Grade I Veneer shall be of one (1) piece of firm smoothly cut veneer. The veneers shall be free from knots, worm and beetle holes, splits, dots, glue stains, filling or inlaying of any kind or other damages and defects therein. No end joints shall be allowed or permissible.
- b) Grade II Veneer shall present a solid surface free from open defects or damages. Veneer may be in one (1) or two (2) pieces.
- c) Veneers when jointed need not necessarily be matched for color or be of equal width. A few sound knots shall be approved or permitted with occasional minor discoloration and slight glue stains, isolated pin holes not along the plane of the veneer.
- d) Grade I veneered plywood shall only be used if not specified otherwise herein.
- e) Grade II shall be used if specified and where subsequent painting and/or veneering is intended.

iii) Laminated Veneered Board.

It shall be built up board, with narrow strip 3 to 7 mm wide, faced both sides with either one (1) or two (2) veneers from 1.2 mm to 3.7 mm thick. Where single or double face veneers are

used, the grain shall usually run at right angles to the grain of the core strip. This type of board, conforming to or complying with B.S. 3444 and of a thickness between thirteen (13) mm to twenty-five (25) mm shall be the base for the highest class of veneered wood.

iv) Block Veneered Board.

Block board conforming to or comply with B.S. 3444 shall be of similar construction as of laminated board but the core shall be built-up of blocks up to twenty-five (25) mm wide. The same shall be used as a base for veneering and for painted work.

v) Fiber Building & Chip Board

The term 'board' in general sense shall cover or include fiber building boards and the chip boards (or particle boards). The fiber building boards shall cover or include hard boards, insulation boards and straw boards.

a) Fiber Building Boards

- Hard Board:-

Mass per unit volume of hard boards shall range from 480 to 800 Kg per cubic meter (m^3) and shall be classified according to this density (mass per unit volume). Tempered hard board or standard hard board shall be treated so as to increase hardness and resistance to water.

- Insulation Board:-

Insulation board shall have maximum density of 400 Kg/Cu meter, minimum thickness of eleven (11) mm and maximum thermal conductivity (K) of 0.45. Insulation boards classified as homogeneous laminated, bitumen bonded bitumen impregnated and acoustic shall have good qualities of thermal insulation and sound absorption. Acoustic boards shall be of low density and specially designed (often with perforated surface) to increase sound absorption.

- Straw Board:-

Straw boards shall be made of straw compressed and formed into slabs fifty (50) mm thick by heat and pressure and with proprietary paper glued to the sides. Edges too shall be bound with paper. The slabs shall be fairly stiff and shall have thermal conductivity (k) of 0.6.

b) Chip Board (Particle Board)

Chip boards shall be made of wood particles in the form of chips or shavings of a controlled size combined with a thermo setting synthetic resin glue binder and formed into panels under the influence of mechanical pressure and heat. The process of adhesion shall be controlled resulting in a variety of boards with different but predictable physical properties. Chip Board, if specified herein, shall be used in sheathing, flooring and sub-flooring wall paneling, partitions, shelves, furniture and veneered boards. The same shall not be influenced or affected dimensionally by changes in atmospheric humidity, though in wet conditions, the same shall have a limited resistance to moisture.

The surface finish of standard boards shall be comparatively rough and to support good quality paint or varnish finish, the same shall require sanding and filling. Special grade of the board which has a paper surface permanently bonded to the board during manufacture shall be used for painting.

Chip boards shall be classified in grades of high, medium and low density mainly in thickness of thirteen (13) mm and nineteen (19) mm. The density range of this board is from 480-800 Kg per cubic meter (m^3).

8.1.5 ADHESIVES

For joinery work, animal glues conforming to or complying with B.S:745 or synthetic resin adhesive complying with B.S:1204 shall be used. For flush doors and other forms of construction that rely mainly upon the adhesive, and particularly where exposure conditions are severe and prolonged dampness is likely to occur, one of the more moisture resistant adhesive shall be applied or employed, the choice depending upon the severity of the conditions to which the work will be exposed.

8.1.6 HARDWARE

i) Nails and Screws

For joining work, wire nails oval, chequered head, lost head round or panel-pins complying with BS: 1202, or wood screws in conformity / accordance with BS: 1210 shall be used. The gauge of nail or screw used shall be suited to the woods being fixed and to which a fixing is being made, and the length shall be such as will provide a sufficiently strong and secure fixing. CP: 112 shall be followed which provide relationship between gauge, amount of penetration and strength. All nails and screws used with reactive timber (becoming stained and disfigured by reaction with ferrous metals) shall be of non-ferrous metals or shall be provided with protective coating before use if the woodwork is likely to be subject to moist conditions, e.g. external doors.

ii) Finish Hardware

Hinges, tower bolts, handles, locks, catchers, stoppers, railings, supports, appurtenances, fixings, steel railings / channels, fittings and all other items considered as finish hardware and approved by the Project Manager.

8.1.7 CARPENTRY & JOINERY

Whereas carpenters work shall cover or include (without limitation) all work on timber used in roofs, floors, verandas, stair-cases, doors and windows, frames, bridges, cantering, shores, struts, large gates and generally all wood work of which the scantling exceeds eight (8) mm, except in case of battens used in roof trellis work which is specially moulded or carved: joiners work shall cover or include (without limitation) furniture, doors & windows turned and carved or moulded work of ail kind. For both types of works, all wrought timber shall be sawed, planed, drilled or otherwise machined or worked to the correct sizes and shapes required.

Unless otherwise specified herein, all joints shall be simple tenon and mortise joints with the ends of tenons exposed to view. All mortise and tenon joints or scarps shall fit truly and fully without filling. Thus the joiner shall perform all necessary mortising, tenoning, grooving, matching, tonguing, rebating and all other works necessary for correct jointing. The Contractor shall also provide or furnish all metal plates, screws, nails and other fixings that may be necessary for the proper execution of the joinery works specified herein. The joiner shall also carry out or execute all works necessary for the proper construction of all framing, lining, holdfasts and other contrivances in accordance with the specific requirements of architectural details and/or instructions of the Project Manager for their adequate support and fixing in the building.

Loose joints shall be made where provision is required to be made for shrinkage or other movements acting in the direction other than that of the stresses because of loading. Glued joints shall be used where provision need not be made for shrinkage or other movements in the connection, and where sealed joints are required. All glued joints shall be cross-tongued or otherwise reinforced. All nails, springs and the like, shall be punched and puttied. All cutting edges of tools shall be sharp to avoid burnishing.

All woodwork, as far as reasonably practicable, shall be assembled in shop, finished and prime coated before delivery for fixing. In addition to machine sanding, al woodwork shall be smoothed by hand using "00" sand paper to have the required smooth surface, free from machine and tool

marks, abrasions, raised grains and other un-desirable damages and defects therein. All woodwork shall be fitted to plaster and other finished work in a careful workmanlike manner so as not to injure these surfaces. Where plaster or other work is damaged or disturbed, the same shall be restored or reinstated to its original state by the Contractor at no additional cost or extra cost.

All woodwork shall be neatly finished to the exact dimensions specified herein. All nails and screws shall be of approved type. Holes of correct size shall be drilled before inserting screw. Hammer shall not be used for driving in or starting in the screws. All screws shall be dipped in oil before the same are inserted in the wood. The heads of nails or screws shall be sunk and dealt with as directed or instructed by the Project Manager.

The Contractor shall provide at least seven (7) days' notice to the Project Manager in writing where any timber is to be covered or included in the ground or in walls or otherwise. Failing this, the Project Manager may order or require the same to be uncovered at the Contractor's cost and risk.

Ply wood shall be worked upon by all normal wood working tools both hand and machine and shall be fixed by panel pins, screws, rivets, gluing, grooving, into framing, tonguing and grooving and by metal tooth plate or split ring connectors, for exterior work, galvanized and copper nails and also water-proof adhesives shall be used or employed.

The door and window frames shall be secured or ensured in place by means of corrugated anchors of non-ferrous metal or galvanized ferrous metal bent up against the back of the jambs and screwed in place and built into the masonry as the same is being constructed. There shall be one (1) such anchor near the top and bottom of each jamb at not over nine hundred (900) mm intervals between the top and bottom anchors. Frames shall be secured to the anchors by means of nine (9) mm diameter bolts or screws-extending through the frames, heads of bolts or screws shall be counter sunk and covered with the stops, which shall be screwed in place.

8.1.8 FITTING, HANGING & TRIMMING

- i) All Woodwork shall be fitted, hung and trimmed as indicated or envisaged on the Drawings. One (1) sample of each fitting to be used shall be deposited by the Contractor in the office of the Project Manager. Hinges shall be counter sunk into the frames. The recesses being cut to the exact size and depth of the hinge. No subsequent packing shall be allowed. Brass screws shall be used with brass fittings unless otherwise specified herein. Hardware shall be fixed as specified in the Drawings, Locks and other hardware items shall be fixed at heights as shown on the Drawings or as directed or instructed by the Project Manager.
- ii) Items of hardware specified or envisaged in the Drawings shall be carefully fitted and securely attached on completion of the work. Hardware shall be shown or demonstrated to work freely; keys shall be fitted into their respective locks and upon acceptance of the work, and keys shall be tagged and delivered in duplicate to the Project Manager.
- iii) An air space of six (6) mm shall be left along sides of wooden battens and other wood work buried in masonry work.
- iv) As a precaution against fire, no wood work shall be fixed within 0.6 m of the interior face of a chimney flue.

8.1.9 DEFECTIVE WORK

The Contractor shall be liable or responsible for the easing or otherwise of all doors and the like; and closing down of all open joints which may occur within maintenance period work and which in the opinion of the Project Manager of works required attention. Should any shrinkage or warping occur or any other damages or defects appear in the joiner's work, before the end of Maintenance Period or Defect Notification Period (DNP), such damaged or defective work shall be taken down and replaced to the satisfaction of the Project Manager and any other work disturbed shall be made good or repaired at the Contractor's cost and risk.

8.2 WOODEN DOORS AND WINDOWS

8.2.1 QUALITY OF MATERIALS AND WORKMANSHIP

Unless otherwise specified herein, the quality of materials & workmanship for doors and windows shall conform to or comply with 9.1 for Wood Work (General) in all respects, except those specified hereunder. All the doors and frames shall be polished after transportation at the site and approval of the Project Manager in charge.

8.2.2 SIZE OF DOORS & WINDOWS

The size of doors and windows shall be as shown or envisaged on the Drawings as specified herein and/or as directed or instructed by the Project Manager.

8.2.3 CHOWKAT, FRAMING & CORNERS

Chowkats shall be properly framed and mortised together. Door and window chowkats shall have 11.5 cm wide horns left on the heads (also on sills where these are provided) or the corners of the chowkats bound with 6.5 cm by 2.5 mm iron straps bent into a right angle having legs of a length equal to the depth of the chowkats, and fixed with four 5 cm screws. The cost of horns or straps shall be covered or included in the unit price and rate. Unless otherwise specified herein, the latter method shall be adopted.

8.2.4 REBATES

Chowkats shall have a rebate cut to receive the leaves. The rebate shall be 13 mm deep and its width shall be equal to the thickness of the leaf. The other side shall be finished with a bead and quirk, or other simple molding unless wire gauze is to be fitted. Where the plaster butts against the chowkat 13 mm deep rebate with a slight cut back shall be provided or furnished to serve as key to the plaster.

8.2.5 POSITION OF CHOWKAT IN JAMBS

Unless otherwise specified herein, doors and windows opening to another room to a corridor or verandah, shall have the chowkats so fixed that they project ten (10) mm from the plastered face of the wall.

The plaster shall stop against the chowkat which shall have the rebate mentioned or specified in the above paragraph as key for the plaster.

Other doors and windows shall be set back 11.5 cm from the face of the wall.

In the case of doors and windows in dhujji walls, the depth of the chowkat shall be equal to the thickness of the wall and the faces flush with the plaster.

8.2.6 CHOWKAT PAINTING WITH PRESERVATIVES

No chowkat shall be painted or fixed before the Project Manager as and when necessary. The same shall be inspected and approved by the Project Manager. All chowkats shall be ready before the work reaches the sill level so that the same can be built in as brick/block work or masonry proceeds.

Before fixing, chowkat shall have the side in contact with the brick/blockwork or masonry painted with two (2) coats of hot soignunr creosote, coal tar or other wood preservatives approved or permitted by the Project Manager. If doors and windows are to be subsequently painted, the priming coat shall be painted on the chowkats before the same are fixed.

8.2.7 HOLD FASTS

Chowkats shall be secured or ensured to the brick/block work or masonry by holdfasts which shall be built into the wall with specified mortar. Hold fasts shall be made 38 mm x 7 mm flat steel Patti bent over at both ends leaving thirty-three (33) cm clear length between bends; one (1) bend shall have two (2) screwed holes to which the chowkat is secured by bolt thirteen (13) mm in diameter. The head of the bolt shall be sunk into the chowkats and the hole plugged, with wood. Where the chowkat is fixed at the extreme edges of the jambs, the hold fasts shall be worked or bent as directed or instructed by the Project Manager. The number of holdfasts to each chowkat shall be as indicated or specified, with the exception that, where no sill has been provided, one (1) additional hold fast shall be given on each side. The feet of the chowkat shall, in this case, rest on the damp proof course or floor, as the case may be.

8.2.8 METHOD OF FRAMING LEAVES

All stiles and rails shall be properly and accurately mortised and tenoned. The thickness of the tenon shall not exceed one-fourth (1/4) the thickness of the plank and the width shall not exceed five (5) times the thickness. All rails over 17.5 cm in depth shall have double tenons. All tenons shall pass completely rough stiles and shall be secured or ensured by ten (10) mm hard wood or bamboo pins. All rails shall be haunched to the depth of groove for panels.

8.2.9 GLUING

All tenons at the final assembly of the doors shall be glued and wedged at top and bottom of the tenon with glued wedges. Immediately after gluing, the frames shall be tightly clamped and so left till the glue has set.

8.2.10 HINGES

Unless otherwise specified herein, leaves shall be hung on hinges of the size and the number specified. These hinges are to be of an approved type and quality. The same shall be counter sunk into the chowkat as well as in the leaf; the recesses being cut to the exact size and depth of the hinge, no subsequent packing shall be allowed. Five (5) cm screws shall be used with thirteen (13) cm to one hundred and fifteen (115) cm hinges and four (4) cm for smaller sizes.

8.2.11 SPECIAL DOOR FURNITURE

Where special ironmongery or door furniture is required, the same shall be supplied or furnished by the department, or provided by the Contractor at an extra cost and risk. The cost of fixing or mounting such special furniture shall, howsoever, be covered or included in the unit price and rate. The cost of fittings superseded by the special ones, and thus not actually supplied, shall be deducted or decreased from the sum paid for wood work.

8.2.12 SCREWS

Screws of such diameter shall be used as fill completely the holes and cups in the fittings which the same secure, and shall be oiled before being inserted. Unless the head can be counter-sunk flush with the fittings, round headed screws shall be used. Brass fittings of specified type shall be secured with brass screws.

8.2.13 CHOCKS

Hinged chocks shall invariably be fitted to all doors and windows to keep them open Chocks shall be of hard wood and swung on three (3) inches bet hinges and shall act on a sheet metal protector fixed to the door stile.

8.2.14 STOPS

Wooden stops of a size suitable for the leaf concerned shall be fixed to the door or window chowkats so as to avoid or prevent the leaf from damaging the plaster of the jamb when fully opened.

8.2.15 LOCKS

The door locks (mortise/handle locks and other required as per drawings & BOQ) shall be of brass material or stainless steel best quality as approved by the Project Manager.

8.3 PANELLED AND GLAZED WOODEN DOORS AND WINDOWS

8.3.1 SCOPE

Unless otherwise specified herein, these shall conform to or comply with Specification No. 9.1 for wood work General and Specifications for wooden doors and windows 9.2 except those specified hereunder.

8.3.2 DESIGN

Unless otherwise specified herein, the paneled and glazed doors and windows shall conform to or comply with the design shown or envisaged in the Drawings.

i) **Paneled doors**

Paneled doors shall be provided or furnished in accordance with the specific requirements (Part I or British Standard Specification No. 459 with the additional requirement that panels in exterior openings shall be assembled or furnished with waterproof glue. Loose beads shall be provided or furnished for holding glass. Ends of lower blades shall be set into edges of door stiles, glued and tacked in place.

ii) **Flush doors.**

Flush doors shall be provided or furnished with plywood as specified herein. The same shall be synthetic resin bonded plywood suitable for both internal and external flush doors.

8.3.3 DIMENSIONS

Unless otherwise specified herein, the dimensions of paneled and glazed doors and windows shall be as shown or envisaged on the approved Drawing, as specified herein and or as directed or instructed by the Project Manager

8.3.4 DOOR FRAME

- i) The members shall be joined with close fitting mortise and tenon joints which shall be further pinned with corrosion resisting metal pins of not less than eight (8) mm diameter or with hard wood pins whose diameter shall not be less than ten (10) mm. The framing shall be such as to secure or ensure complete rigidity throughout.
- ii) The entire surface of frame coming in contact with masonry shall be treated with a preservative of an approved type and quality.
- iii) The frame thereof shall be fixed to the masonry with at least four (4) hold fasts. Two (2) additional hold fasts shall be used if the chowkat is without a sill.

8.3.5 SHUTTER FRAME

The stiles and rails of the frame shall be mortised and tenoned together. The thickness of each tenon shall be approximately 1/3rd the thickness of the rail, and the width of each tenon shall not exceed fifty-five (55) times its own thickness.

8.3.6 PANEL

- i) Panels shall be made of solid wood or hard board or water resistant plywood having both sides properly finished. The same shall be truly cut and framed into rebates to a depth not less than ten (10) mm. Their thickness shall not be less than twelve (12) mm; in case of plywood and hard board, the same shall not be less than 7.5 mm. Panels shall be in one (1) piece up to thirty (30) cm clear in case of deodar and forty-five (45) cm clear in case of teak. In larger sizes. The same shall be jointed, but the joints shall be glued and doweled together to avoid or prevent all possibilities of its opening out afterwards.
- ii) Panels shall be absolutely smooth so that no marks are visible. Unless otherwise specified herein, panels shall be splayed and fielded on both sides and the arises of the frame receiving the panels finished with a simple mould.

8.3.7 SASH BARS

Sash bars shall be of the same thickness as the leaf and shall be twenty-five (25) mm to thirty (30) mm wide, according to the size of the doors, and shall be twice moulded and twice rebated and mitred on the outside. The size of the rebate shall be 9 mm x 12 mm to receive the glass and its fittings.

8.3.8 GLAZING

All glazing shall be provided in accordance with the specifications 9.7 for glazing. If specified herein, the doors and windows of bedroom and bathroom shall be glazed with blind glass up to full eye level. The glass panels of appropriate sizes shall be fitted into 9 mm rebates and shall be retained in position with a thin layer of putty which shall be covered with wood beading.

8.4 WIRE GAUZED DOORS

8.4.1 MATERIALS

Unless otherwise specified herein, leaves of wire gauze doors shall be made from deodar, irrespective of the wood used in making the chowkats or the other leaves hung from the same chowkat.

8.4.2 CHOWKAT

Wire Gauzed doors shall normally be hung on the same chowkat as other doors, and the rate shall cover or include the provision of extra depth in the chowkat to take the rebate for the wire gauze leaf. Where wire gauze doors are hung on a separate chowkat a special rate shall be settled.

8.4.3 WIRE GAUZE

Unless otherwise specified herein, wire gauze shall be of best quality and uniformly woven wire webbing 12 x 12 meshes to the 6.45 sq. cm made from 22 gauge galvanized iron wire. All wire gauze panels shall be in one (1) piece, no joints being allowed in the gauze.

8.4.4 FIXING

Wire gauze shall be fixed to the frame of the leaf after being stretched from out to out of rebate and nailed down taut by nails spaced at not more than five (5) cm and then fixed that by a fillet of 19 mm x 19 mm screwed into a rebate of that size. The screws shall not be less than three (3) cm in length, nor spaced further than 22.5 cm. All exposed arises of the fillet shall be finished with a small neat mould.

8.4.5 SPRING HINGES

Unless otherwise specified herein, all wire gauze doors shall be hung on self-closing spring hinges which shall be of an approved quality.

8.4.6 DOUBLE DOORS TO PROJECT

All double leaf wire gauzes doors shall close with the meeting stiles butting against each other a felt or niwar strip being fixed to one (1) leaf to close the joint. The leaves shall close to such an extent that the junction projects from the face of the chowkat, the projection being twenty-five (25) mm for each thirty (30) cm width of leaf. The top of the chowkat (and sill when the same has been provided) shall be enlarged to a corresponding wedge shape the cost of this being covered or included in the unit price and rate.

8.4.7 MATCHING INNER LEAVES

Unless otherwise specified herein, the width and position of lock and bottom rails on wire gauze doors shall be the same type as those of the other leaves hung on the same chowkat.

8.4.8 OTHER RESPECTS

In all other respects, the same shall conform to or comply with Specifications No. 9.2 for Doors and Windows (General).

8.5 WIRE GAUZED WINDOWS

- i) Where moveable wire gauze flaps or leaves are provided to windows, Specifications No. 9.8 for Wire Gauzed Doors shall be followed with the following modifications. .
- ii) Wire gauze windows shall not be provided or furnished with springs or spring hinges.
- iii) Double hung wire gauze windows shall close flush with the chowkat without the meeting stiles projecting in any way.
- iv) Unless otherwise specified herein, wire Gauzed windows shall open outwards and shall be provided or furnished with hinged chocks to keep the same in the open position, and with stops to avoid or prevent damage or defect to plaster.

8.5.1 OTHER RESPECTS

In all other respects, the same shall conform to or comply with Specifications No. 9.2 for doors and windows (General).

8.6 FIXED WIRE GAUZE

8.6.1 WIRE GAUZE

Unless otherwise specified herein, the wire gauze shall be of an approved quality, uniformly woven, wire webbing of 12 x 12 meshes to 6.45 sq. cm made from 22 gauge galvanized iron wire. All panels shall be in one (1) piece and no joints shall be allowed or permitted in the gauze.

8.6.2 METHOD OF FIXING

Wire gauze shall be fixed to the outside of the chowkat. This shall be drawn taut to the full width of the chowkat and nailed down by nails spaced not more than five (5) cm and a cover strip. Nineteen (19) mm in thickness and of the same width as the chowkat so as to seem a part of the chowkat, fixed all round with three (3) cm screws fixed not more than twenty-three (23) cm apart.

8.6.3 ALTERNATIVE METHOD

If specially required or instructed by the Project Manager, the wire gauze shall be fixed to the chowkat by a fillet, 19 mm x 19 mm, screwed into a rebate of the same size. The wire gauze shall be stretched taut and nailed down by nails spaced not more than five (5) cm to the chowkat, and then the fillet screwed down with twenty-five (25) mm screws spaced not more than 22.5 cm apart.

8.6.4 FINISHING RATE

Exposed arises shall be finished with a small but neat mould in each case. The rate shall be the same for either method of fixing.

8.7 GLAZING

8.7.1 SCOPE

The work shall cover or include furnishing of all materials, labor, equipment and services to complete installation and setting up of glass, glass blocks and poly-glass glazing as specified or envisaged on the drawings and/or as directed or instructed by the Project Manager.

8.7.2 MATERIALS

i) Glass:-

Unless otherwise specified, all glass shall be flat sheet glass of fine quality known in the trade as "seconds". Glass shall be of the following thickness or as specified in the drawings for the various sizes mentioned below for each frame section. The following glass thicknesses are for individual frame size not for the whole door/window/ventilator. If dimensions of the frame section differs than the below mentioned, the thickness shall be provided based on the area.

- a. Equal or Less than 90cm x 90cm (5 mm thick)
- b. Exceeding 90 cm x 90 cm but less than 180 cm x 180 cm plate glass (6.5 mm thick)
- c. Exceeding 180 cm x 180 cm (12 mm thick)

Glass shall be free from specks, bubbles, distortion and flaws of every kind, and shall be properly cut to fit the rebates, so as to leave a uniform space of 1.5 mm all-round the panes between the edge of the glass and the rebate.

ii) Poly Glass:-

All 'Poly Glass' shall be high quality transparent, colorless, polycarbonate sheets conforming to ASTM D-4802 material, and shall possess the following characteristics / properties:

Glass shall be free from specks, bubbles, distortion and flaws of every kind, and shall be properly cut to fit the rebates.

8.7.3 PUTTY (METHOD OF PREPARING)

Putty shall be prepared from pure raw linseed oil and best whiting, specially dry and ground fine to pass a sieve of 45x45 meshes to 645.16 sq. mm. The two (2) shall be well mixed by hand and kneaded into a stiff paste. The same shall then be left for twelve (12) hours and worked up in small pieces till the same becomes quite smooth. If the putty becomes dry, the same shall be restored or reinstated by heating and working the same up again while hot where the rebate is small a little white lead shall be added in making the putty. Putty required for glazing large panes or for bedding plate glass shall be made with a mixture of linseed oil and tallow with whiting so as to make it pliable and capable of standing expansion of the panes. Where required or instructed, putty shall be colored to match the wood work.

8.7.4 PAINTING OR PRIMING REBATES

If rebates have not been painted, the same shall be well primed with boiled linseed oil to avoid or prevent the wood from drawing oil out of the putty. Putty shall be painted at the same time and the same number of coats as wood work.

8.7.5 FIXING GLASS WITH PUTTY

Each pane of glass shall then be bedded on a thin layer of putty called "back putty" and secured into position with proper glazing springs or nails. "Front Putty" shall then be applied chamfered and finished off neatly so as to secure or ensure that the depth of the putty is exactly equal to the rebate.

8.7.6 FIXING GLASS WITH WOOD FILLETS

In the case of all panes exceeding thirty (30) cm in width, front putty shall not be used but the glass secured with fillets of wood, without extra cost or additional cost. The fillets shall be plain or moulded and of a size depending on the type of door being glazed. The glass shall be protected from contact with the wood by putty made with tallow to act as a cushion.

8.7.7 FIXING BLIND GLASS & POLY GLASS

i) Blind Glass

Where blind glass is fixed, the frosted face shall be away from the putty.

ii) Poly Glass

- a. Poly glass glazing shall be carried out strictly in accordance with the suppliers / manufacturer's instructions or recommendations.
- b. Glazing channels, stops and rabbits shall be thoroughly cleaned before receiving glazing materials
- c. The glass shall be protected or safeguarded from damage and shall be stored in strict accordance with the manufacturer's instructions or recommendations.
- d. The glass shall be cut to conform exactly to the shape and sizes shown or envisaged on the drawings.

8.7.8 PUTTY (COMING OFF)

All glass that has been fixed by the Contractor shall if the same becomes loose during the period specified in the contract, be refixed and puttied by him at his own cost and risk.

8.7.9 CLEANING AND FINISHING

No glazing shall be considered complete until or unless all paint and other stains have been removed from the surface of the glass. Glass shall be cleaned and polished with pads of damp newspaper, and then with a clean dry soft cloth (unsized) Cleaning shall be finished by two (2) men working on opposite sides of the same pane at the same time. The Contractor shall make good or reinstate ail glass broken by his workers while cleaning the glass. On completion of the work, all doors and windows shall be cleaned, damaged putty or glazing repaired and the whole work left perfect with a workmanlike finish.

CHAPTER-9
PAINTING AND VARNISHING

Chapter-9: PAINTING AND VARNISHING

9.1 GENERAL

9.1.1 SCOPE

- i) All painting and/or varnishing required to be performed or carried out under these specifications shall be completed in conformity / accordance with the applicable or specific requirements herein set forth including (without limitation) furnishing of labor, materials, equipment, accessories, surface preparation, mixing and applying paint or varnish / khaki mixture, bitumen or coal tar / creosote / solignum, polishing, finishing of concrete masonry surfaces, woodwork, metal work, structural steel, pipes, valves, regulation gates and all such surfaces as are shown or envisaged on the Drawings, specifications and/or as directed / instructed by the Project Manager, and the protection of the completed work until accepted or approved by the Project Manager. The provisions and requirements herein set forth shall apply to all items, above stated, unless specifically modified or rectified by the Project Manager for any particular item of work.
- ii) The Contractor shall furnish and apply all materials for cleaning, painting, coating and protecting gates, frames, hoists, structural steel, steel pipe, miscellaneous metal work and all other equipment and materials as specified herein.
- iii) The Contractor shall repair or make good at his own cost and risk all damaged or defective areas of shop-painted equipment, woodwork, metal work and the like. Metal surfaces against which the concrete is to be placed shall be provided or furnished shop-painted and shall be cleaned prior to being embedded in concrete. Galvanized surfaces and non-ferrous metallic surfaces shall not require painting except where such surfaces are specially noted to be painted.
- iv) Unless otherwise specified herein, no painting shall be finished during wet, foggy or dusty weather or in the direct rays of the hot sun.

9.1.2 INSPECTION, SAMPLING AND TESTING

(i) General

The Contractor shall prepare or submit samples of the materials in ample quantity for inspection and tests. If the Project Manager instructs or requires material to be tested, this shall be done by the Contractor at his own cost and risk from a laboratory approved or permitted by the Project Manager.

(ii) Drying Time

The paint, after complete removal of any surface skin, shall be well mixed by shaking and/or stirring, as may be necessary. The mixed paint shall then be brushed out on a clean non-absorbent surface such as a piece of glass 15 cm x 15 cm, and exposed in a vertical position in a well-ventilated room at thirty-five (35) to forty (40) degrees Centigrade. The painted surface shall be illuminated by diffused day light for at least six (6) hours during the drying period. To avoid or prevent interference through excessive humidity, the temperature of the room shall remain above the dew-point, throughout the drying process. The paint when tested in the above manner should not become "Surface Dry" in less than two (2) hours and shall become "Hard Dry" in not more than twenty-four (24) hours. (Paint is "Surface Dry" when clean, dry silver particles passing U.S. 45 sieve and retained on 100 sieve, sprinkled on to the surface of the paint and allowed to remain there for one (1) minute, shall be removed with a camel hair brush without injury or damage to the paint film. Paint is "Hard Dry" when a second coat of paint could be satisfactorily applied over the same.)

(iii) Color, Opacity, Finish and Consistency

The paint film, after drying for forty-eight (48) hours shall match in color, opacity and finish (i.e. gloss smoothness of surface, freedom from runs, specks, and the like.) with a film prepared in the same way at the same time from an approved sample.

(iv) Fastness of Color Exposure

Direct exposure (i.e. glass not intervening) to bright sunlight for one hundred (100) hours shall be a sufficiently good test for fastness of color to exposure. In the absence of such sunlight. The paint film shall be exposed to standard lamp for eighty (80) hours. The change of color of the direct paint film shall not be greater than that of a film of an agreed sample tested in the same manner at the same time.

(v) Water Contents

The paint shall not contain more than 0.5 percent of water. The flash point (Abel Close test) shall not be below 32.3 degree Centigrade.

9.1.3 PROPERTIES OF PAINTS

(i) Compounding

All materials shall be compounded by the manufacturer only and shall not be adulterated by the Contractor except for approved activating, thinning and mixing as approved by the Project Manager.

(ii) Condition in Containers

The product shall be thoroughly mixed and ground. It shall not be settled, caked or thickened to such a degree that it cannot be mixed easily with a paddle be stirring to a good uniform brushing consistency.

(iii) Flexibility

Paint shall show no evidence of cracking, chipping, flaking and holiday (as areas has no paint).

(iv) Skinning

Paint shall not skin (form a thin membrane surface at the top of the liquid) within forty-eight (48) hours in a filled closed container.

(v) Odour

Paint in the container, during and after application, shall not be abnormally pungent, offensive or disagreeable.

(vi) Working Consistency

Paint shall show easy brushing, good flowing and spreading, and good leveling properties. These properties shall be demonstrated on test specimens at the request or instruction of the Project Manager. Coats that have shown poor or fair spreading and flowing properties shall not be acceptable or permissible.

(vii) Appearance of Painted Surfaces

Paint shall dry to a uniform, smooth, flat appearance under ordinary conditions of illumination and wearing. There shall be no laps, skips, high-lighted spots or brush marks. Tinted paints shall dry to a uniform color.

(viii) Self-Lifting Properties

Recoating of a previous painted surface shall produce no lighting, softening or other film irregularities

(ix) Quality

All materials shall be acceptable, proven, top or high grade products and shall meet or exceed the minimum standards of reputable manufacturers as approved or permitted by the Project Manager. Paint material shall be M/s ICI, M/s Nippon paint or equivalent approved.

(x) Color

The color of the paint shall match or meet the approved sample and color shall be pure, shall have non-fading pigments shall be mildew-proof, sun-proof, and finely ground in approved medium Colors used on the plaster and concrete surfaces shall be lime-proof. All materials shall be subject to the Project Manager's approval or permission.

9.1.4 SELECTION OF PAINTS

(i) Woodwork

- a) **Exterior Surfaces:** Ready mixed, linseed oil vehicle type pigmented paints shall be used on exterior wood surfaces which are dry. Acrylic resin latex paints, if specified herein, shall be used on new wooden surfaces which have small amounts of moisture.
- b) **Interior Surfaces:** Where pigmented paints are specified, quick drying varnish, paints or alkyd vehicle paints shall be used or full gloss enamel paints in variety of colors shall be used as specified herein Where clear coating on interior woodwork is required, varnish, lacquer, bleached shellac, wax polish or spirit polish, whichever specified, shall be applied.

(ii) Metalwork

- a) **Underwater Exposure:** For metalwork which remains under water or buried in the ground, hot applied coal tar enamel coating shall be given on external surfaces and where specified on internal surfaces.
- b) **Air and Water Exposure:** For intermittent sun and water exposure, the metalwork shall be provided or furnished with a two (2) component coal tar epoxy paint coating and top coated with sunlight resistant aluminum pigmented paint. Vinyl resin paints, phenolic red lead with aluminum paint overcoat, zinc coating or hot-dip galvanizing shall be applied to such metalwork wherever specified herein.
- c) **Outside Atmospheric Exposure:** Metalwork which is exposed to outside weathering involving only the action of sunlight, air and normal precipitation shall be protected by aluminum finish or enamel finish paints after priming.

(iii) Concrete and Masonry (plastered)

- a) **Exterior Surfaces:** Acrylic based weather resistant paint for exterior surfaces (weather shield) shall conform to BS EN 1062 or as recommended by the manufacturer and the same approved by the Project Manager.
- b) **Interior Surfaces:** Where white washing is specified herein, unslaked lime and marine blue shall be used. For color washing pigment as directed or instructed by the Project Manager shall be mixed in the white wash. No additional cost for pigment will be made to be added in the white washing.

Synthetic polyvinyl distemper paint shall be used if specified on internal surfaces in ready mixed shades as approved or instructed by the Project Manager.

Plastic emulsion paint or similar as approved or permitted by the Project Manager shall be applied wherever specified

- c) **Bitumen Paint:** The material for bitumen painting shall consist of bitumen with penetration from 10 to 20 at 25 degree centigrade. It shall be used in foundations or wherever recommended by the Project Manager.
- d) **Antimicrobial paint:** It shall be as per manufacturer recommendations.

9.1.5 PRIMERS

(i) Ferrous Metalwork

Red lead priming paints so as to avoid or prevent rust shall be used when metalwork is exposed to weather when surface is not perfectly clean boiled linseed oil shall be used or applied in ordinary atmospheric conditions

When exposed to excessive moisture phenolic vehicle primers shall be used

(ii) Woodwork

Semi-gloss enamel paint thinned with turpentine or mineral spirits shall be used or applied for interior surfaces.

Enamel paint thinned with twenty-five percent (25%) volume of mixture having two (2) parts of boiled linseed oil and one (1) part turpentine for optimum wearing quality shall be used both inside and outside.

(iii) Concrete and Masonry

Boiled linseed oil or silicone water repellent primers shall be used on concrete and masonry/plastered surfaces. Before application of paint concrete and masonry plastered surface shall be allowed or permitted to dry for at least three (3) weeks after cessation of curing.

9.1.6 FILLERS, SEALERS ETC.

(i) Fillers

- a) **Woodwork:** Glaziers putty on general woodwork, litharge and glue for varnished timbers and bees wax for polished surfaces shall be used.
- b) **Concrete Masonry:** Paste of zinc oxide and varnish thinned with turpentine shall be used as filler on masonry/plastered and concrete or as recommended by the manufacturer and the same approved by the Project Manager.
- c) **Steel Work:** Epoxy resin with metal powder shall be used for surface preparation of metalwork.

(ii) Sealers

- a) **Woodwork:** Rubber based caulking material shall be used for sealing joints and cracks and polishing type wax for finishing woodwork.
- b) **Concrete and Masonry:** Water insoluble and water repellent substances dissolved in solvent such as petroleum naphtha or the special clear silicone compounds shall be used to seal masonry plastered surfaces or as recommended by the manufacturer and the same approved by the Project Manager.

(iii) Solvents

- a) **Steelwork:** Mineral spirits, low boiling petroleum naphtha, xylem and low boiling coal tar naphtha shall be used or applied as cleaning solvents. Benzene-benzyl and high boiling fractions such as kerosene shall not be used nor applied.
- b) **Wood and Masonry/plastered:** Mineral spirits and turpentine shall be used or applied as solvents in ordinary oil and varnish vehicle paints. Water shall be used as solvent for emulsion paints, whitewash, distempers and cement based paints.

(iv) Color Pigments

These shall be pure, non-fading and finely grounded with particle size ranging from 0.0001 to 0.006 mm (at least 99 percent passing Sieve No. 325). The particles of the pigment shall be in a completely wetted condition and fully dispersed in the vehicle. They shall not change their color when exposed to heat, sun rays or acid-laden atmosphere.

(v) Dies

Dies shall not be used without Project Manager's approval.

(vi) Thinners

Thinners such as turpentine, mineral spirit, water, xylem and linseed oil of approved quality shall only be used or applied in accordance with the manufacturer's instructions or recommendations and with prior approval or permission of the Project Manager.

(vii) Brushes

All brushes used for painting work shall conform to B.S 2992 or equivalent American Standards.

9.1.7 SURFACE PREPARATION

- i) Hardware, hardware accessories, machines, plates, lighting fixtures and similar items in contact with painted surfaces and not to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Such removal shall be finished by workmen skilled in the trades involved.
- ii) Exposed nails and other ferrous metal on wooden and masonry surfaces to be painted with water-thinned paints shall be spot primed with basic lead silicon chromate primer.
- iii) Oil and grease from metalwork shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning, except when sand-blasting is employed. Cleaning solvents shall be as specified. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process shall not fall on wet or newly painted surfaces.
- iv) Concrete / plastered surfaces to be painted shall be prepared by eliminating or removing efflorescence, chalk, dust, dirt, grease, oil asphalt, excessive mortar and mortar droppings by using metallic scrapers and wire brushes if appropriate or necessary, and by roughening to remove glaze. Alkali salts shall be removed by washing with a five (5) to ten (10) percent solution of muriatic acid, allowed to stand until efflorescence ceases, and then rinsed with clean water to remove all traces of acid. Concrete surfaces shall be washed with zinc sulphate solution. Treated surfaces shall be allowed or permitted to dry thoroughly before application of paint. Surface deposits of free iron shall be cleaned and removed prior to painting. Alternatively, if the efflorescence on the plaster and concrete surface occurs, it shall be removed with a dry cloth or brush followed by wiping with a damp cloth wrung out frequently in clean water avoiding excessive wetting.
- v) If the efflorescence on the plaster and concrete surface occurs, it shall be removed with a dry cloth or brush followed by wiping with a damp cloth wrung out frequently in clean water avoiding excessive wetting.
- vi) Concrete and metal surfaces which are to receive coal tar epoxy paint coating shall be acid etched or lightly sand blasted. Plastered surfaces shall not be acid etched or sand blasted.
- vii) Prior to application of primer, all existing holes, dents, gouges, marks, scratches and other surface imperfections in concrete surfaces / plastered surfaces, and all cracks which cannot be covered adequately with a smooth coating, free of porosity, shall be filled with a mixture of the basic primer or coating material and a finely powdered filler, such as one hundred (100) mesh of finer sand or Portland Cement (if compatible with the coating) or with a proprietary filler and bonding compound specified by the manufacturer or supplier. This shall apply also to holes and imperfections opened up by etching or sand blasting. Imperfections shall be filled smooth and flush and rough areas and projections sanded. If the repaired surface is more than one (1) mm below the surface of the surrounding concrete, the same shall be refilled flush with the surface and sanded.
- viii) All grooves around flanges of penetrations, grooves in construction joints and other joints which are in areas to be coated and which are required to be caulked shall be caulked before priming of concrete. If such grooves are not filled flush with the surface, primer or coating shall not be applied over them until or unless they have been made flush.

- ix) At all floor to wall joints where the floor is to be coated or lined, an epoxy filleting compound shall be applied to the joint so as to form a smooth fillet of twenty-five (25) mm minimum radius. The floor coating or lining system shall then be applied to cover the fillet.
- x) In case of damp wall, prior to application of paint, primer coating 12-8 comprising the following ingredients shall be applied, unless otherwise specified herein. Take paraffin ten (10) liters, benzoline eight (8) liters, pale resin five and half (5.5) kilograms in a vessel and shake them well. When completely dissolved add ten (10) kilograms whiting and grind the whole mixture thoroughly. This mixture shall be kept airtight so as to avoid or prevent drying and one (1) or two (2) coats, depending upon the dampness of the wall, shall be applied as ordinary paint. On drying up hard, any suitable variety of paint shall be applied.

9.1.8 MIXINGS, THINNING

At time of application, paint shall show no signs of hard setting, excessive skinning, livering or other deterioration. Emulsion paints shall be protected from exposure to cold weather by keeping in shelters so as to avoid or prevent freezing of the paint. Paint shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Paints of different manufacturers or suppliers shall not be mixed together. Where necessary to suit conditions of surface, temperature, weather, and method of application, packaged paint other than block filler may be thinned immediately prior to application in conformity / accordance with the manufacturer's instructions or recommendations. The use of thinner for any reason shall not relieve the Contractor from obtaining complete hiding.

9.1.9 PAINT APPLICATION

- i) Except as otherwise specified herein, all painting shall be applied in conformity / compliance with B.S 6150 as applicable to the work.
- ii) Colors of priming coats (and body coats where specified) shall be lighter than those of finish coat. The Project Manager shall have unlimited choice of colors.
- iii) Paint or finish to any surface shall be applied when ambient temperature is ten (10) degree centigrade or above and less than forty-three (43) degree centigrade unless otherwise instructed or recommended by the manufacturer. No painting shall be applied above ninety percent (90%) relative humidity.
- iv) Drop cloths shall be placed to adequately protect all finished work.
- v) All paint and coating materials shall be in thoroughly mixed condition at the time of application. All work shall be completed in a workman-like manner, leaving the finished surface free from drips, ridges, waves, laps, and brush marks. All paints shall be applied under dry and dust free conditions.
- vi) The first coat of paint shall be applied by brush to ferrous surfaces except that the same may be applied by spray or brush to surfaces which have been blast cleaned. All other coats to ferrous surfaces shall, unless otherwise specified herein; be brushed or sprayed.

The first coat of paint on masonry or wooden surfaces shall be applied by brush except that roller application may be authorized for specific surfaces, subsequent coats may be applied by roller, spray or brush.
- vii) When paint is applied by spraying, suitable measures or methods shall be taken so as to avoid or prevent segregation of the paint in the container during painting application or operation. Effective means or methods shall be adopted for removing all free oil and moisture from the air supply lines of the spraying equipment.
- viii) Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after installation shall be completely painted prior to installation.
- ix) Only as much material of cement based paints shall be mixed as can be used up in one (1) hour. Over thinning shall not be allowed nor permitted.

- x) Plastic emulsion paint or vinyl distemper whichever is specified of the approved make and shade shall be applied to internal surfaces as shown or envisaged on the Drawings and as per manufacturer's instructions or recommendations. The number of coats shall be as indicated or specified on the Drawings or as directed by the Project Manager.
- xi) All metal doors, windows and ventilators shall be painted with approved enamel paint over (1) one coat of a red lead oxide primer as directed or instructed by the Project Manager. All metal surfaces shall be properly shop primed.
- xii) Where shown or envisaged on the Drawings, the exterior finishes shall be painted with minimum two (2) coats of cement based paint or weather resistant / shield paint as specified or required in approved colors as per manufacturer's specifications or recommendations.
- xiii) Wherever specified, two (2) coats of bitumen paint or Solignum or Creosote or coal tar shall be applied. The first coat shall be allowed to dry for about six (6) hours before applying the second coat. During the operation of painting, due attention and special care shall be taken so as to avoid or prevent air bubbles. The manufacturer's instructions and recommendations and Project Manager's directions shall be abided by or adhered to.
- xiv) Thickness of each coat shall be followed as per manufacturer's recommendations.

9.1.10 POLISHING

Surfaces to be prepared and polished shall be rubbed down with suitable sand paper to smooth surface. Filling shall be finished with approved filler and again rubbed so that the surface is smooth free from raised grains, holes, rough spots and provides a silky feeling. The same shall then be finished with wax polish or spirit polish.

9.2 PAINTING WOOD WORK

9.2.1 SCOPE

In respect of Scope, it shall conform to Specifications 9.1.1 for "Painting" General.

9.2.2 PREPARATION OF SURFACE

(i) Planning and Rubbing

Unless otherwise specified herein, wood work to be painted shall be finished smooth with the plane, but free from plane marks of every kind and rubbed smooth with sand paper, first with 2-1/2 grade and then with 1-1/2 grade or pumice stone, as specified or directed by the Project Manager.

(ii) Knotting

After rubbing all knots in the wood, the same shall be killed or covered with:-

- a) Two (2) coats of patent knotting as specified or directed / instructed by the Project Manager. If not specified herein, generally shellac dissolved in naphtha shall be applied.
- b) Varnish shall be applied as specified or as directed / instructed by the Project Manager. If not specified herein, generally 150 grams Shellac mixed with 1/2 liter of methylated spirit of wine, thoroughly dissolved and stirred with 15 grams red lead shall be applied.
- c) Any other preparation as specified or directed / instructed by the Project Manager shall be applied. If not specified herein, generally, a preparation of red lead and glue in equal weight shall be applied hot. Knots in deodar or other resinous wood shall be painted over with hot lime. This paint shall be scrapped off after twenty-four (24) hours, the knots primed with red lead and glue laid hot. Then one (1) coat of knotting varnish shall be applied.

(iii) Rubbing

After knotting, the surface thereof shall be rubbed again with pumice stone, or fine sand paper before the priming coat is applied.

(iv) Priming or First coat of Paint

All new wood work shall be properly primed before being fixed in position in accordance with the specifications or as directed or instructed by the Project Manager. In the absence of an approved ready-made priming paint, the same shall be prepared by mixing the following ingredients:-

- a) For inside work (except in white and very pale shade):-
 - White lead. 4.54 kg
 - Red lead. 0.11 kg
 - Boiled Linseed oil. 2.20 liters
 - Raw Linseed oil. 1.10 liters
 - Turpentine. 0.50 unit
- b) For outside work:
 - White lead. 4.54 kg
 - Red Lead. 0.10 kg
 - Boiled linseed oil. 1.10 liters
 - Raw linseed oil. 2.25 liters
 - Turpentine. 0.50 unit
- c) For white or light shade:
 - White lead. 7.26 kg
 - Lamp black. 0.23 kg
 - Raw linseed oil. 2.75 liters
 - Turpentine. 0.50 unit
- d) Genuine white lead 3.20 kg
 - Genuine red lead 3.20 kg
 - Boiled linseed oilOR
 - White lead 6.75 kg
 - Red lead 0.15 kg
 - Litharge (drier) 1.15 unit
 - Linseed oil 3.58 liters

The priming paints shall be applied either by brushes or by spraying machines as specified herein.

(v) Stopping

After priming, all holes, cracks, gapping, joints and similar other damages or defects shall be stopped with approved putty made from pure whiting mixed to the proper consistency with raw linseed oil. A little white lead shall be worked in after mixing so as to help the hardening of the putty.

9.2.3 NUMBER OF COATS

Unless otherwise specified herein, all wood and iron work shall be provided with three (3) coats, including the priming coat

9.2.4 SECOND AND SUBSEQUENT COATS

Unless otherwise specified herein, second and subsequent coats thereof shall be applied in conformity / compliance with Specifications 10.1.9 – General

9.3 PAINTING METAL WORK

9.3.1 SCOPE

In respect of Scope, the same shall conform to or comply with the Specifications 9.1 (1) for painting General.

9.3.2 SURFACE PREPARATION

All oil, grease, dirt and rust preventive compound shall be eliminated or removed from the surfaces by the use of a suitable solvent and clean wiping material. Following the solvent cleaning, surfaces to be painted, including (without limitation) the damaged or defective areas of shop painted surfaces, shall be cleaned of all rust, loose mill scale, dirt and other foreign substances by scraping, chipping, blasting, wire brushing, or other effective means, except shop painted metal surfaces against which concrete shall be placed, and surfaces which will receive vinyl-resin paint shall be cleaned to base metal by sand blasting or grit blasting. In the event that rust forms, or the surfaces become otherwise contaminated in the interval between cleaning and painting, recleaning shall be required. Surfaces adjacent to metal work being cleaned or painted shall be protected by effective masking, or other suitable means, during the cleaning and painting operations.

9.3.3 PAINT MATERIALS

- i) All paint and coating materials shall be provided or furnished and prepared in accordance with the specific requirements as specified or as directed or instructed by the Project Manager. In the absence of any such specifications, the following requirements shall be generally followed or adhered to.
 - a) Alkyd priming paint for use under aluminum paint and machinery paint shall contain or consist of zinc chromate pigment in an alkyd varnish base.
 - b) Aluminum paint shall be prepared on the job by mixing 0.90 kg of aluminum paste with 4.5 liters of aluminum mixing varnish.
 - c) Red lead priming paint shall be an approved type consisting of lead oxide in a linseed oil vehicle.
 - d) Red lead and red iron oxide priming paint shall be an approved mixture of lead oxide and iron oxide in a linseed oil vehicle.
 - e) Phenolic resin aluminum paint shall be prepared on the job by mixing 0.90 kg of aluminum paste and 4.5 liters of phenolic resin varnish.
 - f) Vinyl resin paint shall be formulation, which will serve both as a primer and as top coats. The paint shall bond to steel and shall maintain the bond when recoated. The vehicle composition shall be the same for all colors and shall contain or consist of suitable vinyl resins, plasticizers and solvents. Only lead free pigments shall be used. The paint shall be of the air drying type and shall dry sufficiently within hours at room temperature and five percent (5%) relative humidity so as to permit recoating without producing surface irregularities.
 - g) Machinery paint shall be of semi-gloss, medium length oil modified glycerol phthalate base paint. The paint shall be ready mixed, easily brush-able, non-sagging and shall level to a smooth finish without brush marks.

- h) Titanium under coat paint shall be an approved mixture of titanium dioxide and iron oxide in an alkyd resin vehicle.
- i) Red-iron oxide finish paint shall be an approved type consisting of iron oxide in an alkyd resin vehicle.

ii) Paint

All paint shall be the best available of its type and shall be approved by the Project Manager, prior to its procurement. The paint shall not settle or separate within six (6) months after delivery to the extent that the same cannot easily be restored to a smooth homogeneous mixture by manual stirring.

9.3.4 APPLICATION PROCEDURE

- i) All paint and coating materials shall be in a thoroughly mixed condition at the time of application. If appropriate and necessary, in order to improve application properties, cold applied paints shall be heated by means of a hot water bath to temperatures not exceeding thirty-eight (38) degrees centigrade. Aluminum paint, phenolic resin aluminum paint, red lead priming paint, red lead and red iron oxide priming paint, titanium undercoat paint, alkyd priming paint and machinery paint shall be thinned, if necessary, in order to improve application properties, but shall be thinned only with mineral spirits or turpentine, not exceeding 0.60 liter of thinner per 4.5 liters of paint.

Vinyl resin paint shall not be thinned except as instructed or recommended by the manufacturer. Paint shall not be applied when the temperature of the metal, or of the surrounding air, is below seven (7) degree centigrade. Surfaces shall be free from moisture at the time of painting. The first coat of paint shall be applied immediately after cleaning. All priming paint shall be applied by brushing when paint is applied by spraying, suitable means and methods shall be provided or furnished so as to avoid or prevent segregation of the paint in the container during the painting operations. Effective means and methods shall be provided or furnished for removing all free oil and moisture from the air supply lines of all spraying and blast cleaning equipment. Each coat of paint shall completely cover the surfaces and shall be free from runs, sags and holidays. Each coat shall be allowed or permitted to dry or harden thoroughly before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after installation shall be completely painted prior to installation.

- ii) Alkyd priming paint for use under aluminum paint and machinery paint shall be applied by brushing at a coverage rate of approximately 10.3 sq. metre per liter. An additional priming coat shall be applied by brushing over all regularities, such as rivets, welds, bolts, seams, and the like, before the application of the aluminum paint.
- iii) Aluminum paint shall be applied at a maximum coverage of 10.3 sq. meters per liter per coat except the maximum coverage for phenolic resin aluminum paint shall be 8.3 square meter per liter per coat.
- iv) Red lead priming paint shall be applied at a maximum coverage of 8.3 square meters per liter per coat. The first coat shall be applied by brush and subsequent coats shall be applied by either brush or spray. Following the first coat, an additional tinted brush coat shall be applied over all rivets, welds, bolts, seams, sharp corners and edges before subsequent painting. Alternate coats shall be tinted for color contrast.
- v) Red-lead and red iron oxide priming paint, titanium undercoat paint and red iron oxide finish paint for railway bridges shall each be applied by either brush or spray at a maximum coverage of 8.3 square meters per liter per coat.
- vi) Application of vinyl resin paint shall be as follows, except an additional brush coat of contrasting color shall be applied over all rivets, welds, bolts. Seams sharp corners and edges and allowed to dry four (4) hours before application of the first coat.

Coat	Apply by	Maximum coverage	Dry-Film thickness	Color	Minimum drying time
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		(sq. m/liter)	(mm)		
1	Brush	4.6	0.038	Red	12 Hours
2	Spray	4.6	0.038	Black	12 Hours
3	Spray	4.6	0.038	Red	12 Hours
4	Spray	4.6	0.038	Black	12 Hours
5	Spray	4.6	0.038	Red	12 Hours
6	Spray	4.6	0.038	Black	At least 10 days before placing in service

The minimum acceptable dry film thickness through the second coat shall be 0.075 mm and the minimum acceptable dry film thickness for the completed system shall be 0.225 mm. Paint applied by brush shall be applied in generous bluishful and quickly brushed out smooth before significant evaporation of solvents occurs and before brush drag develops. Application by means of spraying shall be such as to avoid or prevent excessive loss of volatile before the paint spray strikes the surface. Each stroke of the spray gun shall make a good lap over the previous stroke so that a continuous wet film is obtained on the surface. To avoid or prevent sagging and to secure or ensure the minimum dry film thickness, the same may be necessary to make repeated passes with the spray gun. Where this is necessary, each additional pass shall be by strokes at right angles to the previous pass.

- vii) Machinery paint shall be applied at a maximum coverage of 10.3 square meter per liter per coat
- viii) For the various locations and exposures, the paint and number of coats thereof shall be as specified or as directed / instructed by the Project Manager. In case particular specifications are not prescribed or specified herein, the following are the generally accepted specifications.

Sr. No.	Item	Paint or Coating Material	Number of coats
1.	Interior surfaces of steel pipes for aqueducts, including interior surfaces of expansion collar connections and appurtenances	Vinyl resin paint	6
2.	Exterior surfaces of exposed steel pipe, structural steel and metalwork which are not submerged in water or subjected to excessive moisture.	Alkyd priming paint	1
		Aluminum paint	2
3.	Structural steel for railway bridges	Red lead and red iron oxide priming paint	1
		Titanium under coat paint	
		Red iron oxide finish paint	1
4.	Surfaces of metal items such as fixed wheel gate and slide gate hoists and guides, structural steel, exterior of steel pipe air vents and miscellaneous metal work which are not submerged in water or subjected to excessive moisture	Alkyd priming paint	1
		Aluminum paint	2

Sr. No.	Item	Paint or Coating Material	Number of coats
5.	Structural steel, exterior surfaces of steel pipes for aqueducts and air vents, and miscellaneous metal work that will be submerged in water or subjected to excessive moisture from spray or condensation such as fixed wheel gates, frames and guide and slide gates	Red lead priming paint Phenolic resin aluminum paint. The complete coating shall have a minimum dry film thickness of 0.125 mm	2 2
6.	Surfaces which are to be in rolling or sliding contact and which will not be lubricated	Gasoline soluble rust preventive compound	1
7.	Metal surfaces to be embedded in concrete or masonry and galvanized surfaces	No painting or coating required.	

9.4 FRENCH POLISHING

9.4.1 SCOPE

In respect of scope, the same shall conform to or comply with the Specifications 9.1.7 for painting General.

9.4.2 SURFACE PREPARATION

In respect of surface preparation, the same shall conform to or comply with Specifications 9.1.7 for painting General.

9.4.3 POLISHING

- i) After the surface has been prepared, the same shall be first painted with filler composed of 2.25 kg of whiting mixed with 1.50 liter of methylated spirit and then rubbed with sand paper. A thin coat of the polish shall then be applied. The surface shall then be rubbed with sand paper before the second and subsequent coats are applied.
- ii) Alternatively, plaster of Paris, red ochre (sufficient to tint it), and linseed oil shall be mixed together to form a stiff paste which shall be applied sparingly and rubbed hard on the surface to fill up the pores of the wood. Prior to this, a piece of rag moistened with linseed oil shall be rubbed on the surface.
- iii) The surface shall be rubbed smooth with fine glass paper a few hours later and then polished.
- iv) Unless otherwise specified herein, two (2) coats of French polish of an approved type shall be applied.
- v) To finish off, the surface shall be rubbed lightly and quickly with a circular motion by means of a piece of flannel rolled into the form of a rubber, covered with a piece of rag slightly damp with methylated spirit. If the rag sticks, the surface thereof shall be touched with linseed oil.

9.4.4 OTHER RESPECTS

In all other respects, it shall conform to Specifications No. 9.5 for "Varnishing".

9.5 BITUMEN PAINT

9.5.1 SCOPE

In all other respects, the same shall conform to or comply with Specifications No. 9.1.75 for "Varnishing".

9.5.2 PREPARATION OF SURFACE

In respect of surface preparation, the same shall conform to or comply with Specifications 9.1.7 (iv, v, vi, vii, viii) for "painting" General.

9.5.3 SELECTION OF BITUMEN

In respect of selection of Bitumen, the same shall conform to or comply with Specifications 9.1.4 for "painting" General.

9.5.4 BITUMEN APPLICATION

In respect of Bitumen Application, the same shall conform to or comply with specifications 9.1.9(xii) for "Painting" General.

CHAPTER-10
CEMENT, SAND, AGGREGATE AND REVETMENT MATERIAL

Chapter-10: CEMENT, SAND, AGGREGATE & REVETMENT MATERIALS

10.1 PORTLAND CEMENT

10.1.1 REQUIREMENTS

- i) Cement shall be fresh, furnished in sacks or in bulk from as approved or permitted by the Project Manager. Unless otherwise permitted or approved, cement from not more than two (2) plants shall be used or employed and in general, the product of only one (1) plant shall be used or employed in any particular section of the work. Cement recovered through cleaning of sacks shall not be used nor employed.
- ii) Portland cement shall be of Pakistan origin and manufacture unless otherwise specifically approved or permitted by the Project Manager. Portland cement shall conform to or comply with Pakistan Standard 232 or to British Standard 12 or to ASTM C 150-17 type I. Portland cement conforming to or complying with ASTM C 150-17, Rapid hardening type III or Sulphate resistant type V, low alkali cement may also be used in certain parts of the works as directed or instructed by the Project Manager without additional cost.
- iii) Cement manufactured through approved methods and conforming to above relevant standards or codes only shall be accepted on the basis of the seven (7) day test results provided the quality history of the cement manufacturer has been established within the past twelve (12) months, otherwise the results of the twenty-eight (28) day tests at the normal testing rate shall be approved or permitted prior to shipment of the cement from the plant.
- iv) Unless otherwise permitted herein, cement from only one Plant shall be used in any particular work or section of the work. Thus at the site of the work a sufficient supply of accepted cement shall be available and precautions taken to guard against possible shortage from every cause.

10.1.2 INSPECTION & TESTS

- i) Before taking delivery of cement by the Project Manager or its use in work, sampling, inspection and testing of all cement will be performed or required by the Project Manager and such sampling, inspection and testing shall be conducted in accordance with ASTM Designation: C150 or British Standards Institution No.12 or equivalent tests as designated or instructed by the Project Manager. The Project Manager shall always have the right or entitlement at all times so as to inspect the materials used in the process of manufacture, the laboratory records of analysis and tests-made at the cement plant and to take samples of cement for testing. The Contractor shall provide or furnish all necessary assistance or support to the Engineering the above regard and for taking the samples.
- ii) The Project Manager may also test the cement kept or maintained in storage at any time before use. Cement failing to pass such tests shall be refused or rejected. If any cement proves unsatisfactory and portions of the same have been used in the work, then such work, or part thereof as deemed necessary by the Project Manager shall be ordered to be removed and replaced, using acceptable cement at the Contractor's cost and risk. Test cylinders from concrete or mortar being used in the work may be made by the Project Manager at any time for purposes of testing. The Contractor shall provide or furnish all cement and concrete required for testing without charge to the Project Manager and/or the Employer.

10.1.3 STORAGE

- i) The cement when stored at approved or designated places convenient to the work, and the cement shall at all times be carefully protected against moisture and exposure to air. Cement storehouses shall be of weather-tight shall have tight floors set a proper distance above the ground shall be large enough to keep or maintain a sufficient supply of cement on hand to

avoid or prevent delays, interruptions or disruption to the work and shall have sufficient floor space affording convenient access for sampling, counting of packages and removal. Cement in packages shall not be piled to a height exceeding 2.20 meters.

- ii) To avoid or prevent undue aging of sacked cement, each lot of the same shall be used in the chronological order in which the same was received.
- iii) Loose cement received in Bulk shall be stored in weather tight bins or silos, plans of which shall be approved or permitted beforehand. The bins or silos shall be efficiently operated and maintained. All such storage bins shall be constructed or provided so that there will be no dead storage. Also the storage bins shall be regularly emptied and cleaned. However, the intervals between required cleanings shall normally not be less than four (4) months.

10.1.4 MODE OF DELIVERY

- i) Delivery of Cement in sacks shall be accepted in strong, well made, paper or cloth bags, each plainly marked with the manufacturer's brand; and each packed with fifty (50) kg cement. The weight of all bags and packages shall be uniform. Packages received in broken, damaged or defective condition shall be refused or rejected, or accepted only as fractional packages. All lots or packages of sacked cement in which more than five (5) percent of the sacks weigh less than fifty (50) kg will be cause for rejecting the entire lot or package shipment.
- ii) Delivery of loose Cement in bulk (Whenever so desired) shall be accepted only from approved storage, having weighing devices and all other necessary facilities so as to secure or ensure keeping and supplying the cement in good condition and affording a correct measure of the cement supplied or delivered.

10.2 SAND

10.2.1 SCOPE

All sand, aggregates and revetment materials, shall consist of the materials herein specified and shall be in accordance with the herein stated requirements. The stipulations and requirements herein set forth shall apply except where such stipulations and requirements are specifically modified by the Project Manager for any particular item of work.

10.2.2 PRODUCTION OF SAND

(i) Scope

All sand, aggregates and revetment materials, shall contain or consist of the materials specified herein and shall be in accordance with the said requirements or provisions. The stipulations and requirements herein set forth shall apply except where such stipulations and requirements are specifically modified by the Project Manager for any particular item of work.

(ii) Quality

- a) The sand particles of finished sand shall be hard, dense, durable, unquoted inorganic rock fragments and all sand shall be washed free from injurious amounts of clay lumps, soft or flaky particles, shale, alkali, organic matter, loam, mica and other foreign materials or deleterious substances. The maximum percentage of individual foreign materials or deleterious substances in the sand shall not exceed the following values:-

Percent, By Weight

Materials Passing No.200 Screen

(ASTM Designation: C117) 3%

Lightweight Material

(ASTM Designation: C142) 2%

Clay Lumps

(ASTM Designation: C143) 1%

Total of Other Deleterious Substances

(Such as Alkali, Mica,

Coated Grains, Soft

Flaky Particles and Loam. 2%

- b) The sum of the percentages of all foreign materials or deleterious substances shall not exceed five (5) percent, by weight. Sand producing a color darker than the standard in the colorimetric test for organic impurities (ASTM Designation: C40) shall be refused or rejected. When required or instructed by the Project Manager, the sand shall be subjected to a soundness test and shall be refused or rejected if the portion retained on a No. 50 screen, when subjected to five (5) cycles of the sodium Sulphate test for soundness (ASTM Designation; C88), shows or demonstrates a weighted average loss of more than eight (8) percent. By weight.

(iii) Grading

- a) Sand that is manufactured from quarry rock will conform, when tested by means of standard screens (ASTM Designation:E11), to the following limits when delivered to the Contractor:

SCREEN NO	INDIVIDUAL PER CENT, BY WEIGHT, RETAINED ON SCREEN
4.	0-5
8.	5-20
16.	15-30
30.	15-35
50.	20-40
100.	0-5
PAN	0-2

- b) Sand that is produced from gravel deposits shall be well-graded and when the finished sand shall be tested by means of standard screens (ASTM Designation : E 11) shall conform to or comply with the following limits:

SCREEN NO.	INDIVIDUAL PER CENT, BY WEIGHT, RETAINED ON SCREEN
4.	0-5
8.	6-15.
16.	10-25
30.	10-30
50.	15-35
100.	12-20
PAN	3-7

Blend of the manufactured sand with natural sand shall be in such proportions as and when deemed necessary to provide or furnish the finished sand, which when tested by means of standard screens (ASTM Designation. E11) shall conform to or comply with the limits described or specified under Sand produced for gravel deposit. However If the individual percentage retained on the No.16 screen shall be twenty (20) percent or less, the maximum limit for the individual percent retained on the No.8 screen may be increased to twenty (20) percent.

- c) During normal operation or maintenance of the processing plant, the grading of sand from both the quarry rock and gravel deposits shall be controlled so that the fineness modulus of at least nine (9) out of ten (10) consecutive test samples of finished sand taken hourly at the plant shall not vary more than 0.25 above or below the average fineness modulus of the ten (10) test samples.
- d) All sand for mortar used in the construction of paving, lining and masonry shall be natural sand and when tested by means of standard screens (ASTM Designation: E11) shall conform to or comply with the following limits:

SCREEN NO.	PER CENTBY WEIGHT, PASSING SCREEN.
8	100
100	15 (Maximum)

Within the above range, the sand shall be well graded and as coarse as practicable for the production of workable mortar.

10.3 AGGREGATES

10.3.1 SCOPE

The term "Aggregates" shall be used to designate aggregates which are reasonably well graded within the range of five (5) mm to eight (8) cm or any size or range of sizes within such limits. Aggregates under these Specifications shall contain or consist of natural gravel or crushed rock.

10.3.2 QUALITY

- i) The aggregates shall contain or consist of well-shaped, hard, dense, durable; unquoted rock fragments and all aggregates shall be free from damaged or injurious amounts of foreign matters or deleterious substances. The percentages of individual foreign matters or deleterious substances in any size aggregates shall not exceed the following values:-

Percent by Weight

Materials passing No.200 screen

(ASTM Designation: C117) 1

Lightweight Material

(ASTM Designation: C123) 2

Clay Lumps

(ASTM Designation: C142) 1/2

Other deleterious substances 1

- ii) The sum of the percentages of all foreign matters or deleterious substances in any size shall not exceed three (3) percent by weight. Aggregates may be refused or rejected if the same fail to meet the following test requirements:-
 - a) Los Angeles Abrasion test (ASTM Designation: C131). If the loss exceeds ten (10) percent, by weight, at one hundred (100) revolutions, or forty (40) percent, by weight, at five hundred (500) revolutions.
 - b) Sodium Sulphate test for soundness (ASTM Designation: C88). If the weighted average loss after five (5) cycles shall be more than ten (10) percent by weight.
 - c) Specific gravity (ASTM Designation: C127). If the specific gravity (saturated surface- dry basis) shall be less than 2.60.

10.3.3 GRADING

- i) The aggregates shall be graded as follows:-

Designation of Size	Nominal Size Range	Minimum Percent Retained on Screens Indicated
19 mm aggregate	5 mm to 19 mm	45 to 80 percent on 9 mm
38 mm aggregate	19 mm to 38 mm	45 to 80 percent on 25 mm
75 mm aggregate	38 mm to 75 mm	25 to 40 percent on 64 mm

- ii) Separation of the aggregates into specified sizes shall be such that, when the aggregates are tested by screening on the screens designated in the following tabulation, the material passing the undersize test screen (significant undersize) shall not exceed two percent, by weight, and all materials shall pass the over-size test screen.

Size	Size of Square Opening in Screen	
	For Undersize	For Oversize Test
19 mm aggregate	No. 5	23 mm
38 mm aggregate	16 mm	46 mm
75 mm aggregate	32 mm	88 mm

- iii) All screens used for gradation tests, for oversize and under size tests shall be woven wire cloth sieves conforming to the requirements of ASTM designation: E11 with respect to permissible variations in average openings.

10.3.4 TESTS & APPROVAL

All aggregates shall be subject to testing by the Project Manager in conformity / accordance with the designated test methods so as to determine whether the aggregates meet the specific requirements of these Specifications. Aggregates not meeting the requirements of these Specifications as determined by tests or inspection, shall be refused or rejected.

10.4 PRODUCTION OF REVETMENT MATERIALS

10.4.1 SCOPE

The term "revetment materials" shall be used to designate rock materials, reasonably well graded within the maximum and the minimum size range specified for each nominal separation for revetment stone, rock spalls and base course. Revetment materials under these Specifications shall contain or consist of natural rock quarried from approved locations except that base course materials may be obtained or provided from both approved quarries and gravel deposits.

10.4.2 QUALITY

The revetment materials shall consist of reasonably well shaped, hard, dense and durable rock. The Specific gravity of rock used for the production of revetment materials shall be not less than 2.60.

10.4.3 SIZES

The revetment materials shall be produced or furnished in three (3) nominal size separations and shall be graded as follows:-

- a) Revetment Stone 20 KG to 120 KG or(40 to 250 pounds):
Eighty (80) percent shall be 40Kg (80 lbs.), or larger and not more than five (5) percent shall be less than twenty (20) kg (40 lbs.).
- b) Rock Spawls 50 mm to 100 mm (20 Kg)
Not more than twenty-five (25) percent shall be larger than one hundred (100) mm and not more than five (5) percent shall be smaller than fifty (50) mm:
- c) Base Course (minus 75 mm)
Not more than twenty-five (25) percent shall be larger than seventy-five (75) mm and not more than ten (10) percent shall be smaller than five (5) mm

10.4.4 TEST REQUIREMENTS

Revetment materials shall be refused or rejected if the same fail to meet the following test requirements:-

- a) Los Angles Abrasion test (ASTM Designation: C131). If the loss exceeds ten (10) percent by weight, at one hundred (100) revolutions, or forty (40) percent, by weight, at four hundred (400) revolutions.
- b) Specific gravity (ASTM Designation: C 127). If the Specific gravity; (saturated surface dry basis) is less than 2.60

10.4.5 INSPECTION & APPROVAL

All revetment materials shall be subject to inspection and, if necessary, may require testing by the Project Manager to determine whether the revetment materials meet the specific requirements of these Specifications. All revetment materials shall be subject to inspection and, if deemed necessary, testing to determine whether the revetment materials meet the specific requirements of these Specifications as required or instructed by the Project Manager.. Revetment materials not meeting the requirements of these Specifications, as determined or inspected by tests, shall be refused or rejected. The Contractor shall be entitled to no compensation for revetment materials which are refused or rejected by reason of failure so as to meet and satisfy the requirements of these Specifications, as determined or required by the Project Manager, and shall bear all costs and expenses incidental to the removal and disposition of rejected revetment materials.

CHAPTER-11
MISCELLANEOUS

Chapter-11: MISCELLANEOUS

11.1 JUNGLE CLEARANCE

11.1.1 SCOPE

Unless otherwise specified herein, the work shall cover or include cutting and removing the following in a workman like manner, within the area demarcated for the jungle clearance:-

- i) Standing trees along with their stumps.
- ii) Dead and fallen trees with their stumps.
- iii) Shrubs, Plants, Crops, Herbs, Weed growth; Vegetables and grass:

And their carriage up to thirty-one (31) meters along the specified route or as directed or instructed by the Project Manager.

The Project Manager shall decide or determine on the basis of the actual sizes and concentration of such material, whether rate for "Light" jungle clearance or "Thick" Jungle Clearance is to be paid. Decision or determination of the Project Manager shall be final.

The work shall also cover or include (but not limited to) furnishing of all labor, materials, tools and plants, cranes, chain pulley blocks and other accessories commensurate with the requirements of work as specified in the Terms of Agreement or as directed or instructed by the Project Manager.

11.1.2 METHODOLOGY

- i) The crane and chain pulley blocks used shall be of such a capacity as to lift and pull up all the trees in the Area specified lengthwise and breadth wise.
- ii) The trees shall be cut by axe or saw as directed or instructed by the Project Manager. The log portion shall be cleared and removed first and stacked. The timber, fuel wood and branch wood shall be separately stacked.
- iii) Roots, stumps shall be dug out up to a depth as specified or as directed or instructed by the Project Manager, pulled up. And removed.
- iv) The unit price and rate shall cover or include the cost of making trenches or side trenching, drenching and refilling the earth surface properly in accordance with specifications or as directed or instructed by the Project Manager
- v) No payment for earthwork involved in trenching and refilling shall be made because the unit price and rate of cutting removing trees, uprooting stumps and their removal shall cover or include the cost of drenching, trenching and refilling and the like.
- vi) Likelihood of occurrence of damage or defect to buildings, walls, structures of any kind, while falling of trees, shall be avoided or prevented by adopting appropriate or necessary protective measures or methods.
- vii) The local inhabitants of the area specified for jungle clearance shall have to be informed or notified well in time so as to obviate the risk or adverse effect of life and limb.
- viii) Security measures shall be taken to protect or safeguard timber or fuel as the case may be.
- ix) The byproducts achieved in the form of timber, fuel or brush wood shall be carried to store or auctioned to protect the interest of Employer, as directed or instructed by the Project Manager.

11.2 IRON WORK

11.2.1 SCOPE

The work shall cover or include all labor, materials, equipment, tools & plants and services required for procurement of steel, its cutting, drilling, welding, riveting, handling, assembling and fixing in position.

The same shall also cover or include (but not limited to) its fabrication for making trusses, girders, tanks, railings of bridges, buildings, stairs, electric poles, doors, windows, ventilators, rolling shutters including wire gauze, fittings, grills, glazing's, and the like.in accordance with Drawings, specifications or directions / instructions of the Project Manager.

11.2.2 GENERAL REQUIREMENTS

- i) All iron products i.e. doors, windows, trusses, water tanks, R.S. beams, shutters, shall be of reputable manufacturer in accordance with Drawings or as specified or direction or instructions of the Project Manager.
- ii) All vertical members shall be true to Plumb, and all horizontal members shall be exactly horizontal and checked with hand level. All inclined members shall be in accordance with angles specified or envisaged in the Drawings.
- iii) All doors and windows shutters shall be of cold rolled steel of good quality. The hold fasts shall be fifty (50) mm wide and six (6) mm thick and three hundred (300) mm long, which shall be concealed and secured to frame.
- iv) Windows and ventilators frame sections shall be of mild steel. Hinges shall be subject to the approval or permission of the Project Manager. All operating hardware shall be of bronze lacquered iron.
- v) All structural steel shall conform to or comply with the specific requirements of ASTM Designation A36/A36M or same equivalent.
- vi) All welding shall be executed and inspected in accordance with the latest provision of the applicable code of the American Welding Society, or same equivalent.
- vii) All bolts, including anchor bolts shall conform to or comply with the requirements of ASTM Designation A307-14e1 or same equivalent.
- viii) All contours and arises i.e. corners and straight edges in metal door shall be true and sharp as can be produced in the thickness of metal required.
- ix) Construction joint of steel work welded to full depth & width, or equivalent splice plates shall be welded on unexposed faces of frames. Exposed surfaces of welded joints shall be dressed and ground smooth to produce invisible connections.
- x) Reinforcement and stiffeners shall be welded to the inside of the frame surfaces.
- xi) Window frames and ventilators shall conform to or comply with the sections shown or envisaged on the detailed Drawings and all corners shall be electrically flash welded and finished smooth,
- xii) Weather baffles shall be integrally rolled and shall provide or furnish contact on all the four (4) sides of the operating ventilators.
- xiii) Weep holes and drips shall be provided or furnished for drainage in accordance with Drawings or instructions of Project Manager.
- xiv) All windows shall be designed for exterior glazing to accommodate glass thickness specified herein.
- xv) Ventilators shall show or demonstrate in or out, as indicated or envisaged on the Drawings and shall be mounted over heavy steel pivots with brass pins.

- xvi) Push bars for out swinging windows shall be a notched device for fixed settings and designed to lock shutters in open or closed position.
- xvii) In-swinging windows shall be provided or furnished with a casement for fastener, designed and arranged to close with wedging erection to draw each leaf firmly into contact with window fixed rail.
- xviii) Windows shall be provided or furnished with all necessary clips and anchors required for securing the windows to the structure.

11.2.3 FABRICATION OF DOORS AND WINDOWS

(i) Shape

The steel sections shall be thoroughly straightened in the shape by methods that will not injure the same before being laid off or worked in any way.

(ii) Cutting and Forming

All members shall be so cut and formed that they can be accurately assembled without being unduly cracked strained or forced into position.

(iii) Jointing

The jointing of different parts of the members of mild steel shall be carried out or executed by welding process in accordance with the specific requirements of American Welding Society or equivalent Pakistani Standard for such joints. Welding points shall be made quite smooth by filing the same and making smooth.

(iv) Galvanizing

If required, all exterior doors, frames, anchors, reinforcing and related items shall be fabricated from hot dipped galvanized steel, conforming to BS 729 Part 1 or Equivalent Pakistan Standard. After fabrication, all welds shall be touched up with liquid zinc.

Windows frames and ventilators shall be hot dipped galvanized after fabrication conforming to BS 729 Part 1 or Equivalent Pakistan Standard.

11.2.4 FABRICATION OF ROLLING SHUTTERS

(i) Shutters

The shutters shall be fabricated using standard galvanized corrugated segments of the required length according to size of the shutter and of twenty (20) gauge thickness. These segments shall be interred linked properly so as to allow or permit rotation for smooth rolling up and down. In order to reduce noise during operation. Fifty (50) mm wide wire reinforced canvas belt shall be riveted (using aluminum rivets) to both shutter ends and aluminum rollers shall be installed at top.

(ii) Guide

The Guide for the shutter shall be fabricated or assembled from mild steel plates and shall be embedded to wall or columns by providing necessary anchors.

(iii) Main Rollers

The main rollers mounted on the supporting pipe, on which the shutter has to roll up; shall be of mild steel with deep groove.

(iv) Supporting Shaft

The supporting shaft shall be of standard mild steel pipe strong enough to support the load of the shutter with minimum distortion or deflection. This shaft shall have adequate supports at

the ends fabricated from mild steel plates. Each shutter shall have separate bracket supports. However, due to space limitation for mounting, the same may be made common for adjacent shutter.

(v) Coil Spring

On each end, between the bracket support and the roller coil, a spring shall be provided or furnished. The spring shall be of spring steel one end of which shall be fixed to the pipe and the other to the roller. These springs shall be suitable so as to balance the weight of the shutter to allow smooth operation.

(vi) Cover

The cover shall be fabricated from twenty-two (22) gauge mild steel sheet of uniform shape and size without distortion or deformations.

11.2.5 INSTALLATION

(i) Doors, Windows and Ventilators.

The Contractor shall be liable or responsible for proper protection and installation of all items furnished. Should the prime coat be damaged or defective, or rust scale appears, the Contractor shall at his own cost and risk and at the Project Manager's direction or instruction, have all exposed surfaces cleaned to bare bright and re-primed with an approved priming coat before finish painting.

All items shall be installed or furnished with plumb and square and shall be solidly anchored in a good workman-like manner in accordance with the approved shop Drawings. The Contractor shall be responsible for the protection of installed items from damages or defects by other trades. All items shall be left in operating neat and clean condition free from dirt finger marks, of like nature. The Contractor shall be responsible for final cleaning before final acceptance or delivery.

(ii) Wire Gauze

Unless otherwise specified herein or directed or instructed by the Project Manager, the wire gauze to be fixed with doors, windows and ventilators shall be twenty-two (22) gauges having 12 x 12 meshes per 645 mm².

11.2.6 PRIMARY COAT AND FINISHING

- i) The non-galvanized doors, windows and ventilators shall be painted with primary coat of red oxide and good quality double boiled linseed oil or any approved anti-corrosion paint after proper grinding or surface preparation.
- ii) The finished work shall be strong and rigid; neat in appearance and free from damages or defects. Plain surfaces shall be smooth and free from warp or buckle. Moulded members shall be clean, straight and true. Fastenings shall be concealed where practicable.

11.2.7 ARCHITECTURAL / ENGINEERING METALWORK

Metal fabrication shall include furnishing of all labor, materials, equipment, plant and services required to supply, fabricate and install all the architectural metal work such as stairs, ladders, railings, guard rails, balustrades, grills, gates, gratings, chequered plate flooring, embedded metalwork, fencing, cabinets, lockers, and the like. Metals shall include iron, steel, bronze and aluminum and work shall include casting, forging, welding, bolting, fabrication, erecting, installing and painting, wherever required for the architectural metalwork as shown or envisaged in the Drawings, specified herein and/or as directed or instructed by the Project Manager.

11.2.8 METALS

(i) Structural Steel

Structural steel for structures shall conform to or comply with the requirements of ASTM Designation A36/A36M-14 or same equivalent.

(ii) High Strength Low Alloy Steel

High strength low alloy steel shall conform to the requirements of ASTM Designation A441/A441M. Discontinued 1989 - Replaced by ASTM A572/A572M-15 - Specification for High Strength low Alloy structural manganese vanadium steel or equivalent Pakistan Standard.

(iii) Sheet Steel

Sheet steel for structures where no welding is required shall conform to or comply with the requirements of ASTM A366 or equivalent Pakistan Standard. For structures where welding is required sheet steel shall conform to or comply with the requirements of ASTM Designation A1011 or same equivalent.

(iv) Steel Forging

Steel forgings shall conform to or comply with the requirements of ASTM A 668-17 or same equivalent.

(v) Steel Casting

Steel casting shall conform to or comply with the requirements of ASTM A 27-17 and ASTM A 148-15a or same equivalent

11.2.9 WELDING RODS

Except as otherwise shown or envisaged on the Drawings, welding rod shall conform to or comply with the following requirements;

(i) Structural Welding Rod

Welding rod for manual welding of structural carbon and low alloy steels shall conform to or comply with the applicable requirements of American Society or same equivalent.

For structural carbon steel E-60 or E-70 series electrodes shall be used. For high strength low alloy steels, E-70 series, low-hydrogen electrodes shall be used or its equivalent.

(ii) Corrosion Resisting Welding Rod

Welding rod for corrosion resisting welds shall conform to or comply with the applicable or specific requirements of American Welding Society for Corrosion-Resisting Chromium and Chromium Nickel Steel Covered Welding Electrodes, following series shall be used;

(iii) Aluminum Welding Rod

Welding rod for aluminum welding shall conform to or comply with the applicable or specific requirements of American Welding Society for Aluminum and Aluminum Alloy Metal Arc Welding Electrodes and Alloy Welding Rods and Bare Electrodes.

11.2.10 BOLTS, NUTS AND WASHERS

Except as otherwise indicated or envisaged on the Drawings or specified herein, bolts and nuts shall conform to or comply with the requirements of ASTM A 307 or Equivalent. Bolts shall be grade A for general application, with square or hexagon heads.

11.2.11 PREPARATION

(i) Clarification Prior to Fabrication

The Contractor shall notify the Project Manager of any problems, doubts or errors discovered in the Drawings for clarification or rectification well in time so as to avoid or prevent any fabrication errors. Fabrication shall not be commenced until or unless approval or permission has been obtained or granted from the Project Manager.

(ii) Straightening Material

Rolled material, before being worked upon, shall be straightened within tolerances. Straightening necessarily shall be finished by mechanical means or by the application of a limited amount of localized heat.

(iii) Cutting

As far as possible cutting shall be finished by shearing. Oxygen cutting shall be finished where shear cutting is not possible and shall preferably be finished by a machine. All edges shall be free from gouges, notches or burrs. If deemed necessary, the same shall be removed by grinding.

(iv) Holes Punching and Drilling

Holes shall be punched where thickness of the material is not greater than the diameter of bolt or rivet or three (3) mm whichever is bigger.

Where the thickness of the material is greater than three (3) mm the holes shall either be drilled or sub punched and then reamed to size. The die for all sub punched holes and the drill of all sub drilled holes shall be at least two (2) mm smaller than the nominal diameter of the rivet or bolt. Holes for A 514 steel plates over twelve (12) mm thick shall be drilled.

Holes shall be drilled or punched at right angles to the surface of the metal not more than two (2) mm larger than the connector diameter. Holes shall not be made or enlarged by burning. Material having a thickness in excess of the connector diameter and material thicker than twenty-two (22) mm shall be drilled. Holes shall be clean - cut without torn or ragged edges or outside burrs resulting from drilling operations.

(v) Holes, Slots and Openings

Holes Slots and Openings required by other work shall be provided or furnished together with necessary reinforcing as specified and by using suitable templates for proper location of these openings. Steel requiring adjustment shall be provided or furnished with slotted holes as specified. No change in location of openings shall be allowed or permitted without prior approval of the Project Manager.

11.2.12 WELDING

(i) Requirements

Structural welding shall not begin until or unless joint elements are bolted or tacked in intimate contact and adjusted to dimensions specified with allowance for any weld shrinkage that is expected. Heavy sections and those having a high degree of restraint shall be welded with low hydrogen type electrodes. No members shall be spliced without approval or permission of the Project Manager.

(ii) Workmanship

Unless otherwise authorized or specified herein, welding shall be electric arc welding process, using a method which excludes the atmosphere from the molten metal.

(iii) Welding Equipment

Manual and automatic arc-welding machines and equipment may be of either the alternating current or direct current type and shall conform to or comply with the requirement for arc-welding equipment as specified or set forth in the AWS D 2 or its equivalent. When the use of gas welding equipment is specifically authorized or permitted by the Project Manager, such equipment shall also conform to or comply with this specification.

(iv) Filler Metal

Unless otherwise specified herein or authorized or permitted by the Project Manager, all deposited weld metal shall have elastic limits and ultimate tensile strengths not less than those specified for the respective base metals welded, shall have an elongation in fifty (50) mm, length of material using annealed samples, of at least ninety five percent (95%) of the value specified for the base metal or at least seventy five percent (75%) using un annealed samples; shall have chemical composition similar to that of the base metal: and , when subject to approved tests shall have corrosion resistance at least equivalent to that of the base metal. These properties shall be verified and determined by testing in accordance with the applicable provisions of the American Welding Society Specifications, or as otherwise approved or permitted by the Project Manager.

11.2.13 RIVETING

Punching, drilling, reaming and riveting shall be in accordance with the best commercial and/or Engineering practice for the type of work concerned and as approved or permitted by the Project Manager.

11.2.14 BOLTED CONNECTIONS

(i) Bolt Holes

Holes for unfinished bolts shall be not more than 1.6 mm larger than the nominal diameter of the bolts. Unless otherwise specified herein or shown / envisaged on the Drawings, holes for turned bolts shall be not more than 0.5 mm larger than the nominal diameter of the bolt, holes for unfinished bolts shall be sub punched and reamed or sub-drilled and reamed or drilled from the solid. Holes for turned bolts shall be truly cylindrical throughout and drilling or reaming shall be finished after the parts or sections to be connected shall be assembled. Poor matching of holes shall be the cause of refusal or rejection accordingly.

(ii) High Strength Bolted Connections.

High strength bolts shall be installed or furnished in conformity or accordance with the applicable or specific requirements of the Specifications for Structural joints.

11.2.15 PAINTING METAL WORKS AND GALVANIZING

(i) Surface Preparation

All structural steel material i.e. rolled steel section, plates, flat bars, chequered plates etc. shall be cleaned free from loose scale, rust, burrs, slag and the like by sand blasting.

The sand used for this purpose shall be free from earth dust, clay and moisture. The size of sand particles, air pressure and size of the hose nozzle shall be correlated to give proper and acceptable surface.

Material which is to be used for fabrication of components to be galvanized later on shall not be cleaned.

(ii) Painting

Immediately after surface preparation, all material shall be provided with a prime coat of rust preventive paint.

After fabrication and test assembly all shop assemblies shall be provided with one (1) shop coat of prime paint and then one (1) coat of enamel paint.

One (1) final coat of enamel paint shall be applied after erection of all components.

Unless otherwise specified or envisaged in the Drawings, the type of Primer and paint, thickness of each coat and the number of coats shall be as specified under Chapter-9 "Painting and Varnishing".

(iii) Steel Work / Surfaces not to be painted

Steel work to be encased or embedded in concrete or surface in contact with concrete or grout shall be provided with a cement wash after sand blasting.

Machine finished surfaces shall not be painted but shall be coated with rust preventive compound approved or permitted by the Project Manager immediately after finishing. Such surfaces shall also be protected or safeguarded with wooden pads or other suitable means during transportation. Unassembled pins, keys, and bolt thread shall be greased and wrapped with moisture resistant paper.

Contact surfaces of connections using high strength bolts in friction type connection shall not be painted. Such surfaces of all components, after fabrication, shall be cleaned free of paint, grease, burrs and/ or slag by means of sand blasting. No coating whatsoever shall then be applied to such surfaces. The surface roughness for high strength friction grip bolts is a very important factor and therefore components shall not be erected or provided unless or until duly approved or permitted by the Project Manager.

11.2.16 ITEMS FURNISHED AND INSTALLED ON THE BASIS OF WEIGHT

i) General

Items of metal fabrication for which the unit prices and rates have been quoted on weight basis and for which detailed workshop drawings have not been made shall be measured net as installed at site as per sketches and direction or instructions of the Project Manager. After measurement, the theoretical weight shall be calculated from standard tables of sections and weights in the manner followed in the preparation of drawings. One (1) cubic meter (m³) of steel shall be taken as 7,849 kilograms.

Items of metal fabrication for which the unit prices and rates have been quoted on weight basis and for which the detailed workshop drawings have been prepared, measurement thereof shall be made at site so as to verify or confirm whether the items fabricated, supplied and erected in position are in conformity / accordance with the workshop drawings of the same. If so verified or confirmed to the satisfaction of the Project Manager, the weights specified in workshop drawing shall form the basis for payment of bills.

11.3 BOUNDARY WALL / FENCING

11.3.1 SCOPE

The work shall cover or include measurement adopted so as to provide or furnish boundary wall or fencing for protection or to avoid or prevent trespass or unauthorized or unpermitted entry and associated works and the like. In connection therewith, supply of material, labor, plant, equipment, accessories also falls within the scope of work. The pay items of boundary wall is incorporated in Bill-B of the BOQ.

11.3.2 GENERAL

- i) The Specifications for providing Block masonry wall and Plain Cement Concrete foundation block shall be the same as specified in the Chapter- 3 “Concrete.”
- ii) The Specifications for Steel Reinforcement binding wire shall conform to or comply with Chapter-3 “Concrete” for steel.
- iii) The barbed wire shall be a manufacture of a recognized or reputable firm and the best available in Pakistan in conformity or compliance with Drawing or as directed or instructed by the Project Manager.
- iv) L iron post shall be exactly as shown or envisaged on the drawings and/or as directed or instructed by the Project Manager.
- v) The barbed wire shall be stretched straight without any sag anywhere and checked or examined by the Project Manager at site

11.4 ALUMINUM WORKS

11.4.1 SCOPE

The work covered under this section comprises of the following:

- i) Fixing in position windows, doors, and ventilators etc. complete as required by the Project Manager with hinges, handles, locks, nylon wheels, vinyl weather strips etc.
- ii) Placing of aluminum expansion joint covers complete in all respect for floors, walls and corners.
- iii) Fixing glass of specified quality and thickness to windows, ventilators and doors, including all fillers or fasteners.

11.4.2 GENERAL COMPLIANCE

- i) All sectional dimensions shown on drawings are only indicative. The contractor, shall be responsible to determine the adequacy of these with respect to actual structural and performance requirements. All extrusions shall be of adequate strength, not only to meet the structural performance, but also to minimize the risk of distortion in the finished surfaces.
- ii) All dimensions given on drawings are between structural openings and/or between finished surface and allowances shall be made for variation due to constructional tolerances. The contractor, shall be responsible to measure actual final dimensions from the Site before fabrication of doors, windows and other assemblies/units.
- iii) Weather tightness and operations shall suit the weather conditions prevailing in the area of installation. All windows and ventilators will be fabricated as completely air and water tight units including gaskets for glazing, weather stripping, latches, locks, bolts for fixing etc.
- iv) The fixed glazed windows shall be as far as possible reasonably air tight under all weather conditions.

11.4.3 MATERIAL REQUIREMENTS

Aluminum Sections

All aluminum sections shall be extruded Aluminum Alloy 6063 T-5 , conforming to International Standard for alloy quality and extrusion. Some of the properties of these alloys are as follows:

Property	T-5 Alloy
Aluminum	max. 97.5%
Magnesium	0.45-0.9%
Silicon	0.2-0.6%
Iron	max. 0.35%
Copper	max. 0.1%
Zinc	max. 0.1%
Ultimate Tensile Strength	186 MPa
Yield Tensile Strength	145 MPa
Hardness, Brinell (500Kg load, 10mm ball)	60
Elongation (In 5cm sample 1.6mm thick)	12%
Fatigue Strength (500 million cycles)	68.9 MPa
Electrical Resistivity at 68 °F	3.16x10 ⁻⁶ Ohm-cm

- (i) Wall thickness of frames for Windows & Ventilators shall be minimum 1.6 and 2.5mm for Doors.
- (ii) 75mm wide aluminum cover strip for floor & roof (1.2mm thick)
- (iii) Aluminum cover on corners angle shape each side 40mm wide (2mm thick)
- (iv) 1.6mm thickness for covers to be used in exposed pipe lines or as directed by the Project Manager.

Aluminum sections/frame shall be natural or printed (anodized) as directed by the Project Manager.

Aluminum sections for slideable / openable segments, fixed segments and frame shall be as approved by the Project Manager. Tolerance in Aluminum section wall thickness shall be ±10% of specified wall thickness. All other tolerances shall be as specified in EN 12020-2.

Bolts and Nuts shall conform to BS 4190 “Black hexagon bolts, screws and nuts. Specifications”. Bolts shall be oil protected on the threaded parts.

Washers shall conform to BS 4320 “Specification for metal washers for general Engineering purposes”.

Glass of required thickness shall conform to BS 952-1 “Glass for glazing. Classification” and shall perfectly flat or parallel surfaces, free from distortion specks bubbles and flaws of every kind. Glass shall be of Safety Glass (SG) quality.

Clear glass shall also be free from tints and shall transmit 85% of the diffused light falling on it. Tinted glass shall be of approved color and shade.

Hardware/Access, Iron-mongery and Fixtures Iron mongery, fittings, handles and locks shall be of brass or stainless steel or aluminum as approved by the Project Manager.

11.4.4 CONSTRUCTION REQUIREMENTS

The Aluminum windows and ventilators shall be manufactured by an approved manufacturer in this trade. They shall be fabricated as complete unit, fully airtight and watertight including rubber gasket for glazing and necessary holes for fixing.

The manufacturer shall use the latest and approved method of jointing employed in the manufacture of high class work viz. mechanical jointing, reinforced with concealed welding shall be used in the manufacture of Ventilators and windows.

a) FIXING

The fixing to concrete openings shall be carried out in an approved method as indicated in the drawings or as directed. Provision of necessary groove or rebate and holdfasts in the concrete shall be made in the formwork and holing or drilling shall be avoided in the exposed concrete finishes. These shall be erected in position after the building structure is completed and by using proper holdfasts as shown on drawings or counter sunk bolts and screws as directed in accordance with site requirements.

b) HANDLING

Care shall be taken in handling windows and ventilators etc., during transportation and site. These shall be stored under cover and shall be installed only by skilled mechanics, set plumb, level, in alignment and properly braced to prevent distortion.

Protection

- a) The joint between window and doorframes and the building should be caulked with approved building mastic for total weatherproofing.
- b) After installation windows and ventilators shall be protected from construction hazards that will interfere with their operation or damage their appearance or finish. They shall be cleaned on inside and outside of all mortar, plaster, paint of other foreign matter to present a neat appearance. Hardware and moving parts shall be lubricated.

11.4.5 GLAZING

The work of fixing glazing to windows and ventilators shall be carried out with the type and quality of glass specified for each and as indicated in the drawings and specifications or as directed.

The glazing of glass should be in accordance with the recommendations of BS 6262 “Code of practice for glazing for buildings.”

All glass shall be factory labelled on each pane and the label shall not be removed until finally approved. Glass will be fixed with best quality mastic compound of approved make suitable for the type of glass or with special bead or moulding as shown on the drawing or as directed. Special rubber lining and weather proof brush joints for sliding surfaces shall be provided where indicated.

Glass shall be fixed using flexible compounds, sealants, preformed strips or gaskets as per recommendation of the manufacturer.

1500mm when the clearance shall be at least 5mm edge cover shall be adequate to retain the glass in position under the design wind loading. The rebate depth edge clearance plus edge cover shall not be less than 11mm for 6.5mm glass. The width of the rebate platform must accommodate the glass, the front and back compound, and glazing bead. The bead depth

should not be less than the rebate depth. Setting blocks, distance pieces, and location blocks shall be used as appropriate.

Glass shall be protected against damage. After inspection, any labels, and paint spots shall be removed and glass shall be washed clean. Damages or broken glass shall be removed and replaced before acceptance at no extra expense. After the installation of glass it shall be cleaned using a soft cloth with water and mild soap or liquid detergent, followed by rinsing with clean water and then drying.

11.5 STAINLESS STEEL

Where stainless steel is specified it shall be Austenitic 18-8 type, 304 type, with a content of 17% to 19% chrome, 8% to 10% nickel and maximum carbon content of 0.11%, Stainless steel shall be free from scale and all surfaces shall be polished to # 14 commercial finish, or to special finish as selected by the Project Manager.

11.6 LIQUEFIED TESTING.

Provided following conditions is applicable to geological data of ground, the liquefied test is required by the Contractor.

- i) Saturated ground layer is shallower than 20m from ground elevation.
- ii) Ground water level is shallower than 10m from ground level.
- iii) Rate of content of Fine-grain fraction is less than 35%
- iv) Average of grain size (D50) is smaller than 10mm.
- v) 10% grain size ((D10) is smaller than 1mm.

11.7 SETTLEMENT OF STRUCTURE.

The two types of regulation values for settlement of independent footing of structure is prescribed. The Contractor is instructed to perform the following if in case the structure is in fill area.

(1) The immediate settlement:

The standard value of the immediate settlement is less than 2.0cm, and maximum value of it is less than 3.0cm.

(2) The allowable settlement in case of consolidation settlement:

The standard value of the allowable settlement is less than 5.0cm, and the maximum value of it is less than 10.0cm.

11.8 LAND PREPARATION AND PLANTATION OF GRASS

Work covered under this section consists of furnishing all labor, equipment and material necessary to perform all operations required for land preparation, finished grading, supplying and spreading of soil and manures, grass for lawns up to maintenance period and incidental to completing all the turfing operations and the associated works in a workmanship like manner.

11.8.1 LAND PREPARATION

The Contractor shall prepare the lawn by removing of stones, boulders, weeds, undesirable grass, roots, hard clay, other injurious matters and ploughing, leveling and dressing of lawn (on

level or slopes), The Contractor is also responsible for disposal of this rubbish to the area designated by the Contractor and approved by the Project Manager including all lead and lifts.

11.8.2 PLANTATION OF GRASS

Grass shall be installed as soon as possible after delivery to the Site. Grass shall be protected from exposure to wind and direct sunlight prior to installation. Grass not installed on the day of arrival shall be stored in shaded areas, protected from the wind and maintained and watered to good horticultural standards until planted. Care shall be taken to ensure that the grass does not dry out.

The Contractor shall deliver and provide the compost and fertilizers to the Site and stored separately in approved locations and in a manner to avoid contamination and wetting until soil mixing operations commence.

Grass sod shall consist of a healthy, dense and well rooted growth of living grass. The grass sod shall be cut in to uniform squares approximately 30cm by 30cm or in rolls of uniform width of approximately 40cm and shall have a minimum thickness of 5cm (excluding grass blades)

The sod strips are all laid in this fashion, roll the sod with roller half filled with water to smooth out rough spots and bond the sod with soil. Now water a little more carefully than usual for a few days till the grass is set.

Grass shall be strongly rooted, free of weeds and undesirable native grass. Only turf that is capable of vigorous growth and development when laid shall be used. Grass shall be of a uniform size in width and length. Broken pads or pads with uneven ends will not be acceptable.

The Contractor shall be responsible for watering and maintenance of levels and the grass free from weeded and fit for mowing until taken over by the Employer.

During the maintenance period, any irregularities arising in ground levels due to watering or due to trampling by labor shall be constantly made up to the proper levels with earth as available or brought from outside as necessary. Constant watch shall be maintained to ensure that dead patches are replanted and weeds are removed.

Preparation of lawn shall be paid separately as per specifications for "Land Preparation". However the cost of compost and fertilizers is included in the item of Grass sodding and shall not be paid separately.

11.9 EMULSIFIED BITUMEN

Emulsified bitumen on plastered & concrete surfaces for footing, column & other structures in contact with soil shall be composed of a bituminous base uniformly emulsified with water and an emulsifying or stabilizing agent and shall be used as per manufacturer's recommendation and approval of the Project Manager.

The rate of emulsified bitumen shall be @ 0.60kg/m².

11.10 RAZOR CONCERTINA WIRE

GI wire Crossed type shall be used and shall fulfil the requirements as per drawings. Outer dia of the ring shall be 600mm with blade thickness 0.5mm and wire dia 2.5mm. Blade length shall be 22mm having spacing of 50mm. GI wire dia 3.0mm two nos. horizontally shall also be used.

11.11 WHITE BOARD

It shall be made with melamine board with aluminum frame. With thickness approved by the Project Manager or available in the market. Size of the board normally 2mx1.25m or as approved by the Project Manager.

11.12 GYPSUM BOARD FALSE CEILING

The **Gypsum tiles False Ceiling** shall be of high quality gypsum plaster so as to produce a high quality product that meets or fulfils the specific quality requirements for gypsum board false ceiling i.e. ASCE 7, ASTM E580 & E580M-16 specs. The tiles shall be installed in T-grids metal systems so as to form suspended interior ceilings. These ceiling shall be used or employed in all types of commercial, education and institutional buildings such as offices, schools, hospitals, colleges, restaurant and shops. The panels shall also be required with decorative vinyl lamination (if specified on drawings or directed / instructed by the Project Manager) on the exposed side.

11.12.1 MATERIALS & WORKMANSHIP:-

- i) All materials brought to the site and meant to be used shall be of best of their respective kinds.
Samples of all materials shall be approved or permitted by the Project Manager in charge and shall be deposited with him before the order is placed with the supplier. The material brought on the work for actual installation shall confirm to or comply with approved samples (the dimensions of approved brands may vary from dimensions specified in following paragraphs).
- ii) Any material that has not been found to conform to or comply with the specification shall be refused or rejected forthwith and shall be removed from the site by the Contractor.
- iii) All works shall be level plumb and square corners, edges arises in all cases shall be unbroken and finished neat.
- iv) Gypsum Tiles
 - Size: 600 x 600 mm or 610 x 1220 mm
 - Thickness 9mm or 12.5mm
 - Light reflectance (%): 85%
 - Humidity resistance (% RH): 99
 - Fire reaction: Class 1
- v) Support System concealed G I Section:
 - Main Section W type section @ 610 mm c/c
 - Cross Section W-Flat Type @ 610 mm c/c
 - Perimeter section U-25 type Section
 - Suspenders G I / M S Flat or Adjustable M S Rod

11.12.2 WORK ELEMENT TO BE INCLUDED:-

- i) Procurement transportation of all material to the site of work.
- ii) Fixing hangers for frame work support including (without limitation) threading, welding to the inserts or brackets in RC slab, beams or structural steel roof at specified spacing in conformity / accordance with drawings or manufacturer's specifications or recommendations.

- iii) Providing & fixing G.I. Perimeter channels, of size 0.55mm thick having one (1) flange of twenty (20) mm & another flange of thirty (30) mm & a web of twenty-seven (27) mm along with perimeter of ceiling, screw fixed to block wall or partition with the help of nylon sleeves and screws, at six hundred and ten (610) mm centers or as specified spacing as in conformity / accordance with drawings or manufacturers specifications or recommendations.
- iv) Providing & fixing suspending G.I. Intermediate channels of size forty-five (45) mm, 0.9mm thick with two (2) flanges of fifteen (15) mm each from the soffit at 1220mm centers with G.I. Angle 25mm X 10mm X 0.55mm thick fixed to soffit with G.I. Cleat & Steel expansion fastener.
- v) Ceiling section of 0.55mm thickness having knurled web of 51.5mm & two (2) flanges of twenty-six (26) mm each with lips of 10.5mm are then fixed to intermediate channel with the help of connecting clips & in direction particular to be the intermediate channel at 457mm centers. 12.5mm tapered edge Gypsum board shall be then screw fixed to the ceiling section with twenty-five (25) mm drywall screws at two hundred thirty (230) mm centers. Screw fixing shall be finished mechanically with drilling machine & suitable attachment.
- vi) Finally the boards shall be jointed & finished so as to have a flush look which cover or include (without limitation) filling & finishing with jointing compound, paper tape and two (2) coats of top coats suitable for Gypsum board in conformity / compliance with drawings or manufacturer's specifications or recommendations.
- vii) Providing access panels and provisions at places indicated or specified for electrical installations and other services.
- viii) Protection false ceiling work till Final Acceptance. Erection of temporary scaffolding for installation work

11.13 DISMANTLING

The term "Dismantling" means to carefully take apart one or more parts of a building or structure without damaging the other parts. The term 'Demolition' on the other hand implies breaking up. The work may comprise dismantling/demolishing whole or part of work including all relevant items consisting of but not limited to stone work, brick/block work, concrete, floorings, roofing and iron work as specified and or shown on the drawings.

Dismantling and Demolition work shall comply with BS 6187 Code.

11.13.1 PRECAUTIONS

- i) All materials retrieved from dismantling or demolition shall be properly stored/ stacked and shall be the property of the Employer unless otherwise specified and shall be kept in safe custody until they are handed over to the Project Manager/Employer.
- ii) Before commencement of dismantling/demolition, the Contractor shall prepare and submit his proposals and program for proceeding with the work for approval of the Project Manager. Generally, the Contractor will be permitted to demolish the structures only through approved means, Blasting can be permitted provided the necessary precautions are taken to protect the Works, public and private property and all persons in the vicinity of the Works, except if there be pumps, motors, hand rails, structural steel, bricks/blocks/stone and other usable materials, the Contractor shall salvage and immediately handover to the Employer at the site of salvaging all such equipment and materials prior to demolishing or removing the structure.

- iii) The work should generally be performed in reverse order of the one in which the structure was constructed. 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. Temporary enclosures or partitions and necessary scaffolding wherever specified shall also be provided, as directed by the Project Manager.
- iv) Necessary steps/ precautions should be taken to keep noise and dust nuisance to a minimum. If specified or directed by the Engineer-in-Charge, the Contractor shall provide, erect and remove screens of canvas or other suitable material to minimize the nuisance from dust and shall provide for watering as the work of demolition proceeds. Helmets, goggles, safety belts etc. should be used whenever required and as directed by the Project Manager. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cutters may be used carefully as directed. The dismantled articles should be removed manually or lowered to the ground and then properly stacked as directed by the Project Manager.
- v) Dismantling shall be done by taking out the fixtures 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 Project Manager. All unserviceable materials, rubbish etc. shall be disposed of as directed by the Project Manager.
- vi) The contractor shall maintain/ disconnect existing services, whether temporary or permanent. No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area. Screens shall be placed where necessary to prevent injuries due to falling pieces. Water may be used to reduce dust while tearing down plaster from brick work. Safety belts shall be used by laborers while working at higher level to prevent falling from the structure. First-aid equipment shall be got available at all demolition works of any magnitude.

11.13.2 MEASURE TO BE TAKEN FOR CERTAIN TYPE OF STRUCTURES

- i) **Roof Trusses:**

In case of a pitched roof, the roof structure should be removed to wall plate level manually. Sufficient purlins and bracing should be retained to ensure stability of the remaining roof trusses while each individual truss is removed progressively. Temporary bracing should be introduced, where necessary, to maintain stability. The end frame opposite to the end where dismantling is commenced, should be independently and securely guyed in both directions before commencement of work. The bottom tie of roof trusses should not be cut until the principal rafters are prevented from making outward movement.
- ii) **Heavy Floor Beams**

Heavy bulks of timber and steel beams should be supported before cutting at the farthest point and should then be lowered to a safe working place.
- iii) **Jack Arches:**

Where tie rods are present between main supporting beams, these should not be cut until the arch or series of arches in the floor have been removed. Due care should be exercised and full examination of this type of structure undertaken before demolition is commenced. The floor should be demolished in strips parallel to the span of the arch rings (at right angles to the main floor beams).
- iv) **Block Arches**

Full time supervision should be given by experienced persons fully conversant in the type of work to ensure that the structure is stable at all times. Dead loads as much as possible may be removed provided it does not interfere with the stability of the main arch rings but it should be noted that the load-carrying capacity of many old arches relies on the filling between the spandrels. The restraining influence of the abutments should not be removed before the dead load of the spandrel fill and the arch rings has been removed.

Special temporary support shall be provided in the case of skew bridges. A single span arch can be demolished by hand by cutting narrow segments progressively from each springing parallel to the span of the arch until the width of the arch has been reduced to a minimum which can then be collapsed. Where it is impossible to allow debris to fall to the ground below, centering designed to carry the load should be erected and the arch demolished progressively. The design of the centering should make appropriate allowance for impact.

Where deliberate collapse is feasible the crown may be broken by the demolition ball method working progressively from edges to the centre. Collapse of the structure can be affected in one action by the use of explosives. Charges should be inserted into boreholes drilled in both arch and abutments. This method is the most effective for demolition of tall viaducts.

In multi-span arches before individual spans are removed, lateral restraint should be provided at the springing level. Demolition may then proceed as for a single span, care being taken to demolish the spandrels down to the springing line as the work proceeds. Where explosives are used it is preferable to ensure the collapse of the whole structure in one operation to prevent the chance of leaving unstable portions standing.

v) **Cantilever not Part of Framed Structures:**

A cantilever type of construction depends on the super imposed structure for its stability. Canopies, cornices, staircases and balconies should be demolished or supported before the tailing down load is removed.

vi) **In situ Reinforced Concrete**

Demolition of RCC shall comply with ACI 555R-01 Standard.

Before commencing demolition, the nature and condition of the concrete, the condition and position of reinforcement, and the possibility of lack of continuity of reinforcement should be ascertained. Attention should be paid to the principles of the structural design to determine which parts of the structure depend on each other to maintain overall stability. Demolitions should be commenced by removing partitions and external non-load bearing cladding. It should be noted that in some buildings the frame may rely on the panel walls for stability. Where hard demolition methods are to be used, the following procedures should be used.

a) **Reinforced Concrete Beams**

For beams, a supporting rope should be attached to the beam. The concrete should then be removed from both ends by pneumatic drill and the reinforcement expose. The reinforcement should then be cut in such a manner so as to allow the beam to be lowered under control to the floor.

b) **Reinforced Concrete Columns**

In case of columns, the reinforcement should be exposed at the base after restraining wire guy ropes have been placed round the member at the top. The reinforcement should then be cut in such a manner so as to allow the column to be pulled down to the floor under control.

c) **Reinforced Concrete Walls**

Reinforced concrete walls should be cut into strips and demolished.

d) **Reinforced Concrete Slabs**

Reinforced concrete slabs should be demolished in the following manner:

- i. Safety gear comprising of hard hat, goggles, face mask, gloves and hard shoes should be worn by workers.
- ii. Slab which is to be demolished should be clear of any utility line e.g. electric, gas or water lines etc.

- iii. The method to break up large slabs is to break it up into smaller sections. Breaking of slab should start at the farthest end and proceed slowly towards the near end, always making sure that solid flat concrete footing is available for the workers
- iv. Breaking of slab should be carried out by jack hammer, sledge hammer or other suitable tools.
- v. Concrete should be broken down into smaller pieces which can be disposed of easily by workers.
- vi. Reinforcement can be cut into smaller pieces and disposed of after concrete has been removed.

11.13.3 ELECTRICAL ITEMS

Electrical Cables shall be identified and tagged for removal by the contractor. The same shall be verified by the Engineer prior to removal. It shall be ensured that no other cable is disturbed/damaged in the process of removal of tagged cables.

Electrical points and fixtures shall be removed carefully in such a way that their components are not damaged.

11.13.4 METHODS OF DISMANTLING

Dismantling of various Structures and Elements of Structures can be carried out by adopting Manual or Mechanized method. The following procedure shall be adopted for Dismantling.

a) Manual Method

The Engineer and the Contractor will jointly agree to the Quantum of work to be dismantled like Doors, Windows, and Bathroom fittings, Tiles of various kinds, Trusses and Electrical items.

b) Mechanized Method

The Engineer shall determine the Measurement/Quantum of work pertaining to Concrete and Brick/block/Stone masonry to be dismantled. The equipment to be used for dismantling shall be approved by the Engineer prior to start of work.

CHAPTER-12

WATER SUPPLY AND SANITATION

Chapter-12: WATER SUPPLY AND SANITATION

12.1 WATER SUPPLY PIPE LINES AND APPURTENANCES

12.1.1 SCOPE

The work covered or included by this Section of the specifications shall contain or consist in furnishing all plant, labor, equipment, appliances and materials and performing all operations -in connection with the installation and testing of water supply lines and appurtenances in conformity or compliance with this section of the specifications.

12.1.2 MATERIALS

(i) Pipes

Material of the water supply pipes shall conform to or comply with the respective specifications and other requirements specified hereinafter. The pipes shall be of brand new and unused unless otherwise specifically specified herein or directed / instructed by the Project Manager. The standard length of pipes of each material as specified herein shall be used or employed.

a) Cast Iron Pipes and Fittings

Cast iron pipes & fittings shall conform to or comply with BS-78 for spigot & socket vertically cast pipes BS-1211 for spigot and socket spun iron pipes and BS-2035 for flanged pipes.

b) Ductile Iron Pipes and Fittings

Ductile iron pipes shall be made or provided from a suitable spheroidal graphite iron centrifugally cast in lined or unlined metal mould in conformity / compliance with the I.S.O Standard 2531 Class K9 or its equivalent. The pipes shall have spigot and socket ends employing elastomer gaskets for making push on joint. Pipes with mechanical joints shall be used wherever rigidity is required and shall have flanges with appropriate nuts and bolts and the gasket. Fittings and specials shall be of ductile iron, made so as to match or meet the type and size of pipes. Except tees, all standard fittings shall conform to or comply with I.S.O Standard K12 whereas tees shall conform to or comply with K14.

c) Galvanized Iron Pipes and Fittings

The galvanized iron pipes shall strictly conform to or comply with BS-788 Specifications for "Wrought Iron Tubes and Tubulars suitable for screwing to BS-21 pipe threads". A complete and uniform adherent coating of zinc white shall be provided or furnished for galvanized iron pipes and fittings.

d) Mild Steel Pipes and Fittings

The mild steel pipes and fittings shall conform to or comply with BSS-1387.

e) PVC Pipes and Fittings

PVC pipes shall conform to ASTM D1785, specially molded fittings shall be used and shall not be modified in the field.)

f) Un-plasticized Polyvinyl Chloride (uPVC) Pipes and Fittings

Un-plasticized polyvinyl chloride (uPVC) pipes and fittings shall conform to the following standards:

- BS-3505/PS-3051
- BS-4346

- PS-3214
- PS-1915
- ISO-3633
- ISO-4633

Physical Properties of uPVC Pipes

PROPERTY	VALUE	UNIT
Specific Gravity	1.42 – 1.46	--
Tensile Strength at 20 °C	500-600	Kgf/cm ²
Modulus of Elasticity at 20 °C	30000	Kgf/cm ²
Compressive Strength	650 - 750	Kgf/cm ²
Stiffness	1000	Kgf/cm ²
Specific Heat at 20 °C	0.23 – 0.35	Cal/gm/ °C
Upper Limit Service Temperature	75	°C
Softening Point	80 – 85	°C
Thermal Conductivity	0.12 – 0.15	k. Cal/mh °C
Co Efficient of Linear Expansion	7-8 X 10-5	m/m/ °C
Welding Temperature	180	°C
Moulding Temperature	190 - 195	°C
Chemical Resistivity	Highly resistant to aqueous solutions, acids and alkalies at low temperatures	

uPVC Pipe Sizes

Pipe dimensions for a 9 bar Class C, 12 bar Class D and 15 bar Class E Pipes are tabulated below as Table

Table- Pipe Dimensions for 9 bar (Class C), 12 bar (Class D) and 15 Bar (Class E) Pipes													
Nominal Size	Mean Out side Diameter		Individual Out side Diameter		Wall Thickness								
	min	max	min	Max	9 bar (Class C)			12 bar (Class D)			15 bar (Class E)		
					Average Value	Individual Value		Average Value	Individual Value		Average Value	Individual Value	
					max	min	max	max	min	max	max	min	max
inch	mm	mm	mm	Mm	mm	mm	mm	mm	mm	mm	mm	mm	Mm
3/8	17	17.3	17	17.3	-	-	-	-	-	-	1.9	1.5	.9
½	21.2	21.5	21.2	21.5	-	-	-	-	-	-	2.1	1.7	2.1
¾	26.6	26.9	26.6	26.9	-	-	-	-	-	-	2.5	1.9	2.5
1	33.4	33.7	33.3	33.8	-	-	-	-	-	-	2.7	2.2	2.7
1-1/4	42.1	42.4	42	42.5	-	-	-	2.7	2.2	2.7	3.2	2.7	3.2
1-1/2	48.1	48.4	48	48.5	-	-	-	3	2.5	3	3.7	3.1	3.7
2	60.2	60.5	60	60.7	3	2.5	3	3.7	3.1	3.7	4.5	3.9	4.5
3	88.7	89.1	88.4	89.4	4.1	3.5	4.1	5.3	4.6	5.3	6.5	5.7	6.5
4	114.1	114.5	113.7	114.9	5.2	4.5	5.2	6.8	6	6.8	8.3	7.3	8.3
5	140	140.4	139.4	141.0	6.3	5.5	6.4	8.3	7.3	8.3	10.1	9	10.4
6	168	168.5	167.4	169.1	7.5	6.6	7.6	9.9	8.8	9.9	12.1	10.8	12.5
8	218.8	219.4	218.0	220.2	8.8	7.8	9	11.6	10.3	11.6	14.1	12.6	14.5
10	272.6	273.4	271.6	274.4	10.9	9.7	11.2	14.3	12.8	14.3	17.5	15.7	18.1
12	323.4	324.3	322.2	325.3	12.9	11.5	13.3	17	15.2	17	20.8	18.7	21.6
14	355	356	353.7	357.3	14.1	12.6	14.5	18.6	16.7	18.6	22.8	20.5	23.6
16	405.9	406.9	404.3	408.5	16.2	14.5	16.7	21.1	19	21.1	26	23.4	27
18	456.7	457.7	454.9	459.5	18.2	16.3	18.8	23.8	21.4	23.8	-	-	-
20	507.5	508.5	505.4	510.6	20.2	18.1	20.9	-	-	-	-	-	-
24	609.1	610.1	606.5	612.7	24.1	21.7	25	-	-	-	-	-	-

g) Polypropylene Random (P.P.R) Pipes and Fittings

Polypropylene random pipes and fitting shall confirm or comply with to following standard.

DIN 8076	Standard for testing metal threaded joints,
DIN 8077	Polypropylene (PP) pipe dimensions.
DIN 8078	Polypropylene (PP) pipes; general quality requirements testing & chemical resistance of pipes and fittings.
DIN 16928	Installation, pipe and fitting connections
OHSAS 18001	British standard for Health and safety management system

PPR Pipe Sizes

Standard PPR Pipe sizes are mentioned in the table below.

DN	SDR 6 (PN 20)		
	O.D(mm)	e (mm)	I.D (mm)	MI (Kg/m)
20	3.4	13.2	0.172
25	4.2	16.6	0.266
32	5.4	21.2	0.434
40	6.7	26.6	0.671
50	8.3	33.4	1.04
63	10.5	42	1.65
75	12.5	50	2.34
90	15	60	3.36
110	18.3	73.4	5.01

Note: The pipes of greater diameter can be ordered and manufactured according to the need.

h) High Density Polyethylene (HDPE) Pipes and Fittings

Polyethylene Pressure Pipes (PE 100) for potable water application shall conform to ISO 4427 or DIN 8074/8075. PE pipes are suitable for outside water supply and distribution network and for other applications.

Polyethylene used for Pipes shall contain Carbon Black (2% min.) as UV stabilizer when they are to be used in exposed conditions.

Pipes up to 75 mm Outer Diameter (OD) shall be joined by using compression fittings of the same operating pressure as the pipe. Pipes of 90mm or larger OD shall be joined using Butt Fusion or Electro Fusion methods as specified by the manufacturer. Manufacturer's recommendations shall be strictly followed to ensure proper joints in pipes. Cost of jointing is included in the pay item of pipe work.

Cold Bending Radius for PE pipes at 20°C shall not be less than 22 x Pipe OD. For lesser radii, Bend fittings shall be used.

Typical Physical Properties of PE-100 pipes:

Properties		Typical Value	Unit	Test Method
Density	(Compound)	950-959	Kg/m ³	ISO 1183

Melt Flow Rate	(190°C/5.0 kg)	0.3	g/10 min	ISO 1133
Tensile Stress at Yield	50 mm/min	19-21	MPa	ISO 1133
Elongation at Yield		9	%	ISO 527-2
Elongation At Break		>350	%	ISO 527-2
Charpy Impact Strength, notched	0°C	14	Kj/m ²	ISO 179/1eA
Carbon Black Content		≥2	%	ASTM D 1603
Brittleness Temperature		<-70	°C	ASTM D 746
BSCR	10% Igepal, F ₆₀	>10000	h	ASTM D 1693-A
Thermal Satiability	210°C	>15	Min	EN 728

(ii) Sluice (Gate) Valve/Check Valve

Valves shall be wedge gate valves/check valve cast iron conforming to or complying with British Standard Specification No. 5163, PN-10. Ends of valves shall be suitable for the type of pipe to which the valves will be connected.

(iii) Fire Hydrants

The metal of fire hydrant shall conform to or comply with BS-750 and shall be of screw down streamline pattern. The body shall be best quality, closed grain, gray cast iron with spindle of manganese bronze having tensile strength of not less than 1.63 Kg/mm machined from solid rolled bars, the seating valves and other parts shall be of best quality gun metal with Brinell Hardness No. 80. The direction of closing shall be by clockwise rotation and outlet shall have screwed joint for accommodation 63 mm dia hose connection and shall be single nose. Inlet flanges of hydrant shall be suitable for jointing with flanges of hydrant bends and tees. All fire hydrants shall be coated with three coats of solution from an approved manufacturer to give a uniform protective coating on cast iron.

(iv) Air Valves

The material of the air valves shall be shown or demonstrated as follows:

- Small Orifice: Cast iron body cover; cast iron bowl with gunmetal seat and rubber covered ball or other arrangement approved or permitted by the Project Manager.
- Large Orifice: Cast iron body cover cast iron bowl with rubber seat and vulcanite covered ball or other arrangement approved or permitted by the Project Manager.
- Valves with air intake or exhaust facilities: shall have approved screening arrangements so as to avoid or prevent the ingress of air borne sand.
- Body ends: shall be flanged with raised faces and drilled in conformity / compliance with BS- 4504 for the nominal pressure specified or envisaged in the drawings.

a) Double Orifice Air Valves

Double orifice air valves shall meet and/or satisfy the following conditions:

- Expulsion of air during charging of the pipe-line;
- Admit air during emptying of the pipeline so as to avoid or prevent the occurrence of negative pressure;
- Expulsion of air accumulated at summit points along the pipe line under normal operating conditions.

The first two (2) conditions shall be met by the employment of a large orifice capable of handling large volumes of air at high flow rate, and the last condition can be met by a small orifice capable of discharging small quantities of air as the same accumulate.

The large orifice shall be sealed by a buoyant rigid ball and the chamber housing shall be such as to avoid or prevent premature closing of the valve by the air whilst being discharged. The small orifice shall be sealed by a buoyant ball at all pressures above atmospheric except when air accumulates in the valve chamber.

b) Single Orifice Air Valves

These shall be able to remove or expel out the air accumulated at suitable points along the pipe line under normal operating conditions. Each valve shall be provided or furnished with only a small orifice which shall operate in the same manner as that in a double acting air valve.

(v) Surface Boxes

The surface boxes shall be manufactured or assembled in conformity / compliance with drawings. Cover and frame shall be of cast iron.

(vi) Ferrules

Brass ferrules of the sizes required shall be provided or furnished with straps and cast iron / HDPE saddles or as approved by the Project Manager.

(vii) Pressure Reducing Valve

Pressure Reducing Valve shall conform to or comply with British Standard Specification No. BS EN 1567:1999. Ends of valves shall be matched or suitable for the type of pipe to which the valve shall be connected. Valve shall be properly sized. The same shall not be small enough to avoid or prevent noisy operation and large enough to pass ten percent (10%) to fifteen percent (15%) of the maximum flow rate desired or required in the system. Two (2) stage serial reductions shall be used so as to control the pressure in water mains if pressure exceeds two hundred (200) psi.

(viii) Filling Material

Compacted Earth

Excavated material to be free from organic and all other external material approved or permitted by the Project Manager shall be used for filling around the pipes as compacted earth.

Crushed Stone

Crushed stone shall have sharp edges, clear fracture at faces and shall be free from elongated or laminated pieces and shall have a maximum gauge of thirty-eight (38) mm and shall not contain more than ten percent (10%) passing through screen made of six (6) mm diameter bars spaced at six (6) mm center to center.

Sand for Filling

Sand for filling for bedding, around pipes and above pipe crown should be free from organic and all other external materials and should be approved by the Project Manager. It shall also fulfill the specifications section 1.2.11 provided in chapter-1.

(ix) Bitumen for Coating

Bitumen for coating shall conform to or comply with British standard BS-3416:1991.

(x) Chlorinator

Chlorinator shall be of vacuum feed, manually set cylinder mounted type, capable of meeting requirements of water flows ranging from twenty-eight (28) liters/second to fifty-six (56) liter/second and delivering up to ½ kg/hr. of chlorine gas in solution to provide a maximum dosing rate of two (2) ppm. The chlorinator shall be complete with all standard accessories so as to ensure satisfactory operation.

The chlorinator shall cover or include (without limitation) among its accessories an injector, a water booster pump with electric controls, a chlorine gas inlet connected via pressure regulating valve, a linear feed rate indicator, a feed rate adjuster a pressure relief valve, a drain relief valve and chlorine pressure gauge. Along with each chlorinator, a water pump for boosting water pressure so as to meet specific requirement of the chlorinator. The pumps shall have adequate pumping capacity and so as to secure or ensure proper mixing of chlorine and water in the injection assembly of chlorinator. The pumps shall be electrically driven or provided by single phase motor capable of operation on 220 V, 50 Hz with +10% fluctuations in voltage. The pumps shall be complete with suction and delivery isolating valves, pressure gauge and approximate starters.

With each chlorinator two 68 kg (150 lb) empty chlorine cylinder designed and fabricated in accordance with AWWA or ASTM specification or equivalent. The welded seams shall be fully stress relieved after fabrication. A corrosion allowance of 1.56 mm shall be ASTM A-515-10 (2015) GRADE 60 or ASTM A-285-12 GRADE C or equivalent.

Cylinder shall be provided or furnished with matching outlets corresponding to chlorinator. Each cylinder shall also have a protection cap provided along with the cylinder.

Solution feed hypo chlorination feeding. Chlorine solution from chemical solution tank shall be injected by Positive Displacement pump coupled with air cooled heavy duty electric motor with following capacity.

Feeding capacity range 0-150 liter per day

Injection pressure range from 0.7-1.7 MPa

(xi) Bridge for Crossing Water Supply Pipe Line at Natural Nullah

Construction of bridge for crossing water supply pipe over a natural Nullah where pipe could not be crossed underground shall be constructed or provided in conformity / compliance with dimension and specification as shown or envisaged in the drawing and as directed or instructed by the Project Manager

12.1.3 APPROVAL OF MATERIALS AND EQUIPMENT

All materials and equipment to be employed or incorporated in the work shall conform to or comply with the specifications and as shown or envisaged on the drawings and shall be approved or permitted by the Project Manager.

12.1.4 INSTALLATION

(i) Handling

Pipes and accessories shall be handled in such a manner as to secure or ensure their delivery to the trench in sound, undamaged condition but in good working condition. If any pipe or fitting is damaged or defective, the repair or replacement thereof shall be made by the Contractor at his cost and risk in a satisfactory manner. No other pipe or material of any kind shall be placed inside of a pipe or fittings. Pipes shall be carried into position and not dragged. The interior of pipe & accessories shall be thoroughly cleaned of foreign matter or deleterious substance before being lowered into the trench and shall be kept clean during laying operations .by plugging or other approved method or measure. The plugging when so required shall be provided or furnished with tapered wood (such as Kikar) blocks or the pipe ends shall be covered with PVC caps. Before installation, the pipe shall be inspected for damages or defects therein. Material found to be damaged or defective before or after laying shall be replaced with sound material without additional cost or extra cost to the Employer. Rubber gaskets that are not to be installed immediately shall be kept or stored in a cool dark place and protected against the direct rays of the sun.

(ii) Cutting of Pipe

This shall be provided or furnished in a neat workman-like manner without damage or defect to the pipe. Unless otherwise authorized or approved by the Project Manager or recommended by the manufacturer, cutting thereof shall be provided with a mechanical cutter of approved type. Wheel cutters shall be used or employed wherever practicable.

(iii) Location

Where the location of the water pipe is not clearly defined or specified by dimensions on the drawings, the water pipe shall be located as directed or instructed by the Project Manager.

(iv) Excavation in Trenches and Backfilling

The trenches shall be set out to suit or meet alignment of the pipe lines. The trenches shall be carefully trimmed at sides and bottom so that pipe lines when laid shall rest on the firm bed throughout the length. Shallow joint holes shall be left for the joint where appropriate and necessary. Where pipe line is to be laid in plains, the depth of cover, i.e., the normal distance from ground level to the top of the pipe to be kept at about eight hundred (800) mm and shall not be less than seven hundred fifty (750) mm except due to special reasons or grounds where the Project Manager directs or instructs in writing to the Contrary as deemed necessary.

(v) Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick ropes, belt slings, or other suitable equipment. Under no circumstances shall any of the water line materials be dropped or dumped into the trench. Due attention and care shall be taken to avoid or prevent abrasion of the pipe coating. Poles used as levers shall be of wood and shall have broad flat faces so as to avoid or prevent damage or defect to the pipe. Except where necessary in making connections with other lines as authorized or approved by the Project Manager, pipe shall be laid with the bells facing in the direction of laying.

The full length of each section, of pipe shall rest solidly upon the pipe bed with recesses excavated so as to accommodate bell coupling and joints. Pipe that has the grade or the joint disturbed after laying shall be taken out and relaid. Pipe shall not be laid in water. Water shall be kept out of the trench until the materials in the joints have hardened or until caulking or jointing is completed. When work is not in progress, open ends of pipes, fittings, and valves shall be securely closed so that no trench water, earth, or other substances will enter the pipes or fittings. Where any part of a coating or lining is damaged or defective, the repair shall be made by the Contractor at his cost and risk in a satisfactory manner. Pipe ends (left for future connections shall be valved, plugged or capped, and anchored, as shown herein or as directed or instructed by the Project Manager, where connections shall be made by using specials and fittings to suit or meet the actual conditions.

(vi) Jointing

All screwed joints, shall be examined or verified before jointing to secure or ensure that the threads are perfect or satisfactory. In case of any flaw, proper dies shall be used to make threads before they are jointed. The screwed ends of the pipes or specials to be jointed shall be very slightly tapered so that in so far as the joint is screwed up, the threads shall bind together more and more tightly to secure water tightness.

The jointing work shall be so arranged in case of every joint that the two (2) ends of pipes or specials joined thereby shall be equidistant from the middle of the socket and shall have a space of not more than $\frac{1}{4}$ " between them in the center of the socket. Before any joint is made all burrs from the ends of the thread joints shall be removed. A few very thin strands of best quality country cotton yarn, smeared over carefully with genuine.

Red lead shall be wound in the grooves of the threads from end to end of the joint if the screwed joint is a little slack in order to secure or ensure tightness. For this purpose hemp or jute or any material other than that described above shall on no account be allowed or permitted to be used. A paste of genuine red and white lead mix shall be lightly smeared over the threads to act as a lubricant. The pipes shall be screwed up tightly with pipe fitter's tongs or

wrenches to ensure that each and every joint is perfectly water tight against the test head of water. No red and white lead paste or cotton yarn shall project outside the ends of the joints.

A). Manufacturer's Recommendations

- a) - The joints shall be provided or furnished in accordance / compliance with the recommendations of the manufacturer as approved or permitted by the Project Manager.
- b) - Connections between different types of pipes and accessories shall be made or provided with transition fittings where recommended by the pipe manufacturer.
- c) - Service connections shall be made or provided as indicated and in accordance with the recommendations of the pipe manufacturer or supplier.

In case manufacturer's recommendations are not available, the jointing of pipes of various materials shall be carried out as follows:

B). Cast Iron/Ductile Iron Pipes and Fittings

a) Rubber Gasket Joints:

Rubber gasket joints shall be used or employed for socket and spigot pipes, where called for Rubber gasket joints shall be made or provided by using specified rubber gaskets, conforming to or complying with PS-428:1984 and I.S.O 160-1980 made to fit the applicable socket and spigot pipes. An approved rubber ring lubricant (but not grease), shall be used or employed for jointing the pipes. Due attention and care shall be taken so as to avoid or prevent contamination of the gasket and lubricated surface with earth or other undesirable material during installation.

b) Lead Caulked Joints:

The socket joints of the pipes and special castings shall be made with lead and white spun yarn. The joints shall be made by forcing the spigot end of one (1) pipe into the socket end of the preceding one. A gasket of spun yarn being then driven and caulked into the joint keeping the pipes concentric. The gasket shall either be driven or provided in complete rings, or better still a spiral coil of yarn shall be inserted. In the former case, due care shall be taken that the joints of the successive rings do not coincide. Each ring thereof shall be packed with thin steel "yarning" tool and then lightly hand caulked to ensure that the yarn is solidly packed. Short pieces of yarn forming less than a complete ring shall not be used or employed. The yarn shall be caulked to such a depth as to leave clear the following depths measured from the faces of the sockets for the lead joints:

I/D of Pipe (cm)	Finished Depth of Lead Joints (mm)
5 to 12.5	40
15, 18	45
20, 23	48
20, 30	50

A jointing ring shall be placed round the barrel and against the face of socket. Molten lead shall be poured in to fill the remainder of the socket. Before making any joint, due care shall be taken to remove or eliminate all thick bituminous material or coal tar from the spigot end and from the inside of the socket. Both shall be thoroughly cleaned and dried before the joint is made.

After the lead has solidified in the joint, the jointing ring shall be removed and the lead shall be caulked right round the joint to make up for the shrinkage of the molten metal on cooling. The joint shall be set back by caulking, not less than four (4) mm inside the face of pipe socket.

c) Lead Wool Caulked Joints:

This type of lead caulking shall be completed where the same shall be inconvenient or dangerous to use molten lead for joints for example, in cases such as inverted joints or in wet trenches. The spun yarn shall first be inserted and caulked into the socket as specified under jointing with molten lead. Lead wool or lead yarn shall then be introduced in the joint in strings not less than six (6) mm thick and the caulking Repeated with each turn of lead wool. The whole of the lead wool shall be compressed into a dense mass. The joint shall then be finally finished flush with face of the socket. The lead wool brought to the site shall be properly protected and packed with wax paper or polythene sheet, to avoid or prevent oxidation.

d) Flanged Joints:

These shall be made using three (3) mm rubber insertion jointing discs accurately cut. The bolts of the joints shall be tightened up systematically and uniformly in such a manner that the tension in all the bolts shall be similar and there shall be no tendency to distortion or deflection. No bolt shall be stressed beyond its elastic limit.

C). G.I /M.S Pipes and Fittings

a) Screwed Joints:

All screwed joints, both internal and external, shall be examined or verified before jointing, to ensure that the threads are perfect for the full depths of the joints. The jointing shall be such that the ends of pipes or specials remain equidistant from the middle of the socket and space between them in the center of the socket is not more than six (6) mm. All burrs from the ends of the threaded joints shall be removed or eliminated.

To make the joints water tight thin strands of best quality country cotton yarn smeared over carefully with genuine Red lead shall be used. A paste of genuine red and white lead mix shall be lightly smeared over the threads to act as a lubricant and to make up for imperfections in the threads when the pipes are screwed up. No red and white lead paste or cotton yarn shall project outside the ends of the joints.

b) Flanged Joints:

In the case of pipe lines lay in open country whether in trenches or on the surface, flanged joints shall be provided or furnished at intervals of not more than one hundred fifty (150) m. The flanges shall be screwed on to the pipes in the same manner and using the same jointing composition as already specified for screwed joints so as to be water tight. All flanges shall be screwed home and the end of the pipe projecting in front of the flange faces shall be neatly cut off, filed and made perfectly smooth and not to project ahead of the faces of the flanges so as not to interfere with the accuracy or preciseness of the joints. Each flanged joint shall be made by inserting an accurately cut disc of tough multiple rubber insertion about three (3) mm thick of approved quality between the flanges. The bolt holes in the rubber insertion as well as in the flanges shall be drilled to template. The bolts shall be pulled up gradually and evenly so as to secure or ensure a perfect joint. They shall, however, not be over strained.

c) T-Bar Cradle Supports

In case of pipe line lay in open and at steep slopes cast iron T-Bar cradle supports of suitable size shall be provided or furnished at a distance not more than fifteen (15) m or otherwise directed or instructed by the Project Manager.

D). Asbestos Cement Pipes

a) Comete Couplings:

Comete couplings manufactured in asbestos cement and provided with two (2) jointing rings, one (1) at each end shall be used or employed. The rings shall be supplied or furnished by the pipe manufacturer. The same shall be lip seal type conforming to or complying with P.S-1438, latest version. "Rubber sealing rings for joints in asbestos cement water piping". The joints shall not only withstand internal test pressures but also provide adequate protection or safeguards against seepage of ground water into pipe lines.

b) Flanged Joints:

Gaskets for flanged joints shall conform to or comply with the specific requirements of Standard Specifications for "Sheet Buffer Packing" (latest ASTM Code or equivalent). Grade No. 1, black colour, and thickness of eight (8) mm.

E). PVC Pipes

The joints in the pipe line shall be "Z" type rubber ringed joints. For jointing with specials like valves, special stub flanges and steel flanges drilled to shape and size of flange on the special fitting shall be used or employed. For jointing with CI or asbestos cement pipes special socketed pieces or spigotted pieces or pieces with stub joints on one end and socket or spigot on the other end.

Pipes should be jointed outside on the side of trench and then lowered into prepared trench with necessary bedding already in place. Heavy fittings will be jointed in the trench. For achieving reliable and satisfactory installation, factory made fittings must be used and due consideration be given to thermal effect on PVC and to supporting heavy fittings like valves independently so that these do not bend or damage the pipe.

On hot days, the pipe shall be allowed or permitted to cool off in the trench before being fixed to valves and the like, so as to avoid or prevent pressure or stresses on Shrinkage. Hot air in the body of pipe is released through air valves or through taps connected to saddle tapings. Use of 71 types joint reduces the risk of shrinkage as the same allows movement. Branching shall be finished or provided by special welding process, which shall be obtained or procured from the manufacturer and should preferably be provided by his crew or by specially trained workers.

Only special jointing solution and other items like rubber rings supplied by the manufacturer shall be used. The solution shall be applied uniformly, evenly and thinly. A thick layer shall not improve but may weaken the joint. Only tapping saddles made from gun metal and supplied by the manufacturer of pipes shall be used for making house connections End connections with screwed GI pipes shall be made with special socketed and screwed connecting pieces obtained or procured from the pipe manufacturer.

F). uPVC Pipes

• Jointing of uPVC Pipes

Solution Cement Joint

In solution cement jointing method, the outside of spigot and inside of socket shall be cleaned properly. A coat of solution shall be applied sufficiently covering the inside of the socket and outside of the spigot. The Pipes shall be then assembled in position immediately after wards. Then the setting time of ten (10) to twenty-five (25) minutes shall be provided for the solution to be firmly dried up before further installation. During the setting time, the joint shall not be moved.

Rubber Ring Joint

A grooved face shall be formed on the end of the pipe as integrated part of the same in the factory. The same shall contain or consist of a socket which is designed to provide a clearance fit on the outside diameter of the corresponding pipe spigot end. In the socket, the same shall be formed a rectangular groove for rubber ring.

Clean the pipe's spigot end from the outside and the sealing groove of the fitting from inside. Insert the rubber ring into the socket end of the pipe. Ensure that the rubber ring shall be fixed in the right direction. Apply the lubricant (soapy solution) uniformly to the spigot end and sealing ring and push the spigot end into the socket containing sealing ring until fully home. Prior to insertion, mark the position of the socket edge with a pencil or felt-tip pen on the pipe and withdraw the pipe from a socket by approximately ten (10) mm to allow or permit for thermal expansion.

- **Laying of uPVC Pipes**

Pipes and accessories shall be carefully examined or verified before being laid and defective or damaged pipes shall not be used or employed. The pipes shall be brushed clean inside and outside so as to remove any soil, foreign matter or deleterious substance that may have accumulated, including inside of the sockets and outside of spigots, before being lowered into the trench, and shall be kept clean during laying operation by plugging or other approved method or measure.

The bottom of the trench shall be shaped to provide substantially uniform circumferential support to the lower fourth of each pipe. Pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe pointing in the direction of flow. Each pipe shall be laid true to line and grade and in such manner as to form close concentric joint with the adjoining pipe. If the width of the trench at the pipe is exceeded than necessary, due to any reason or ground other than under direction or instruction from the Project Manager, the Contractor shall install at no additional cost or extract cost to the Employer, such concrete cradling pipe encasement or other bedding as may be required or instructed by the Project Manager to satisfactorily support the added load of the backfill.

Trenches shall be kept free from water until or unless the pipe jointing material has set, and pipe shall not be laid when the condition of the trench or the weather condition is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no trench water, earth or other substance will enter the pipe and fittings

In so far as the work progresses, the interior of the pipe shall be cleaned of all dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept or maintained in the pipe and pulled forward past each joint immediately after the jointing has been completed.

Where pipe cross above water line, the pipe for a distance of three (3) meter (10 feet) each side of the crossing shall be fully encased in concrete of min. Fifteen (15) cm. (6") thicknesses.

Any section of the pipe found to be damaged or defective before and after laying shall be replaced with sound pipe without additional cost or extra cost to the Employer

G). Polypropylene Random Pipes & Jointing

- a) **Jointing Techniques**

The surface of the pipes and fittings shall be clean and without impurities. Pipe ends shall be clean, cut at right angles. It is advised or recommended to cut one (1) cm from the pipe ends in order to avoid or prevent possible micro cracking due to incautious handling.

Before carrying out the welding, check that the poly-fusion device operates correctly and that the same reached the required welding temperature (260°C and that the same reaches the required welding temperature (260°C±5).

Jointing is done by heat fusion (welding) by means of welding machine. Welding is carried out by means of heating simultaneously the male and female parts to be joined together, once the welding temperature is reached the joint is made and held for cooling time.

b) Welding Instructions using socket welding machine.

- i). Check whether the welding tool corresponds to the size you need to join.
- ii). The welding tool or device has reached the necessary operating temperature of $260^{\circ}\text{C}+10$.
- iii). Cut the pipe at right angles to the pipe axis by using cutter or a hack saw.
- iv). Clean the pipe from burrs, cutting and chips.
- v). Mark the welding depths at the end of pipe.
- vi). Push the end of pipe up to the marked welding depths in the welding tool, at the same time push the fitting, into the welding tools.
- vii). After the specified heating time quickly remove or eliminate pipe and fitting from the welding tools and join them immediately, forcing the pipe into the fitting unless or until the marked welding depth is covered by the bead of Polypropylene from the fitting.
- viii). The joint elements have to be fixed and aligned within the specified assembly time.
- ix). After cooling time, the fused joint shall be ready for use. The heating time starts when pipe and fitting have fused joint shall be ready for use. The heating time starts when pipe and fitting have been pushed to the correct welding depth in the welding tool.
- x). The heating time shall be increased by fifty percent (50%) if average temperature is under $+5^{\circ}\text{C}$.

c) Welding of PPR Pipes

- i). Cutting of pipe at right angle with a cutter.
- ii). Marking of welding depth on the pipe end.
- iii). Simultaneous heating of both pipe and fittings according to required heating time (as per specified data).
- iv). Pushing of pipe end into the fitting and alignment of the assembly within specified time period.
- v). Finish joint.
- vi). Installation Principles
- vii). Fastening technique for open installation.

The selection of fastening material and its application shall be made or determined as:

- Fixed Point.
- Sliding Point.

Pipe clamps are such as to meet or satisfy all requirements and ensure that no mechanical damage or defect on the pipe surface can occur.

viii). Fixed Point

Valves and connections resisting to bending stresses shall be fastened by means of points. In particular cases, the fixed points shall be positioned closed to branches or wall passages. The axial closed to branched or wall passages. The axial expansion shall be compensated between two (2) points. The assess of the resistance of the fixed points one has to take into consideration the stresses to which the same shall be subject, caused by linear expansion, shall be subject, caused by linear expansion, weight of the piping and weight of the transportation fluid. Fixed points shall be delimited on both sides of the clamp, availing oneself of the rim fittings of valves.

ix). Sliding Point

The sliding points shall keep the system aligned and support the same, and allow or permit the axial sliding of the piping as well. The sliding shall be firmly mounted in order to avoid or prevent vibration and transmission of noise.

(vii) Deflection

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets shall be two (2) for Asbestos Cement Pipe unless or until otherwise required or recommended by the manufacturer. If the alignment requires deflections in excess of the specified limitations special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth, as instructed or approved by the Project Manager.

(viii) Chambers for Valves and Fire Hydrants

Chambers shall be constructed according to the drawings or as instructed by the Project Manager. The concrete work shall be according to the provision of the relevant Sections of Chapter-3.

(ix) Setting of Fire Hydrants, Valves & Surface Boxes

Fire hydrants shall be located and installed, as shown or envisaged on the drawings Hydrants shall be set plumb and in accordance with the manufacturer's instructions or recommendations.

Valves and surface boxes to be installed as shown herein or directed or instructed by the Project Manager, and shall be set plumb. Surface shall be centered on the stems or operators. Concrete, concrete pipe, brick/stone ballast used in chambers shall conform to or comply with the relevant clause of the Specification. Where feasible valves or operators shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box to the satisfaction of the Project Manager on all sides of the box, or to the undisturbed trench face if less than 1.20 meters.

Hydrants and valves shall have the interiors cleaned of all foreign matter or deleterious substance before installation. Surface boxes shall be lighted and the hydrant or valve shall be inspected in open and closed positions to ensure that all parts are in working condition

(x) Ferrule Connections

Service connections to water mains shall be made either by drilling and tapping the main after the pressure has been shut off, or by use of special tapping apparatus whereby the main shall be drilled and tapped and the ferrule introduced while the main remains under pressure. The later method shall be used for trunk mains or in other cases where the same would be inconvenient to shut off the water while the connection is being made..

In order to make a service connection to an asbestos cement water main, a malleable iron saddle piece with a flat boss shall be first bolted round the main with a rubber washer between the main and the boss. The boss and the pipe shall then be drilled and tapped together, giving a continuous thread through the boss and the wall of the main.

(xi) Thrust Blocks

Backing shall be placed between solid ground and the hydrant or fitting to be anchored the area, of bearing shall be as shown or demonstrated on the drawing. The back filling shall be so placed that fitting joints shall be accessible for repair or reinstatement. The concrete shall be plain cement concrete of class as specified in the drawings.

12.1.5 FLUSHING

(i) Initial Flushing

Flushing of line shall be finished section by section. For each valves section of pipe line a temporary hose connection between the water pipe line and the pipe line under test shall be made or provided. Water shall be pumped into the section to be flushed. The arrangements for supply or pumping of water into pipeline to be flushed and disposal of water shall be subject to the approval or permission of the Project Manager. The pipe line shall be flushed by keeping all the branching pipes open. Flushing shall be continued unless or until clean water starts flowing through the other end. Section by section, the entire pipe line shall be flushed at a minimum flushing velocity of 0.75 m/sec.

(ii) Final Flushing

Following complete disinfection of the pipe line, as per 12.1.7 hereafter all treated water shall be thoroughly flushed out from the pipe line at its extremities.

Treated water and water used for flushing the pipe lines shall be disposed of in a manner directed or instructed by the Project Manager. Fresh treated water shall be filled in the line and water tested for presence of coliform. The test result shall indicate or show negative coliform presence. If the test indicates any positive coliform, the entire process of disinfection thereof shall be repeated or improved upon unless or until coliform free samples are obtained or supplied.

12.1.6 LEAKAGE TEST

(i) Before Backfilling

Flushing of the pipe line shall be followed by a leakage test. Before the testing of pipe line, the Contractor shall ensure that concrete backing blocks have been provided where necessary. The test shall be performed only after all concrete work in contact with pipe to be tested has set for a minimum of twenty-four (24) hours. All joints shall be left exposed. Leakage test of the main supply line (on the streets/roads) shall be performed by keeping the end of the pipe line closed by proper plugs/blocks to resist 150 percent of the working pressure. The pressure should applied by means of a manually operated test pump or by a power driven test pump provided that the pump is not left unattended. While filling the line all valves and openings shall be kept open and water shall be filled in slowly. When the main pipe line is completely filled with water and all air expelled, the test should be maximum working pressure plus 50 percent and the test pressure shall be maintained for at least 2 hours. However, test pressure for pipes in the buildings shall be performed with a pressure of 60 meters head (6 kg/cm²). Precaution must always be taken to see that the test pressure is not exceeded. Pressure gauges must be accurate and if necessary should be recalibrate before the test. Each and every joint shall be inspected for leaks and for all visible leakage tests a Displacement Leakage Test shall be performed by the Contractor, for the newly laid pipe line. No piping installation will be accepted until the leakage is stopped or reduced to permissible limits determined by the Project Manager.

In the event of the pipe line failing the leakage test, the damaged or defective pipe fitting or joint shall be located and repaired. For dewatering the line, direction or instructions given by the Project Manager for disposal of water shall be followed or adhered to. After repairs of the line, the same shall be retested. The line shall not be accepted nor permitted unless or until the same passes the leakage test. No extra payment or additional cost shall be made for the repairing, replacement and dewatering the line for repair.

(ii) Retesting after Backfill

After the pipe trench has been backfilled, the entire length shall be subject to leakage test as a whole unit. The Contractor shall repair or make good the line if the same fails to pass the leakage test requirements specified hereinbefore. The test shall be repeated and repairs affected unless or until the pipe line passes the leakage test.

12.1.7 PIPE LINE DISINFECTION

(i) General

Disinfection of the pipe line shall be accomplished after the lines have been tested for leakage but before they have been connected to the main system. Disinfections of the pipe lines shall be finished in the presence of the Project Manager's representative or delegates with equipment approved or permitted by the Project Manager. Disinfection shall be conducted or carried out by any one (1) of the following methods or measures after approval or permission by the Project Manager.

(ii) Chlorination

A chlorine and water mixture shall be supplied or provided by means of a solution feed chlorination device. The chlorine solution thereof shall be supplied or furnished at one end of the pipe line through a tap, in such a manner that as the pipe line is filled with water, the dosage applied to the water entering the pipe shall be at least (25 ppm) or enough to meet or satisfy the specific requirements specified hereinafter. Chlorinated water shall be retained in the pipe line for a period of at least twenty-four (24) hours.

After the chlorine treated water has been retained for the required time, the chlorine residual at the pipe extremities and at such other representative points shall be at least ten (10) parts per million. This procedure shall be repeated unless or until the required residual chlorine concentration is obtained. During the process of the chlorination, the pipe line, all valves or other appurtenances thereof shall be operated while the pipe line is filled with the heavily chlorinated water.

(iii) By Adding Chlorinated Lime

Chlorinated lime shall be dissolved in a water tank and is led into mains along with water for sufficient to secure or ensure complete freedom from pollution. In general, the following amount of chlorinated lime for each 3.5 meters length of main shall be adequate or sufficient.

Diameter of Main (mm)	100	150	200	250	300
Chlorinated lime in Milliliters	10	20	40	60	85
Chlorinated lime in table spoonful	0.5	1	2	3	4

(iv) By Adding Bleaching Powder

After the mains have passed the pressure tests, the same shall be thoroughly scoured out; and further to secure or ensure that the pipe system is free from injurious matter or deleterious substance, the same shall be filled with solution of bleaching powder (Calcium Hypochlorite) or of Permanganate of Potash and allowed or permitted to remain there for twenty-four (24) hours. After the period, the system shall again be scoured out and filled with the water of supply main.

12.1.8 SAMPLING AND TESTING

After disinfection of the pipe line and appurtenances sample of water shall be collected or provided for analysis by the Contractor. Should the sample reveal presence of coliform, the Contractor shall again disinfect the pipe line and appurtenances after which sampling and testing shall again be provided and the process shall continue unless or until coliform free samples are obtained. The cost of sampling and testing thereof shall be borne by the Contractor.

12.1.9 CLEAN-UP

Upon completion of the installation of the water supply lines, distribution system and appurtenance, all debris and surplus materials (which is no longer required) resulting from the

work shall be removed and disposed off in a manner acceptable or satisfactory to the Project Manager.

12.1.10 INDICATION PLATES

The indication plates shall be installed or furnished in accordance with the drawings and as directed or instructed by the Project Manager.

12.1.11 WASHOUTS

Exact positioning of the washouts shall be verified and determined with regard to topography and the approval or permission of the Project Manager. At least three (3.0) m of the washout pipe work, inclusive of the isolating valve, measured from the center line of the pipe line, shall be laid at the same time as the pipe line and suitably capped to avoid or prevent ingress of foreign material or deleterious substance. The minimum gradient for the washout pipe work shall be one (1) in one hundred (100).

12.1.12 HDPE WATER TANKS

The work under this section of the specifications includes furnishing all plant, labor, equipment, appliances, materials and in performing all operations required in connection with providing of High-density polyethylene (HDPE) water tanks, in accordance with the Contract or as directed by the Project Manager and the manufacturer's recommendations.

HDPE water tanks shall conform to NSF/ANSI 61 with 5 layers food grade, BPA free and FDA compliant material. Venting equipment shall be sized to limit pressure or vacuum to a maximum of 12mm water column (0.018psi).

(i) Material

Tanks shall be new and unused. In cases where manufacturer are specified, tanks shall be of the same manufacturers. In all other cases, the Contractor shall submit the names of the manufacturer from whom he intends to buy. Other information such as diagrams, drawings and descriptive data shall be supplied as desired by the Project Manager. Approval of water tank under this provision shall not be construed as authorizing any deviations from specifications.

(ii) Manufacturing

The material from which the water tank is produced shall consist substantially of polyethylene, to which may be added only those additives that are needed to facilitate the manufacture of the polymer, and production of sound, durable pipe of good surface finish, mechanical strength. None of these additives shall be used separately or together in quantities sufficient to constitute a toxic hazard, or to impair the fabrication of welding properties of the pipe, or to impair its chemical and physical properties. Water tanks shall conform to ASTM D1998.

(iii) Jointing

Jointing shall be made by butt fusion/socket fusion using plain/socket ended polyethylene fittings except for joining of valves and appurtenances.

12.2 SEWER PIPE LINE AND APPURTENANCES

12.2.1 SCOPE

The work covered by this section of the specifications consists of furnishing all u-PVC pipes, plant, labor, equipment, appliances and materials and of performing all operations required for installing and testing the sewer pipes in strict accordance with the specifications of this section and the applicable drawings and subject to the terms and conditions of the contract.

12.2.2 GENERAL

Materials, Laying & jointing of uPVC sewer pipes shall be followed provided in the section 12.1.2(i)(f) & 12.1.4(F) of this chapter.

A). Filling Material

Compacted Earth

Excavated material free from organic and all other external material approved or permitted by the Project Manager shall be used for filling around the pipes as compacted earth.

Crushed Stone

Crushed stone shall have sharp edges, clear fracture at faces and shall be free from elongated or laminated pieces and shall have a maximum gauge of thirty-eight (38) mm and shall not contain or consist of more than ten percent (10%) passing through screen made of six (6) mm diameter bars spaced at six (6) mm center to center.

B). Filter Material for Upflow Anaerobic Tank

Gravel fill

Gravel material should be well graded having of size about 20mm aggregates.

12.2.3 WORKS

a. House Connections

House Connections shall be made through manholes as indicated in the drawings or as directed or instructed by the Project Manager.

House connection shall be provided individually for each plot by means of a 150 mm dia u-PVC Class-C. Sewer pipe and a dead end, laid at an average depth of 600 mm below N.S.L. level and in such a manner that other services such as water supply, and telephone lines are not disturbed or interfered. The work of laying the sewer pipe shall conform to or comply with the specifications laid down in the relevant section of this contract.

The inlet of each house connection shall be plugged with block masonry 112 mm thick in 1:6 cement sand mortar both in the manhole and the pipe in the plot.

b. Septic Tank

Construction of Septic Tank along with all its components according to the dimensions and specifications as shown or envisaged in the drawing and directed or instructed by the Project Manager.

12.2.4 GULLY GRATING

Gully grating shall be made through manholes as indicated or envisaged in the drawings or as directed or instructed by the Project Manager.

Gully grating shall be provided or furnished on the road junctions as mentioned in the drawings by means of a 150mm uPVC class C sewer pipe connecting the nearest manhole with the chamber of size 600 mm x 600 mm. The pipe is laid in such a manner that other services such as water supply and sewerage system are not disturbed or interfered. The work of laying uPVC pipe shall conform to the specifications laid down in the relevant section of this contract. Approved grating shall be fixed at the top.

12.2.5 INSTALLATION

(i) Excavation and Backfill

The excavation and backfill for sewer installations shall be as specified in applicable provisions of these technical specifications and will be paid as provided in the relevant item of BOQ.

(ii) Crushed Stone Bedding

Crushed stone bedding shall be from an approved source. The same shall be strong, durable, hard and impervious, having crystalline structure, the broken stone shall have sharp edges and clear fractured faces, shall be free from thin elongated or laminated pieces.

The crushed stone shall have a maximum gauge of thirty-eight (38) mm and shall be graded down to twenty (20) mm. When shifted through a screen made of eight (8) mm diameter bars spaced twenty (20) mm center to center, the same shall yield no more than ten (10) percent by volume of fine materials.

(iii) Sand Bedding

Sand for filling for bedding, around pipes and above pipe crown should be free from organic and all other external materials and should be approved by the Project Manager. It shall also fulfill the specifications clause 1.2.11 provided in chapter-1.

12.2.6 LAYING OF SEWERS

Neither any sewer pipe nor the bedding shall be laid or placed till the alignment of the sewer, and its levels and gradients have been carefully checked and tested with the trench excavation and found correct.

Each length of sewer pipe shall be checked for cracks and defects before placing in the line. Defects which in the opinion of the Project Manager indicate or show imperfect placing, shall make, the pipe liable to rejection. Each pipe shall be placed carefully to line and grade and in close contact with adjoining pipe. These specifications require rejection of the work if the sewer invert varies as much thirteen (13) mm from the proper elevation. As shown or envisaged on Drawings, the bottom of the trench must be shaped to fit the pipe barrel, with holes left for the bells. If excavation has been carried below the correct grade, refilling must be done with satisfactory materials as approved or permitted by the Project Manager at no extra cost. The u-PVC sewer pipe joints shall be of the type specified above and shall be made in accordance with the aforesaid specifications.

When laying is not in progress, the open pipe shall be closed with a tapered wooden plug to keep out foreign matter.

12.2.7 TESTING OF SEWER LINES

(i) General

All sewers (internal & external) built under this contract shall be tested for infiltration or ex-filtration as specified hereinafter. The tests shall be made at times selected or approved by the Project Manager. Sections of the completed sewer shall be isolated and measurements of the infiltration or ex-filtration shall be made by approved method. The contractor shall furnish all labor, material and equipment required for making the tests with no extra compensation over and above the agreed contract prices for the laying of sewer lines.

(ii) Infiltration Tests

The sewers which are constructed with the ground water level above the invert level of the pipe shall be tested or examined for infiltration after the sewers have been installed and backfilling has been substantially completed. The tests and measurement shall be performed by the Contractor in the presence of and in a manner approved by the Project Manager. The duration of the tests shall be only long enough to establish the true rate of infiltration. The amount of leakage over a twenty-four (24) hour period shall then be calculated from the result of the measured true rate of infiltration.

(iii) Ex-filtration Tests

The sewers which are constructed with the ground water level below the invert level of the pipe shall be tested or examined for ex-filtration by isolating a section of sewers between manholes by means of approved temporary type of water tight bulk heads. The method of testing for ex-filtration shall be generally as follows:

- a) After isolation of sewer section, the same shall be filled with water to a level which is above the crown of the pipe at the higher end of the isolated section under test. The level will not be more than two (2) M above the invert level of the sewer pipe at its lower end.
- b) The duration of the ex-filtration test shall be one hour after the filling with water has been completed.
- c) Determination of the amount of ex-filtration shall be made by measuring the total loss of volume of water in the manholes.
- d) The amount of ex-filtration over a twenty-four (24) hour period will then be calculated from the measured loss of volume during the test observation period.

(iv) Allowable Infiltration or Ex-filtration

The calculated amount of infiltration or ex-filtration over a twenty-four (24) hour period shall not exceed nine hundred (900) liter per centimeter of pipe diameter per mile of sewer which rate shall be applied to the actual sewer size and length tested to determine the allowable infiltration over the twenty-four (24) hour period.

If the measured infiltration or ex-filtration exceeds the specified allowable limits, then the Contractor shall locate the points of leakage and make necessary repairs so as to reduce or minimize the leakage to less than the permissible maximum stated above.

(v) Cleaning of Sewer Lines

The Contractor shall clean all the sewer lines at no extra cost or additional cost with the method or measure approved or permitted by the Project Manager prior to handing it over to the Employer.

12.2.8 CONSTRUCTION OF MANHOLES

(i) Scope

The work shall contain or consist of constructing manholes for sewerage at positions shown or envisaged on the plans or where otherwise directed or instructed by the Project Manager, and in accordance with the Detailed Drawings provided from time to time, complete in all respects. The Contractor shall provide or furnish all plant, labor equipment and materials in performing all operations in connection with the construction of manholes.

The various items of work involved in the construction of manholes shall be carried out strictly in accordance with respective technical specifications laid down for item of work in these Specifications.

(ii) Materials

Portland cement concrete, and other materials shall meet or satisfy the specific requirements of the relevant sections of the specifications. Cast iron frame shall conform to or comply with the specifications in conformity or compliance with BS 497. Manhole rungs shall be of galvanized mild steel. The galvanized steel shall conform to or comply with the provision of AASHTO M-111.

(iii) Construction Requirements

Manholes shall be constructed as per Drawings. Reinforcement and concrete shall conform to the requirements of Chapter-3, "CONCRETE". Galvanized mild steel rungs shall be installed at three hundred (300) mm interval inside the manhole during the construction of the manhole walls. Cutting holes into the wall for the steps after construction will not be approved or permitted. Top rung shall be 0.5 m below the manhole cover and the lowest not more than 300 mm above the benching (floor).

Depth of manhole shall be from invert level of sewer to the top of manhole.

12.3 PLUMBING

12.3.1 GENERAL

All pipes, fittings and fixtures shall be of the kind, grade, type and qualities as shown or envisaged on the Drawings and as specified herein or as approved by the Project Manager. Plumbing fixtures shall be of brand M/s Master, M/s Faisal, M/s Sonex or equivalent.

All pipes shall be jointed with fittings compatible with the pipe and of the suitable type for the intended service.

Union joints shall be properly provided in piping to allow disassembly of the piping for maintenance services or for any modification or rectification of the system.

Flanges shall be provided or furnished for pipes seventy-five (75) mm diameter and large. The flanges shall be compatible with and shall have the same rating as the companion flange of the valve or the fittings. Full face rubber gaskets shall be provided or furnished to all flanges joints.

All piping shall be fitted and assembled to introduce minimum stress to the pipe and fittings. All pipes shall be supported where shown or envisaged on the Drawings and as required or instructed by the Project Manager.

The same standard of thread shall be used throughout the works.

All piping to be embedded shall be tested and approved by the Project Manager prior to being embedded.

Sleeves or check-outs shall be provided where pipe passes through concrete or block masonry structures. The space shall be filled or caulked with suitable materials. Where pipe passes through a wall or floor where water tightness is required, the space shall be filled with yarn and lead or with the approved expanding grout.

Cleanouts and manholes shall be provided or furnished as shown or envisaged on the Drawings and as directed or instructed by the Project Manager.

All pipes embedded in the ground shall be at the pipe top a minimum thirty (30) cm below the grade where no heavy traffic is expected and minimum ninety (90) cm below the grade at road crossings and where heavy traffic is expected. Pitch of the pipe line shall conform to or comply with the applicable code, regulations and as directed or instructed by the Project Manager.

Change in pipe size shall be made with reducing fittings. The use of bushings shall not be allowed nor permitted.

Change in direction shall be made with fittings except that bending of galvanized steel pipe one hundred (100) mm and smaller shall be permitted or approved. Provided that a pipe bender is used and wide sweep bends are formed. The center line radius of bends shall not be less than six (6) times the diameter of the pipe. Bent pipe showing kinks wrinkles, flattening or other malformations shall not be accepted nor permitted.

Exposed piping shall be run in parallel with the lines of the building unless otherwise specified herein.

Connections between ferrous and nonferrous metallic pipe installed underground shall be made with dietetic unions or flanges.

12.3.2 SCOPE

The work shall include furnishing and supplying as required, all labor, materials, fittings, fixtures, accessories, equipment and services for the execution, completion, testing and commissioning of sewerage and drainage works as shown in the drawings, specified herein and/or as directed by Project Manager.

12.3.3 SUBMITTALS

The Contractor shall prepare and submit samples of materials such as fittings, fixtures and accessories to be incorporated into the works for approval or permission of the Project Manager.

12.3.4 SOIL, WASTE AND VENT PIPES

All uPVC soil, waste and vent pipes and fittings shall conform to the specifications BS 3505 Class-C. These shall also be according to the specifications mentioned in the section 12.1.2 (f).

12.3.5 TRAPS AND CLEANOUTS

(i) Floor Traps

Traps shall be of self-cleaning design, provided with thirty-eight (38) mm water seal. All UPVC pipes fittings used for underground installation shall be in conformity / accordance with BS EN 1401-1:1998 or an approved equivalent. The average thickness of wall shall be five (5) mm and at no point shall thickness be less than four (4) mm all waste traps shall have grating or cross bars formed integrally. The grating shall be of suitable design so as not to unduly restrict the flow of waste water.

(ii) Gully Traps

Base of the gully traps shall be in plain concrete and walls in brick/block masonry internally plastered. The top shall be in RCC as shown or envisaged on the drawings. Each gully trap shall have one (1) manhole with frame and cover as shown or envisaged in drawings.

(iii) Floor Clean Outs

All cleanouts in the sewerage system shall be closed with screw caps. Each screw cap shall have solid square or hexagonal nut not less than twenty-five (25) mm high, with a minimum diameter of thirty-eight (38) mm. The body of the clean out ferrule shall be at least equal in weight and thickness as of the caulking ferrule for the same size of. The engaging parts of the screw cap shall not have less than six (6) threads. All UPVC pipes fittings used for underground installation shall be in conformity / accordance with BS EN 1401-1:1998 or an approved equivalent.

Nominal Pipe Size (mm)	Actual Pipe Size (mm)	Length (mm)	Weight (kg)
50	56	113	0.45
75	81	113	0.79
100	106	113	1.14

The pipe and fittings shall be bitumen coated in accordance with BS-416.

12.3.6 FIXTURES

(i) Wash Basins

a) Basin

The wash basins shall be white glazed earthen ware in sizes 63.5 cm x 46 cm (25"x 18"), 56 cm x 41 cm (22"x 16") and 46 cm x 28 cm (18"x 12"). The following shall be provided at the time of manufacture;

A slot for the overflow shall 6.3 cm long and thirteen (13) mm (0.5") deep so designed as to facilities cleaning.

Soap tray or sinking shall be provided or furnished as to drain into the basin.

Tap holes shall be square to fit pillar taps shall be beveled around the opening. They shall be so situated as to allow or permit supply pipes to be clear of waste and vent pipes and shall have enough space to avoid or prevent the users striking the head on the tap.

Waste hole shall have a minimum diameter of 63 mm (2.5"). The outlet shall be beveled or rebated. The hole shall be square in shape and each side shall be 25.4 mm (1-1/8") length.

Plug chain stay hole shall not be lower than the over flow slot.

Back skirting shall be true to receive splash back.

Stud slots shall be monolithically cast with the wash basin. These shall receive the brackets on the inside of the basin shall be so situated that the brackets remain five (5) cm (2") away from the face. These shall not exceed thirteen (13) mm (1/2") in dia eight (8) mm (5/16") in height and shall be 13.4 cm (12") from the back of the basin to the center of the side.

b) Brackets

The length of the brackets shall be such as to enable ten 10 cm (4") embedding in the wall or fixed to the wall with the help of screws. Bracket shall be of painted iron on white porcelain enameled.

c) Pillar Taps

Pillar taps shall be manufactured from gun metal and shall be chromium plated. These shall be of screw type with jam nut. Internal dia of the tap shall be thirteen 13 mm (1/2").

d) Plug and Chain

Plug shall be of rubber. The diameter of the plug shall be such as to fit snugly in the waste hole. The chain shall be of brass, chromium plated, one end fixed to the plug and the other held in the chain stay hole.

e) Combined Supply and Waste Fitting

This shall comprise of thirteen 13 mm (1/2") combine taps with discharge nozzle and 3.17 cm (1-1/4") pop up waste. Waste outlet shall be screwed 3.17 cm (1-1/4") to B.S pipe male. All of these fittings shall be of gun metal with chromium plating.

f) Waste Pipe

This shall be of uPVC and shall have diameter to fit at the bottom of the waste fitting flange. Its length shall extend from the bottom of waste flange to the floor.

g) Pedestal

Pedestal shall conform to or comply with the corresponding specifications of wash basin for composition, manufacture and quality. The same shall be completely recessed at the back for the reception of supply and waste pipes, the same shall be such that the basin is tightly and adequately supported and shall be so arranged that the height from the floor to the top of the rim of basin is seventy-nine (79) cm (31").

(ii) Mirror

One beveled edge glass mirror of first class quality securely fixed on bard board packing required to be fixed on the wall for wash basin shall be at least six (6) mm thick and shall be of requisite dimensions.

(iii) Kitchen Sinks

a) Sinks

Kitchen sink shall be stainless steel or glazed earthenware of approved make, single or double bowl with integral drain board. The sizes of the sinks shall be either 61 cm x 45 cm

x 25 cm (24"x18"x10") or 51 cm x 101 cm x 25 cm (20"x40"x10") or 51 cm x 122 cm x 25 cm (20"x48"x10").

b) Brackets

The Brackets shall be either of such a length as to enable ten (10) cm (4") embedding in the wall or shall be such as to be fixed to the wall with the help of screws. The bracket shall be of painted iron or porcelain enameled.

c) Pillar Taps

Pillar taps shall be manufactured from gun metal and shall be chromium plated. These shall be of screw down type with jam nuts. Internal diameter of the taps shall be thirteen (13) mm (1/2").

d) Plug

The rubber or vulcanite plug shall fit in the waste pipe.

e) Waste Fitting Flanges

The waste fitting flanges shall be eight-five (85) mm (3-3/8") diameter, the tail eighty-seven (87) mm (3-1/2") long, screwed with thirty-seven (37) mm (1-1/2") B.S parallel thread and the sliding flange of backnut if eighty-one (81) mm (3-1/4") diameter.

f) Waste Pipe

This shall be of UPVC and shall have diameter to fit at the bottom of the waste fitting flange its length shall extend from the bottom of waste pipe flange to the floor.

(iv) Water Closets

a) European Type Water Closets

The WC shall be pedestal type white glazed earthen ware durable non-absorbent material with a water pool of good effective seal not less than five (5) cm (2") There shall be no sharp angles, the surface shall be so rounded as to be easily cleaned. The closets shall be of syphonic action or washed down type or as directed or instructed by the Project Manager. Two (2) holes six (6) mm (0.25") shall be provided in the pedestal for fixing the W.C to the floor.

b) Indian Type Water Closets

The water closets shall be of white glazed earthen ware nonabsorbent durable material there shall be no sharp angles; the surface shall be so rounded as to be easily cleaned. The closets shall be embedded below the flow in lean concrete with its stop level with the floor. The foot rest shall be either integral part of the W.C or shall be provided separately in which case shall be of the same material as the pan.

c) Trap

The trap P or S for European type W.C shall be self-cleaning with a minimum water seal of fifty (50) mm (2") and made of the uPVC.

d) Seat

The seat for the European type W C shall be of PVC. The seat cover shall be of the same material as that of the seat.

e) Flushing Cistern

i) Low Level Flushing Cistern

The low level cistern shall be of 13.6 liters (3 gallons) capacity. The same shall be either of glazed earthen ware or PVC as approved or permitted by the Project Manager

completes with all internal fittings. The bottom of the cistern shall be thirty (30) cm (2.5 feet) above ground level.

The inlet to the cistern shall be controlled by thirteen (13) mm (1/2") ball valve and thirteen (13) mm (1/2") stop cock both made from gun metal or brass. The cistern shall be silent filling with an overflow arrangement.

The cistern shall be supported on M.S or C.I cantilever brackets and painted with approved enamel paint with ten (10) cm (4") support in the wall or the same shall be attached to the wall with the help of wooden screws.

The flush pipe shall be thirty (30) mm (1-1/4") G.I or PVC painted with approved paint. Moulded rubber cone shall be provided or furnished for connection with the pan.

ii) **High Level Flushing Cistern**

High level cistern shall be manufactured from cast iron or pressed steel. The same shall be painted with corrosion resisting paint. The same shall discharge at the rate of nine (9) liters in five (5) seconds.

The inlet to the cistern shall be controlled by thirteen (13) mm (1/2") ball valve and thirteen (13) mm (1/2") stop cock both made from gun metal or brass. The cistern shall be silent filling with an overflow arrangement.

The cistern shall be supported on M.S to C.I cantilever brackets and painted with approved enamel paint with 10 cm. (4") support in the wall.

The flush pipe shall be thirty (30) mm (1-1/4") G.I or PVC painted with approved paint. Moulded rubber cone shall be provided or furnished for connection with the pan.

The flush shall be operated by pulling a chain handle preferably by a thin rod with as few joints as possible.

f) Soil Connection

Ordinarily in case of European type W.C the closet shall have trap above the floor and the connection with the steel pipe through an external wall.

g) Size of Closet

Ordinarily the closet shall be forty (40) cm (16") for schools, nurseries thirty-five (35) cm (14") thirty (30) cm (12") and twenty-five (25) cm (10") be adopted in accordance with direction or instructions of the Project Manager.

h) Connection of Water Closet with Soil Pipe

Water closet with soil pipe shall be connected with gaskets and 1:2 cement sand mortar joint.

i) Connection between Trap and Soil Pipe

Trap and soil pipe shall be connected with the UPVC pipe.

(v) Bidets

Bidets shall be of white glazed earthenware durable, non-absorbent material with horizontal inlet to flushing rim, standing waste and over flow and ascending spray or jet.

The hot and cold supplies shall be controlled by a mixing valve so that any desired temperature shall be obtained or provided from the jet. By passing heated water through the hollow rim the same may be warmed.

(vi) Toilet Paper Holder

The toilet paper roll holder shall be PVC along brackets and screws and the like. and shall be fixed in the wall adjacent to water closet.

(vii) Urinals

a) Squatting Type Urinals

These shall be white glazed channel ten (10) cm (4"high) for front and side walls. The channel, if separate shall be of superior quality white glazed fire clay with circular projection for fitting in trap. The latter shall be sixty-two (62) mm (2.5") to seventy-five (75) mm (3"), depending on the number of seats. The inlet end of the trap shall be provided or furnished with CP brass discharge of removable type. The urinal slab shall be of the design with back flush. The flushing cistern shall be of plastic automatic type. The capacity of the cistern shall be according to the number of stalls to be flushed. A connection from the flushed pipe shall be provided or furnished with spreader (one to each seat) to flush the front.

Traps shall be of self-cleaning design provided with twenty-five (25) mm (1") puff pipe the specifications for these shall be the same as for soil waste and vent pipes.

b) European Type Stall Urinals

These shall be of white glazed fire clay and of the following dimensions;

- Height from treads to top of division - 45 cm (1.5 feet)
- Width center to center of divisions - 60 cm (2 feet)

The urinal range shall be provided or furnished with automatic or hand pulled flushing cistern in white glazed fire clay or PVC of the capacity according to the numbers of stalls to be flushed. The flush pipe and spreader shall be of C.P brass. The trap shall be of C.I sixty-two (62 mm (2.5") to seventy-five (75) mm (3") depending on the number of stalls in the range and approved or permitted by the Project Manager.

(viii) Showers

A shower head shall contain or consist of corrosion resisting cast of fabricated sheet metal rose having perforations and shall be adjustable to give varying degrees of spray. Shower unit shall be complete with hot and cold water mixing arrangements and stainless steel rigid or flexible pipe extension and an additional low down water trap.

(ix) Bath Tubs

These shall be of fiber glass. The bath tub shall be provided or furnished with twenty-seven (27) mm (1-1/2") trap, over flow and anti-syphonic arrangements and connected to .be waste and anti-syphonic stacks on the outside wall. Waste water shall be allowed or permitted to .discharge through over flow trap, the same is directed or instructed by the Project Manager. The bath shall be fitted with two (2) CP pillar cocks and CP chain with a plug to control cocks thirteen (13) mm (1/2") shall be provided with each bath. The approximate dimensions of the bath tubs shall be tabulated as per table below:

TABLE

	Pattern					
	Manna		Rectangular		Parallel	
	cm	In	cm	in	cm	in

	Pattern					
	Manna		Rectangular		Parallel	
	cm	In	cm	in	cm	in
Length overall	166	66	183	72	168	66
Width overall	71	28	71	28	71	29
Depth inside at Waste	44	17-1/2	44	17-1/2	43	17
Height overall-exclusive feet and waste	46	18	46	18	44	17-1/2
Height overall-with ft. for 38 mm (1-1/2") seal trap	58	23	58	23	57	22-1/2
High overall for 76 mm (3") seal trap top holes 35 mm (1-3/8") square centered	62	24-1/8	62	24-1/8	61	24
On-roll-Hole distance apart	18	7-1/8	18	7-1/8	18	7-1/8
Waste hole 57 mm (2-1/4) clear diameter distance from edge of roll at tap & to center of waste hole	29	11-1/4	29	11-1/4	25	10
Overflow center-distance below top edge	10	4	10	4	9	3-1/2
Capacity	118 L	26 Gal	127 L	28 Gal	122 L	27 Gal

The fall along the bottom from head end to outlet shall be adequate for complete emptying.

The feet shall be suitable for bath tubs with traps having twenty-seven (27) mm (1-1/2") seal or for bath tubs with taps having seventy-five (75) mm (3") seal.

Bath tub outlets may be rebated or tapered to receive the outlet piece. The later comprises a Chamfered flange 7.3 mm (2-7/8") diameter with tail thirty-five (35) mm (1-3/8") long provided at the end having an integral grating. A riding flange 7.3 cm (2-7/8") diameter for tightening to the bottom of the bath tub is also provided.

The overflow holes on magna/rectangular bath tubs shall be ten (10) cm (4") from top of bath tub to center and on parallel bath tubs nine (9) cm (3-1/2") from top to center.

Overflow holes on parallel bath tubs shall be 4.4 cm (1-3/4") in diameter intended for 3.1 cm (1-1/4") overflows.

A grating shall be fixed in the overflow hole. A brass bend 5.7 cm (2-1/4") long shall be attached to the grating. The tail of which shall have threads 3.18 cm (1-1/4") for connection to outflow pipe

(x) Towel Rail, Soap Dish, Tumbler Holder & Tooth Brush Holder with Tooth Paste Dish

The towel rail shall be nineteen (19) mm or thirteen (13) mm round or square C.P brass or stainless steel rod with end brackets and screws of similar material. Soap dish shall be straining type heavy duty glazed earthen ware, chromium plated or stainless steel or plastic complete with screws. Tumbler holder shall be of glazed earthen ware, chromium plated, stainless steel or plastic complete with screws. Tooth brush holder with tooth paste dish shall be of glazed earthen ware, chromium plated, stainless steel or plastic complete with screws and the like.

(xi) Ablution Tap/Sprinkler

Adjacent to the water closet, a water connection for ablution shall be either a CP brass water tap or a water sprinkler with flexible pipe armoured with stainless steel strip.

(xii) Muslim Shower

Muslim Shower shall be best quality (with double bib as specified in BOQ) from manufacturer approved by the Project Manager. It shall consist of C.P. brass "T" Stop Cock at height of 150mm from finished floor level, complete with 12mm dia flexible stainless steel hose 0.9m (3 ft.) long and hand spray, C.P. brass hose hook including the cost of all cutting, binding and making good, complete in all respects.

(xiii) Glass Shelves

Glass shelves may be provided or furnished below the mirror in front of wash basin. The length of the shelf shall depend on the size of the mirror, its width shall be one hundred thirty (130) mm & thickness six (6) mm and shall be held by 2 Nos. CP brackets, the shelf shall be provided with CP railing.

- a) The Contractor shall be liable or responsible for the safety of his work and shall replace any material and equipment that may be damaged or lost without any additional cost or extra cost to the Employer until or unless the works are completed and taken over by the Employer.
- b) All openings left in floor for passage of lines of soil, waste, vent and the like. shall be covered and protected.

All open ends of pipes shall be properly plugged to avoid or prevent any foreign material or deleterious substance from entering the pipe.
- c) Before erection, all pipes, valves, fittings and the like shall be thoroughly cleaned of oil grease or other material.

All metal fixture trimmings shall be thoroughly covered with non-corrosive grease, which shall be maintained unless or until all work is completed. Upon the completion of the work, all fixtures and trimmings shall be thoroughly cleaned, polished and left in first class condition.
- d) All pipes shall be properly installed as shown or envisaged on the drawings and/or as directed or instructed by the Project Manager, and shall be as straight as possible forming right angles and parallel lines with the walls and other pipe lines as far as possible, the position gradients alignment and inverts shall be two percent (2%) for pipes of two hundred (200) mm or larger dia or as shown or envisaged on the drawings and/or as directed or instructed by the Project Manager.
- e) The arrangement, positions and connections of pipe fittings and appurtenances shall be shown or envisaged on the drawings. The Project Manager shall reserve the right to change the location and the like. Special precautions shall be taken for the installation of concealed pipes as shown or envisaged on the drawings and/or as required or instructed by the Project Manager. Should it be necessary to correct piping so installed, the Contractor shall be held liable or responsible for any damage or defect caused to other works in the correction of piping.
- f) A minimum distance between different services shall be maintained as shown or envisaged on the drawings and/or as approved or permitted by the Project Manager. Pipes shall be installed in such a manner that minimum distance is always maintained between the pipes and the walls, beams, columns and the like as shown or envisaged on the drawings and/or as approved or permitted by the Project Manager.
- g) Waste water outlet from each fixture or a battery of fixtures directly connected to the sewerage system shall be equipped with a water-seal trap.
- h) Each vent terminal shall extend to the outer air and terminate in cowl or wire mesh balloon and be so installed as to avoid or prevent the possibilities of clogging and the return of foul air to the building. Vent and waste stacks shall extend three hundred (300) mm above roof the same not used by occupants and 2000 mm if used by occupants.
- i) When the roughing-in is completed, the plumbing system shall be subjected to test prior to concealing the roughing-in, in order to ascertain that all threads and connections are gas and watertight.
- j) Cast iron soil and drainage fittings for change in direction shall be used as follows:
 - i). VERTICAL TO HORIZONTAL: short sweep or long turn for diameter seventy-five (75) mm and larger: long sweep or extra-long turn for less than 75 mm dia.
 - ii). HORIZONTAL TO VERTICAL: quarter bend or short turn.
 - iii). VENTING IN ANY DIRECTION: quarter bend or short turn.
- k) All fittings with hubs shall be aligned so that the hub faces upstream.
- l) No drainage or vent piping shall be drilled or tapped,

- m) No structural member shall be weakened or impaired by cutting, notching or otherwise, except to the extent allowed by the Project Manager.
- n) All exterior openings provided for the passage of piping shall be properly sealed with snugly fitting collars of metal or other approved rat-proof material securely fastened into place
- o) Joints at the roof, around vent pipes, shall be made watertight by the use of lead, or other approved flashing material Exterior wall openings shall be made watertight.
- p) Bolts and nuts for wall hanging fixtures shall be of heavy construction steel to fully carry the weight that will be placed on the earner by the fixture and users
- q) Where different sizes of pipes, or pipes and fittings are to be connected, the proper size reducers or reduced fittings shall be used between the two (2) sizes. Bush fittings shall not be used.
- r) Any fitting or connection, which has an enlargement, chamber or recess with a ledge, shoulder or reduction of pipe area that offers and obstruction to flow through the drain, shall be prohibited.
- s) The vertical distance from the fixture outlet to the trap weir shall not exceed six hundred (600) mm
- t) Each fixture trap shall have a water seal of not less than fifty (50) mm and not more than one hundred (100) mm,
- u) Full S. bell, crown vented .traps and traps depending for their seal upon the action of moveable parts shall be prohibited. No fixture shall be double trapped.
- v) Where fixture comes in contact with wall and floors, the joint shall be watertight.
- w) Pipes in ground shall be laid on a firm bed for its entire length.
- x) Pipes in the plumbing system shall be installed without undue strains and stresses. Vertical piping shall be securely held to keep the pipe in alignment and carry the weight of the pipe and contents. Horizontal piping shall be supported to keep the same in alignment and prevent sagging. Hangers and anchors shall be of metal of sufficient strength to maintain their proportional share of pipe alignments and prevent rattling. Hangers and anchors shall be securely attached to the building. The Contractor shall be fully liable or responsible for hangers and supports and shall obtain prior approval or permission, of design as to the shape, material, dimensions, spacing and the like.
- y) Pipes in concrete or masonry walls or footings shall be placed or installed in sleeves, which will allow or permit access to the piping for repair or replacement. All holes or slots made in the walls, roofs, ceiling and floors for installation of pipes shall be properly made good and finished to original conditions to satisfaction of the Project Manager.
- z) The indirect waste pipes from food handling equipment, water cooler and dish washer and the like shall so discharge that the air gap between the indirect waste and the building drainage system is at twice the effective diameter of the drain served.

12.3.7 INSTALLATION OF FIXTURES

- i) Plumbing fixtures shall be installed or provided in a manner to afford easy access for cleaning. The space between the fixture and the wall shall be closely fitted and painted so that there is no chance for dirt or vermin to collect.
- ii) Where practical, all pipes from fixtures shall be run to the nearest wall.
- iii) Where fixtures shall be rigidly supported by metal supporting members so that no strain transmitted to the connections. Flush tanks and similar appurtenances shall be secured or ensured by approved non corrosive screws or bolts.
- iv) Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet shall be set closer than four hundred (400) mm from its center to any side wall. No urinal shall be set closer than neither three hundred (300) mm from its center to any side wall or partition nor closer than six hundred (600) mm center to center No wash basin shall be set

closer than one hundred (100) mm to the side wall or partition or closer than six hundred (600) mm center to center.

- v) The supply lines or fittings for every plumbing fixture shall be so installed or furnished as to avoid or prevent backflow.
- vi) All cuttings and holes shall be made good.

12.3.8 LAYING OF SEWER PIPES

Sewer pipes shall be laid in accordance with section 12.2 'Sewer Pipe Lines and Appurtenances'. The following conditions shall be taken care of particularly.

- i) Each length of pipe between manholes shall be in straight line and true to the alignment, position, gradient and levels,
- ii) Sewer laying shall proceed in all uphill direction, laying spigot end into already laid bell end. Reverse laying shall not be allowed or permitted and any such work shall be refused or rejected.
- iii) Each length of sewer pipe shall be checked or verified for cracks and defects before placing in the line. Each pipe shall be placed carefully to the requisite line and grade and joined perfectly with connecting pipes.
- iv) Pipes shall be cut only where directed or instructed by the Project Manager in order to complete a length between manholes. All pipes shall be cut neatly and at right angles to the axis of the pipe and the cut of the pipe shall be smooth and truly circular.
- v) The top of bedding material shall be shaped to fit the pipe barrel, with pits left for the bells. When laying is not in progress, the open end shall be closed with a tapered wooden plug to keep out foreign matter or deleterious substance

12.3.9 INSTALLATION OF TRAPS, DRAINS AND CLEAN OUTS

- i) Floor traps shall have openings for connection of inlet pipes from fixtures. The invert level of inlet pipes shall be at least twenty-five (25) mm above the trap weir level.
- ii) Floor traps shall be well set in position so that there is no leakage at the joint between trap and the floor.
- iii) All the requirements specified hereinbefore for floor traps are equally applicable for floor drains except that no water seal shall be required and the same shall be of the specified size.
- iv) Roof drains shall have strainers extending at least ten (10) mm above the roof surface immediately adjacent to them when installed on flat part. Bottom of strainer shall be flush with the roof surface when installed on vertical part. Strainer shall have an available inlet area above roof level, of not less than 1-1/2 times the area of the down-pipe to which the drain is connected. The connection between roof and roof drain shall be made watertight by the use of proper flashing material.
- v) Clean outs shall be turned up through floors by long sweep fittings, wherever the space so permitted or approved. Top finish of clean outs shall be flush with the floor when located in open area. The same may not be flush with the floor when installed near wall and levels are not deep enough to make them flush.
- vi) Clean out shall be so installed or provided that there is a clearance of at least three hundred (300) mm for pipe less than seventy-five (75) mm diameter and at least four hundred fifty (450) mm for pipes of seventy-five (75) mm and larger diameter for the purpose of rodding. Permanent finishing material shall not be placed over clean out
- vii) Clean out in open areas shall be placed in concrete boxes with access cover of heavy duty 300 x 300 mm size. The access cover and frame shall be cast iron.
- viii) Clean out near wall shall be embedded in concrete, and excepting cast iron pipe used with clean out all other work of ferrule, plug, concrete work, frame and cover and the like shall be covered or included under clean out item.

- ix) Gulleys shall be fixed on concrete foundation three hundred (300) mm square and not less than one hundred fifty (150) mm thick. A block curb in cement mortar about seventy-five (75) mm high from the ground level shall be built round top edge of gully in such a manner that surface water shall not be allowed to enter the gully. The same shall be used for waste water only before entering into the manhole.

12.3.10 INSTALLATION OF SOIL, WASTE AND VENT PIPE

- i) All soil waste and vent pipes and fittings shall be installed or furnished with plumb and true to lines and grades shown or envisaged on the drawings or as directly or instructed by the Project Manager.
- ii) Where installed vertically, pipes shall be supported from wall by metal clamps of approved type and make at each floor just below the Horizontal branch pipe connection and at intermediate levels.

The spacing of vertical and horizontal pipe supports shall be 1.5 m to 3 m respectively and dia of steel support shall thirteen (13) mm.

- iii) Pipes passing through walls, floors or roof shall be placed or provided in metal sleeves of approved design. The annular space between the sleeve and pipe shall be at least fifteen (15) mm. The space shall be packed with approved filler (Oakum or Hemp) and shall be sealed at both ends with approved sealant (Bituminous material or mastic).
- iv) Where stacks are vented, vent stacks shall be connected to soil and waste stacks above the base and at each floor above the floor of highest fixture at an angle of thirty (30) to fifty (50) degree with the vertical in the upward direction as shown or envisaged on the drawings or as directed or instructed by the Project Manager.

12.3.11 JOINTS

G.I Pipes shall be jointed or furnished with pipe threads as per BS-21. Elastomeric joint rings (rubber rings) conforming to or complying with BS-2494 shall be used for cast iron and concrete pipes. Lead caulking shall be used only for cast iron pipes, if specified herein and mortar with one (1) part cement and two (2) parts sand shall be used only for concrete pipes if specified herein.

12.3.12 MANHOLES

- i) The type, size and shape of the manholes shall be as shown or envisaged in the drawings; invert and other shall be directed or instructed by the Project Manager.
- ii) The manhole shall be constructed or provided according to the provision of section 12.2 "Sewer Pipe Lines and Appurtenances".

12.3.13 TESTING

- i). All lengths of sewers and drains up to seven hundred and fifty (750) mm in diameter and all manholes and inspection chambers shall be tested or examined for water-tightness.
- ii). Water tests shall be applied after laying and before back-filling or placing bedding of surround concrete to identify the cracked or porous pipes and faulty joints.
- iii). Wherever possible, testing shall be carried out from manholes to manholes short branch drains connected to a main sewer manholes shall be tested or examined as one (1) system with the main sewer.
- iv). Drains and sewers shall be subjected to an internal pressure test of 1.2 m head of water above the crown of the pipe at the high end but no more than six (6) m at the low end. Steeply graded sewers shall be tested or examined if the maximum head at low end exceeds in case of the whole section.
- v). The test shall be earned out by inserting suitably strutted plugs in the lower end of the sewer

and in connections and by filling the system with water. For small pipes a knuckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to the same so as to provide or furnish the required test head, but for both large and small pipes a hose pipe shall be connected to a plug with pressure gauge or stand-pipe.

- vi). The loss of water over a period of thirty (30) minutes shall be measured by adding water from a measuring vessel at regular intervals of ten (10) minutes and noting the quantity required to maintain the original water level. For acceptance or permission under this test, the average quantity of water added to pipe lines up to five hundred (500) mm diameter shall not exceed one (1) liter per linear meter of length for each meter of nominal internal diameter of pipe.

12.4 WATER UTILITY SERVICES

12.4.1 SCOPE

The work for piped utility services in buildings shall cover or include furnishing of all labor, plant, equipment, materials and services and supplying, installing, testing and commissioning of cold and hot water supply systems in the buildings as shown or envisaged in the drawings, required in accordance with specifications and or directed or instructed by the Project Manager.

12.4.2 SUBMITTALS

The Contractor shall prepare and submit samples of fittings, fixtures and accessories to be incorporated into the works.

12.4.3 FITTINGS AND SPECIALS

(i) Valves

Sluice Valve shall have (i) cast iron body; (ii) gunmetal spindle; (iii) cast iron gate with gunmetal sealing wings for size seventy-five (75) mm and above; (iv) solid gunmetal gate for size lower than seventy-five (75) mm and (v) shall pass a test pressure of 1.5.MPa or equivalent to NP-16.

Peet Valve screwed threaded or flanged shall be shall pass a test pressure of 1.5 MPa or equivalent to NP-16.

Cast Iron Check Valves size seventy-five (75) mm and above shall have cast iron body, gunmetal door and a test pressure of 1.5 MPa or equivalent to NP-16.

C.I. Globe Valves size five (5) mm and above shall be similar to Cast Iron Sluice Valves.

Copper Alloy Globe Valve size lower than seventy-five (75) mm threaded shall pass a test pressure of 1.5 MPa or equivalent to NP-16.

The working pressure on valves shall not be less than the working pressure of the system on which the same are installed or provided, but in no case the same shall be less than NP-6 (6Kg/Sq.m) or 0.6 Mpa.

(i) Fire Hydrants

Fire Hydrant shall conform to or comply with BS-750 with a body of cast iron and spindle of manganese-bronze. The direction of closing shall be by clockwise rotation and the outlet shall have screwed joints for accommodating hose connection.

(iii) Pipe Strainers

The strainer flange shall conform to or comply with the specifications of BS 4504. The pipe strainer shall have cast iron or bronze bodies suitable to withstand the working pressure, removable screens of copper, brass, nickel or stainless steel, flanged bodies with tapings for size thirty-seven (37) mm and above and of such a design as to allow or permit blowing out of

accumulated dirt and easy removal and replacement of straining screen without disconnecting the main piping.

(iv) Puddle Flange

Puddle flanges of specified dia shall be provided or furnished where the pipe crosses R.C.C. wall; retaining water or soil. For metal pipes a ten (10) mm thick M.S. square plate of size shown or envisaged on plan, cut with a hole equal to external dia of pipe, shall be welded with the pipe with both ends of G.I. pipe provided with flanges, and the whole assembly shall hot-dipped galvanized before being cast in R.C.C. wall.

(v) Float Valve, Level Controller, Flow Switch

Float Valves, Level Controllers and Flow Switches shall conform to or comply with the specimens submitted by the Contractor and approved or permitted by the Project Manager and shall be the best quality available locally.

12.4.4 FIXTURES AND EQUIPMENT

(i) Taps and Stop Cocks

All bib, pillar and stop cocks and mixers shall be of high quality screw down, made of CP brass and shall conform to or comply with BS-1010 or any other requirements or instructions of the Project Manager. Spindles, glands, crutches, washer plates and nuts shall be of brass or manganese. Taps shall have crutches or capstab leads as required or instructed by the Project Manager. The waterway shall not be less than the area of a circle equal to the nominal size of the tap. Working pressure of taps, stocks shall not be less than pressure in the system but not less than 0.6 MPa or NP-6 in any case.

(ii) Water Heater

Electric water heater shall be of storage type with adjustable thermostat range of forty (40) Deg. C to eighty (80) Deg. C. The same shall be of approved manufacturer all controls are to be automatic.

The same shall automatically shut off (electric) when temperature of hot water reaches eighty (80) Deg. C and restart when temperature drops below forty (40) Deg. C.

The vessel of water heater shall be constructed or provided of steel with welded joints. The vessel shall be lined with copper on the inside and painted with baked stove enamel on the outside. The annular space between the copper and steel cylinders shall be filled with insulation material of thermal conductivity not more than 0.045 Watts/m² Deg. C. The heater vessel shall be rated for a working pressure of 0.6 MPa and test pressure of 1 MPa.

In electric water heater, the electric heating elements shall be withdraw-able, mineral insulated, metal clad copper rods.

The capacity of the heating equipment shall be sufficient to raise the temperature of water from +10 °C to + 70 °C in not more than one (1) hour.

Water Heater shall be provided or furnished with the following accessories and control:

- a) Thermostat
- b) Pressure Relief Valve
- c) Thermometer
- d) Pressure Gauge
- e) Drain Valve
- f) In electric water heaters Automatic High Temperature Cut-off

12.4.5 LAYING OF PIPES IN TRENCHES

(i) Excavation of Trenches and Refilling

The trenches shall be set out to suit or meet alignment of the pipe lines. The trenches shall be carefully trimmed on sides and bottom so that pipe lines when laid shall rest on the firm bed throughout the length. Shallow joint holes shall be left for the joints, where appropriate or necessary. Where pipe line is to be laid in plains the depth of cover, i.e. the normal distance from ground level to the top of the pipe be kept at about eight hundred (800) mm and shall not be less than seven hundred fifty (750) mm except due to special reasons or grounds where the Project Manager directs or instructs in writing to the contrary.

(ii) Flanges

Flanged joints shall be provided or furnished at intervals of not more than one hundred fifty (150) m or as directed or instructed by the Project Manager. Each flanged joint shall be made by inserting an accurately cut disc of tough multiply rubber insertion about three (3) mm thick of approved quality between the flanges. The bolt holes in the rubber insert as well as in the flanges shall be drilled to template. The bolts and nuts for all flanged joints shall conform to or comply with British Standard 10 and shall be of mild steel, hexagonal round and diagonal. The bolts shall be pulled up gradually and evenly by the use of standard spanners, so as to secure or ensure a perfect joint.

(iii) Bends, Tees and Other Specials

Bends, tees, reducers and other specials shall be provided and jointed at points as shown or envisaged on the drawings or as directed or instructed by the Project Manager. All changes in direction shall be effected by means of bends wherever practicable and the use of elbows shall be restricted only to cases where there is no room for bends. In such cases, only round elbows shall be allowed.

12.4.6 PIPES ANCHORED TO WALLS OR CEILINGS

- i) Suitable and substantial hangers or fixings shall be provided or furnished for all horizontal and vertical lines of approved types and special vibration eliminating and flexible hangers shall be provided or furnished for all pipe work affected by moving machinery oil expansion and contraction including building expansion joints.
- ii) Hot and cold horizontal piping shall be supported in accordance with the schedule provided as under: In Vertical run

Pipe dia in mm	Maximum Spacing of Fixings in meters		Rod size of Hangers Dia. in mm
	In Vertical run	In Horizontal run	
<u>G.I. and Flexible</u>			
15-25	3.0	2.5	10
31 -50	3.6	3.0	10
62-75	4.5	3.6	13
100- 150	4.5	4.0	13
<u>Cast Iron</u>			
All Sizes	3.0	1.5	13

One fixing shall be provided for each fitting.

- iii) Hanger shall be supported from approved concrete inserts in concrete slabs for all pipes of dia 50 mm and above. Insert shall be as approved by the Project Manager and shall have space for nuts of all size. All inserts shall have a reinforcing rod of specified diameter to be installed through slot provided for this purpose, and the Contractor shall be responsible for its being in place when concrete is poured.

- iv) If any pipe has to be hung where no inserts have been provided or furnished, the Contractor shall drill holes from below through concrete slabs and provide rods and hangers attached to not less than two (2) approved type expansion shield each one capable of taking full maximum load. The rods and complete hangers shall be of adequate size to support the load, which they carry.
- v) Approved roller supports, floor stands, wall brackets, masonry, and the like for all lines running above the floors, and which can be properly supported by the walls shall be provided or furnished. Pipe lines near walls may also be hung by hangers, carried from approved wall bracket at a higher level than the pipe.
- vi) Pipes shall not be hung from the pipes of other trades or other pipes except for small water branches in toilet where no other practical means support can be found, in which case specific approval for the installation shall be obtained from the Project Manager. Hangers shall not be fastened by means of vertical expansion bolts. Hanger shall be of heavy construction suitable for the size of pipe to be supported. All materials, except roller shall be a malleable iron or steel. Rollers shall be cast iron. Hanger shall be swivel split ring, wrought pipe clamp, or adjustable type or as approved or permitted by the Project Manager.
- vii) Special cares shall be taken in the placing of hangers at the top, bottom and in offsets of hot water risers so as to permit or allow for expansion of the vertical piping. Vertical risers shall be securely supported from the building construction by means of pipe clamps at every floor,
- viii) For cast iron hub and spigot pipe and fittings hangers -shall be provided or furnished on not more than 1.5 meters centers or a minimum of one (1) hanger for each length of pipe. Where excessive number of fittings is installed between hangers, the Contractor shall provide or furnish additional hangers or reinforcing as required or instructed to the satisfaction of the Project Manager. Fittings shall be securely anchored to the building construction at changes of direction so as to eliminate all horizontal movement. The Contractor shall furnish and install steel channels and angles for piping support. These supports shall be required where there is not roof slab or where the building structure is not directly usable for pipe support.

12.4.7 PIPE SLEEVES

Pipe line laid through any wall, floor, ceiling or roof shall be arranged to pass through proper hot dipped galvanized sleeve pipes of ample diameter embedded therein to enable the pipe lines to pass easily and freely. The length of every such sleeve pipe shall be of the full width or thickness of the wall and in the case of roof, ceiling or floor, shall be at least forty (40) mm longer than the thickness thereof and shall project to that extent above the upper surface thereof unless or until the Project Manager orders to the contrary. Inside diameter of sleeves shall be at least twenty-five (25) mm greater than the outside diameter of pipe passing through the same. Space between pipe and sleeve shall be caulked and made water tight wherever required.

12.4.8 HOT WATER SYSTEM

All Hot Water supply piping shall be insulated as specified herein. Prior to insulation the pipes shall be thoroughly cleaned of all rust, scales and other containments by wire brushing, sand blasting and the like and by using aromatic solvents to eliminate or remove oil, grease of like nature. Subsequent to the cleaning operation, the pipe shall be coated with two (2) coats of approved, temperature resistant, anti-corrosion paint. Insulation shall be applied to the -painted pipe only after hydraulic testing as specified herein and shall be of a thickness shown or demonstrated as follows:-

Nominal Pipe Dia (mm)	Insulation Thickness (mm)
15-20	20
25-40	25
50-100	32

The insulation, covering and jacket canvas shall be suitably fixed and an approved temperature resistant adhesive shall be used. The circumferential and longitudinal joints for the kraft covering and canvas jacket shall be lapped at least forty (40) mm.

Further reinforcement shall be provided or furnished by the use of twenty (20) mm wide soft aluminum bands, generally spaced at four hundred fifty (450) mm and on either sides of elbows, tees, valves and other piping specialties. All butt joints shall be sealed with self-adhesive type of approved quality adhesive tape.

All valves, fittings and other specials shall be insulated with plain glass fibre wool blanket of thickness equal to the adjoining pipe insulation and shall be covered by kraft paper and canvas jacketing as specified earlier. Two (2) coats moisture proof approved paint shall also be applied. The adjoining insulation near these fittings shall be trimmed into suitable sections to fit closely around the valves, flanges and fittings. All trimmed sections shall be secured or ensured by wrapping of approved type of self- adhesive tape so as to form a complete water proof seal. All work shall be completed in a neat and workmanlike manner, and shall reflect recommended practice.

12.4.9 EMBEDDED PIPELINES

Chassis shall be left in concrete or masonry walls where pipe lines are to be embedded. The cavity shall be deep enough so that after installation of pipes sufficient space is available for cover. Pipes shall be laid before plastering walls or laying of concrete floors so that no joint or cover is visible. Hot and cold lines shall be laid or furnished in separate chassis or cavities and wherever specified herein shall be painted with two (2) coats of bitumen and wrapped in hessian cloth or polythene sheet.

12.4.10 PAINTING OF EXPOSED PIPES

All exposed pipes for cold, hot and mixed water supply shall be painted if required in different colors as specified herein. One (1) coat of red oxide primer and two (2) coats of synthetic paint shall be given to all M.S hangers, brackets and pipes.

12.4.11 DISMANTLING OF GI/WI PIPES

Whenever dismantling of GI/WI pipe system is required, all the joints shall be carefully opened and the components such as pipes, sockets, specials, valves & fittings and holder bats and the like shall be carefully removed, cleaned, all the usable materials shall be sorted out and stacked properly for subsequent use.

12.4.12 INSTALLATION OF FIXTURES

(i) Taps, Stop Cocks and Valves

All taps, stop cocks and valves shall be eased and greased before fixing. The washers and gland packing shall be equally suitable for hot & cold water.

(ii) Water Heater

Water Heater shall be installed or furnished on levels at locations shown or envisaged in the drawings or as directed or instructed by the Project Manager. Electric water heaters fixed on the wall shall be supported by brackets anchored into the wall. The heaters thereof shall be connected or electric supply, incoming cold water supply and outgoing hot water supply. The heaters shall be tested for water leakage, thermostat control and requisite supply of hot water.

12.5 LIST OF APPROVED MANUFACTURER FOR PUBLIC HEALTH WORKS

This list of recommended manufactures / Suppliers of different materials / equipment with brand names has been provided in order to establish a standard level of performance. The Contractor is supposed to provide and fix the materials / equipment of acceptable quality from the list or equivalent as approved by the Project Manager. Material from approved list shall stand rejected, if it fails in any of the specified tests or quality standards

Sanitary Ware	Master, ICL, Porta, Marachi
Bath / Kit. Fittings	Master, Faisal, Sonex, Porta
PPR-C Pipes & Fitting	Dadex, Beta, Master, Plasco, Turk Plast, Popular Pipe, , Dura Built,
uPVC Pipes & Fittings	Fast Flow, Dadex, Beta, Turk Plast, Jamal, Plasco, Popular Pipe, Master,
RCC Pipe	Shalimar, Pakistan Pipes, National Pipe Industry
Sluice Valves	KITZ (Star Corporation), Teepu, Rehman Group, Sirajia Trading co.
G.I. Fittings	KITZ (Star Corporation), Health Engineering (HE)
C. I. Fittings & Valves	Teepu, Alpine, Sirajia Trading co.
C. I. Manhole Cover	CME, Teepu, Alpine, Turk Plast
MS Seamless Pipe	Huffaz Industries, Jamal, KITZ, Sirajia Trading co., Master Pipes, Victory
Gas Geyser	Cannon, General, Negas
Water Pump (Imported)	KSB, DAB (Italy), Lowara, Grundfos, HMA (Vansan, Rovatti), SAER (Italy), XYLEM (USA), WILO (Germany)
PVC Water Stop	Fosroc, Sika, Decora, Marflex
HDPE pipe and Fittings	Dadex, Jamal, Plasco, Turk Plast, Beta, Popular Pipe, Accufit, IIL,DURA BUILT, Builtec, Fast Flow,

CHAPTER-13
INTERNAL ELECTRIFICATION

Chapter-13: INTERNAL ELECTRIFICATION

13.1 INTRODUCTION

It shall covers all necessary facilities and amenities required in the public structures to facilitate the community.

13.2 SCOPE

It will cover general requirements for supply, wiring, installation, inspection, testing and commissioning of various items of internal electrification. Laying of service cable from electric meter and connecting to the Distribution Board (DB) inside the building will be the responsibility of the contractor of internal electrification works.

Wiring and switchboard installation for Air Conditions (AC) and Water Heater shall be in the scope of internal electrification works.

13.3 LOAD REQUIREMENT

Internal electrification design has been planned on illumination and appliances load for different building areas and accordingly the number of required lights, sockets, fans, and AC load demand and diversity factor.

- a. Residential buildings.
- b. Non-residential buildings
- c. Commercial area.
- d. Public Buildings

13.4 CODES, REGULATIONS, NOTICES

The whole of the work shall be carried out in strict compliance to the respective latest NTDC/WAPDA technical specifications and latest edition of Building Codes of Pakistan. In case of any ambiguity/conflict between NTDC/WAPDA technical specifications and Building Codes of Pakistan, the latest one shall be followed.

Any special conditions and requirements of WAPDA shall be met. The work shall be carried out only by suitably qualified workman. Other conditions with respect to the Project Managers and firms qualification as laid down by the Pakistan Engineering Council will be fulfilled and necessary documents in support thereof shall be furnished. The CVs of the Key-Staff will be submitted to the Project Manager for approval before commencement of the work.

All permits, licenses, fees, inspections and arrangements required for the work under this contract shall be obtained by the Contractor at his expense. It will be the responsibility of the Contractor to complete all the technical requirements for electrification project.

13.5 REFERENCE STANDARDS

For internal electrification the various specified standards to be followed are as given below:

- | | |
|---------------|--|
| i. ANSI C1 | National Electrical Code. |
| ii. ANSI C7.4 | Tinned soft or annealed copper wire for electrical purposes. |
| iii. ASTM B33 | Tinned soft or annealed copper wire for electrical purposes. |
| iv. BS 2484 | Straight concrete and clayware cable covers |
| v. CIBS | Codes of practice. |

vi. IEE	Regulations for electrical equipment of buildings.
vii. IEEE 80	Guide for safety in AC substation grounding.
viii. NEMA WC-30	Color coding of wires and cables.
ix. ASTM A36	Specification for structural steel
x. ASTM A525	Specification for general requirements for steel sheet, zinc-coated (galvanized) by the hot-dip, process
xi. BS 449	Use of cold formed steel sections in building
xii. BS 5467	Armored cables with thermosetting insulation for electricity supply
xiii. BS 6346	PVC- insulated cables for electricity supply
xiv. ICEA S-19	Rubber insulated wire and cable for the transmission and distribution of electrical energy.

13.6 SUPPLY

The installations will cover supply for normal lighting, fancy lights, chandelier, 230 V single-phase and 400 V, 3-phase, socket outlets, ceiling fans, bracket fans, exhaust fans, Main/ Sub Distribution Boards, cables of appropriate sizes, etc.; in the buildings.

Contractor shall undertake the complete Engineering of installations including:

- Main / Sub Distribution Boards with MCCB and MCB's for normal lighting and socket outlets in all types of buildings under the scope as shown on drawings to be fed from the 400/230 V mains.
- Lighting:
 - Indoor lighting in all types of buildings under the scope as shown on drawings.
 - Lighting Fittings with LED Batten Light, Fluorescent Tubes, energy savers and LED Lights.
 - 230 V AC light with fittings for the interior area preferably LED light.
 - 230 V AC Water proof light with fittings for the exterior
 - 24 V DC emergency lighting with fittings in where required in the drawings.
 -
- Socket Outlets: Socket outlets and power points shall be installed in all areas as follows:
 - Normal Duty Socket Outlets: Single phase 230 V, 10 A. All areas shall be reached with cable length of maximum 10 m.
 - Power Outlets: Single phase outlets 230 V, 20 A. All areas shall be reached with a cable length of maximum 20 m and for air conditioners & electric water heaters.
- Fans: Ceiling Fans, Bracket Fans and Exhaust Fans shall be installed in all area as follows:
 - Ceiling Fans: ceiling fans with operating voltage 230 V shall be installed with an appropriate size to get average air delivery all area of a room/ hall.
 - Bracket Fans: bracket fans with operating voltage 230 V shall be installed as per requirement.
 - Exhaust Fans: exhaust fans with operating voltage 230 V shall be installed in washrooms, kitchens and as required.

13.6.1 TECHNICAL REQUIREMENTS

i) General

All the wiring and the installations shall be in accordance with latest NTDC/WAPDA technical specifications and latest edition of Building Codes of Pakistan.

ii) Distribution Boards and Panels

- Distribution boards and panels shall be self-ventilated. No ventilating fans shall be used. These shall be designed for easy access to the equipment, cable terminals, etc., during maintenance.
- Permissible temperature rises shall not be exceeded.
- Each Distribution Board shall have at least 25 % spare installed capacity but maximum 06 breaker in large size DBs.
- Bus-bars shall be of copper and shall have three phases and a combined neutral bar and earthing bar.
- Generally molded case circuit breakers (MCCB) and miniature circuit breakers (MCB's) shall be used. Use of ordinary fuses will not be permitted.

iii) Lighting System

- An adequate indoor and outdoor lighting with illumination levels in accordance with the table given in sub clause 13.6.1(v) will be provided.
- Fluorescent and LED indoor lighting fittings will be preferred, where feasible.
- For outdoor lighting, waterproof lighting fixtures are recommended.
- Lighting and power socket-outlets shall be for 230 V single-phase, connected between phase and neutral of the 400 V 3phase, 4wire power system
- Loads shall, as far as possible, be evenly distributed between the phases
- In addition to the current-carrying conductors, an Earthing conductor shall be run in each cable and circuit running from the distribution board to the equipment and appliances, which are to be earthed.
- The color temperature shall be 4000K - 6500K preferably 5500K. The Contractor shall use a single color temperature from above mentioned in a building preferably in whole project.

iv) Lighting Installations

- For outdoor areas, only normal lighting shall be installed.
- During normal conditions normal lighting shall be lit.
- Both indoor and outdoor lighting systems shall be fed by separate circuits.
- Normal lighting shall be supplied from distribution boards and panels.
- Permanently emergency lighting comprising fixtures and exit luminaries shall be supplied from a distribution panel dedicated for this purpose. About 10% of all fixtures shall be emergency fixtures with minimum one such fixture in each room. The exit luminaries shall be installed above doors and corridors etc. The exit illumination shall have a sufficient distribution to ensure safe egress from the areas during a blackout.
- Emergency lighting shall only be controlled by switches mounted on the front of the emergency lighting distribution panel / Board.
- All indoor and outdoor lighting shall be controlled by wall-mounted switches.
- Outdoor lighting shall be centralized as much as possible and all lighting shall be controlled from a lighting control panel/board.
- All light fixtures will be waterproof.

v) Illumination Levels

- The average (minimum) illumination levels, as measured at a height of 0.8 m above floor at any location, after approximately 100 - 150 operation hours, shall be as follows:

Type of Area	Illumination Level
a) Outdoor:	
Areas with common staff traffic	100 lux
Roads and yard.	100 lux
b) Indoor:	

Offices, control rooms and switch-gear rooms.	400 lux
Canteen, kitchen, bed rooms, living rooms, drawing rooms and dining rooms, bath rooms.	200 lux
laundry	300 lux
Corridors	100 lux

- Illumination requirement for the emergency lighting shall be at least 15 lux all over the related areas.
- The lighting fittings shall be mounted in such a manner that the light, as far as possible, will be evenly distributed throughout the rooms or areas.

vi) Fans Installation

- The ceiling fans, bracket fans and exhaust fans shall be fed by separate circuit from switch board.
- Maximum three ceiling fans shall be operated with a single switch in the hall / space where more than six ceiling fans have been installed.
- Ceiling/ bracket fans with respect to size shall be installed in a manner so that the average air delivery could be met in the area.
- Exhaust fan shall be so selected and installed that the odors, pollution and humidity could be eliminated.

vii) Wiring and Accessories

- For all installations insulated single core cables and multi-core cables shall be used for the wiring. Wiring shall be laid on or in the walls and ceilings. The wiring shall be installed in a neat and orderly manner. All cables shall be run either horizontally or vertically.
- All installations shall be carried out in accordance with internationally accepted methods to a high standard of workmanship.
- Cable and wire termination shall be performed without damage to the conductors.
- Lugs shall be used for all cables above 4 mm². Lugs shall be soldered or shrunk with approved tools.
- The following installation levels shall be used, referring to the height above the finished floor or finished ground (outdoor):
 - Lighting switches 1.30 m
 - Socket-outlets, offices, etc. 0.30 m

viii) Buildings External Area Lighting

- The buildings external lighting installations will cover wall bracket lights, luminaries on steel masts and cables, foundations complete. All fittings will be delivered with light sources.
- The Contractor shall furnish and install Park lights on tubular steel masts in the compound area of the building for the lighting to be controlled from its Distribution Board, generally in accordance with the requirements of Metal Work Specifications.

ix) Cables and Cable Trays

- The specifications will cover the requirement of medium voltage power cables, low voltage wires, power cables and accessories.
- Low voltage cables shall be laid on cable racks and the cable trenches where required as mentioned in drawings or as directed by Project Manager.

- The final cable routing will be determined during detailed design by the contractor and approved by the Project Manager keeping in view the actual situation.
- DC cables between chargers and batteries and between batteries and distribution panels/Boards shall be single core type without metallic shield or armor.
- The conductor cross section will be calculated according to:
 - i. Rated current at temperature of 90 °C or 70 °C for LV cables.
 - ii. Short circuit current at temperature of 250°C or 160°C for LV cables.
 - iii. Maximum voltage drops of 2.5 %.
 - iv. Ambient temperature is 40°C.

a. Standards

Design, manufacturing and testing shall, comply with the standards listed below:-

- | | | |
|-------|--------------------|---|
| i. | IEC Safety | Handbook containing all basic safety standards |
| ii. | IEC 60038 | Standard Voltages |
| iii. | IEC 60059 | Standard Current Ratings |
| iv. | IEC 60228 | Conductors, solid or stranded plain copper |
| v. | IEC 60287 | Calculation of the continuous current rating of cables |
| vi. | IEC 60332 | Tests on electric cables under fire conditions, Part 3: Tests on Bunched Wires or cables, Category C. |
| vii. | IEC 60446 | Color codes |
| viii. | IEC 60502 voltages | Extruded solid dielectric insulated power cables for rated from 1 kV up to 30 kV |
| ix. | IEC 60811 | Common test methods for insulating and sheathing materials of electric cables |

b. Cable Accessories

These shall cover termination material, clamps, cable boxes and all necessary material for installation and erection of the cables.

c. Fire Protection Material

- i. 1 (one) lot of fire-proof paint for painting all cables one meter on both side of any fire cell passage (block-outs) and one meter for each 5 meter on the cable lengths.
- ii. 1 (one) lot of material for fire proof barriers in all blackouts for cables in walls and floors.

d. Technical Description

Cables shall comprise:

- i. Conductors, solid or stranded plain copper conform to IEC standards.
- ii. Conductor screen for medium voltage cables of extruded sheath or tape.
- iii. Conductor insulation of PVC or XLPE identified by colour code according to applicable IEC standards, identification by colours.
- iv. Black outer sheath of PVC for medium and low voltage cables.
- v. Grey outer sheath of PVC for control and measure cables.

e. Cable Trays

- i. The cable trays are the mechanical devices over which the cables between equipment power sources are laid. In this particular case, these will be continual structure cable trays. These will also include: trays support; ladders; and sectional irons.
- ii. Technical Description:

- The cable trays consist of trays, ladder or perforated plate type, fitted on brackets. The bracket itself is fixed to the vertical supports or hanging supports fixed either to the main building structure, or directly to the concrete walls.
 - Each tray is made of pieces, fitted on the supports. These supports are directly gripped. The cable trays for measuring cables are made of plain or perforated sheet metal with folded flanges and fitted with a lid.
 - The cable trays are said "simple" when one or more trays are fitted on one side only of their support or on the wall.
 - The cable trays are said "dual" when trays are fitted on both sides of their support.
 - The vertical cable trays consist of one or several cable rises, which are parallel on a vertical plane.
 - The design of the trays is such that appropriate natural ventilation of the cables and their easy outlet through the trays lower part are ensured.
 - The connection pieces used for the direction or level changes are calculated taking into account the cables radius or curvature.
 - The general structure of the cable trays should be designed to receive a cover for eventual mechanical protection.
- iii. Surface Treatments:
- The cable trays including equipment to be protected against corrosion by galvanization.
 - Supports and brackets of the trays are hot dip galvanized according to the French norms NFA 36321 and NFA 36322.
 - The thickness of the coating is about 15 microns per side (275 gr/m²).
 - After site welding or cutting, cold galvanization is carried out by SENDZIMIR process.
 - The bolts and nuts for fixation of the cable trays are electro-galvanized.
- iv. Cable Trenches:
- The trenches shall be laid true to line and level and shall be completely embedded in concrete, with a minimum 150 mm thickness of concrete of grade 20 MPa surrounding the ducts on all sides.
 - Ducts shall be sealed at each end after installation of the cable with split hard wood plugs and bitumen or by other approved means to exclude water and vermin.
- v. Cable Protective Covers:
- Cable protective covers shall be of reinforced concrete and, unless otherwise approved, be 300 mm wide, 50 mm thick and 1 m long. The covers shall be designed for interlocking one with the other, both vertically and laterally. Special covers shall be provided where required for short radius bends. All cable protective covers shall meet the requirements of BS 2484.
 - The covers shall have the legend "ELECTRIC CABLE" cast into the upper surface and shall be installed in accordance with these Specifications.

x) Earthing System and Protective Conductor

f. General

- The scope covers Earthing arrangement for electrical equipment, buildings and other installations.
- The design, installation and testing shall comply with the NTDC/WAPDA specifications. Earthing Instructions

g. Building Earthing Arrangement

The consumer's main earthing terminal shall be connected to earth in compliance with the following:

- i) The earthing arrangement may be used for the protective or functional purpose according to the requirement of the installation.
- ii) The earthing arrangement shall be such that:

- a) The value of resistance from the consumer's main earthing terminal to the earthed point of the supply, shall be in accordance with the protective requirement of the installation i.e. 1 ohm and expected to be continuously effective
- b) Earth fault current and earth current likely to occur are carried without danger, particularly from thermal, thermo-mechanical and electro-mechanical stress and
- c) They are adequately robust or have additional mechanical protection appropriate to the assessed conditions of the external influence.

h. Earthing Electrode

The following types of Electrode are normally in use for the purpose of these regulations depending on soil conditions, temperature, and composition of soil, salt and moisture:

- a) Earth rod or pipe
- b) Earth tape or wire
- c) Earth plates.

i. Earthing Conductor

- i) Every Earthing Conductor where buried in soil, shall have cross sectional area not less than 16mm² (where protected) and 25mm² and 50mm².
- ii) Circular earthing conductor from terminal point to the earth plate/rod shall be laid in G.I. pipe 25 mm dia. and shall be run at a depth not less than 600 mm from ground level,
- iii) Aluminum and copper clad aluminum conductor shall not be used for final connection to earth.
- iv) The connection of an earthing conductor to an earth Electrode or other means of earthing shall be normally made with brass nuts, bolts, and washers of appropriate sizes so as to be electrically as well as mechanically satisfactory.

j. Main Earthing Terminal/Point

Every earthing terminal having tinned copper flat with 10 mm dia. brass nut bolt and washer fixed on porcelain base and housed in M.S box, shall- be provided to connect the following conductors to the earthing conductors.

- i) Main Earthing Conductor.
- ii) The circuit Protective Conductor
- iii) Main Bonding Conductor.

k. Protective Conductor

- i) Every protective conductor shall be green or green/ yellow coloured PVC insulated or hard drawn bare copper conductor as per requirement of the installation.
- ii) The cross sectional area shall not be less than as under.
 - a) 2.5 mm² if the mechanical protection is provided'.
 - b) 4 mm² if the mechanical protection is not provided for an earthing conductor.
- iii) Where a protective conductor is common to several circuit, the cross sectional area of protective conductor shall be selected so as to correspond to the cross sectional area of the largest phase conductor of the circuit.
- iv) All metallic accessories i.e. Fan Regulators. Pedestal, fixture, open to weather shall be properly earthed with protective conductor of size 2.5 mm².
- v) Flexible conduit shall not be used as protective conductor.
- vi) Protective conductor 10 mm² or less shall be of copper or copper clad aluminum.

I. Earthing Conductor Connections

- i. Connections between the main earth ring and the branch earth conductors shall be made with brass lugs hard soldered to the copper strand and tinned, riveted and sweated to the main earth bars or by exothermic welding or equal as per approval of the Project Manager.
- ii. Stranded earthing conductors between any two points shall be in a continuous length and be straight. Through jointing is prohibited.
- iii. No reliance shall be placed on the conductivity of metal to metal joints in structural or equipment metalwork to provide earth continuity.

m. Neutral Earthing

- i. The neutral earthing points on the equipment shall be connected to earth in accordance with the single line diagrams or as directed by the Project Manager.
- ii. The neutral earthing point on each transformer shall be solidly earthed.

n. Lightning Protection

- i. Lightning protection system for the buildings shall be designed by the Contractor and submitted to the Project Manager for approval.
- ii. All equipment shall be installed in accordance with the approved layout drawings. Connections to lightning points shall be taken by the shortest possible route without bends down to ground level or the earthing ring for connection to an earth electrode or the adjacent earthing system.

o. Tests

- i. After the on-site construction, the resistance to earth of each earthing electrode system shall be measured. The earthing system in all the installations shall be measured collectively under operating conditions and shall be disconnected into separate systems for measuring of the separate elements of the system. The Contractor shall suggest the measurement set-up for approval by the Project Manager.
- ii. The earthing electrode systems shall be checked for resistance and reliable connections.
- iii. Complete underground earthing system shall be checked and tested to prove its adequacy as per relevant standards and these specifications and to the satisfaction of the Project Manager.
- iv. Test results shall be recorded.

13.6.2 TESTING

i) General

Inspection and testing of all items of electrification work shall be in conformity with the applicable recognized standards for making such tests and inspections.

ii) Electrical Equipment and Wiring

- All electrical equipment and wiring shall be tested in accordance with NTDC/WAPDA technical specifications and Building Codes of Pakistan.
- The test results and plans shall be submitted to the Project Manager for approval.

iii) Provision of Instruments and Labor:

Contractor shall provide supervision, labor, apparatus and instruments required to adjust and thoroughly test the installation, to his own satisfaction, as well as the Project Manager.

iv) Testing Upon Completion:

The following tests shall be carried out:

- Insulation tests between all phases, from each phase to neutral to earth.
- Resistance tests on the earth continuity conductor and on any or all circuits as the Project Manager's representative shall choose.
- The resistance to earth of any or all earth electrodes, as the Project Manager's representative shall choose; Ref BS-7176 and BS -7430.
- The correct operation of controls, lights and other outlets.
- Measurement of illumination level.

13.7 REGULATIONS FOR ELECTRICAL EQUIPMENT OF BUILDINGS

13.7.1 GENERAL

The installation shall be carried out in conformity with latest Edition of the NTDC/WAPDA Standards and Specifications.

The definitions of terms in the latest Edition shall apply. A point shall consist of the branch wiring from the branch distribution board or from the point of service entry where there is a no branch distribution board together with a switch if required, as for as including the ceiling rose or wall socket etc. In case there is more than one point the average length of the conduit as the system shall be considered a particular distribution system for the purpose of ascertaining the length of each point wiring.

13.7.2 SYSTEM OF WIRING

- i) The wiring shall be carried out on such system as may be stated in the special conditions or as otherwise specified. The wiring is to be done on the distribution system with main branch distribution board at convenient centers and without isolated fuses. All conductors shall be run as far as possible, along the walls and ceilings, so as to be easily accessible and capable of being inspected. In no case the wiring is to be run above ceiling without the special approval in writing of the Project Manager. The balancing of Circuit in 3 wires or 3 phase installations shall be arranged beforehand by the Project Manager. Circuit of 3 wire system or different phase of 3 phases are to be kept as far apart as possible in all cases.
- ii) For medium pressure (400 V) wiring, all associated apparatus shall comply in all respects with the latest Building Codes of Pakistan.
- iii) Where more than one phase wires are to be carried out on the same route, they must bond with two distinct earth.
- iv) All the current consuming devices shall be suitable for the pressure and frequency of the supply stated in the special condition of the contract.

13.7.3 OBJECT OF WIRING

The primary object of any system of wiring is to distribute the electrical energy to the various points at which it is required and the consideration which should be taken into account are as follows:

i) Electrical Safety

This is the first consideration and under no circumstances must there be any danger of leakage or of electrical shock to person using the supply.

ii) Mechanical Immunity

The wiring must be protected from damage of physical nature during the ordinary usage of the building.

iii) Permanence

In this connection the wiring must not deteriorate unduly due to the action of weather, fumes, damp etc. and thus the actual situation may affect the system used.

iv) Appearance

It is evident that for certain works the appearance or invisibility is an important consideration. Although most wiring for domestic use is buried, there are several systems, which are designed for installation on the surface and are at the same time not unsightly. For factory work the appearance apart from neatness is not usually important.

v) Protection

In general, every cable should have a current rating not less than that of protective fusible element M.C.B. or not less than half the trip current of a protective circuit breaker. However, if motor starter provides excess current protection, the current rating of the fuse, protecting the final sub circuit for the motor may be up to twice of that of the cable.

vi) Accessibility

All equipment shall be arranged so as to facilitate its operation, inspection and maintenance and access to its connection. Such facilities shall not be significantly impaired by mounting equipment in enclosures/compartments. This regulation does not apply to joint in cable where section 13.4 allows such joints to be in accessible.

vii) Identification and Notices

- i) Labels or other suitable means of Identification shall be provided to indicate the purpose of Switch Gear etc. unless there is no possibility of confusion.
- ii) Similarly the protective devices should also be arranged and identified so that the circuit protected may be easily recognized. For this purpose it may be convenient to group them in Distribution Board.

viii) Diagrams and Charts

Diagram and charts shall be prepared indicating the route, provision of junction boxes, number and size of conductor, location of switches, Distribution Board and type of wiring etc.

ix) Supply of Power

- i) Before connecting the installation to the mains, check that the main supply is suitable for your appliances i.e. whether it is A.C or D.C and whether it is at the correct voltage & frequency.
- ii) The installation is properly earthed. Never accept supply from socket and light or lighting outlet.

x) Mutual Detrimental Influence

All Electrical Equipment shall be erected so as to avoid any harmful influence between electrical installation and any non-electrical installation envisaged.

xi) Drawings

- i) All wiring drawings shall be deemed to be drawing within the meaning of term used in general contract.

- ii) In case of addition to existing installation, the Contractor shall himself supply a wiring diagram of the addition only with sufficient details to enable the Project Manager to bring his original wiring diagram of the building up to date.
- iii) Completion Drawing: After completion of the work the Contractor is responsible to submit wiring diagrams indicating clearly in plan, the relative positions of all main Board, branch distribution boards, and the runs of the various main, sub-main and circuit with position of all points and fittings.

xii) Symbols

Only the conventional symbols given in Appendix-3 are to be used, all circuits are to be clearly indicated and numbered on the wiring diagrams and all points are to be numbered with same.

xiii) Codes and Standards

The codes and standards where-ever mentioned in these Specifications shall be Considered British Standard or any equivalent international standards/ specifications approved by WAPDA.

13.8 MATERIALS (CONDUCTORS, CABLES, CONDUITS AND FITTINGS, ACCESSORIES AND FIXTURE)

13.8.1 CONDUCTOR

All conductors/ cables and conduits, fittings, accessories, fixtures shall be in accordance of NTDC/WAPDA specification and Building Codes of Pakistan respectively. The material shall be made by M/s Pakistan Cables, M/s Newage Cables, M/s Fast Cables or equivalent as approved by the Project Manager.

13.8.2 CABLES

- i) Every non flexible cable operating at low voltage shall be selected from one of the following types and shall comply with the appropriate British Standard referred to below, so far as this is applicable. In cables of every type, conductors of cross sectional area 10 mm² or less shall be of copper. The material shall be made by M/s Pakistan Cables, M/s Newage Cables, M/s Fast Cables or equivalent as approved by the Project Manager.
 - a) Armoured PVC insulated cable (BS-6004, BS-6231 type B or BS-6346).
 - b) Non- armored PVC insulated cables (BS-6346).
 - c) Rubber insulated cables (BS 6007).
 - d) Impregnated-paper insulated cable lead sheathed (BS-6480).

For selection of cables to be used for specific works are described in table-13.8.1.

- ii) All cables unless the contrary is expressly stated in the special condition of the contract or otherwise shall be P.V.C. insulated and comply in all respect with the latest British Standard specification i.e. 6004 for light & power and each coil must be accompanied by the makers test certificate stating the class and giving the result of insulation test.
- iii) The standard sizes of conductors which are used for wiring and other purposes are given in the table 13.8.2 (a & b) which are taken from I.E.E Regulation, these tables give full particular as to current carrying capacity, voltage drop and resistance etc.
- iv) According to the table the minimum size of the cable 1/.044 is also manufactured but this size of cable may be used for leading into the fittings and not for any of the runs. The minimum cables size 3/.029 or 1/1.13 mm may be used for wiring purposes.
- v) The cross sectional area of cable for wiring installation must be such as to satisfy the distinct requirement as under:
 - a) It must be sufficient to carry the maximum current without over heating as stipulated in the table.
 - b) It must be sufficient to prevent the maximum voltage drop as prescribed in I.E.E Regulation i.e. 2.5% of the declared pressure of supply.

- c) A cable which satisfies sub clause (a) above may not be large enough to satisfy sub clause (b) above.

TABLE-13.8.1

**SELECTION OF TYPES OF CABLES AND PARTICULAR
 USES AND EXTERNAL INFLUENCES**

For compliance with the requirements of I.E.E Regulation, the selection and erection of wiring systems in relation to risks of mechanical damages and corrosion is given as under:

Type of Cable	Uses	Additional precautions (if any)
PVC or rubber insulated non-Sheathed.	In conduits, cable or trucking but not in such conduits etc. buried underground	
Light circular PVC insulated & sheathed	i) General indoor use other than embedding ii) Underground in conduit or pipes	Addition protection where exposed to serve Mechanical stress.
Flat PVC insulated and sheathed	i) General indoor use ii) On exterior surface walls. iii) Overhead wiring between buildings. iv) Underground in conduits of pipes.	Additional protection where exposed to serve mechanical stress.

TABLE 13.8.2(a)

**IEE CURRENT RATINGS SUBJECT TO VOLTAGE DROP
 PVC Insulated Cables including PVC sheathed types
 SINGLE CORE**

CONDITIONS OF INSTALLATION

- i) Bunched and enclosed in one conduit, toughing or casing
- ii) Bunched in free air or in an open trench Ambient
- iii) temperature: 30°C (86°F)

Size of Conductor		2 Cables D.C or Single		3 or 4 Cables Balanced Three phase		D.C or Single phase A.C	
Nominal Area	Number & Diameter of Wires	Current Rating	Approx. Length of run for 1-volt drop	Current Rating	Approx. Length of run for 1-volt drop *	Current Rating	App. Length of run for 1-volt drop *
Inch ²	Inch	Amp	Ft	Amp	ft.	amp	Ft
0.0015	1/.044	5	16	5	19	5	16
0.002	3/.029	10	10	10	12	10	10
0.003	3/.036	16	11	13	14	13	12
0.0045	7/.029	20	12		19		16
0.007	7/.036	28	13	25	17	22	17
0.01	7/.044	36	16	32	20	29	20
0.0145	7/.052	43	18	39	23	34	23
0.0225	7/.064	53	23	48	29	42	29
0.03	19/.044	62	25	56	32	50	31
0.04	19/.052	74	29	67	37	59	36
0.06	19/.064	97	33	88	42	78	41

* At rated current Increased by 1 ft. for D.C

This table is based on Table 12 of the IEE Regulations (13th edition) and applies to wiring in building for the conditions specified.

Ambient Temperature:

For ambient temperature other than 30°C (86°F) multiply the current ratings and divide the lengths for 1-volt by the approximate factor below:

Ambient Air temperature	25°C(77°F)	35°C(95°F)	40°C(104°F)	45°C(113°F)
Rating Factor	1.13	0.86	0.69	0.47

TABLE 13.8.2 (b)

CURRENT RATINGS & ASSOCIATED VOLTAGE DROP/AMP/METER PVC

Insulated, non-armoured cables, with or without sheath, with COPPER CONDUCTORS

Single core 600/1000 volt

Conditions of installation Single circuit current ratings under conditions as listed below with coarse excess-current protection. For other than single circuit and for close excess current protection see rating factors below. Ambient temperature 30 °C.

Conductor		Bunched and enclosed in conduit or trunking				Clipped direct to a surface or on a cable tray, bunched and unenclosed			
		2 cables, single phase A.C or D.C		3 or 4 cables three phase A.C		2 cables, single phase A.C or D.C		3 or 4 cables three phase A.C	
Nominal cross sectional area	Number & diameter of wires	Current rating	Volt drop/amp /meter*	Current rating	Volt drop/amp /meter*	Current rating	Volt drop/amp /meter*	Current rating	Volt drop/amp /meter
mm ²	mm	amp	mV	Amp	mV	amp	mV	amp	mV
1	2	3	4	5	6	7	8	9	10

1.0	1/1.13	11	40	9	35	13	40	12	35
1.5	1/1.38	13	27	11	23	16	27	15	23
2.5	1/1.78	24	16	16	14	23	16	20	14
4.0	7/0.85	24	10	22	8.8	30	10	27	8.8
5.0	7/1.04	31	6.8	28	5.9	38	6.8	34	5.9
10	7/1.35	42	4.0	39	3.5	51	4.0	46	3.5
16	7/1.70	56	2.6	53	2.2	68	2.6	61	2.2
25	7/1.53	73	1.6	71	1.4	89	1.6	80	1.4
35	19/4.53	90	1.2	88	1.0	109	1.2	98	1.0

* Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage (see IEE Regulation B23 page 126, 14th Edition, and 1969 Supplement). The rating in columns 3 and 5 relate to cables in metal or non-metallic conduit and trunking. For cables in underground pipes and ducts, see item 4(g) page 130 of the IEE Regulation. 14th Edition and 1969 Supplement.

13.8.3 COAXIAL CABLE

TABLE 13.8.3 (a)

MATERIAL SPECIFICATIONS	RG6
Jacket	PVC

Braid	SPC (inner) & Bare Copper (Outer)
Dielectric	PE
Center Conductor	Copper Covered Steel
DIMENSION	RG6
Center Conductor Diameter (Inch) (mm)	0.0285 0.73
Dielectric Diameter (Inch) (mm)	0.185 4.7
Braid Diameter (Inch) (mm)	0.24 6.2
Jacket (Inch) (mm)	0.33 8.5
Impedence	75 ohm

13.8.4 FLEXIBLE CABLES/CORDS

13.8.4.1 Selection of Flexible Cables/Cords for Low Voltage

Every flexible cable and flexible cord for use at low voltage shall be selected from one of the following types and shall comply with the appropriate WAPDA standards/ Building Codes of Pakistan/ British Standard referred to below so far as this is applicable. This regulation does not apply to a flexible cord forming part of a portable appliance or luminaries where the appliance or luminary as a whole is the subject of and complies British Standard. The material shall be made by M/s Pakistan Cables, M/s Newage Cables, M/s Fast Cables or equivalent as approved by the Project Manager.

- i) Insulated flexible cords (BS 6500).
 - ii) Rubber insulated flexible cables (BS 6007).
 - iii) PVC insulated flexible cables (non armored) (BS-6004).
 - iv) Braided traveling cables for lifts (BS 6977).
 - v) Rubber-insulated flexible trailing cables for quarries and miscellaneous mines (BS 6116).
- Such insulated flexible cables and flexible cords may incorporate flexible armor of galvanized steel or phosphor bronze, or a screen of tinned copper wire braid.

13.8.4.2 Selection of Flexible Cables/Cords (General)

Every flexible cable and flexible cord shall be selected from one of the following types:

- i) Braided circular.
- ii) Circular sheathed.
- iii) Flat twin sheathed.
- iv) Parallel twin, only for the wiring of luminaries (where permitted by BS 4533).
- v) Twisted twin non sheathed, only for the wiring of luminaries (where permitted by BS 4533).
- vi) Braided circular twin and three core, insulated with glass fiber, where permitted by clause 13.9.2.8 (ii).

TABLE 13.8.4
FLEXIBLE CORDS – Conductor Sizes and Ratings

Size of conductor	App. Diameter of	Maximum Allowance	Current Rating * Twin, 3-Core or	Maximum Permissible
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Nominal Area	Number of Wires/Diameter	conductor	Resistance at 20° C for Tinned	4-Core (subject to voltage drop)	weight supported by twin flexible
Inch ²	Inch	Inch	Ohm/km	amp	Lb
0.0006	14/.0076	0.034	42.03	2	3
0.001	23/.0076	0.046	25.57	5	5
0.0017	40/.0076	0.057	14.71	10	10
0.003	70/.0076	0.076	8.41	15	10
0.0048	110/.0076	0.092	5.35	20	10
0.007	162/.0076	0.120	3.63	25	10

* Ratings are based on Table 27 of the I.E.E Regulation (13th Edition).

The resistances given are for straight single cores. For twisted twin and multicore flexible cords, and allowance not exceeding 5 percent must be added for the extra lengths due to the lay of the cores.

13.8.5 M.S CONDUITS AND CONDUIT FITTINGS

- i) Conduits and conduit fittings shall comply with the appropriate Standard referred to below:
 - a) Steel conduit and fittings (BS 31).
 - b) Flexible steel conduit (BS 731).
 - c) Steel conduit and fittings with metric (BS 4568).
 - d) Non-metallic conduits & fittings (BS 4607).
- ii) All the conduits to be used in wall & floor, except in damp situation shall be of steel having the thickness 16 SWG should be seamless or welded and painted inside and outside with 2 coats of black enameled paint.
- iii) The conduit accessories such as switch boxes, socket outlet shall be made of cast iron M.S. Sheet 16 SWG and shall have at least 25 mm clear space behind the accessories to accommodate loose wires, while all the pull/junction boxes shall be of cast iron having wall thickness 3 mm.
- iv) All the boxes shall have required number of conduit entry holes and the earth terminal. All switch boxes/ outlets should be painted with black enameled paint so as to avoid rust well before installation.
- v) In concealed wiring under no circumstances fabricated bends or Tees may be used, where necessary to change the direction the conduit shall be given bend according to the site requirements with a proper bending machine.
- vi) No conduit less than 3/4" (19.1 mm) diameter shall be used for wiring light and power circuit.
- vii) No bend shall have a radius less than 2-1/2 time the outside diameter of the conduit pipe.
- viii) In surface wiring only inspection bends and Tees may be used, where the site requirement need the solid bend can however be used after obtaining the approval of the Project Manager.
- ix) In damps situation only galvanized conduit and accessories shall be used.
- x) For concealed wiring the junction box to be used in ceiling shall be 75 mm deep while for surface wiring the junction/pull box shall be as per section 13.9. 2.3.
- xi) The standard sizes of conduit, bends and wiring capacities is given in table 13.8.5(A), 13.8.5(B) and 13.8.5(C).

TABLE 13.8.5-A

STANDARD SIZES OF CLASS-B CONDUIT (BS 31)

Outside diameter	Threads per inch	Maximum length of thread	Minimum length of thread	Minimum Bore
	(ins)	(ins)	(ins)	(ins)

5/8	18	1/2	7/6	0.540
3/4	16	9/16	1/2	0.655
1	16	11/16	5/8	0.932
1-3/4	16	3/4	11/16	1.181
1-1/2	14	13/16	3/4	1.421
2	14	15/16	7/8	1.921
2-1/2	14	1-1/16	1	2.392

TABLE 13.8.5-B
MINIMUM RADIUS OF CONDUIT BENDS

Outside diameter of conduit (ins)	Radius of bend (ins)
3/4	1-7/8
1	2-1/2
1-1/4	3-1/8
1-1/2	3-3/4
2	5
2-1/2	6-1/4

TABLE 13.8.5(C)
CAPACITY OF CONDUITS

Maximum number of single core cables that can be drawn into conduit, (250 and 660 volt grade, V.R.I braided and compounded and PVC insulated cables only)

Size Cable	Light Gauge	Heavy Gauge											
		5/8"		3/4"		1"		1-1/4"		1-1/2"		2"	
Cross Sect. Area	No. & Dia or wire	250 V grade	250 V grade	250 V grade	660 V grade	250 V grade	660 V grade	250 V grade	660 V grade	250 V grade	660 V grade	250 V grade	660 V grade
0.0015	1/.044	6	8	7	...	13	...	20	...	...	...	...	...
0.002	3/.029	5	7	6	4	13	9	20	...	...	...	...	...
0.003	3/.038	4	6	5	3	10	6	16	...	...	...	...	...
0.0045	7/.029	4	5	4	2	9	5	13	9	...	...	...	...
0.007	7/.036	2	4	3	...	7	4	10	8	14	...	...	...
0.01	7/.044	...	...	2	...	5	4	8	7	11	9	...	...
0.00145	7/.052	...	...	...	...	4	3	7	5	9	7	...	...
0.00225	7/.064	...	...	...	...	3	...	5	4	7	6	12	...
0.03	19/.044	...	...	...	...	2	...	4	3	6	5	9	6
0.04	19/.052	...	...	...	...	...	...	3	2	4	4	6	5
0.06	19/.064	...	...	...	...	...	...	...	...	3	3	...	3
0.1	19/.083	...	...	...	...	...	...	...	...	...	...	...	2
0.15	37/.072	...	...	...	...	...	...	...	...	...	...	...	...

13.8.6 TRUNKING, DUCTING & FITTING

Trunking, ducting and fittings shall comply, where applicable with BS 4678 or be of insulating material having the ignitability characteristic as specified in BS 476 part-1.

13.8.7 PVC CONDUIT AND CONDUIT FITTINGS

- i) The conduit for lighting and power wiring shall be of polyvinyl chloride material manufactured as per BS 3505-0. Manufactured smooth bends shall be used where conduit changes directions. Bending of conduit by heating or otherwise shall be allowed only at special situation, for which approval of the Project Manager shall be necessary. The material made by M/s TurkPlast Ltd, M/s Popularpipes Ltd. or equivalent as approved by the Project Manager shall be used.
- ii) The use of sharp 90 degree bends and Tees shall not be allowed. The bends shall have enlarged end to receive conduit without any reduction in the internal diameter of the pipe.
- iii) Round junction boxes shall have galvanized hexagonal nut 5 mm inner dia and 3 mm thick moulded in the box for fixing the cover plate etc.
- iv) The PVC conduit and its accessories shall have the wiring capacity as per Table 13.8.7.

TABLE 13.8.7
MAXIMUM CAPACITY OF PVC CONDUIT PIPES

Single Core Cable Size	Symbol	Conduit Size (Diameters)		
		20 mm (3/4 ")	25 mm (1")	32 mm (1-1/4")
1.5 sq. mm (3/.029)	W	8	18	26
2.5 sq. mm (7/.029)	X	5	11	17
4 sq. mm (7/.036)	Y	4	8	113
6 sq. mm (7/.044)	Z	3	6	10
10 sq. mm (7/.052)	-	2	4	6
16 sq. mm (7/.064)	-	-	3	4
25 sq. mm (19/.052)	-	-	2	3

13.8.8 SWITCHES

- i) Indoor switches controlling light and fans shall be single pole, suitable for 5 amps 250 V 50 Hz. The body of the switch shall be made of plastic or bakelite, suitable flush mounting in PVC outlet box or to be fixed on surface.
- ii) The switch contacts shall be silver tipped and shall operate with snap action. The switches shall be piano type small/large (preferably large) gang type in white colour and made by M/s Clipsal (Schneider Electric), M/s PPI or equivalent as approved by the Project Manager.
- iii) The switches shall be installed in PVC box of appropriate size having 5 mm thick white plastic faced plates and fixed recessed in wall or column.
- iv) The gang switches shall be made of molded plastic having white plastic face plate.
- v) For surface wiring if desired by the Project Manager the switch shall be fixed on teak wood board with white plastic sheet to be fixed on the board.
- vi) Switch for Outdoor Use. The switch for outdoor use shall be Piano type single pole 5 amps, 250 volts, AC totally enclosed in water proof PVC box of suitable size and Casketed between the cover and the base to make it water proof.

13.8.9 SWITCH SOCKETS

- i) Sockets shall be of 3 Pin 5 Amps & 15 Amps 250 Volt A.C and shall be manufactured with good quality Bakelite and white plastic as per BS-62. The sockets shall be made by M/s Clipsal (Schneider Electric), M/s PPI or equivalent as approved by the Project Manager.
- ii) For concealed wiring switch socket shall be combined 2/3 pin 5 Amps and 3 pin 15 Amps molded type with face plate in white colour to be fixed on PVC box.
- iii) The switch and the socket shall have heavy duty silver plated brass/copper terminal and shall be suitable to sustain against the rated current without overheating.

- iv) At least one 2 pin 5 Amp. 250 Volt socket shall be installed on switch board. For such socket is required this shall confirm the specification of switch and switch socket as applicable.
- v) The 2 pin 5 Amp socket if required for mounting on switch board it shall be same shape and dimension as of piano switch installed on board.
- vi) Every plug and socket shall be of non-reversible type with the provision of connection of protective conductor. This requirement does not apply to plug and socket outlet for safety extra low voltage circuit or special circuit mentioned in clause 13.8.9(ix). In low voltage circuits, plug & socket outlet shall confirm with the applicable BS listed in the Table 13.8.8.
- vii) Socket outlet for house hold shall be shutter type and for A.C installation, shall preferably be of a type complying with BS 1363.
- viii) Every Plug & Socket outlet for use in construction site installation shall comply with BS 4343. The requirement need not be observed for site office, toilet etc.
- ix) Plug and Socket other than those complying with BS 1363, 546, 196, 5550 or 4343 may be used in single phase A.C or D.C circuit operating at a voltage not exceeding 250 voltage for:
- x) The connection of electric clocks, provided that the plug shall contain fuse rating not exceeding 3 Ampere as per BS 646 & 1362 as appropriate.
- xi) The connection of electric shaver, provided that socket outlet are either incorporate in shaver unit as per BS 3052 or in room other than bath room are a type complying with BS 4573.

13.8.10 CEILING ROSE

- i) The ceiling rose shall have white plastic molded plate 2½ dia with copper or brass terminal and shall be suitable for 5 Amp. 250 volt. Its cover shall have a suitable hole for cable entry.
- ii) Ceiling rose shall not embody any fuse terminal as an integral part of it.

TABLE 13.8.8

PLUG, SOCKET OUTLET FOR LOW VOLTAGE CIRCUIT

Type of Plug & Socket Outlet	Rating	Applicable BS
• Fused plug & shuttered Socket Outlet 2 Pole & earth for A.C.	13	BS 1363 (Fuses to BS 1362)
• Plug, Fused or Non-fused & Socket Outlet 2 Pole & earth.	5,15,30	BS 546 (Fuses if)
• Plug fused or non-fused & socket outlet, protected type 2 pole with earthing contact	5,15,30	BS 196
• Plug & Socket outlet Industrial type	16,30,63,125	BS 4343
• Plug & Socket outlet (Theatre type)	15 Amp	BS 5550 Sub Section 7.3.1

13.8.11 CEILING FAN

- i) Ceiling Fan shall be capacitor type with five speed suitable for 220-250 volt A.C 50 cycle and shall have the following components:
 - a) Fan motor with capacitor
 - b) Blades.
 - c) Regulator.
 - d) Down Rod.
 - e) Canopy.
- ii) The body of the fan motor should be die casted with high quality of aluminum. The fan motor shall be condenser type with good quality of groove type bearing & shall be totally enclosed:
- iii) The fan blades shall be of aluminum sheet not less than 2 mm thick and shall be enough broad to sweep maximum air as mentioned in table 13.8.10.

- iv) The fan regulator shall be high quality of electric sheet with 5 speeds ON & OFF marked on the cover of the Regulator.
- v) The down rod shall be made of M.S/G.I pipe 19.1 mm dia. 300 mm long duly threaded on one end. The threaded end of the pipe shall be screwed in fan body and to secure it further a split pin shall be passed through them. The other end of the pipe shall cut enough to house the rubber real for fixing with fan hook. The M.S Bolt with Nut, to hold the fan down rod, rubber real and the hook shall not be less than 40.5 x 10 mm.
- vi) The material made by M/s Pak Fans, M/s GFC fans, M/s Royal fans or equivalent if approved by the Project Manager shall be used. The Project Manager could choose any design from the classic series of Pak Fans, elite series of GFC fans or equivalent with respect to the importance of building.
- vii) Fan Hook
 - a) The fan hook shall be made of 12.5 mm (1/2") dia mild steel rod bent to shape of approved design. It should be in the form of loop about 87.5 mm (3-1/2") long and about 50 mm (2") wide. The rod should be bent to have atleast.200 mm extension on both sides for typing to the reinforcement steel of the slab.
 - b) If desired by the Project Manager the box type Fan Hook housed in M.S sheet box 150 mm dia with suitable depth can also be used. The size of M.S bar used in box should be as per clause 13.8.11 (vii). (a).

13.8.12 EXHAUST FAN

- i) The exhaust fan with metallic body shall comprise the fan motor enclosed in the body, metallic blades and the M.S Flat/angle iron ring to be grouted in the wall.
- ii) The Exhaust Fan with plastic body shall comprise the fan motor enclosed in plastic body, plastic blade and the back draft damper, which shall remain open while the fan is in operation.
- iii) The material made by M/s GFC fans; M/s Pak Fans or equivalent if approved by the Project Manager shall be used.
- iv) The Exhaust Fan shall be suitable for 220-250 volt A.C. 50 cycle.
- v) The detail of ceiling fans/exhaust fans in respect of size consumption and air delivery etc. is given in Table 13.8.11.

TABLE 13.8.11

Type	Sweep (Dia)	Consumption (Watts)	Rate Speed (P.R.N)	Average Air Delivery (Cu.Ft / Min)	Service Value (Cu.Ft / Min / Watt)	Temperature Rise above Ambient Temperature (°C)
Ceiling	36"	55	400	5500	100	28
	48"	65	330	7500	115	27
	56"	75	315	12000	160	28
Exhaust	10"	40	1350	880	22	30
	12"	50	1335	1130	22	30
	18"	105	950	3000	28	30

13.8.13 LIGHTING FIXTURES

13.8.13.1 Wall Bracket Light Fitting

- i) Surface mounting wall bracket light fitting shall be of M.S sheet painted with white stove enamel or of satin brass, aluminum anodized finish with lacquer coating. The holes of the wall bracket base shall match with the holes of the outlet provided for the light fitting.
- ii) All the lighting fitting shall have bi-pin/screw brass lamp holder suitable for 5 watt to 200 watt 250 volts manufactured as per BS 161. The glass globes/shades/diffuser of the fitting

shall be of good quality of glass free from any air bubbles or voids etc. The Globe shall generally be opal white, unless otherwise specified in the contract. The shape of the Globe may be spherical, hemi spherical or tablet shaped as approved by the Project Manager.

- iii) The lamp shall have incandescent/LED/fluorescent light and made by M/s Philips, M/s Orient or equivalent as approved by the Project Manager.
- iv) The wall bracket light for outdoor use shall be water proof.

13.8.13.2 Wall Mounted Light with Bakelite Holder

- i) Where wall mounted lights with bakelite holder are provided, bakelite batten holder should be fixed with the outlet or on T-wood round block or otherwise as desired by the Project Manager.
- ii) The lamp holder shall be screw/2 pin type and suitable for 3 watt to 150 watt 250 volts LED lamp and made by M/s Philips, M/s Orient or equivalent as approved by the Project Manager.
- iii) The lumens per watt shall not be less than 100 lm/W and wattage of LED lamp shall be so selected that the lux level as per sub-clause 13.6.1(v) against the provided light points shall be achieved.
- iv) The useful life of lamp shall not less than 10,000 hours.

13.8.13.3 LED Ceiling light fitting

- i) The ceiling light shall be false ceiling recessed/ to be fixed with the outlet or on T-wood round block as desired by the Project Manager.
- ii) The ceiling light shall be round / square/ rectangular shape as directed by the Project Manager.
- iii) The output of the lamp shall not be less than 100 lumens per watt and wattage of LED lamp shall be so selected that the lux level as per sub-clause 13.6.1(v) against the provided light points shall be achieved.
- iv) The useful life of lamp shall not less than 15,000 hours.

13.8.13.4 LED Batten Light

- i) The LED tube light shall be single/double batten 6 – 40 watt as required in the drawings.
- ii) The output of the lamp shall not be less than 100 lumens per watt and wattage of LED lamp shall be so selected that the lux level as per sub-clause 13.6.1(v) against the provided light points shall be achieved.
- iii) The useful life of lamp shall not less than 15,000 hours.

13.8.13.5 Fluorescent Light Fitting

- i) All the light fixture shall have lamp, the ballast, of required wattage, lock in rotary lamp holders, glow type starter in the radio-interference suppressor/ by pass capacitor and the auxiliary wiring carried out with PVC flexible wire 23/76 as per BS 4533.
- ii) The fluorescent lamp shall be 26 mm, 18 watt or 38 mm 20 watt and 26 mm 36 watt or 38 mm 40 watt in the cool day light and day light colour.
- iii) The output of lamps shall not be less than 80 lumens per watt. The useful life the fluorescent lamp shall not be less than 5000 hours.
- iv) The ballast shall be totally enclosed type for operation on 230-250 volt A.C 50 cycle. The core lamination shall be made from best quality of electric steel sheet. The wiring, diagram showing the wattage, voltage frequency current rating and power factor shall be printed on the body of the ballast. The power losses shall not exceed from 10 watt of working the each 40 watt ballast. The ballast shall be noiseless with 3 years guarantee. The ballast shall also be provided with connector for connection.

- v) All the fluorescent fitting shall be provided power factor improvement capacitor so as to improve the P.F up to 0.95.
- vi) The body of the lighting fixture shall be made from M.S sheet 22 SWG duly painted in the stove enameled white finish from inside and white/grey from outside. The industrial type shade shall be white from inside and green from outside or as required by the Project Manager. The provision for cable entry shall be made in fixture with rubber/PVC bush for the protection of the cable.
- vii) The louvers of louver type lighting fixture shall be made of anodized aluminum or plastic molded 3 mm thick.
- viii) The diffuser of lighting fixture shall be made from acrylic Perspex sheet 3 mm thick.
- ix) The material of louver and the paint of metallic part of the fixture shall not deteriorate with ultraviolet radiation from lamp within 5 years of the installation of the fixture.
- x) Pendant type fixture shall be suspended with 2 Nos. 13 mm chromium plated tubes or chain of suitable size as desired by the Project Manager

13.8.14 CHANDELIER

A branched hanging support for several lights, this type of multi lamp fitting comprises:

- i) Main central body, arms, canopy and the hanging pipe 12.5 mm dia or chain. All the above parts shall be made of satin brass with golden anodized finish and lacquer coating or as required.
- ii) The globes of the chandelier shall be good quality of glass free from any bubbles or voids. The glass if not specified shall be of opal white colour. The shape of the globes shall be tablet spherical or hemispherical shaped as required.
- iii) The housing for lamp holder shall be 75 mm long manufactured with good quality of white plastic and suitable for screw type candle lamp 60 watt.
- iv) The crystal type chandelier shall have the imported crystals of stick bowl or tablet shape.

13.8.15 DISTRIBUTION BOARD

- i) The distribution board shall be wall/floor mounting cubicle type suitable for 250 volt or 400 volt A.C.
- ii) The cabinet for housing, component shall be fabricated with M.S sheet 16 SWG thick and if required shall be reinforced with structural steel member welded to it.
- iii) The cabinet after fabricating shall be thoroughly cleaned from dust, remove rust and grease before applying one coat of zinc based primer, and thereafter shall be painted with 2 coats of enamel/powder paint as desired by the Project Manager.
- iv) Front door of the box shall be lockable hinged type and fabricated with M.S sheet of same thickness as of board or with clear Perspex sheet 3 mm thick.
- v) Suitable cable entry glands shall be provided as required for incoming cable. For floor mounting and for wall mounting board exact number of conduit entry holes with brass bushes shall be provided.
- vi) For surface mounting the D.B (Distribution Board) shall be provided with base of M.S board of angle iron size 38 mm x 38 mm x 3 mm framed and covered with M.S sheet 10 SWG by means of G.I flat-head screws 7 mm x 5 mm. The provision for grouting Bolt or Rawl Bolt for mounting D.B with wall shall also be made on the back of the angle iron base.
- vii) The size of the Cabinet/Box shall be suitable for housing all the component given in the drawing.
- viii) Normally every D.B shall have one miniature circuit breaker for each sub circuit and one M.C.B of same capacity shall be left spare in each phase.

- ix) The copper Bar/Flat used in large size DB shall be made of high electrolytic copper. In 400 volt large size DB, the phase identification color shall be provided.
- x) All the Distribution Board shall have clear space of 100 mm and 80 mm in between the lowest row of M.C.B and the bottom of the board and the upper row of breaker and the upper wall of the board respectively. Similarly at least 60 mm clear space should also be left in between breaker and side walls of the body.
- xi) All exposed parts of the large size DB shall be covered with 3 mm thick Bakelite sheet.
- xii) All the MCB's should indicated the location of the light/power installation to which the breaker control.
- xiii) The internal wiring carried out in the factory shall have 25 mm space behind the breakers.

13.8.16 BUS BARS

The air insulated bus bar shall be made of high conductivity (98%) electrolytic Copper, tinned for protection against weather, and of appropriate cross section, for 415 volts. 3 phase and neutral, 50 HZ A.C. The bus bar shall be insulated and braced for minimum short circuit current 25 KA. The phase identification color shall be provided on the bus bar less than 80 mm. The neutral bar shall also be of same section.

13.8.17 AIR CIRCUIT BREAKERS

The air circuit breaker shall be triple pole of specified rating, fixed type ,trip free, spring charged, quick make, quick break manually operator mechanism and visual ON/OFF position indicator. The circuit breaker shall be suitable for continuous duty for the rated current for indefinite period of time under service conditions. The circuit breaker shall have specified breaking capacity.

13.8.18 MOLDED CASE CIRCUIT BREAKERS (MCCB)

The molded case circuit breakers shall be triple pole and of the rating specified on the drawings. The MCCB shall be fixed type, having trip-free, manually operated mechanism and on/off/trip position indicators. The MCCB shall comprise of adjustable hydraulic magnetic releases for overload protection and instantaneous adjustable electro-magnetic releases for short circuit protection. The tripping deices shall have related time current characteristics so that positive discrimination and selective tripping is obtained assuring the tripping under fault conditions for only the breaker in the circuit ahead of the fault location. The MCCB shall have a rupturing capacity of 35 KA (or as specified) and shall be manufactured and tested o IEC Publication 157-1 or BS 4752 or BS 3871 part 1.

13.8.19 MINIATURE CIRCUIT BREAKERS

- i) The incoming line shall have triple pole MCB's suitable for use on 415V 50 Hz, AC whereas the outgoing line shall have single pole or single phase MCB's for use on 220V, 50 Hz, AC. The ratings shall be in accordance with the drawing or as directed by the Project Manager.
- ii) The MCB's shall be molded case type having hydraulic magnetic short circuit releases, contacts, operating mechanism and arcing chambers.
- iii) The MCB's shall be manufactured and tested on BS 3871 and shall have rupturing capacity of 7.5 KA. The MCB's on outgoing sub-circuit shall however be rated of 6 KA. The MCB's shall be manufactured by an approved manufacturer whereas the distribution boards shall be manufactured by any bonafide manufacturer or approved by the Project Manager.

13.8.20 RESIDUAL CURRENT CIRCUIT BREAKER

- i) The residual current circuit breaker shall be molded case type two/four pole manufactured as per EN61008 or any international standard approved by WAPDA. The current rating of the breaker shall be according to the drawing.

- ii) The selectable tripping sensitively shall be from 0.03 Amp to 0.3 Amp as directed by the Project Manager.

13.9 INSTALLATION INSTRUCTIONS

13.9.1 GENERAL

- i) The Contractor shall arrange all labor, materials and T&P required for the complete installation, commissioning -and testing of electrification system of the building.
- ii) For the installation of Factory assembled equipment, 's instruction if required shall be obtained by the Contractor (in form of drawing and description etc.) and shall be followed under the guidance of the Project Manager.
- iii) In case of any deviation from working drawing regarding laying of pipe/cable or location of the equipment, the written approval of the Project Manager shall be obtained before executing the work.

13.9.2 CONDUIT, CONDUIT ACCESSORIES AND WIRING

13.9.2.1 M.S. Conduit Installation (Concealed)

- i) Where concealed Conduit system is required as per drawing the conduit buried in wall, floor and roof except in damp situation shall be of M.S having thickness not less than 16 SWG and should be seamless or welded as per clause 13.8.5 (ii).
- ii) The Conduit recessed in the wall shall be secured by means of metal steel hooks at the interval of not less than 1.5 meters and not more than 3 meters. Care must be taken that the Conduit pipes are at least 19 mm from the finished surface of the plaster and that all the inspection boxes and outlets are on the same level as that of plaster.
- iii) The outer surface of conduit pipes including all bends and inspection boxes shall be painted with 2 coats of hot bitumen before they are finally embedded in the plaster and concrete. Care must be taken to see that bitumen does not get into the pipe and inspection boxes through loose covers and joints. All the screwed joints should be made thoroughly tight and then treated in the bitumen.
- iv) The length of the pipe shall be joined by means of socket. Thread shall be free from grease/oil and no material of this nature shall be allowed to come in contact with the conduit so as to be electrically continuous without any resistance. While preparing the Conduit the greatest care shall be taken that no sharp edges or burrs left in the pipe end which damage the insulation of cables. The Project Manager, with view to ensure that the above provision is carried out, may require (if he should consider it necessary) that separate length of conduit, after it is prepared shall be submitted for inspection before being fixed.
- v) For cutting pipe, the use of hacksaw shall be preferred instead of pipe cutter, because the later causes more burrs as compared with Hacksaw.
- vi) All conduit pipes shall be screwed in accordance with BSS-31. The screwed ends shall be free from dust and grease before they are screwed together so as to be electrically continuous right from Distribution Board to outlet for switches and other accessories.
- vii) The conduit pipe shall be brought round corners of walls by means of bends or circular inspection boxes as may be directed.

13.9.2.2 Accessories

- i) The inspection boxes and inspection Tee's etc. shall be of cast iron of thickness not less than 3/16" (5mm). The bends shall be of same material as of Conduit.
- ii) Inspection boxes or bends shall be provided after every 6 meters in straight run and after each bend. The PVC bushes shall be provided in conduit at each inspection box.

- iii) Suitable brass checknuts of thickness not less than 3/16" (5 mm) shall be provided on each end of the Conduit and tightened properly so as to make it mechanically strong and Electrically Continuous.
- iv) The surface of the inspection boxes shall be flush in plaster and should be covered with bakelite or plastic plate of white colour not less than 3 mm thick. Brass screws shall be used for fixing the cover plate. The outlet provided for ceiling rose or batten holder in roof should not be screwed more than two pipes.
- v) The Project Manager shall make suitable arrangement to test the continuity of the Conduits pipes daily before they are finally buried so as to avoid breaking at a later stage.
- vi) Substantial boxes of ample capacity shall be provided at every junction box involving a cable connection in Conduit system. In order to minimize condensation or Sweating inside the pipe, all outlets of Conduit system shall be properly drained and ventilated in such a manner as to prevent the entry of insects.
- vii) The Conduit system concealed in wall, floor, roof slabs shall be so installed that the wiring can readily be inserted after the whole of the Conduit installation has been erected and in all wall, ceiling and floor finishes have been completed. In all chases made in wall, the Conduit shall be recessed sufficiently so as to obtain a minimum thickness of 3/4" (19.1 mm) plaster or other finish over the pipe.
- viii) Cast iron box of suitable sizes or mild steel welded boxes of 16 (1.62 mm) SWG thick shall be provided for housing switches and regulator as per site requirement.
- ix) The depth of these boxes should be such as to leave at least 25 mm space behind the regulator in order to accommodate loose wires.
- x) All such boxes shall be covered with 5 mm thick chamfered bakelite/white plastic plate skillfully fitted with brass screws size 5/32" so as the knobs of the switches and regulator shall project out.
- xi) The whole system shall be erected and completed before the Conductors are drawn in. The whole metal system of Conduit shall be electrically continuous throughout and shall be permanently, efficiently connected to the earth in accordance with clause 13.9.9. & 13.10. Water pipe may only be used with written approval of the Project Manager.
- xii) On completion, the whole of the installation shall be tested in the presence of Project Manager at Contractor's cost and a certificate shall be submitted to the Project Manager on Form prescribed in I.E.E Regulation (specimen attached).

13.9.2.3 M.S. Conduit on Surface

- i) Surface mounted Conduit shall be screwed at a maximum interval of 1 meter by means of C.1 spacer bar saddles, where a multiple run occurs, but distance saddles shall be used on individual runs such as down drop to switch or socket outlet. In addition while terminating the Conduit to any Pull/Junction box the saddles shall be provided on either sides of the Junction/Pull Boxes at a distance of not more than 75 mm. Similarly the any ending box/outlet that may be for Switch or Socket it shall also be provided with additional saddle at 75 mm distance from outlet.
- ii) All burrs shall be removed from cut length and surplus screwing oil shall be wiped from thread prior to fixing of the Conduit.
- iii) In no case shall the Conduit be mounted directly on the surface of wall and ceiling, a minimum spacing of 5 mm to the back of Conduit is required.
- iv) All Conduits should be kept clear of Gas, Air, Water and pipes of other services. Conduit should be either rerouted or set out so that it remains at least 50 mm apart from any other service. The Conduit run particularly where visible shall be arranged in neat and inconspicuous manner.
- v) The use of Crumplet is restricted to securing the pipe only in cases pending plastering.
- vi) In building like Industrial/Warehouse, the plan stamped saddles may be used for fixing pipe with ceiling or M.S angle iron bracket shall be used for laying Conduit.

- vii) Hole shall not be drilled in any structural steel work or reinforced concrete without obtaining prior approval in writing from the Project Manager.
- viii) Conduit shall be terminated in accessories, fuse board or other equipment either by being screwed with the tapped spout or hole where such as provided or by locking into holes by means of coupler/socket and smooth bore brass bushes.
- ix) Ring bushes and Lock Nut shall not be allowed.
- x) While erecting the pipe on surface if the Galvanizing or enamel is damaged, it shall be made good by the Contractor with good quality of enamel or aluminum paint as the case may be.

13.9.2.4 Conduit in Damp Situation

- i) In damp situation and exposed to weather Galvanized conduit and accessories shall be used. All joints shall be made water tight by using suitable metallic paint and if necessary small quantity of hemp/thread shall be used without impairing the electrical continuity of the system.
- ii) The Conduit run shall be so arranged that any condensation moisture if any shall be drained out. For this purpose a hole shall be drilled at the lowest point of the conduit system, or alternatively the junction boxes with drainage hole should be fitted.

13.9.2.5 Flexible Metallic Tubing

- i) Flexible Metallic Tubing shall be used for the final connection of the rigid Conduit to the terminal box of the equipment where vibration is likely to occur.
- ii) Flexible Tubing shall also be provided to semi portable equipment such as cookers, washers and similar machine where limited amount of movement is required for cleaning and maintenance purposes.
- iii) The above does not apply to small machines normally connected to socket outlet by flexible cable.
- iv) Unless specified the flexible tubing shall be galvanized and non-water tight where normal conditions are anticipated, but, water tight class shall be used where exposed to the weather or where tubing is likely to be splashed or subjected to heavy moisture condition. The situation of moisture condition shall be decided by the Project Manager.
- v) In all instances the tubing shall be terminated in screwed through screwed brass adopter.
- vi) Flexible Tubing shall not be used in lieu of sets and bending in rigid Conduit system.

13.9.2.6 PVC Conduit and Accessories (Concealed)

- i) The PVC conduit for wiring lighting Power shall be of good quality as per specification 13.8.7 (i).
- ii) Manufactured smooth bends shall be used where conduit changed direction. Bending of conduit by heating shall be allowed at special instruction only by the Project Manager.
- iii) The bends shall have enlarged end to receive the conduit without any reduction of internal diameter of the conduit end. The use of sharp 90 degree bends and Tee shall not be allowed.
- iv) The junction/pull boxes shall have galvanized nuts embedded during moulding as per clause 13.8.7(iii).
- v) In ceiling the entire junction/pull box shall be of cast iron having the depth not less than 75 mm as specified in clause 13.8.5(x).
- vi) After every 6 meters straight run or every bend junction box shall be provided to facilitate the pulling of wires in pipe.
- vii) The rectangular PVC boxes for fixing switches, regulator shall be of same type and quality as specified in clauses 13.9.2.2(ix) to 13.9.2.2(xi) of conduit installation.
- viii) Regarding embedding the PVC pipe in walls, all the clauses enforced in M.S. conduit system shall strictly be complied.

- ix) All the pipes laid in roof shall be secured in the steel reinforcement by means of using binding wire, before concrete is poured.

13.9.2.7 Wiring

- i) The wiring through the conduit shall not be started before following conditions are not fulfilled.
 - a) All the conduit system and its continuity shall be checked thoroughly.
 - b) All the obstructions are removed.
 - c) Water that has entered in conduit pipe during curing of the plaster shall completely be removed by drawing suitable swab through the conduit so as system is dried out.
- ii) The wiring shall be carried out in loop system. Joints or connector other than those required for connection of fittings and other purposes particularly mentioned in special condition of the contract, shall not be allowed.
- iii) For lighting and power circuit the cables size 2.5 mm and 4 mm 250/400 volt single core shall be used and for point wiring PVC single core size 1/1.13mm (3/0.029) 250/400 volt shall be used.
- iv) All cable shall be manufactured in accordance with BS-6004, and BS-6346 as specified in clause 13.8.2(i).
- v) The quantity and sizes of cables contained in any one conduit shall not be excess of the capacities of conduit prescribed in Table 13.8.5(c).
- vi) On all A.C supplies care must be taken to ensure that both the live lead and the neutral are contained in the same conduit, and that every single pole switch and circuit breaker in a 2 wire circuit derived from 3-wire or 4-wire circuit or supply.
- vii) In case the joints are unavoidable, these shall be made by means of proper connector and shall be mechanically and electrically sound.
- viii) Each circuit of cable contained in trunking shall be taped or bunched together at 600 mm intervals throughout the run of entire wiring and suitably labeled at each junction and terminal point for identification.
- ix) Power wiring shall be kept separate and distinct from lighting wiring.
- x) All cables shall be delivered at site as complete coil with wrapper and seal intact and contain test certificate.
- xi) Cables used for wiring shall be in healthy condition and their insulation is not damaged / deteriorated.
- xii) No lubricants or any other material except as recommended by the manufacturer shall be used on wires for reducing friction during pulling wires through the pipe/cable trunking.
- xiii) Care shall be taken that while pulling wire through the conduit the insulation is not damaged.
- xiv) To ensure that the insulation is not damaged, the insulation test of entire wiring shall be carried out before energizing the system

13.9.2.8 Flexible Wire

Flexible wires are:

- i) Flexible cords, where they are exposed to risk of mechanical damage, shall be of a type sheathed with rubber or PVC and where necessary shall also be armored, provided that for domestic and similar applications where flexible cords are subject only to use for pendants etc. and must not be used for wiring purpose. It is now considered bad practice to have flex permanently alive and switch should be provided so that the flexible wire is dead when the apparatus to which it is connected not in use. Hanging pear switches do not conform to this, but still are in general use. Ceiling switches with pull action have been introduced to meet this difficulty. In electric fires etc. it is now usual for one of the element to be connected direct so that these fires cannot be entirely switched off except at the other end of the flex, moderate bending and/or wear, unkinkable flexible cords complying with BS-6500 may be used.

- ii) Braided circular twin and three core flexible cords insulated with glass fiber shall be used only for luminaries or for other applications where the cord is not subject to abrasion undue flexing.
- iii) Flexible cords shall not be used as fixed wiring, except as permitted as per clause 13.8.4.2 (vi), unless contained in an enclosure affording mechanical protection.
- iv) Flexible cables or flexible cords shall be used for connections to portable equipment. For the purpose of this regulation an electric cooker of rated input exceeding 3kW is considered not be portable. Such flexible cables or flexible cords shall be of suitable length to avoid undue risk of mechanical damage.
- v) Exposed length of flexible cable or flexible cord used for final connections to the fixed equipment shall be as short as possible and connected to the fixed wiring by a suitable accessory device or devices for over-current protection, insulation and switching.
- vi) Where a flexible cord supports or partly supports a luminaries, the maximum mass supported by the cord shall not exceed the appropriate value indicated below:

Nominal cross sectional area of conductor (mm ²)	Maximum Mass (kg)
0.5	2
0.75	3
1.0	5

- vii) Every core of flexible cable or flexible cord shall be identifiable throughout its length as appropriate to its function.
- viii) Flexible cables or flexible cords having the following core colours shall not be used: green alone, yellow alone, or any bicolour than the colour combination green and yellow.

TABLE 13.9.2.8
COLOUR IDENTIFICATION OF CORES OF FLEXIBLE CABLES
AND FLEXIBLE CORDS

Number of Cores	Function of Cores	Colour (s) of Cores
1	Phase	Brown
	Neutral	Blue
	Protective	Green & Yellow
2	Phase	Brown
	Neutral	Blue
3	Phase	Brown
	Neutral	Blue
	Protective	Green & Yellow
4 or 5	Phase	Brown or Black
	Neutral	Blue
	Protective	Green & Yellow

13.9.3 SWITCHES

- i) Switch shall be installed in PVC box for surface mounting or recessed in wall. When switches and fan regulator are to be provided at one place these shall be installed on common white plastic plate 5 mm thick fixed on the face of the box.

- ii) The fixing of plate shall be done by means of brass machine screws size 5/32 sunk in plastic plate so as to finish with surface. The edges of the plate shall be properly chamfered.
- iii) Where more than one and up to four switches are to be installed at one place gang type flush switches shall be installed. The entry hole for pipe shall be provided with P.V.C bush to protect the cable from damage.
- iv) The switch to be installed exposed to weather shall be water proof as per clauses 13.8.8.(vi).
- v) The pipe to be terminated in switch box shall have at least 12 mm threads to be tightened fully to make the switch water proof.
- vi) The mounting height if not specified in special condition of the contract shall be 1.37 meter from the floor level.

13.9.4 SWITCH SOCKET

- i) Every plug and socket out shall comply with all appropriate requirements of clauses 13.8.9(i) to 13.8.9(viii).
- ii) It shall not be possible for any pin of the plug to be engaged with any live contact of its associated socket while other pin of the plug is completely exposed.
- iii) It shall not possible for any pin of the plug to be engaged with any live: contact of any socket outlet within the same installation other than the socket outlet for which the plug is designed.
- iv) Switch socket shall be 3 pin 5 Amp. or 15 Amp. 250 volt A.C moulded with white face plate as per clauses 13.8.9(i) to 13.8.9(ii) suitable for mounting recessed in walls/column on PVC box of appropriate size as desired by the Project Manager .
- v) The connection in the switch socket shall be so arranged that the live wire connected with socket should route through switch, while the neutral wire is connected in socket directly.
- vi) The earthing terminal shall be connected with protective copper conductor not less than 2.5mm² already laid in pipe with power circuit. The entry hole for the pipe in box shall be provided with PVC bush.
- vii) Where a socket outlet is mounted vertically on wall or other structure, it shall be mounted at height above structure, such as to minimize the risk of mechanical damage, to the socket or to an associated plug and its flexible cord which might be caused during insertion, or withdrawal of the plug.
- viii) The provision shall be made so that every portable appliance and portable luminaire can be fed from on adjustment and conveniently accessible socket out let.
- ix) Unless specified in contract the mounting height of socket shall not exceed 300 mm.
- x) The switch and socket 15 Amp. 250 volt to be installed exposed to weather shall be housed in PVC box of appropriate size having the same specification as of weather proof switch. Care must be taken that the conduit or trunking laid for such installation shall be mechanically strong and electrical continuity is perfect. The protective conductor shall also be not less than 2.5mm².

13.9.5 FAN

13.9.5.1 Ceiling Fan

- i) Ceiling fan shall be wired from ceiling rose and suspended from hook as per clause 13.8.11(vi) already provided in ceiling while pouring concrete.
- ii) The suspension down rod shall be as per clause 13.8.11(v) having no joint in it.
- iii) The screwed end of the pipe shall be screwed in the body of the fan motor and to strengthen it further split pin shall be passed through the inlet of the body and the suspension rod.
- iv) The other cutted end shall be fixed with hook by means of rubber reel and the M.S bolt as specified in clause 13.8.11 (vi).
- v) The canopy at the top of suspension down rod shall hide the fan hook effectively.

- vi) The fan shall be wired with PVC wire size 1/1.13 mm (3/0.029) unless otherwise stated in special condition of the contract.
- vii) All fans shall be suspended at such height that the blades of the fans shall be from 2.75-3.5m feet above the floor according to utility of room.
- viii) Each fan shall have a separate switch and speed regulator/fan dimmer.

13.9.5.2 Wall Bracket Fan

- i) The wall bracket fan shall be mounted with wall in neat and clean manner with the fitting supplied by the manufacturer.
- ii) The height and location of the fan shall be followed from the drawing or as desired by the Project Manager.
- iii) The fan shall be connected with outlet/ceiling rose already provided, through the lead available with the fan. The lead shall be of flexible PVC insulated/sheathed 3 core size of 0.001 mm dia.

13.9.5.3 Exhaust Fan

The opening of the fan shall be provided in wall during the construction as per drawing or as desired by the Project Manager. Mounting of frame and accessories shall be embedded in wall as and when hole finished smoothly flushed with wall. The fan shall be connected to the ceiling rose/outlet already provided for same.

13.9.6 LIGHTING FIXTURE

13.9.6.1 Wall Mounting Light

- i) Unless specified in special condition of the contract or desired by the Project Manager the height of the wall mounting lighting fixture shall be 2.3 meters above floor level. The fixtures shall be installed very carefully in neat and clean manners.
- ii) The wall mounting light fixture shall be installed on the lighting outlet already provided in wall in conduit run for the purpose.
- iii) If the holes of lighting fixture and of the lighting outlet do not match the fitting shall be fixed by means of PVC/Nylon Raw plug and wooden screw matching the metal of the fitting.
- iv) In bath rooms totally enclosed fitting shall be installed.
- v) During the installation of the fixture if any finish surface of the wall/ceiling is damaged the contractor is responsible to make good matching the surrounding surface.

13.9.6.2 Fluorescent Lighting Fixture

While fixing fluorescent fitting the following consideration shall be taken into account.

- i) It shall be fixed on the surface of wall/ceiling without damaging finishes.
- ii) It shall be installed in symmetrical position so it should not give ugly look in the room.
- iii) It should give uniform light in entire area for which it is provided.
- iv) It should be installed close to outlet provided for the same so as unnecessary loose wire shall not be seen.
- v) For fixing fixture PVC raw plug No. 12 or M.S wooden screw 50 mm size shall be used.
- vi) PVC insulated/sheathed twin flexible cable size 0.001 mm shall be used for making connection from lighting outlet to the fitting through ceiling rose.

13.9.6.3 Ceiling Fitting

- i) The light fixture shall be installed on the lighting outlet already provided in ceiling or recessed in ceiling in conduit run for the purpose.

- ii) If the holes of lighting fixture and of the lighting outlet do not match the fitting shall be fixed by means of PVC/Nylon Raw plug and wooden screw matching the metal of the fitting.
- iii) In bath rooms totally enclosed fitting shall be installed.

13.9.7 CABLE

13.9.7.1 Method of Installation

Method of installation of cables and conductors in common use for which these regulations specifically provided are described in Table 13.8.1. The use of other methods is not precluded where specified by a suitably qualified Project Manager, provided that the applicable requirements of section 13.11 are complied with.

13.9.7.2 Cable on Surface

- i) The cable run on the surface shall be installed in straight uniform manners. The radius bend shall be in accordance with IEE Regulation. Table-13.9.7(a).
- ii) Cable entering in the building shall also pass through the protective GI/PVC pipe. The end of the protective pipe shall be plugged with sealing compound
- iii) Where multiple run occur, the cable shall be installed in such an order that the crossover of the cables are eliminated unless absolutely necessary Cable shall be well clear of the other services lines or pipe.
- iv) Cables to be installed vertically shall be secured on wooden cleats fitted on M.S angle iron bracket of suitable size to be fixed with structure.
- v) Horizontal cables when not carried on cable trays shall be supported on approved type M.S angle iron hangers fitted with wooden cleats for holding the cables.
- vi) In all cases the cable shall be secure on proper manners and joint or termination shall not be subjected to weight or strain. The spacing of cable supports shall strictly be followed as per IEE Regulation. Table-13.9.7(a).
- vii) Cables shall be laid side by side and the width of the trays shall be sufficient for this to be effected. Stacking of cables shall not be permitted. This does not preclude the laying of single core cable, in "trefoil" formation.

TABLE 13.9.7(a)
MINIMUM INTERNAL RADII OF BENDS IN
CABLES FOR FIXED WIRING

Insulation	Finish	Overall Diameter	Factor to be applied to overall diameter of cable to determine minimum internal radius bend
Rubber or PVC (circular or circular standard copper or aluminum conductors)	Non armoured	Not exceeding 10 mm	3 (2)
		Exceeding 10 mm but not exceeding 25 mm	4 (3)
		Exceeding 25 mm	6
	Armored	Any	6
PVC (Solid Aluminum or shaped copper conductor)	Armored or non-armored	Any	8
Impregnated paper	Lead sheath	Any	12

Insulation	Finish	Overall Diameter	Factor to be applied to overall diameter of cable to determine minimum internal radius bend
Mineral	Copper or aluminum sheath with or without PVC covering	Any	6

13.9.7.3 Cable Underground

- i) All cables if not specified shall be buried solid in the ground at minimum depth of 600 mm from the ground level.
- ii) A layer of 100 mm of sand shall be provided for each cable.
- iii) Where cable cross the road it shall be laid in PVC or G.I pipe of suitable size or as desired by the Project Manager.
- iv) When the routing of cable is not indicated on drawing or described in the specification of contract. The contractor shall submit the details of his proposed routing to the Project Manager for approval prior to commencing the installation.
- v) Bending of the cables whether installed underground or in a trench shall not bent to a radius less than 10 times the whole over all diameter of the cable. In general the cable manufacturer's recommendations shall be accepted.

13.9.7.4 Jointing/Terminating

- i) The armoring of wire armored cables shall be brought over the sheathing wipe and secured under the armor clamp.
- ii) Each cable core shall be sweated solid at the midway point in the box the core than continued to the terminal of the equipment. These cores shall be insulated by Empire/H.T tape for the voltage concerned.
- iii) Where the compound is to be filled the cable box shall be thoroughly cleaned and dried prior to filling with hot cable compound of best quality.
- iv) Box shall finally be topped to make up any voids caused by shrinkage of the compound during setting period.
- v) The jointing/terminating all cable shall only be carried out by an experienced person.
- vi) Care must be taken that the cables are not subjected to excess heating from adjacent service line, heater circuit or plants operating of abnormal temperature. When these conditions are likely to be sever and cannot be avoided, baffles plates of heat resisting material shall be interposed or the cable suitably protected with layer of thermal insulation.

13.9.8 DISTRIBUTION BOARD

The Distribution Boards which comprises one incoming M.C.C.B and required number of circuit breakers shall comply with the requirement of clause 13.8.19(i) to 13.8.19(iii). Circuit breaker for terminating final sub circuit of the building shall be installed on surface or concealed in wall as specified in the drawing or desired by the Project Manager.

13.9.8.1 Surface Mounting

- i) The Distribution Boards if not specified in drawing shall be mounted on the surface of wall at the minimum height of not less than 1500 mm from ground level.
- ii) The location of the Distribution Board shall be accessible so as to attend the fault without any unnecessary wasting of time.
- iii) The Distribution Board shall have the M.S angle iron board of suitable size as per clause 13.8.15(vi) to be fitted with wall with appropriate size of M.S Rawl Bolt.

- iv) Distribution Boards having beaker 3 phase 400 volt with capacity less than 100 Amp. shall have a 3 phase volt meter with selector switch and phase indication lights.
- v) Distribution Boards having beaker 1 phase 230 volt with capacity 63 amp. or less shall have a single phase volt meter and phase indication light.
- vi) The Distribution Board having capacity 100 Amp. and above shall be provided with volt meter, Amp. Meter, C.T.S's, selector switches and phase indication lights.
- vii) In case of sub-DBs, the main DB shall be provided with volt meter, amp meter. C.Ts, selector switches and phase indicating lights. The sub-DBs shall be provided only phase lights.
- viii) Every sub-circuit to be terminated in D.B shall be provided with independent miniature circuit breaker.
- ix) The lighting circuit shall be provided with breaker of 10 Amp. Capacity while for power circuit breaker of 20 Amp capacities shall be provided.
- x) All distribution boards shall be provided with substantial circuit sheet fixed by the screw to the inside of the front cover indicating the function of the each circuit under the respective circuit number.

13.9.8.2 Distribution Board (Concealed)

- i) The opening in wall for fixing Distribution Board shall be left during the construction of wall.
- ii) While fixing the Distribution Board in wall its cover and component shall be removed to avoid any damage during construction/plastering.
- iii) During a course of installation and commissioning if any of the component/paint is damage, it is the responsibility of the Contractor to arrange the replacement and make good. The door of the Distribution Board shall be flushed with surface of wall.
- iv) Other specifications regarding size and its manufacturing, the clause 13.8.15 shall be strictly followed.
- v) All the 3 phase 400 volts Distribution Board shall be earthed with earthing wire cable.
- vi) If the DB's are at the distance from the main supply, these shall be earthed through the earthing cable .
- vii) For earthing D.B.S with circular conductor, the thimble of appropriate size shall be used.
- viii) All the earthing connection shall be mechanically strong and electrically continuous to ensure the electrical continuity from DB's to main supply.
- ix) Distribution Boards having beaker 3 phase 400 volt with capacity less than 100 Amp. shall have a 3 phase volt meter with selector switch and phase indication lights.
- x) Distribution Boards having beaker 1 phase 230 volt with capacity 63 amp. or less shall have a single phase volt meter and phase indication light.
- xi) The Distribution Board having capacity 100 Amp. and above shall be provided with volt meter, Amp. Meter, C.T.S's, selector switches and phase indication lights.
- xii) In case of sub-DBs, the main DB shall be provided with volt meter, amp meter. C.Ts, selector switches and phase indicating lights. The sub-DBs shall be provided only phase lights.
- xiii) The diagram giving to description of circuit controlled from the board shall be given together with number of miniature circuit breaker controlling it. The Distribution Board shall be totally enclosed moisture and vermin proof and no part there of which is energized shall be accessible when the lid of the DB is closed.

13.9.8.3 Floor Mounted Main Panel Installation

- i) All the main LV panels and shall have required number of outgoing Circuit Breakers and incoming Circuit Breaker to control the entire electrical system of the building.
- ii) The Main panel, sub main panel shall be erected in level with foundation/row bolts, washer, nut etc.

- iii) Floor mounting cubical type panel, sub main panel shall be installed on the foundation raised at 300 mm from finish floor level.
- iv) All the cable shall be brought in from the opening made in the bottom of the panel through cable end box or cable glands of appropriate size.
- v) The switch board/power shall have the necessary volt/ampere meter; C.Ts and selector switch as per clause 13.9.8.1(iv) and 13.9.8.1(v).
- vi) The C.T operated magnetic thermal tripping unit shall be provided inverse time thermal over current and adjustable time magnetic short circuit protection. The short circuit relays shall have adjustable time characteristics to provide discriminative tripping between incoming and outgoing breakers.
- vii) The current transformer for protection and metering shall have 5 Amp secondary and accuracy class "C".
- viii) The bus bar of the panel shall be made of high conductivity electrolytic copper, tinned for protection against weather.
- ix) The cross sectional area of the bus bar shall be appropriate for 415 volt 3 phase & neutral and shall sustain against rated current.
- x) The bus bar shall be insulated and braced for minimum short circuit current 20 kA.
- xi) The phase identification colour shall be given on bus bar.
- xii) For jointing cable with bus bar all nuts, bolts and washer shall be of brass or tinned copper.
- xiii) The switch board/sub main board (lighting/power) shall be earthed properly to ensure the connection mechanically strong and electrically continuous.
- xiv) The board installation shall include, also the connecting of all incoming/outgoing cable with appropriate size of nut bolt and washer.
- xv) The switch board/sub main board shall be totally enclosed and no any part of switch/bus bars which is energized shall be exposed when its cover has been fixed.
- xvi) The switch board shall be painted as desired by the Project Manager before painting a coat of anti-rust paint shall be given as a primer.
- xvii) During installation/testing if any component/part is damaged the contractor is responsible for its replacement.
- xviii) In case the paint of any of the portion is damaged the contractor is responsible for making good as per instruction of the Project Manager.

13.9.9 EARTHING ARRANGEMENT AND PROTECTIVE CONDUCTOR

13.9.9.1 General

- i) Every means of earthing and every protective conductor shall be selected and erected so as to satisfy the requirement of regulations for the safety and proper functioning of the associated equipment of the installation.
- ii) The earthing system of the installation shall consist of earthed electrode, earthing conductor lead. Protective conductor (continuity conductor), earthing point and all accessories required to satisfy the regulations of section 13.9.9.

13.9.9.2 Earthing Arrangement

The consumer's main earthing terminal shall be connected to earth as described in NTDC/WAPDA specifications and in compliance with the following:

- i) The earthing arrangement may be used for the protective or functional purpose according to the requirement of the installation.
- ii) The earthing arrangement shall be such that:

- a) The value of resistance from the consumer's main earthing terminal to the earthed point of the supply, shall be in accordance with the protective requirement of the installation i.e. 1 ohm and expected to be continuously effective
 - b) Earth fault current and earth current likely to occur are carried without danger, particularly from thermal, thermo-mechanical and electro-mechanical stress and
 - c) They are adequately robust or have additional mechanical protection appropriate to the assessed conditions of the external influence.
- iii) Precaution shall be taken against the risk of damage to other metallic parts through electrolysis.
- iv) Where number of installations has separate earthing arrangement, any protective conductor running between any two of the separate installation shall either be capable for carrying the maximum fault current likely to flow through it or be earthed within one installation only and insulated from the earthing arrangement of any other installation. In later circumstance, if the protective conductor forms any part of a cable, protective conductor shall be earthed only in the installation containing the associated protective device.

13.9.9.3 Earthing Electrode

- i) The following types of Electrode are normally in use for the purpose of these regulations:
 - a) Earth rod or pipe
 - b) Earth tape or wire
 - c) Earth plates.
 - ii) To achieve the efficiency and the longer life of the earthing Electrode, the following factors shall be taken in to account while preparing the size, depth and the material of the electrode:
 - a) Soil condition.
 - b) Moisture contents.
 - c) Nature of salt available in the soil.
 - d) Degree of brackishness.
 - e) Composition of soil and temperature.
 - iii) The type and the embedded depth of earth Electrode shall be such that soil drying, freezing will not increase the resistance of the earthing Electrode above the required value.
 - iv) The metal used for the earth Electrode shall be such as to withstand damage to corrosion.
 - v) The design of earthing arrangement shall take account of possible increase in the earth resistance of Electrode due to corrosion.
 - vi) By increasing the depth of the Electrode the same may be driven to such depth so as to obtain the required value of the resistance.
 - vii) The earthing Electrode shall be put so deep, that the lower end shall have the direct contact with wet soil.
 - viii) If the maximum required value (5 ohm) is not achieved from one Electrode, there shall be another earthing Electrode lowered in soil instead of lowering the Electrode having, bigger cross sectional area.
 - ix) If not specified in the special conditions of the contact M.S steel copper coated (with .33 mm thick copper layer) earthing Electrode or plate size 600 mm x 600mm x 6 mm shall be used.
 - x) In case, the plates are to be used these shall be copper or G.I having sizes not less than $\frac{3}{4}$ '' x $1\frac{1}{2}$ '' x 12'' buried as per clause 13.9.9.
 - xi) A layer of 300 mm of charcoal and salt stone shall be provided around the plate.
 - xii) Earth plates.
- In case, the plates are to be used these shall be copper or G.I having sizes not less than $\frac{3}{4}$ '' x $1\frac{1}{2}$ '' x 12'' buried as per clause 13.9.9.
- a) Where earth plate is embedded, water should be ponded for at least 3 days so as to consolidate the excavated earth.

- b) For periodic watering of the earth plate G.I. pipe 300 mm dia shall be arranged from the top of the plate to nearest water supply point.
- xiii) The metal work of the public water services shall not be used as a sole earthing Electrode. This requirement does not preclude the bonding of such metal work as per IEE Regulation.
- xiv) Lead sheaths and other metallic coverage not liable to deterioration through excessive corrosion may be used as earth Electrode provided the consent of the owner of the cable is obtained and suitable arrangement exist for the owner of the electrical installation to be warned of any proposed changes to the cable, that might affect its suitability as an earth Electrode.

13.9.9.4 Earthing Conductor (Lead)

- i) Every Earthing Conductor shall comply with the requirements of section 13.9.9.1 and in addition, where buried in soil, shall have cross sectional area not less than that stated in Table-13.9.9 (a) given below:

TABLE 13.9.9 (a)
Minimum Cross Sectional Area of Buried Earthing Conductor

	Mechanically Protected	Not Mechanically Protected
Protected against corrosion	As required By 13.10.4 (i)	16 mm ² copper 16 mm ² copper Coated Steel
Not Protected Against corrosion	25 mm ² copper 50 mm ² copper Coated Steel	25 mm ² 50 mm ² copper Coated Steel

Note: For tape or strip conductors, the thickness should be adequate to withstand mechanical damage and corrosion.

- ii) Circular earthing conductor from terminal point to the earth plate/rod shall be laid in G.I. pipe 25 mm dia and shall be run at a depth not less than 600 mm from ground level,
- iii) Aluminum and copper clad aluminum conductor shall not be used for final connection to earth.
- iv) The connection of an earthing conductor to an earth Electrode or other means of earthing shall be normally made with brass nuts, bolts, and washers of appropriate sizes so as to be electrically as well as mechanically satisfactory, and labeled in accordance with regulation. A permanent label duly marked with the "safety electrical connections do not remove" in legible type not less than 4.75 mm high shall be permanently fixed in a visible position at or the near:
 - a) The point of connection of every earthing conductor to an earth electrode.
 - b) The point of connection of every bonding conductor to extraneous conductive point.

13.9.9.5 Main Earthing Terminal/Point

- i) Every earthing terminal having tinned copper flat with 10 mm dia brass nut bolt and washer fixed on porcelain base and housed in M.S box, shall- be provided to connect the following conductors to the earthing conductors.
 - a) Main Earthing Conductor.
 - b) The circuit Protective Conductor
 - c) Main Bonding Conductor.

- ii) Provision shall be made in an accessible position for disconnecting the main Earthing terminal from the means of earthing, to permit measurement of the resistance of the earthing arrangement. This joint shall be such that could be disconnected only by means of Tools, be mechanically strong & reliably maintain Electrical continuity.

13.9.9.6 Protective Conductor

- i) Every protective conductor shall be green or green/ yellow colored PVC insulated or hard drawn bare copper conductor as per -requirement of the installation.
- ii) The cross sectional area of every protective conductor, other than an equipotential bonding conductor shall be selected in accordance with clause 13.9.9. If the protective conductor is separate (i.e. does not form part of a cable, is not formed by conduit ducting or trunking and is not contained in an enclosure formed by a wiring system), its cross sectional area shall not be less than as under.
 - a) 2.5 mm² if the mechanical protection is provided'.
 - b) 4 mm² if the mechanical protection is not provided for an earthing conductor clause 13.11.4(i) shall also apply.

Where a protective conductor is common to several circuit, the cross sectional area of protective conductor shall be selected in accordance with clause 13.9.9. So as to correspond to the cross sectional area of the largest phase conductor of the circuit.

- iii) Where the protective conductor is made of the same material as the associated phase conductor, by selection of the appropriate value of the S.P from the table given below. Where the application of the Table produces non-standard size of a conductor having the nearest standard cross sectional area is used.

TABLE 13.9.9(b)

Minimum Cross Sectional Area of Protective Conductor in relation to the Area of associated phase conductor.

Cross Sectional Area of Phase Conductor (S)	Minimum Cross Sectional Area and the Corresponding Protective Conductor (SP)
mm ²	mm ²
S < 16	S
16 < S < 35	16
S > 35	S/2

13.9.9.7 Type of Protective Conductor

Every protective conductor shall comply with appropriate requirements of the following clauses:

- i) The protective conductor may form part of the same cable as the associated live conductors in which case it shall apply with the applicable requirement of the British Standard for the cable (clauses 13.8.2 to 13.8.4).
- iii) The circuit protective conductor of every ring final circuit (other than that formed by metal covering or enclosure of cable) shall also be run in the form of ring having both and connected to the earth terminal point at the origin of the circuit.
- iv) Any joints along their run shall be made in accordance with clause 13.9.9. Provision shall be made for the connection to them of other protective conductor as necessary.
- v) Where protective conductor formed by conduit trunking, ducting or metal sheath and or armor of the cables, the earthing-terminal of each socket outlet be connected by a separate protective conductor to an earthing terminal incorporated in the associated box of other enclosure.
- vi) Flexible conduit shall not be used as protective conductor.

vii) Protective conductor 10 mm² or less shall be of copper or copper clad aluminum.

13.9.9.8 Preservation of Electrical Continuity of Protective Conductor

- i) Protective conductors shall be suitably protected against mechanical and chemical deterioration and electro-dynamic effects. Every protective conductor not forming part of cable and cable enclosure and having cross sectional area up to and including 6 mm² shall be protected throughout by insulation at least equivalent that provided for a single core non sheathed cable of appropriate size complying BSS-6004. This requirement does not apply to copper strip where the sheath of the cable incorporating an un-insulated protective conductor is removed adjacent to joint and termination, protective conductor of a cross sectional area up to and including 6mm² shall be protected by insulating sleeving complying with BSS-2848.
- ii) Connection for protective conductor shall comply with the requirement of clause 13.11.4 for accessibility. These requirements, however, shall not apply to the joints in metal conduit trunking or ducting etc.
- iii) No switching device shall be inserted in a protective conductor as desired by rule 51 of Electricity Act (clause 4.9), but the joints which can be disconnected for testing purpose by use of a tool are permitted.
- iv) All joints in metallic conduit shall be made mechanically and electrically continuous by screwing or by substantial mechanical clamp. Plain slip or pin grip socket shall not be used.
- v) All metallic accessories i.e. Fan Regulators. Pedestal, fixture, open to weather shall be properly earthed with protective conductor of size 2.5 mm².

13.10 INSPECTION AND TESTING

13.10.1 GENERAL

- i) Every installation shall, on completion and before being energized, be inspected and tested in accordance with the requirement of this chapter to verify, as far as practicable, that the requirement of these regulations have been met.
- ii) The method of test shall be such that no danger to persons or property or damaged to requirement may occur even if the circuit tested is defective. The following information shall be provided to the person carrying out tests:
 - a) Diagrams, chart, indicating the type and composition of the circuit (point of utilization served, number and size of conductor and type of wiring).
 - b) The information necessary for the identification of devices, performing the functions of protection, isolation and switching, and their location.

13.10.2 VISUAL INSPECTION

- i) A visual inspection shall be made to verify that installed equipment is in accordance with the Electrical regulation and as per recommendation of the manufacturer.
- ii) Visibly no damage to the equipment is seen so as to impair safety.

13.10.3 INSULATION RESISTANCE TEST

- i) The installation resistance shall be measured between earth and the whole system of conductors or any section thereof, with all fuses in place and all switches on, a direct, current pressure of not less than twice the working pressure. Where the supply is derived from a three wire (alternating or direct current) of poly phase system the neutral of which is connected to earth either or through added resistance, the working of the outer or phase conductor and the neutral.
- ii) When measured between all the conductors connected to any one phase or pole of the supply and in turn all conductors to each other phase the insulation resistance shall not be

less than 1 mega ohm. Where ever practicable, so that all parts of the wiring may be tested, all lamps shall be removed and all current using equipment shall be disconnected and all local switches controlling lamps or other equipment shall closed. Where the removal of clamps or the disconnection of current using equipment is impracticable the local switches controlling such lamp/equipment shall be open. Particular attention is given to the presence of electronic devices connected in the installation and such installation shall be isolated so that they are not damaged by the test voltage.

- iii) Any installation shall not be required to have an insulation resistance greater than 1 mega ohm.
- iv) Lighting circuits shall be tested with all lamps in place except in the case of earthed concentric wiring system.
- v) If the equipment has exposed conductive parts and as per these regulations required to be connected with protective conductor, the insulation resistance between the exposed conductive parts and all live parts of the equipment (generator, motor, arc lamp) shall not be less than 0.5 mega ohm.
- vi) The metal conduits or metallic envelopes of cables in all cases where such methods are used for the mechanical protection electrical conductors shall be rested for electric continuity and the electrical resistance of such conduits or sheathing measured between than main switch and any other point of the completed installation shall not exceed one ohms.
- vii) In order to determine that the joints of the metal sheath or conduits are capable of carrying leakage currents, the metal sheath or conduit shall be used as a. return conductor of a system carrying atleast 15 amps current and voltage drop measured between two points (one at main board and the other at any points) and this voltage drop shall not exceed 30 volts.
- viii) Before making the connection of the cable on each end its insulation test shall be carried out. In multi-core cable each conductor of the cable shall be tested individually with conductor of the cable as well as Armour/Earth.

13.10.4 POLARITY

A test of polarity shall be made and it shall be verified that all fuses and single pole central devices are connected in the phase conductor only, that centre contact layout and Edison type screw lamp holders in circuit having an earthed neutral conductor have their outer or screwed contacts-connected to that conductor, and that wiring has been correctly connected to the socket outlet.

13.10.5 EARTH RESISTANCE

- i) The earth resistance test of the earthing system shall be carried out on disconnecting and reconnection each connection.
- ii) The electrical resistance of E.C.C together with resistance of earthing conductor measured from the connection with earth electrode to any other position shall not exceed one ohm.
- iii) Where multiple earthing sets are installed, the resistance between two sets measured by means of Resistance Bridge Instrument shall not exceed one ohm and each earthing set should not exceed 5 ohm.

13.11 OPERATIONAL, ENVIRONMENTAL AND OTHER CONDITIONS

13.11.1 GENERAL

- i) The installation in general shall be carried out as per WAPDA's specifications for the wiring and installation of the Electrical equipment of the building 1995 or in conformity with I.E.E Regulation 15th edition 1981 incorporated up to 1984 for the electrical equipment of the buildings.

- ii) The cross sectional area of the wire/cable conductor shall be such that its current carrying capacity is not less than the maximum sustained current which will normally pass through it. For the purpose of this regulation the limiting temperature to which the current capacity relates shall not exceed that appropriate to the type of cable insulation concerned.
- iii) The size of every bare conductor or cable shall be such that the voltage drop within the installation does not exceed a value appropriate to the safe functioning of the associated equipment in its normal service.
- iv) Bus Bar connections and bare conductor forming part of equipment of switch board shall comply as regard current carrying capacity and limits of the temperature the requirement of BS-5486 part-II and the temperature should not exceed 90°C in any case.
- v) Cable connected in parallel shall be of same type, cross sectional area, length and disposition be arranged so as to carry substantially equal currents.
- vi) In determining the current carrying capacity of bare conductors, account shall be taken of the arrangement made for their expansion and contraction, their joints and the physical limitation of the metal of which they are made.
- vii) Where cables are to be connected to bare conductors or Bus Bar it shall be verified that their type of insulation and of sheath is suitable for the maximum operating temperature of the bare conductor or the Bus Bar. Alternatively the insulation and/or sheath of the cable shall be removed for a distance of 150 mm from the connection and replaced if necessary by suitable heat resisting insulation.
- viii) Where a cable is to be run for significant length in a space to which thermal insulation is likely to be applied the cable shall where ever practicable be fixed in a position such that it shall not be covered by the thermal insulation. Where fixing in such a position is impracticable, the current carrying capacity of the cable shall be appropriately reduced.
- ix) Voltage Drop: The size of every bare conductor or cable conductor shall be such that the voltage drop within the installation does not exceed a value appropriate to the safe functioning of the associated equipment in normal service. For final circuits protected by an over current protective device having a nominal current not exceeding 100A, this requirement is deemed to be satisfied if the drop in voltage from the origin of the circuit to any other point in the circuit does not exceed 2.5% of the nominal voltage at the design current, disregarding starting conditions. Where an allowance is made for diversity in accordance with manufacturer's recommendations, this may be taken into account in calculating voltage drop.

13.11.2 ENVIRONMENTAL CONDITIONS

13.11.2.1 Ambient Temperature

- i) The type and current carrying capacity of every conductor, cable and flexible cord, termination and joints shall be selected so as to be suitable for the highest operating temperature likely to occur in normal service, account be taken of any transfer of heat from any accessory, appliance or luminaries to which the conductor, cable or flexible cord is connected.
- ii) For cable, other than heating cables, installed in a heated floor or other heated part of a building, the maximum normal operating temperature of that part of the floor etc., in which the cable is installed shall be taken as the relevant ambient temperature.
- iii) Parts of a cable or flexible cord within an accessory, appliance or luminaries shall be suitable for the temperatures likely to be encountered, as determined In accordance with clause 13.11.4(ii) shall be provided with additional insulation suitable for those temperatures. Such additional insulation shall be fitted over the individual cores of the cable or flexible cores in such a way that the normal insulation of the cores is not relied upon to prevent a short circuit between conductors or an earth fault.
- iv) In determining the normal operational conditions of conductors and cables, account need, not be taken of the minimum ambient temperature likely to occur. However, precautions shall be taken to avoid risk of mechanical damage to cables susceptible to low temperatures.

- v) The enclosures of wiring systems for conductors and cables shall be selected and installed so that they are suitable for the extremes of ambient temperature to which they are likely to be exposed in normal service. If a non-metallic or composite outlet box is used for the suspension of or is in contact with aluminaire and where a thermoplastic material (e.g. PVC) is the principal load bearing member, care shall be taken that the temperature of the box does not exceed 60 °C and that the mass suspended from the box does not exceed 3 kg.
- vi) In every vertical channel, duct, or trunking containing conductors or cables, internal barriers shall be provided so as to prevent the air at the top of the channel, duct, or trunking from attaining an excessively high temperature. The distance between barriers shall be the distance between floors or 5 m whichever is the less.

13.11.2.2 Presence of Water or Moisture

- i) Every wiring system shall either be installed where it will not be exposed to rain, dripping water, steam, condensed water or accumulations of water or be of a type designed to withstand such exposure.
- ii) In damp situations and wherever they are exposed to the weather, all metal sheaths and armour of cable, metal conduit, ducts, trunking, clips and their fixings, shall be of corrosion-resisting material or finish and shall not be placed in contact with other metals with which they are liable to set up electrolytic action.
- iii) Copper clad aluminum conductors shall not be used in situations where the terminations of the conductors are likely to be exposed to sustained wet conditions.
- iv) A plain aluminum conductor shall not be placed in contact with a terminal of brass or other metal having a high copper content, unless the terminal is suitably plated or other precautions are taken to maintain electrical continuity.
- v) In any situation, the exposed conductor and insulation at terminations and joints of cables insulated with impregnated paper shall be protected from ingress of moisture by being suitably sealed.
- vi) The ends of mineral-insulated cables shall be protected from moisture by being suitably sealed and the insulation shall be thoroughly dry before the sealing material is applied. Such sealing material, and any material used to insulate the conductors where they emerge from the insulation, shall have adequate insulating and moisture-proofing properties, and shall retain those properties throughout the range of temperatures to which they may be subjected in service.
- vii) In damp situation, enclosures for cores of sheathed cables which the sheath has been removed and for non-sheathed cables at terminations of conduit, duct, ducting outranking systems shall be damp-proof and corrosion resistant. Every joint in a cable shall be suitably protected against the effects of moisture.
- viii) Enclosures of conductors and their joints and terminations in onerous dust conditions shall have the degree of protection as per BS-5490.
- ix) Soldering fluxes which remain acidic or corrosive at the completion of the soldering process shall not be used unless suitable precautions are taken to neutralize their effects.

13.11.2.3 Mechanical Stress

- i) All conductors and cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of service.
- ii) Where cables are installed under floors or above ceilings they shall be run in such positions that they are not liable to be damaged by contact with the floor or the ceiling or their fixings. Where the cables pass through a timber joist within floor or ceiling construction (e.g., under floor boards), the cable shall be 50 mm measured vertically from the top, or bottom as appropriate, of the joist. Alternatively; cables not protected by an earthed metallic sheath shall be protected by enclosure in earthed steel conduit securely supported or by equivalent mechanical protection sufficient to prevent penetration of the cable by nails, screws.
- iii) Where cables pass through holes in metal-work, precautions shall be taken to prevent abrasion of the cables on any sharp edges.

- iv) Non-sheathed cables for fixed wiring shall be enclosed in conduit, duct, ducting or trunking. Such non sheathed cables shall not be installed in ducts cast in situ in concrete where any part of the completed duct is formed by the concrete or screed.
- v) Cables buried direct in the ground shall be of a type incorporating an armour or metal sheath or both, or be of the PVC insulated concentric type. Such cables shall be marked by cable covers or a suitable marking tape and be buried at a sufficient depth to avoid their being damaged by any disturbance of the ground reasonably likely to occur during the normal use of the premises.
- vi) Cables to be installed in underground ducts or pipes shall be of a type incorporating a sheath and/or armour suitably resistant to any mechanical damage likely to be caused during drawing-in.
- vii) Cables to be installed outdoors on walls and the like shall incorporate a sheath and/or armour suitably resistant to any mechanical damage likely to occur, or be contained in a conduit system or other enclosure affording adequate protection against such damage.
- viii) Cables for overhead wiring between a building and a point of utilization nonattached thereto (e.g. another building) shall be so placed and at such height as to be out of reach of any sources of mechanical damage reasonably to be foreseen in the normal use of the premises. Alternatively, for spans in situations inaccessible to vehicular traffic, such cables may be installed in conduit or other enclosure affording adequate protection against such damage.

Note:-Bare or lightly insulated overhead conductors are required to be placed out of reach of persons and livestock, as per IEE Regulation.

13.11.3 PREVENTION OF MUTUAL DETRIMENTAL INFLUENCE

- i) Low voltage circuits shall be segregated from extra-low voltage circuits as specified in section 13.3.
- ii) Where an installation comprises circuits for telecommunication, fire-alarm or emergency lighting systems, as well as circuits operating at low voltage and connected directly to a main supply system, precautions shall be taken to prevent electrical contact (and for fire-alarm circuits and emergency lighting circuits, physical contact) between the cables of the various types of circuit.
- iii) Cables of Category 1 circuits shall not be drawn into the same conduit, duct or ducting as cables of Category 2 circuits, unless the latter cables are insulated in accordance with the requirements of these Regulations for the highest voltage present in the Category 1 circuits.
- iv) Cables of Category 1 circuits shall not in any circumstances be drawn into the same conduit, duct or ducting as cables of Category 3 circuits.

Note:-BS-5266 recommends that cables of emergency lighting systems shall be segregated from any of the circuits.

- v) In conduit, duct, or trunking systems, where controls or outlets of Category 1 and Category 2 circuits are mounted in or on common boxes, switch plates or blocks, the cables and connections of the two categories of circuit shall be partitioned by means of rigidly fixed screens or barriers.

Note: -BS-5266 recommends such partitions between emergency lighting circuits and all other circuits.

- vi) Metal sheaths and armour of all cables operating at low voltage, and metal conduits, ducts, ducting and trunking and bare protective conductors associated with, such cables, which might otherwise come into fortuitous contact with other fixed metal work shall be either effectually segregated there from, or effectually bonded thereto.
- vii) Electrical services shall not be installed in the same conduit, ducting or trunking as pipes of tubes of non-electrical services, e.g. air, gas, oil or water. This requirement does not apply where the various services are under common supervision and it is confirmed that no mutual detrimental influence can occur.
- viii) No cables shall be run in a lift (or hoist) shaft unless they form part of the lift installation as defined in BS-5655.

13.11.4 ACCESSIBILITY

Joints in non-flexible cables and joints between non-flexible & flexible cables or cords shall be accessible for inspection. However, this requirement shall not apply to joints:

- i) In cables buried underground, or
- ii) Enclosed in building materials having the ignitability characteristics as specified in BS-476 Part 5, or
- iii) Made by welding, soldering, brazing or compression and contained within an enclosure (such as a box) of material having the ignitability characteristic as specified in BS-476 Part 5.
- iv) The joints mentioned in item (b) above, if inaccessible, shall not be made by means of mechanical clamps.

13.11.5 JOINTS AND TERMINATIONS

- i) Every connection at a cable termination or joint shall be mechanically and electrically sound, be protected against mechanical damage and any vibration liable to occur, shall not impose any appreciable mechanical strain on the fixing of the connection, and shall not cause any harmful mechanical damage to the cable conductor. Joints in non-flexible cables shall be made by soldering brazing; welding or mechanical clamps or be of the compression type. All mechanical clamps and compression type sockets shall securely retain all the wires of the conductor.
- ii) Termination and joints shall be suitably insulated for the voltage of the circuits in which they are situated.
- iii) Cores of sheathed cables from which the sheath has been removed and non-sheathed cables at the terminations of conduit, ducting or trunking shall be enclosed in a material having ignitability characteristics as per BS-476, part-I. Alternatively the enclosure may be a box complying with BS-5733 or BS-4662 or pother appropriate British Standard.
- iv) Cable glands shall securely retain without damage the outer sheath or armour of the cables. Mechanical cable glands for rubber and plastics insulated cables shall comply with BS-4121 or BS-6121 where appropriate.
- v) Ends of lengths of conduit shall be free from burrs and where they terminate pat boxes, trunking and accessories not fitted with spout entries, shall be treated so as to obviate damage to cables.
- vi) Substantial boxes of ample capacity shall be provided at every junction involving a cable connection in a conduit system.
- vii) Every outlet for cables from a duct system or ducting system, every joint in such a system and every joint between such a system and another type of duct, ducting, or conduit shall be formed so that the joints are mechanically sound and that the cables drawn in are not liable to suffer damage.

13.11.6 FIRE BARRIERS

- ii) Where cables, conduits ducts, ducting or trunking pass through fire resistant structural elements such as floors and walls designated as fire barriers, the opening made shall be sealed according to the appropriate degree of fire resistance. In addition, where cables, conduits or conductors are installed in channels, ducts, ducting, trunking or shafts which pass through such elements suitable internal fire resistant barriers shall be provided to prevent the spread of fire.
- iii) Supports, Bends: Every cable and conductor used as fixed wiring shall be supported in such a way that it is not exposed to undue mechanical strain and so that there is no appreciable mechanical strain on the terminations of the conductors, account being taken of mechanical strain imposed by the supported mass of the cable or conductor itself.
 - a) All conduit, ducting and trunking shall be properly supported and of a type suitable for any risk of mechanical damage to which they may be liable in normal conditions of

service or adequately protected against such damage. The method of support for rigid PVC conduits shall allow for the longitudinal expansion and contraction of the conduit which may occur with variation of temperature under normal operating conditions.

- b) The use of solid (non-inspection) conduit elbow or tees shall be restricted to:
- Location at the ends of conduits immediately behind a luminaries, outlet box or conduit fitting of the inspection type, or
 - One solid elbow located at a position not more than 500 mm from a readily accessible outlet box in a conduit run not exceeding 10 mm between two outlet points provided that all other bends on the conduit run are not more than the equivalent of one right angle.
- c) The radius of every conduit bend other than a bend complying with BS-4568 or BS-4607 shall be such as to allow compliance with clause 13.5.6.(ii) (a) for bends in cables and, in any event, the inner radius of the bend shall be not less than 2.5 times the outside diameter of the conduit

13.11.7 ESTIMATION OF LOAD

- i) In estimating the current to be carried by any conductor consuming devices are to be rated and calculated as under:

Type of Load	Domestic	Office
LED Light/Tube (each)	...16 Watts	...16 Watts
Fans	...75 Watts	...75 Watts
Table Fan/Bracket	... 60 Watts	... 60 Watts
Plug Point	... 300 Watts	... 300 Watts
Power Plug for A/C	... 2750 Watts	... 2750 Watts
Power Plug for General use	... 2000 Watts	...2000 Watts

- ii) The maximum demand of power for each building shall be calculated as follows:

Type of Buildings	Maximum demand factor for light		Maximum demand factor for fans		Maximum demand factor for A/C	
	Day	Night	Day	Night	Day	Night
Residence	5%	70%	30%	90%	30%	80%
Office	80%	10%	100%	10%	100%	-
Hospital	50%	90%	100%	60%	100%	60%
Hostel	10%	90%	20%	90%	-	-
College	70%	10%	100%	10%	-	-

The design of mains, sub mains and main switches should be strictly based on the above and calculation should be submitted along with the estimate to justify the provisions of the estimate.

APENDIX: APPROVED MANUFACTURERS/SUPPLIER FOR ELECTRICAL WORKS

This list of recommended manufactures/Suppliers of different materials / equipment's with brand names has been provided in order to establish a standard level of performance. The contractor is supposed to provide and fix the materials / equipment's of acceptable quality from the list or equivalent as approved by the Project Manager. Material from approved list shall stand rejected, if it fails in any of the specified tests or quality standards.

Sr. No.	Description	Manufacturer / Brand / Supplier
1	Light Fixtures	Philips, Ledvance, Osram (LED), Thorn Lighting or Equivalent.
2	Distribution Boards and Main and Sub main Panel Boards	Siemens, Acrotech, Schneider or Equivalent.

3	Cables and Wires	Pakistan Cables, Newage Cables, Fast Cables or Equivalent
4.	PVC Conduit & Accessories	Beta, Dadex or Equivalent
5	Steel Conduit & Accessories	Hilal Industries, IIL, Jamal, Pioneer or Equivalent.
6	Switches, Sockets etc.	Bosch, Clipsal, Legrand, ABB or Equivalent.
7	Back Boxes, Pull Boxes, etc.	Bosch, Clipsal, Legrand, ABB or Equivalent.
8	Telephone Cables Dish Antenna Cables	Siemens (Germany), Pakistan Cables Limited, Newage Cables or Equivalent.
9	Telephone Junction Boxes	S.A. Electric, N.R. Industries, MISTO Industries, TIP or Equivalent.
10.	Fire Alarm System and PAS, CCTV	Sunlight, C-XOR, Mega Plus, Samsung, Bosch or Equivalent.
11.	Fans	Pak Fan, GFC, Lahore Fan or Equivalent.
12.	MCCBs, MCBs & ELCBs, etc.	Siemens (Germany), ABB (Italy), Legrand (France), Schneider (Germany) or Equivalent.
14.	Generator Sets	Caterpillar, Siemens, FG Wilson, VPL (Onis Visa), PEL, Hyundai or Equivalent.
15.	Transformers	Siemens (Validus Engg.) or Equivalent.
16.	Earthing/Lightening Protection System	C-XOR (Spain), Mega Plus or Equivalent.
17.	KNX System	ABB, Schneider or Equivalent.
18.	HVAC	Samsung (Korea), GREE (Australia), Mitsubishi, Panasonic or Equivalent.
19.	Fire Fighting	Metron, Haseen Habib, SFFECO GLOBAL(UAE), LIFECO(UAE) or Equivalent.
20.	Poles Steel	Jamal, spleen or Equivalent.
21	Energy meters	M/s PEL, M/s Creative Electronics or equivalent

CHAPTER-14
Method of Measurements and Payments

Chapter-14: METHOD OF MEASUREMENTS AND PAYMENTS

14.1 GENERAL ITEMS

14.1.1 PROVISIONS OF SURVEY TEAMS AND INSTRUMENTS

Description	Unit of Measurement
Provide and maintain survey equipment	Provisional Sum

For Survey Equipment to be provided by the Contractor to the Employer/Project Manager shall be paid from the provisional sum in accordance with Conditions of Contract i.e. (Cost plus 20% as Contractor's overhead and Profit).

14.1.2 OCCUPATIONAL HEALTH AND SAFETY PROVISIONS

Some works shall be measured and paid separately as detailed below and provided in Bill-A of BOQ, the rest of the all the works related to health and safety measures are deemed to be covered or included in the prices and rates for other main items or distributed among all the pay items of the Bill of Quantities (BOQ).

However, if, in the opinion of the Project Manager, proper provision and maintenance of the health and safety measures is not being made, then the Project Manager may withhold payment equal to the value of the work or as evaluated/approved by the Project Manager unless or until a satisfactory level of implementation is provided by the Contractor.

- (a) OHS Staffs
 - i. OHS Supervisor (1)

The cost for the provision of OHS Staffs shall be paid on person-month basis for the period when they are actually working at the site for the fulfillment of tasks. The Contractor shall provide or furnish evidence of his attendance at site to be approved or permitted by the Project Manager. Payment for the assignment of OHS Staffs and implementation of the OHSMP shall be as follows:

- i. The first monthly payment for assignment of OHS Staffs shall be due or payable after the staffs are approved to be mobilized on site,
 - ii. Provided that if, in the opinion of the Project Manager, the monthly monitoring report is not prepared or submitted and/or proper implementation of the Management is not being provided then the Project Manager may withhold payment until a satisfactory level of implementation shall be provided by the Contractor.
- (b) Provision and maintenance of Facilities
 - i. First Aid Kit,
 - ii. First Aid Kit operation and Maintenance
 - iii. Fire Extinguishers Purchase and installation 6kg (20)
 - iv. Fire Extinguishers Refilling & maintenance
 - v. Personal Protective Equipment

The payment will be made when the aforementioned medical facilities are approved and on site. Payment for the operation and maintenance of the respective facilities shall be made at the unit price and rate in the Bill of Quantities (BOQ).

14.1.3 INSURANCE FOR WORKS & CONTRACTOR'S EQUIPMENT

For fulfilling his obligation under Clause 13 of the Conditions of Contract, the Contractor shall be paid on the basis of Lump Sum amount entered against the respective item in the Bill of Quantities which amount shall be deemed to include all of the Contractor's costs incidental to providing and maintaining the specified insurance.

14.1.4 INSURANCE AGAINST DAMAGE TO PROPERTY

For fulfilling his obligation under Clause 13 of the Conditions of Contract, the Contractor shall be paid on the basis of Lump Sum amount entered against the respective item in the Bill of Quantities which amount shall be deemed to include all of the Contractor's costs incidental to providing and maintaining the specified insurance.

14.1.5 INSURANCE FOR CONTRACTOR'S PERSONNEL

For fulfilling his obligation under Clause 13 of the Condition of Contract, the Contractor shall be paid on the basis of Lump Sum amount entered against the respective item in the Bill of Quantities which amount shall be deemed to include all of the Contractor's costs incidental to providing and maintaining the specified insurance.

14.1.6 PROVISIONAL SUM FOR CHANGES IN COST

A provisional sum has been included in the Bills of Quantities for Payment for the adjustment in Cost as per Clause 49.

14.1.7 PROVISIONAL SUM FOR THE ADJUDICATOR

The Provisional Sum for the cost of the Adjudicator shall be used for payments to the Contractor of the Employer's share (one-half) of the invoices of the Adjudicator for its fees and expenses, in accordance with GCC 44 and 45. No prior instruction of the Project Manager shall be required with respect to the work of the Adjudicator. The Contractor shall produce the Adjudicator invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Clause 44 and 45, which contain requests for payment under the Provisional Sum toward the cost of the Adjudicator. The Project Manager's certification of such Statements shall be based upon such invoices and such evidence of payment by the Contractor. Contractor's overhead, profit, etc., shall not be included in the provisional sums for the cost of the Adjudicator.

14.1.8 PROVISIONAL SUM FOR THE PHYSICAL CONTINGENCIES

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Project Manager's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Project Manager shall have instructed. For each Provisional Sum, the Project Manager may instruct:

- a) Work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Clause 42 [Variations]; and/or
- b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause-7) or otherwise; and for which there shall be included in

the Contract Price:

- i. The actual amounts paid (or due to be paid) by the Contractor, and
- ii. An overhead charges and profit to Contractor is ascertained as 20%.

The Contractor shall, when required by the Project Manager, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

14.2 EARTH WORK

14.2.1 (i) EXCAVATION

Excavation of (Surface, Building Foundation, Structural, Roads, Land Development, Trenches, Drains, Manholes, Electrical Works, boundary wall, Path way and Retaining Walls etc.) shall be measured for the payment as the volume of material (m³) in place before excavation, based on agreed ground profiles and specific excavation as shown or envisaged on the drawings. There will be no measurement or payment of over break in excavations.

The rates shall cover or include all costs of conforming to or complying with the relevant requirements of the Specification, the costs of excavating in stages where necessary, and the costs of the items and activities listed labour, equipment, tools and incidental necessary to complete this item. The rate also include dagbelling, dibbling, dressed to design level, section, grade, profile and shoring. The unit rate also include shuttering & timbering to pipe trenches / drains / channels and removal of surface water from trenches and from any other area. Complete in all respects to finish the job.

(ii) Lead

Separate lead will be paid for the surplus material to be disposed, however, no separate payment will be made for lift as it deemed to be included in the pay item of excavation.

The Measurement and payment for the carriage of surplus earthworks materials including loading unloading and stacking shall be made corresponding to items as provided in BOQ and shall constitute full compensation for performance and completion of work in all respects as specified and approved by the Project Manager. The unit rate also include loading, unloading and stacking the earthwork material

14.2.2 FILLING, BACKFILLING AND FORMATION OF EMBANKMENT

(i) Fill / Backfill (Buildings, Structures, Road Embankment and Trenches Etc.)

The cost of filling the over break with concrete, where necessary, will be deemed to be included in the rates for preparing rock surfaces for concreting and the cost of filling the over break with rock fill or earth fill, where necessary, will be deemed to be included in the rates for fill.

Fill/backfill, will be measured for payment as the net volume in place in the fill, calculated from the dimensions and levels on the Drawings, and agreed ground level surveys.

The rates for fill / backfill shall include the costs of spreading, filling over-break in foundation surfaces, placing, watering, ramming, dressing and compacting in layers where necessary, trimming the final surfaces. Rate also include labour, equipment, tools and incidental necessary to complete this item. Complete in all respects as per specifications.

The rates for backfilling of trenches shall include the costs of compacting by any means (mechanically or manually) up to 90% standard or modified proctor depending on soil condition.

Payment for subgrade preparation in earth cut shall be made in square meter with 95% modified AASHTO as per NHA specifications shown which prices and payment shall be full compensation furnishing of material, water, equipment, tools, labour and all other to complete the job.

(ii) Sand Fill

Sand fill will be measured for payment as the net volume in place in the fill, calculated from the dimensions and levels on the Drawings, and agreed ground level surveys.

The unit rate includes material, labour, equipment, tools and all incidental necessary to complete this item as per specifications.

(iii) Filling With Crush Stone

Fill with crush stone will be measured for payment as the net volume in place in the fill, calculated from the dimensions and levels on the Drawings, and agreed ground level surveys.

The unit rate includes material, labour, equipment, tools and all incidental necessary to complete this item as per specifications.

(iv) Compaction of Natural Ground

The measurement shall be made by multiplying the length and breadth of the area approved in writing by the Project Manager to be paid under this item. The measurement of the item shall be in Square meter.

Any subsidence of levels of Natural Ground due to compaction under this item shall not be measured for payment, the contractor is expected to take care of such factors.

The payment under this item shall be made for at the contract unit price for Square meter of compaction of (natural) ground measured as above and shall be deemed to include cost of scarification, watering, mixing, levelling, rolling, labour, equipment, tools, and incidentals necessary to complete this item.

14.2.3 EMULSIFIED BITUMEN

Emulsified Bitumen Coating with penetration grade 10 to 20 on plastered & concrete surfaces for footing, column & other structures in contact with soil or as shown in drawings.

Measurement shall be made in square meter on providing and applying emulsified Bitumen as specified.

Payment shall be made for providing and applying Emulsified Bitumen in square meter and shall constitute full compensation to complete the works.

14.2.4 ANTI-TERMITE

The measurement of termite proofing shall be done by the area of the termite proofing in square meter (m²).

The unit rate includes material, labour, equipment, tools and all incidental necessary to complete this item.

14.2.5 MANUAL MATERIAL SHIFTING ACCESSORIES

Number and kind of Equipment required for different items of work shall be planned by the contractor keeping in view the workmanship required by a particular item and the quantity of finished item required to be carried out in eight hours shift. The Engineer In charge shall approve such planning or any changes shall be proposed for guidance of the Contractor.

However, this procedure shall not relieve the Contractor of his contractual obligations pertaining to performance and maintenance of project.

14.3 CONCRETE

14.3.1 STONE BALLAST

Measurement of the ballast shall be made subject to the actual quantity of ballast consumed from the stack whose cubical contents shall be recorded before commencement of the work and at the end or completion of the work or section.

Unit of payment shall be measured in cubic meters according to unit price and rate by the Contractor in the Bill of Quantities (BOQ).

14.3.2 CEMENT CONCRETE (PLAIN, REINFORCED)

Concrete shall be measured to the neat lines of the structures as shown or envisaged on the Drawings or as modified by the Project Manager of works for the appropriate parts of the structures in which such concrete is incorporated. In measuring concrete, the volume of openings, recess ducts, embedded piping and metal work each of which is smaller than 225 cm² shall be ignored or disregarded. Concrete shall be measured by volume. The unit thereof shall be measured in cubic meter.

Separate measurements shall be recorded for concrete's of different proportions specified herein and if form work was used or not.

The respective unit prices and rates per cubic meter shall cover or include the cost of cement, sand, aggregate, water, mixing, placing, vibrating, curing; and preparing, assembling and removal of forms, and all other operations, procedures and requirements necessary to finish the concrete in accordance with these specifications.

The same shall not cover or include the cost of supplying and fixing water stops and expansion joint filler.

Payment for accepted quantity measured shall be made according to the unit rate per cubic meter as specified or particularized in the Bill of Quantity (BOQ).

14.3.3 SUPPLYING AND FIXING WATER STOP

The measurement for payment of water stops shall be made in meter on the basis of lengths actually used in the concrete and accepted / approved by the Project Manager in accordance with the Drawings and specifications or as per direction or instruction by the Project Manager. No measurement for payment shall be made of wastage in cuttings & other operations including over laps.

Payment shall be made at the unit prices and rates for each meter in the Bill of Quantities (BOQ). The amount shall be full payment for completion of the work as specified herein or elsewhere as directed or instructed by the Project Manager.

14.3.4 STEEL REINFORCEMENT

Measurement for payment for reinforcement shall be made on the basis of the theoretical unit weight, taken from published standard tables, of the reinforcement actually placed in the concrete in accordance with the Drawings or as directed or instructed by the Project Manager. No measurement and payment shall be made for reinforcement used in Precast and/or prestressed concrete.

The amount shall be full payment for completion of the work or section specified herein and elsewhere in these specifications and on the Drawings. No measurement and payment shall be made for the following specified work.

- Providing and installing of chairs, supports, holes, spacers, binding wires; and laps. However laps shall be paid if shown on the shop drawings submitted by the Contractor for approval of the Project Manager.
- Wastage and roiling margin.
- Welded splice done or finished by the Contractor for his convenience.

Payment for reinforcement shall be made at the unit rate per kg in the Bill of Quantities (BOQ).

14.3.5 CONCRETE BLOCK MASONRY

Measurement for cement concrete block masonry under this section of the specification shall be made for the actual works executed at the unit price and rate entered in the Bill of Quantities (BOQ).

Payment shall be made at the unit price and rate specified in the Bill of Quantities (BOQ). Such payment shall constitute full compensation for furnishing all materials, equipment and labor including testing and all other incidental or necessary to complete the work according to drawings and specifications.

14.3.6 POLYTHENE SHEET

Item shall be measured by the superficial area to the applicable item as indicated in the Bill of Quantities. The unit of measurement shall be square meters. Each side of the polythene sheet shall be measured separately.

The unit rate shall include the cost of the material specified in the BOQ for carrying out the work and shall constitute full compensation including labor, tools, equipment, scaffolding and all other necessary to complete the work in all respects. Unit rate also include laying of polythene sheet on polystyrene foam board either with nailing or with chemical bonding or as directed by the Project Manager.

14.3.7 POLYSTYRENE FOAM BOARD

Item shall be measured by the superficial area to the applicable item as indicated in the Bill of Quantities. The unit of measurement shall be square meters.

The unit rate shall include the cost of the material specified in the BOQ for carrying out the work and shall constitute full compensation including labor, tools, equipment, scaffolding and all other necessary to complete the work in all respects. Unit rate also include fixing of polystyrene foam board on the masonry walls either with wood strips or metal strip including nailing etc. or as directed by the Project Manager.

14.4 ROOFING

14.4.1 ROOFING

Roofing shall be measured by the superficial area to the applicable items as indicated or directed by the Project Manager in the Bill of Quantities. The unit of measurement shall be square meters.

The unit rate shall include the cost of the material specified in the BOQ for carrying out the work and shall constitute full compensation including labor, tools, equipment and all other necessary to complete the work in all respects.

Note: The unit rate shall also include Cement mortar (1:6) to be used in adjusting the roof slope.

14.4.2 KHURRAS

A khurra shall be measured complete as a unit including base, floor and walls having dimensions, shape and slope. No separate measurement shall be made for any item or material used in the completion of a khurra.

The unit rate shall cover or include all the labor required for the above operation and (ii) use of all the tools and plants required for carrying out or executing work in accordance with the specifications hereof.

The unit rate shall cover or include the cost of all materials at site of work required for carrying out the work as per above specifications, in addition to the labor rate specified above.

14.4.3 FALSE CEILING

Measurement of acceptably completed work of false ceiling shall be made on the basis of net actual area in square meters as shown on the Drawings or as directed by the Project Manager.

Payment shall be made for the number of square meters measured as above on the basis of contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to the item.

14.4.4 WOOD PLASTIC COMPOSITE EXTERNAL PANNEL CEILING

Measurement of acceptably completed work of ceiling shall be made on the basis of net actual area in square meters as shown on the Drawings or as directed by the Project Manager.

Payment shall be made for the number of square meters measured as above on the basis of contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to the item including labour, material, platform, accessories for ceiling to complete the works.

14.4.5 KUPRAIL TILES

Measurement of acceptably completed work of kuprail tiles shall be made on the basis of net actual area in square meters as shown on the Drawings or as directed by the Project Manager.

Payment shall be made for the number of square meters measured as above on the basis of contract unit rate per square meter of the respective item including cement mortar for jointing and shall constitute full compensation for all the works related to the item.

14.5 FLOORING

Note: No separate payment shall be made for different size of the tiles. The Contractor shall follow the instructions of the Project Manager regarding the size of the tile.

14.5.1 STAIR / COUNTER SLABS

The measurement and payment for the items of the work of Granite or Marble Stair/Counter slabs (of any size as directed by the Project Manager); hereof shall be made corresponding to the applicable items as provided in the Bill of Quantities and shall constitute full compensation, for procurement, transportation, performance in all respects and completion of work as specified herein, including the site clearance as approved by the Project Manager.

The unit rate shall include the cost of all the material supplied at site as specified above including base cement mortar (1:3) 19mm thick, nosing, hardware, grinding and polishing etc. Unit for Payment shall be in Square Meter. The unit rate also includes glue or adhesive to be used in the work item.

14.5.2 FLOORING / TILES

Furnish and Lay flooring with Glazed/Un glazed Ceramic Tiles; Marble Tiles, PVC/vinyl tiles, Porcelain tiles and natural granite polished (of any size as directed by the Project Manager);

No separate measurement and payment shall be made for the under mentioned specified works (i to iv) related to the relevant item of the BOQ. The cost, thereof, shall be deemed to have been included in the quoted unit rate of the respective item of the BOQ and as specified hereunder.

- i) Setting bed 19mm with (1:3) cement sand mortar
- ii) Tile laid in (1:2) White Cement Mortar.
- iii) Filling with color pigment in white cement.
- iv) Grinding, washing, polishing and finishing works of tiles except ceramic and porcelain tiles

Measurement of acceptably completed floor work (ground floor, first and subsequent floors) shall be made on the basis of net actual area in square meters of the tiles laid in position as shown on the Drawings and or as directed by the Project Manager.

Payment shall be made for the number of square meters measured as above on the basis of Contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to complete the item.

The unit rate shall include the cost of all the material, equipment and labor necessary to complete the work in all respect. Unit for Payment shall be in Square Meter.

However, Sand filling, Concrete Class D, Concrete 1:2:4 and Stone Ballast shall be measured paid separately.

14.5.3 MOSAIC/ CEMENT CONCRETE TILE FLOORING

Furnish and Lay flooring with Terrazzo or Mosaic Marble Chips Tiles; Cement Concrete Tiles; PCC Tiles; Coloured Cement Tiles;

No separate measurement and payment shall be made for the under mentioned specified works (i to iii) related to the relevant item of the BOQ. The cost, thereof, shall be deemed to have been included in the quoted unit rate of the respective item of the BOQ and as specified hereunder.

- i) Setting bed 19mm with (1:3) cement sand mortar
- ii) Tile laid in (1:2) Cement Mortar.
- iii) Filling with color pigment in white cement if required.

Measurement of acceptably completed floor work (ground floor, first and subsequent floors) shall be made on the basis of net actual area in square meters of the tiles laid in position as shown on the Drawings and or as directed by the Project Manager.

Payment shall be made for the number of square meters of tiles measured as above on the basis of Contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to complete the item.

The unit rate shall include the cost of all the material, equipment and labor necessary to complete the work in all respect. Unit for Payment shall be in Square Meter.

However, Sand filling, Concrete Class D, Concrete 1:2:4 and Stone Ballast shall be measured and paid separately as per relevant Specifications and BOQ item.

14.5.4 PCC PAVERS

Measurement of acceptably completed work shall be made on the basis of net actual area in square meters of the PCC Pavers laid in position as specified herein, as shown on the Drawings and or as directed by the Project Manager. The cost, thereof, shall be deemed to have been included the items specified under section 3.9 and the labor, material. Equipment, etc. necessary to complete the item in all respect in the quoted unit rate of the respective item of the BOQ.

14.5.5 MARBLE DADO OR SKIRTING

Measurement of acceptably completed work shall be made on the basis of net actual area in square meters of the Marble dado or Skirting laid in position as specified herein, as shown on the Drawings and or as directed by the Project Manager. The cost, thereof, shall be deemed to have been included the labor, material. Equipment, tools etc. necessary to complete the item in all respect in the quoted unit rate of the respective item of the BOQ.

Payment shall be made for the number of square meters measured as above on the basis of Contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to complete the item

14.5.6 GRANITE TOP FOR BATH VANITY

Measurement of acceptably completed work shall be made on the basis of net actual area in square meters of the granite top as specified herein, as shown on the Drawings and/or as directed by the Project Manager. The cost, thereof, shall be deemed to have been included the labor, material, tools, equipment, tools etc. necessary to complete the item in all respect in the quoted unit rate of the respective item of the BOQ

Payment shall be made for the number of square meters measured as above on the basis of Contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to complete the item.

14.5.7 EPOXY FLOORING

Measurement of acceptably completed work shall be made on the basis of net actual area in square meters of the epoxy flooring as specified herein, as shown on the Drawings and/or as directed by the Project Manager. The cost, thereof, shall be deemed to have been included the labor, material, tools, equipment, etc. necessary to complete the item in all respect in the quoted unit rate of the respective item of the BOQ.

Payment shall be made for the number of square meters measured as above on the basis of Contract unit rate per square meter of the respective item and shall constitute full compensation for all the works related to complete the item

14.6 SURFACE RENDERING

14.6.1 CEMENT PLASTERING

Measurement of acceptably completed works of plaster shall be made on the basis of number of square meter (sqm) of the surface area of plaster as shown or envisaged on the approved Drawings or as directed or instructed by the Project Manager.

Deductions shall not be made for ends of joints, beam posts, and openings not exceeding 0.5 sq. m (m²) each and no addition shall be made for reveals, jambs, soffits, sills, of these openings nor for providing the plaster around ends of joints, beams posts, in case of opening of area exceeding 0.5 sq. m each, deduction shall be made for the openings and also no addition shall be made for reveals jambs, soffits, sills, and the like. of these openings.

Payment shall be made for acceptable measured quantity of piaster on the basis of applicable contract unit rate per sq. m (m²) and shall constitute full compensation for all the works related to the item.

14.6.2 WHITE WASHING/COLOR WASHING

White Washing/Color Washing shall be measured by superficial area. The unit of measurement shall be indicated or specified in square meters.

The unit rate shall cover or include:-

- i) When only labor rate is to be paid.
 - a. The preparation of surface and whitewashing as per above specifications.
 - b. The provision, erection and removal of scaffolding and ladders (shot with gunny bags at both ends to prevent damage to the floor and walls.)
 - c. The protection of floor, fixed furniture, doors and windows, as well as all such places and things as are not to be whitewashed. These places and things shall be protected from all droppings and slashes of White Washing/Color Washing, if any, and cleaned.
 - d. Provision of all tools and brushes required for White Washing/Color Washing,
- ii) When rate for completed job is to be paid.
 - a. All items specified in (a) above.
 - b. All materials required for the preparation of lime wash as per above specifications.

Payment shall be made at accepted measured quantity of White Washing / Color Washing on the basis of unit rate per sq. m (m²).

14.6.3 DISTEMPERING

In respect of measurement and rates, the same shall conform to or comply with Specifications No. 8.4 for whitewashing i.e. the measurement thereof shall be made of the superficial area of the completed work. Unit of measurement shall be indicated or specified in sq. m (m²).

Payment shall be made of accepted measured quantity of work substantially completed on the basis of unit price and rate per sq. m. (m²).

14.6.4 FAIR FACE BRICK CLADDING (GUTKA)

Providing and fixing Gutka Bricks of size 230 x 62 x 62 mm including steel nails and binding wire finishing complete in all respects including materials, Scaffold, tools and equipment.

Payment shall be made of accepted measured quantity of work completed on the basis of unit price and rate per sq. m. (m²).

14.7 WOOD WORK

14.7.1 GENERAL

The measurement of wood work or planking shall be the net measurement after fixing in position in sq. meter. No allowance is to be made for waste overlaps, rebates or the dimensions supplied beyond those specified.

The unit rate for wood work shall include the cost of labor to carry out wood work according to above specifications and stated in the specifications, fixed in position and with the exposed arises finished with a bead and quirk as specified. The rate shall further include the cost of labour employed for following operations:-

- a. Fixing all spikes, nails, screws, glue.
- b. Beveled heading joints to boarding.
- c. Boring for bolts as required.
- d. Cleaning of wrought face.
- e. Cramping and wedging.
- f. Fixing with .hardwood or male bamboo pins, nails, spikes, hoop iron and wire in any position.
- g. Halving, tabling, lapping, notching, framing, straight, splay, circular or birds-mouth cutting, splayed and beveled ends, and mitres, fair or returned ends, as required.
- h. Punching and clenching nails.
- i. Treating plugs with wood preservative, and anti-termite treatment to works.
- j. All notching, firings, or squaring to bailies, necessary to obtain level, bedding, boarding or fixings.
- k. Rebates and chambers to door and window frame where required.
- l. The rebate shall further include the use of all tools, plant and scaffolding, staging and ladders, etc., where necessary.
- m. Fixing fly screens,
- n. Steel railings / channels

The unit rate thereof shall cover or include the cost of all materials including fixing of best quality brass mongery as approved by the Project Manager and mentioned in the BOQ including french polishing for Wood Works, nails, bolts, screws, fly screens (if required by the Project Manager), adhesives, glazing, wood preservatives & primary paint used in the completion of work in addition to the labor rate detailed in Para Supra above complete in all respects.

For Amirah and cabinet, the unit rate also includes Chromium plated / SS hanging rod, lock, mongery fittings, steel railings / channels, spirit polish (outside) including surface preparation

and filling complete as per approved shop drawing and quality of hardware as approved by the Project Manager.

14.7.2 SOLID WOODEN DOORS (SINGLE AND DOUBLE LEAF)

The measurement of doors shall be done in square meter area of the clear opening in masonry. In case of circular or other similar joinery, measurement shall be taken of the net area.

The unit rate shall include the cost, of labor involved in making and erecting doors of the specified sizes complete in all respects, with fitting, Hardware (such as handles on both sides, tower bolt, best quality mortice lock, door stopper, brass hinges with pin and bearing arrangement) and furniture according to specifications.

The rate shall also include use of ladders, supports, staging and scaffolding for executing wood work according to above specifications.

The rate shall further include the cost of labor involved in applying two coats of wood preservatives on the chowkats. The unit rate also include the items listed in 14.7.1 as required by the Project Manager. Unit rate also includes fanlight above the door if shown in the drawings of schedule. Chowkat shall be MS metal gauge 14 with enamel paint if provided in the drawings.

The unit rate shall include the cost of all materials supplied at site in addition to the labor rate detailed above.

14.8 PAINTING AND VARNISHING

14.8.1 GENERAL

Painting and varnishing shall be measured by superficial area. The unit of measurement shall be indicated or specified in square meter moulded work of all kinds, unless otherwise specified, shall be measured by running the tape over and into all elevations and depressions, in the case of other classes of work painted on both sides, the flat area of the surface on one side including glazing and chowkat, shall be multiplied by the factors given below to arrive at the correct measurement of both sides for the purpose of making payment.

i) Paneled or battened doors and windows	2 times
ii) Glazed or partly glazed doors or windows	2 times
iii) Plate glass windows (large glazed area)	1 time
iv) Wire gauze doors or windows	1 time
v) Trellis work	2 times
vi) Grated doors and windows and other grating	1 time
vii) Palisade fencing	0.6 time

Note: In the case of chowkat having two (2) rebates, one (1) for wooden door and other for wire gauze shutter, the surface area of the chowkat shall be covered or included in the measurement of only one (1) door.

The unit rate shall cover or include the cost of cleaning, preparing and painting the face in conformity / accordance with the above specifications or any other specifications specially contained in the contract. The same shall further cover or include the cost of providing, using and removing scaffolding, supports, ladders, shot with gunny bags at both ends, brushes or spraying machines of approved type and any other tool or plant required for doing paint as per above specifications and removal with turpentine or other approved methods of all damages and defects from the painted surface to leave it perfect in every respect. The same shall further cover or include the cost of all allied operations like the removal of stains, smears, splashes and droppings on the walls, floors, glazing, furniture and other places.

The unit rate shall include the cost of paint remover in case of painting old work and all other material required for doing painting as per above specifications at site of work in addition to the

labor rate detailed above. The unit rate also include primer and wall filler (putty) if specified in BOQ.

14.8.2 ANTI-MICROBIAL PAINT

In respect of measurement and rate, the same shall conform to or comply with the Specifications 9.8.1 for "Painting and Varnishing" General.

14.8.3 PAINTING METAL WORK

In respect of measurement and rate, the same shall conform to or comply with the Specifications 9.8.1 for "Painting and Varnishing" General.

14.9 CEMENT, SAND, AGGREGATE & REVETMENT MATERIALS

No separate measurement and Payment shall be made for cement, sand, aggregates and revetment materials used in any required construction under these specifications and all costs of providing such sand, aggregate and revetment materials shall be covered or included in the unit rates in the Bill of Quantities for the appropriate items in which such materials are to be used.

14.10 MISCELLANEOUS

14.10.1 JUNGLE CLEARANCE

The measurement and payment of jungle clearance shall not paid separately as it is included in the pay item of excavation or filling/backfilling.

14.10.2 RAZOR CONCERTINA WIRE

Measurement shall be made on the basis of linear meters. Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation

14.10.3 IRON WORK/ ALUMINUM WORK

(i) General

Unless otherwise mentioned in the Bill of Quantity (BOQ), no separate payment will be made of undermentioned items (a to g) for the works covered under this section. The cost thereof shall be deemed to have been covered or included in the Contract unit rate of the respective items of the Bill of Quantity (BOQ) including material and labor, complete in all respects.

- a) Nuts, bolts, screws, rivets, beads, fillets, hold fasts, welds and welding rods.
- b) Galvanizing and anti-corrosive prime coating.
- c) Notches, holes and slots and no allowance shall be made for rolling margin or weld metal.
- d) Glazing, prime coat of paint and manufacturer's recommended paint for iron works and aluminum shall be of the natural or anodized as directed by the Project Manager.
- e) All embedded metal parts; metal fittings and fixtures required for the operational process.
- f) Cleaning with sand blasting.
- g) All finished steelwork hardware such as locks, handles, hinges, latches, aldrops, stoppers and hydraulic door closures if not separately provided in the Bill of Quantity.

(ii) Provide, Install and Complete the Followings:

a. Doors, Windows & Ventilators

Measurement of acceptably completed works of doors, windows and ventilators including glazing (plain or color as per drawings) and Hardware Access, shall be made on the basis of net actual area of opening in square meters (m²).

Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions. Payment / rate for the number of square meters of doors, windows and ventilators including glazing and Hardware Access measured as above shall be made at the Contract unit rate per square meter of the respective item which shall constitute full compensation for all the work related to the Item including Hardwares/accessories.

The rate shall further include mongery as required by the Project Manager with hinges, handles, locks, nylon wheels, vinyl weather strips and appliances mentioned in the specifications/drawings to complete the job. The rate also include all filler or fasteners. The rate shall include all Hardware / Access.

Wherever specified in the drawings, the unit rate also include fly screen/wire mesh for doors, Windows and ventilators.

b. Aluminum Cover

Measurement of Aluminum cover shall be made on the basis of sq. meters fabricated and installed in position as shown on the drawings or as directed by the Project Manager. Payment for the number of sq. meters shall be made at the Contract unit rate per sq. meter. Payment, which shall be at the unit rate, in the Bill of Quantities shall cover all costs of materials, labor, tools & plants & scaffoldings, ladders & equipment.

c. Window Safety Grills

Measurement of acceptably completed works of safety grills shall be made on the basis of net actual area in square meters fabricated and installed in position as shown on the drawings or as directed by the Project Manager.

Payment for the number of square meters of safety grills measured as above shall be made at the Contract unit rate per square meter of the respective item which shall constitute full compensation for all the work related to the Item. Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation.

The item includes the cost of surface preparation, prime coat and two enamel paint.

d. Steel Grated Doors

Measurement of acceptably completed works of doors shall be made on the basis of net actual area in square meters including wire gauze, fabricated and installed in position as shown on the drawings or as directed by the Project Manager including all accessories and fittings.

Payment for the number of square meters of steel doors measured as above shall be made at the Contract unit rate per square meter of the respective item which shall constitute full compensation for all the work related to the Item. Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation. The item also includes the cost of surface preparation, prime coat and two enamel paint.

e. Steel Doors

Measurement of acceptably completed works of steel doors shall be made on the basis of each number and fabricated and installed in position as shown on the drawings or as directed by the Project Manager including all accessories and fittings..

Payment for the number of square meters of steel doors measured as above shall be made at the Contract unit rate for each gate.

Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation, however excluding the civil work items which will be paid as per relevant item of the works. The item also includes the cost of surface preparation, prime coat and two enamel paint.

f. MS Channel Section

Measurement of mild steel channel section shall be made on the basis of linear meters fabricated and installed in position as shown on the drawings or as directed by the Project Manager.

Rates for all the items under this Section shall cover the cost of material, supplying, fabrication, furnishing all the materials labor, scaffoldings and appliances at Site and performing all operations in connection with their installation. The item also includes the cost of surface preparation, prime coat and two enamel paint.

(iii) MS Stair Railing

Measurement of acceptably completed works of furnishing, fabricating and installing of MS steel railing including painting on the basis of running meters of stair provided and installed in position as shown on the Drawings or as directed by the Project Manager. Type of MS stair railing is shown in the drawings either straight, spirals or any other.

Payment shall be made for acceptable measured quantity of furnishing, fabricating, painting and installing of stair railing on the basis of contract unit rate per meter and shall constitute full compensation for all the works related to the items. The unit rate also include any type of the stairs as mentioned above including GI pipe along with wall for public building stairs. Complete in all respects as per drawings.

The item also includes the cost of surface preparation, prime coat and two enamel paint.

(iv) Stainless Steel Stair Railing

Measurement of acceptably completed works of furnishing, fabricating and installing of stainless steel railing shall be made on the basis of running meters of stair provided and installed in position as shown on the Drawings or as directed by the Project Manager. The length of top pipe shall only be measured for payment.

Payment shall be made for acceptable measured quantity of furnishing, fabricating, and installing of stainless steel stair railing on the basis of contract unit rate per meter and shall constitute full compensation for all the works related to the items.

(v) Ladder

Measurement of acceptably completed works of providing and installing of ladder shall be made on the basis of running meter provided and installed in position as shown on the Drawings or as directed by the Project Manager.

Payment shall be made for acceptable measured quantity of providing, installing, furnishing the items including labor, equipment, tools etc on the basis of contract unit rate per meter and shall constitute full compensation for all the works related to the items.

(vi) Stone Filling

Fill with stone shall be measured for payment as the net volume in place in the fill, calculated

from the dimensions and levels on the Drawings, and agreed ground level surveys.

The unit rate includes material, labour, equipment, tools and all incidental necessary to complete this item as per specifications.

14.10.4 PROVIDE AND INSTALL

- a. Kitchen Exhaust Hood
- b. Burner Stove (double/triple)
- c. Cooking range (3 burner stainless steel)

Measurement for above shall be made for each item in numbers acceptably provided and installed complete in all respects. No measurement of ancillary materials and works required to complete the item in position shall be made.

Payment for the number of items measured as above shall be made at the unit price and rate per number of the respective item drawings/BOQ and shall constitute full compensation for all the works related to item

14.10.5 PREPARATION OF LAWN AND INSTALLATION OF TURF GRASS

(i) Preparation of Lawn

Measurement shall be made in square meter for the prepared land including removal of stones, weeds/ undesirable grass and disposal to the area designated by the Contractor and approved by the Project Manager, levelling and dressing of lawns.

Payment shall be made at unit rate per square meter (m²) and shall cover or include all costs of conforming to or complying with the relevant requirements of the Specification.

(ii) Plantation of Grass

Measurement shall be made in square meter of the surface area for the planted grass area.

Payment shall be made at unit rate per square meter and shall include providing, fixing watering, cutting of grass and maintain the lawn till taken over by the Employer.

14.10.6 SIGN BOARD

The board shall be measured for its gross superficial area in square meter. The thickness shall be as directed by the Project Manager.

Payment shall be made for unit rate of each square meter of the work executed. The cost shall include all labor, material, equipment and other works required for the preparation and proper installation as specified.

14.10.7 ITEMS FURNISHED AND INSTALLED ON THE BASIS OF WEIGHT

Items of metal fabrication for which the unit rates have been quoted on weight basis and for which detailed workshop drawings have not been made shall be measured net as installed at site as per sketches and instructions of the Project Manager. After measurement the theoretical weight shall be calculated from standard tables of sections and weights in the manner followed in the preparation of drawings. One cubic meter of steel shall be taken as 7,849 kilograms.

Items of metal fabrication for which the unit rates have been quoted on a weight basis and for which the detailed workshop drawings have been prepared, measurement shall be made at site to verify whether the items fabricated, supplied and erected in position are in conformity / compliance with the workshop drawings of the same. If so verified to the satisfaction of the Project Manager, the weights specified or envisaged in workshop drawing shall form the basis for the payment of bills.

- a. Measurement of acceptably completed works of all metal fabrication shall be made in Kilograms on the basis of actual weight of Metalwork fabricated, erected and installed in position as shown or envisaged on the Drawings and / or as directed or instructed by the Project Manager.”
- b. Payment for all architectural / Engineering metalwork weighed as above shall be made on the basis of Contract unit rate per kilogram (kg) for the respective item and shall constitute full compensation for all the works related to the item comprising material, welding, bolting, fabrication, cutting, drilling, riveting, handling, assembling, fixing, erecting, installing and painting

14.11 WATER SUPPLY AND SANITATION

14.11.1 WATER SUPPLY PIPE LINES AND APPURTENANCES

Measurement and payment of excavation and compacted back-filling in trenches shall be made in conformity / accordance with the provisions of 16.2 "Earth Work".

Measurement of concrete and steel reinforcement thereof shall be in conformity / accordance with the provisions of 17.5 "Concrete".

A). Pipe Work

- i) Supplying, Lowering, Laying Jointing; & Testing Pipes complete with specials.

Measurement of Mild Steel, PPR-C, u-PVC and HDPE pipes acceptably installed complete in all respects as per relevant specifications and drawings or as directed by the Project Manager shall be made in linear meters. Specials, Joints and jointing material shall not be measured separately.

Payment shall be made for the number of linear meters of pipe work as measured above at the unit price per meter and shall constitute full compensation for the cost of pipes, supplying, testing, handle, lay, fittings, coupling, sleeves, nuts, sockets, plugs, Specials, Tees, Joints & jointing material and all other works related to the item.

B). Sluice / Gate/Check Valves /Pressure Reducing Valve/Air valves/washout valves

Providing & Installing Valves of approved quality and size including all fittings but excluding construction of chambers:

Measurement shall be made for the number of approved size acceptably installed complete in all respects as per relevant drawings.

Payment shall be made for the number of valves as above at the unit price for each size of valves and shall constitute full compensation for providing, handling, fixing and jointing and all other related work.

The Concrete chambers shall be measured and paid separately as per relevant item of the works.

C). Fire Hydrants

Providing and Installing Fire Hydrant of approved size including all Fittings:

Measurement shall be made for the number of fire hydrants acceptably installed and completed in all respects as per relevant drawings.

Payment shall be made for the number of fire hydrants measured as above at the Unit Price for each unit and shall constitute full compensation for providing, handling, fixing and jointing and all other work related to the item.

The Concrete chambers shall be measured and paid separately as per relevant item of the works.

D). Overhead Water Tanks

Measurement shall be made for the number of Overhead Water Tanks along with its fittings completed in all respect.

Payment shall be made for the number of Overhead Water Tanks along with its fittings component completed in all respect.

E). Brass Ferrule Assembly

Provide & Install Brass Ferrule assembly of Approved quality and size including tapping, drilling, strap, saddle and the like:

Measurement shall be made for the number of Brass Ferrule Assembly installed and completed in all respects.

Payment shall be made for the number of Brass Ferrule Assembly measured as above at the unit price for each full compensation for providing handling, fixing and jointing.

F). Dead Ends

Provide and lay dead end with PCC class C as per drawings:

Measurement shall be made for the number of Dead Ends installed and completed in all respects.

Payment shall be made for the number of Dead Ends measured as above at the unit price for each full compensation including PCC concrete C.

14.11.2 SEWER PIPE LINE AND APPURTENANCES

Measurement and payment of excavation and compacted back-filling in trenches shall be made in compliance / accordance with the provisions of 14.2 "Earth Work".

Measurement of concrete and steel reinforcement shall be in accordance with the provisions of specification relevant Chapter-3 "Concrete".

Measurement and payment for sanitary sewers will be made in accordance with the provisions given hereafter.

(i) Bedding

The quantity to be paid for under this item will be the number of cubic meter of bedding material acceptably provided & placed under sewers complete in all respects as per relevant drawings.

Payment shall be made for the number of cubic meter (m³) of bedding material measured as provided above at the Contract Unit Price and rate per cu. m (m³) and shall constitute full compensation for all work related to the item.

(ii) Sewers

Measurement shall be made at site of the actual lengths of uPVC Sewer pipes of different sizes and class, supply, installed and tested, as authorized for payment under this contract. The measurement will be made along the center line of the pipe and between the inside walls of manholes or junction chambers. The unit of measurement will be linear meter.

The unit rate quoted in the priced B.O.Q. for uPVC pipes shall include full compensation for the cost of pipes, supplying, testing, labor, fittings, coupling, sleeves, nuts, sockets, plugs, specials, Tees, Joints & jointing material, cleaning of sewer lines and cost of all incidentals for completion of this item of work as per specifications laid down in this section.

(iii) Septic Tank/ Manholes/Miscellaneous

Earthwork and Concrete Works:

Measurement and payment of excavation and compacted back-filling shall be made in accordance with the provisions of 16.2 "Earth Work".

Measurement of concrete and steel reinforcement shall be in accordance with the provisions of relevant chapter-3 of "Concrete".

Vent Pipe

Measurement shall be made in numbers.

Measurement for vent pipe shall be made for providing and fixing of vent pipe as shown on drawing in number including clamp with wire gauze and shall constitute full compensation for all work related to the item.

Payment shall be made for providing and fixing as shown on drawing in number and shall constitute full compensation for all work related to the item including labor, equipment and all necessary to furnish the item.

Bitumen Coating:

Providing and applying 2-coats of hot Bitumen.

Measurement shall be made in square meter (m²) on providing and applying 2-coats of hot Bitumen. Each coat shall have 1.70kg/m² bitumen coating.

Payment shall be made for providing and applying 2-coats of hot Bitumen in square meter (m²) and shall constitute full compensation for all work related to the item including labor, equipment and all necessary to furnish the item.

Water Stopper

Providing and fixing of water stopper.

Measurement shall be made in running meter (m).

Payment shall be made for providing and fixing the water stopper in running meter and shall constitute full compensation for all work related to the item including labor, equipment and all necessary to furnish the item.

Manhole covers

Measurement of RCC manhole covers shall be made in No. of covers installed.

Payment shall be made for providing and fixing RCC manhole covers for the No. of covers installed at the unit price / rate for each and shall constitute full compensation for all work related to the item including labor, equipment and all necessary to furnish the item. Payment also includes cast iron rings, anchors, Notch, rebars and other misc. to furnish the Manhole cover.

Galvanized Mild Steel Rungs

Measurement for providing and installing the rungs shall be made in Nos.

Payment shall be made for No. of rungs Installed at the unit price for each and shall constitute full compensation for all work related to the item including labor, equipment and all necessary to furnish the item.

Crush Stone/ Aggregate

Measurement of crush stone/ aggregate shall be made in cubic meter. Size of the aggregates shall be as mentioned in BOQ or as specified in specifications.

Payment shall be made for crush stone/ aggregate includes the cost of supplying, spreading to required levels including labor, equipment, tools and all necessary to furnish the item.

(iv) House Connections

Measurement shall be made for the number of units of house connections provided & installed at site as per specifications & drawings complete in all respects.

Payment will be made for the number of units of House connections as measured above at the contract unit price for each unit and will constitute full compensation for supply, lay and joint 150 mm dia uPVC class C pipe for house connection including all excavation, backfilling, testing and all other works related to complete the item in accordance with lines and grades as shown or envisaged in the drawings or as directed or instructed by the Project Manager.

(v) Cast Iron Manholes Cover with Frame (in-house)

Measurement shall be made for the number of CI manholes covers with frame as per Specifications laid down in this section and to the approval of the Project Manager.

Payment shall be made for each CI manhole covers with frame as complete unit at the Contract Unit Price to provide and fixing. Measurement and payment for construction of manhole including plastering on both sides, PCC class B, PCC class D lean and crush stones/Aggregate shall be made separately in the relevant pay item of Bill B.

14.11.3 PLUMBING, FIXTURES AND ACCESSORIES

(i) General

Measurement and payment of sewer lines shall be made in conformity / accordance with the provisions of relevant section "Sewer Pipe Lines and Appurtenances". Measurement and payment of concrete and block masonry shall be in conformity / accordance with the provisions relevant chapter-3 of "Concrete". Measurement and payment for excavation and backfilling shall be made as per provisions of 16.2 "Earthwork. Measurement and payment of manholes covers shall be made as per provisions in relevant M&P section of Sewer Pipe Lines and Appurtenances".

All specials with Joints are included in the unit rate of each item for the followings.

(ii) Provide and Install wash hand basin, a complete set acceptably provided and installed as per BOQ, complete in all respects. No measurement of ancillary materials and works required to complete the item in position shall be made. No separate measurement shall be made for connections; coupling, waste pipes S or P traps fittings and fixtures and the like.

Payment shall be made for each set installed and shall constitute full compensation for the sanitary ware, all the ancillary fittings and for all the works related to the item.

(iii) Provide and Install complete

- a. Basin Mixer including connections
- b. Kitchen Sink
- c. Sink Mixer including connections
- d. Water Closet Squatting type with Cistern
- e. Water Closet European type with Cistern
- f. Urinals with cistern.

Measurement for above (a to f) shall be made in numbers acceptably provided and installed. No separate measurement shall be made for flushing cisterns, flushing bends, water inlet

connection, waste outlet connection; coupling, waste pipes S or P traps fittings and fixtures and the like.

Payment for above (a to f) for the numbers measured as above shall be made at the unit price per number of the respective item and shall constitute full compensation for the sanitary ware, all the ancillary fittings and for all the works related to the item.

(iv) Provide and Install

- a. Toilet Paper Holder
- b. Shower Mixer Complete with Stop Cocks, Bib Cock.
- c. Tooth Brush Holder and Tooth Paste Dish
- d. Gully Trap with Chamber
- e. Floor Trap with Chamber

Measurement shall be made for each item in numbers acceptably provided and installed complete in all respects. No measurement of ancillary materials and works required to complete the item in position shall be made.

Payment for the number of items measured as above shall be made at the unit price and rate per number of the respective item as per specifications/drawings and shall constitute full compensation for all the works related to item.

(v) Provide and Install uPVC Pipe (Soil, Waste & Vent with Joint)

Measurement of uPVC pipes shall be made in linear meters, joints, jointing material, clamps and fittings shall not be measured separately.

Payment of the number of linear meters of pipes measured as above shall be made at unit rate / price per linear meter for respective item which constitute full compensation for all the work related to item including jointing, jointing material, clamps and fittings.

(vi) Provide and Install 13 mm or 19 mm Dia CP Tee Stop Cock, Bib Cock, Mixing Valve, Pillar Cock

Measurement shall be made of each item in numbers acceptably provided and installed in position complete in all respects.

Payment shall be made in linear meters of pipe installed in position No separate measurement shall be made for joining, fixing and painting.

(vii) P&F Cast Iron Heads and Shoes to the Rain Water down Pipe

Measurement shall be made in numbers of each item acceptably fixed in position. No separate measurement shall be made for joining, fixing and painting.

Payment shall be made for the numbers measured as above at the unit rate which shall be full compensation for all the work related therein.

(viii) Provide & install Electric water heater

Measurement of acceptably completed works of water heater installed in position as required shall be made on the basis of each item.

Payment shall be made for each item as mentioned above at the unit price and rate per item. Electric water heaters fixed on the wall shall be supported by brackets anchored into the wall. The heaters thereof shall be connected or electric supply, incoming cold water supply and outgoing hot water supply. The heaters shall be tested for water leakage, thermostat control and requisite supply of hot water and the rate shall include complete unit inclusive of all work from inlet connection of water supply to outlet. Complete in all respects with all accessories.

14.11.4 WATER SERVICES

- (i) Provide and Lay PPR Pipes and Specials inside Buildings and in Trenches:

Measurement of PPR pipes acceptably installed complete in all respects as per relevant specifications and drawings or as directed or instructed by the Project Manager shall be made in linear meters. Joints and jointing material shall not be measured separately.

Payment shall be made for acceptable measured quantity of PPR pipes and fittings on the basis of unit price and rate per linear meter and shall constitute full compensation for all the works including earth work; pipe joints clamps; brackets and sleeves; cutting and breaking concrete and masonry in walls and floors and making good or reinstating with mortar or concrete as required; protective painting and coating where required and cleaning and testing related to the items. Fittings for PPR pipes shall cover or include sockets, bends, elbows, reducers, tees and nipples.

- (ii) Provide and Install

- a) - CP Bottle Trap with CP 32 mm dia Waste Pipe
- b) - Brass or Gun Metal Peet Valve Heavy Pattern
- c) - CP double bib tap with Muslim shower
- d) - CP bib tap screw down type

Measurement of acceptably completed works of fixtures and equipment furnished installed in position as required shall be made on the basis of each item.

Payment shall be made for each item as mentioned above at the unit price and rate per item and shall constitute full compensation for all the works related thereto.

14.12 INTERNAL ELECTRIFICATION

14.12.1 SUPPLY AND INSTALLATION OF BUILDINGS INTERNAL ELECTRIFICATION

Measurement for payment for Internal Electrification and Telecom of Buildings structures shall be on the lump sum basis per Block/Building in accordance with the Drawings and Specifications and as directed by the Project Manager.

The unit prices shall include all costs for supply, installation, wiring testing and commissioning of the complete internal electrical system, telephone points, AC & Water Heater points, TV Cable points, Ethernet points, Earthing system, lightning protection system, LV cable from meter to distribution board and miscellaneous items for each category of residence, HVAC in the Hospital, street lights and water lights in WAPDA Club identified in the Bill of Quantities. Final payment for the supply and installation of internal electrification inclusive of cabling shall be made only on the basis of the blocks/buildings entered and no adjustments of the unit rates shall be made should the final installed quantity vary from that shown in the Bill of Quantities.

14.12.2 CABLE TRAYS AND PVC DUCTS

Measurement for payment for the supply and installation of cable trays and PVC ducts for laying cable will be made on unit prices for each type. The unit prices shall include, but not be limited to the cost of all supply, installation and labor of material, requisitioning, loading, transporting, from site storage areas to the sites, erecting together with bolts, nuts, washers and all other associated works necessary for the completion of the cable tray/ duct ready for installation of cables thereon.

14.12.3 SUPPLY AND INSTALLATION OF PARK LIGHT

Measurement for payment for the supply and installation of Park Lights within the premises of each

category of building shall be on the lump sum basis per Block/Building in accordance with the Drawings and Specifications and as directed by the Project Manager.

The unit prices shall include all costs for supply, installation, wiring testing, programming and commissioning of the complete systems inclusive of all casings, connections, cables, switches, mounting systems, and miscellaneous items for category of structure/building identified in the Drawings.

14.12.4 SUPPLY AND INSTALLATION OF FIRE DETECTION AND ALARM SYSTEMS

Measurement for payment for the supply and installation of Fire Detection and Alarm Systems shall be on the lump sum basis per Block/Building in accordance with the Drawings and Specifications and as directed by the Project Manager.

The unit prices shall include all costs for supply, installation, wiring testing, programming and Commissioning of the complete systems inclusive of all casings, connections, cables, switches, mounting systems, smoke detectors, base accessories, alarm arrangements and miscellaneous items for category of structure/building identified in the Bill of Quantities.

14.12.5 SUPPLY AND INSTALLATION OF ELEVATOR

Measurement for payment for the supply and installation of Elevator shall be a on the lump sum basis in accordance with the manufacturer / supplier specifications.

The unit prices shall include all costs for design, supply, installation, wiring testing, programming and Commissioning of the complete systems inclusive of all casings, connections, cables, switches, mounting systems, miscellaneous items for the elevator and allied systems.

14.12.6 SUPPLY AND INSTALLATION OF DATA AND ETHERNET

Measurement for payment for the supply and installation of Data and Ethernet Points shall be on the lump sum basis per Block/Building in accordance with the Drawings and Specifications and as directed by the Project Manager.

The unit prices shall include all costs for supply, installation, wiring testing, programming commissioning of the complete systems inclusive of all casings, connections, cables, switches, mounting systems, and miscellaneous items for category of structure/building identified in the BOQ

14.13 STONE MASONRY WORKS

14.13.1 DRESSED COURSED STONE MASONRY

Measurement

The quantity of stone masonry to be paid (to be used anywhere either in road side retaining walls, retaining walls between the houses, road side drain, cascade and the like) shall be the number of cubic meters measured in the completed work and the limiting dimensions shall not exceed than those shown on the drawings or required by the Project Manager.

Lean concrete shall be measured separately as per dimensions shown or envisaged on the drawings or as directed or instructed by the Project Manager. No separate measurement shall be made for stuck pointing, which is deemed to be covered or included in stone masonry with mortar, however roll pointing shall be measured separately in square meters (m²).

Payment

The quantities determined as specified above shall be paid for at the unit price and rate respectively for each of the particular pay items listed below and shown or envisaged in the Bill of

Quantity (BOQ), which price and payment shall be full compensation for labor, materials, tools, equipment and incidentals to complete the item as specified above and all included as per specifications. XPS foam board 25mm thickness shall be used after every ± 20 m span as expansion joint in stone masonry retaining walls. The cost of XPS foam board is included in the pay item of stone masonry.

Description	Unit of Measurement
Stone Masonry Dressed Coursed with mortar (c/s 1:4).	Cubic Meter (m ³)
Stone Masonry Dressed Coursed with mortar (c/s 1:3).	Cubic Meter (m ³)

14.13.2 FILTER MATERIAL

Measurement

A filter layer of granular material, shall be measured separately by the cubic meters (m³), in place and accepted,

The computation of the quantities shall be based on the volume within the theoretical limiting dimensions designated or envisaged on the Drawings.

Payment

The quantities, measured as provided above shall be paid for at the unit price and rate shown or particularized in the Bill of Quantities (BOQ). Payment shall be full compensation for furnishing all materials, labor, equipment, tools supplies and all other costs related to completion of the work.

Description	Unit of Measurement
Filter Layer of granular Material	m ³

14.13.3 REINFORCED CONCRETE MANHOLE COVERS

The quantities of RCC manhole covers shall be measured in number as per actual.

The payment of RCC manhole covers, measured as specified above shall be paid for at the unit price and rate per number, which payment shall be full compensation for furnishing all labour, materials, tools, equipment's and incidentals and for performing all the works involved in applying coat complete in place, as shown or envisaged on the drawings and in accordance with the Specifications.

Description	Unit of Measurement
RCC Manhole Cover	No.

14.13.4 PROVIDING AND PLACING UPVC CLASS C PIPES

The quantities of uPVC pipes shall be measured in meters.

The payment of uPVC pipes, measured as specified above shall be paid for at the unit price and rate in meters, which payment shall be full compensation for furnishing all labour, materials, tools, equipment's and incidentals and for performing all the works involved in supplying and fixing uPVC pipes complete in place, as shown or envisaged on the drawings and in accordance with the Specifications.

Description	Unit of Measurement
-------------	---------------------

uPVC Class C Pipe 100 mm Dia	Meter (m)
uPVC Class C Pipe 50 mm Dia	Meter (m)

14.13.5 GEOTEXTILE CLOTH

Measurement

The quantity of each element to be paid shall be as specified in BOQ, furnished and installed in place as per drawing or as directed by the Project Manager.

Payment

The quantities measured as determined above shall be paid at the unit price for the pay item as shown in the Bill of Quantities for which price and payment shall be full compensation for furnishing all labour, materials, tools, equipment, including nails, washers and other consumable items duly certified/approved by the Project Manager.

14.14 DISMANTLING

Dismantling (Demolition) shall be carried out as directed by the Engineer and it shall cover the costs of removing the items as indicated in the BOQ or as directed by the Engineer. The sum tendered shall include the cost of removing building items, paving, electrical plumbing, and fencing, and hauling materials to approved spoil areas. Foundation slabs, water reticulation may be left in place. The sum tendered shall include the costs of landscaping to reinstate the site to design condition.

The quantities measured as determined above shall be paid at the unit price for the pay item as shown in the Bill of Quantities for which price and payment shall be full compensation including tool, equipment and all other necessary to furnish the items.



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

DASU HYDROPOWER PROJECT

BIDDING DOCUMENT

NCB NO: DASU- RS-02

PROCUREMENT OF SMALL WORKS

CONSTRUCTION OF SCHOOLS

(Construction of GBPS Looter and Rehabilitation of GBPS Shah Jahanabad)

Section VII

WORKS REQUIREMENTS

Volume 2(b)

– Drawings

**GENERAL MANAGER/ PROJECT DIRECTOR
DASU HYDROPOWER PROJECT
DASU, PAKISTAN**

❖ OCTOBER 2024

LIST OF DRAWINGS		
PACKAGE-2		
DRAWINGS OF RELOCATED PRIMARY SCHOOLS BOYS)		
SR. #	DWG. NO.	TITLE
1	RS-001	LOCATION MAP OF RELOCATED SCHOOLS SHAH JAHANABAD
2	RS-001	LOCATION MAP OF RELOCATED SCHOOLS LOOTER
1. ARCHITECTURAL		
PRIMARY SCHOOL TYPICAL ARCHITECTURAL DRAWINGS		
3	141-041	Ground Floor Plan-Primary School (Sheet-1)
4	141-041	First Floor Plan-Primary School (Sheet-2)
5	141-041	Roof Plan-Primary School (Sheet-3)
6	141-042	First Floor Plan-Primary School (Sheet-1)
7	141-042	Section AA-Primary School (Sheet-2)
8	141-043	Toilet Details(Plan & Elevation)-Primary School
9	141-044	Finshing Schedule-Primary School
PACKAGE-2 (RELOCATED SCHOOLS)		
10	141-051	(GBPS) Govt. Primary School Relocated Looter Layout Plan (Sheet-1)
11	141-051	(GBPS) Govt. Primary School Relocated Looter Section-A-A (Sheet-2)
12	141-054	(GBPS) Govt. Primary School Existing School at Shah Jahanabad Layout Plan (Sheet-1)
13	141-054	(GBPS) Govt. Primary School Renovated School at Shah Jahanabad Ground Floor Plan (Sheet-2)
14	141-054	(GBPS) Govt. Primary School Renovated School at Shah Jahanabad First Floor Plan (Sheet-3)
15	141-054	(GBPS) Govt. Primary School Renovated School at Shah Jahanabad Section-A-A (Sheet-4)
ARCHITECTURAL TYPICAL / MISCELLANOUS DETAILS		
16	141-052	Door Elevations & Typical Detail (Sheet-1)
17	141-052	Windows Safety Grill Details(Sheet-2)
18	141-052	Miscellanous Typical Details (Sheet-3)
19	141-052	Miscellanou Details-S.S Railing (Sheet-4)
20	141-052	Miscellanou Details-M.S Railing (Sheet-5)
21	141-052	Miscellanou Details-M.S Railing (Sheet-6)
22	141-052	Kitchen Cabinet Details(Sheet-7)
23	141-052	Bath Vanity Detail (Sheet-9)
24	141-052	Building Boundary Wall Detail (Sheet-10)

ARCHITECTURAL DRAWINGS

PRIMARY SCHOOL

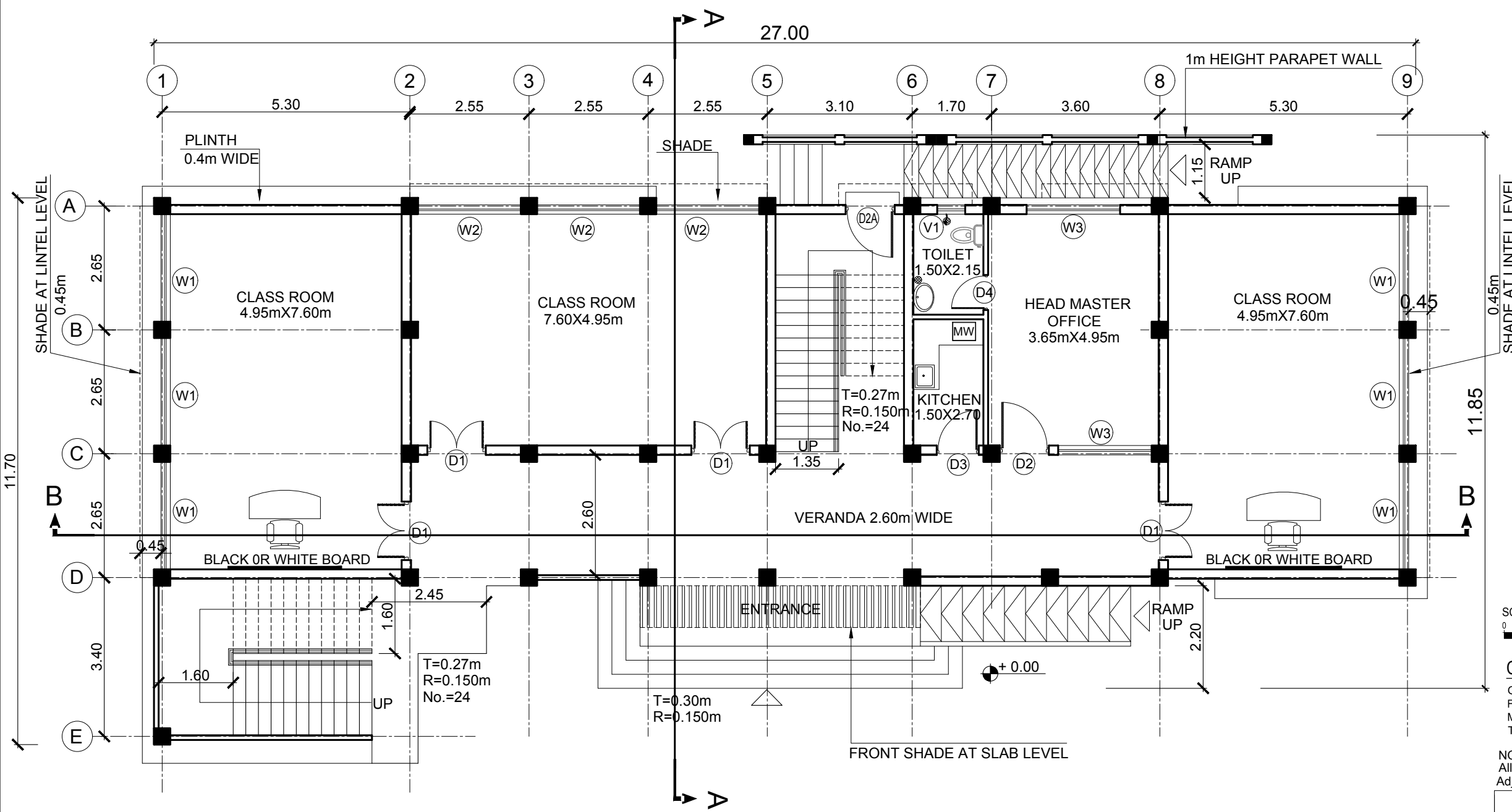


ARCHITECTURAL DRAWINGS

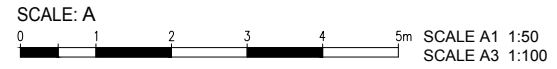
PRIMARY SCHOOL

SCHEDULE OF DOORS & WINDOWS

TYPE	WIDTH	HEIGHT	SILL	QTY.	DESCRIPTION	MATERIAL
D1	1.25m	2.45m	-	8 No.	DOUBLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2	1.05m	2.15m	-	2 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2A	1.05m	2.15m	-	1 No.	SINGLE LEAF DOOR	STEEL DOOR
D3	0.90m	2.15m	-	3 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D3A	0.90m	2.15m	-	1 No.	SINGLE LEAF DOOR	STEEL DOOR
D4	0.75m	2.15m	-	2 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
W1	2.30m	1.50m	0.95m	12 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
W2	2.20m	1.50m	0.95m	6 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
W3	2.00m	1.50m	0.95m	4 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
V1	0.60m	0.60m	1.55m	2 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER



GROUND FLOOR PLAN
SCALE A = 1:100



COVERED AREAS:-

GROUND FLOOR	= 258.9m ²
FIRST FLOOR	= 267.9m ²
MUMTY	= 67.66m ²
TOTAL COVERED	= 594.46m²

NOTES:-
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
GROUND FLOOR PLAN
SHEET(1)

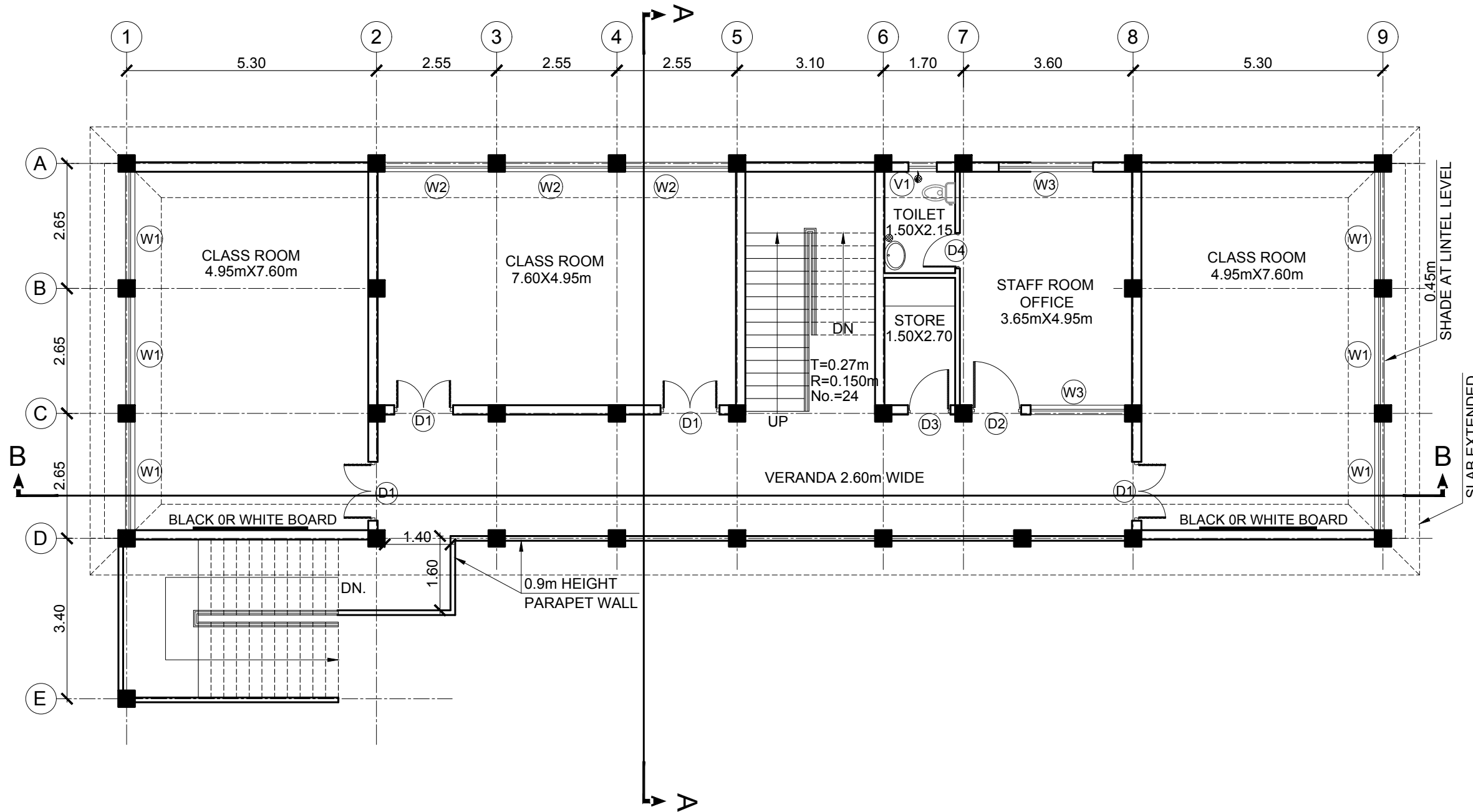
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER CONSULTANTS
DATE: SEP/2024
DRAWING No. 141-041

JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

SCHEDULE OF DOORS & WINDOWS

TYPE	WIDTH	HEIGHT	SILL	QTY.	DESCRIPTION	MATERIAL
D1	1.25m	2.45m	-	8 No.	DOUBLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2	1.05m	2.15m	-	2 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2A	1.05m	2.15m	-	1 No.	SINGLE LEAF DOOR	STEEL DOOR
D3	0.90m	2.15m	-	3 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D3A	0.90m	2.15m	-	1 No.	SINGLE LEAF DOOR	STEEL DOOR
D4	0.75m	2.15m	-	2 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
W1	2.30m	1.50m	0.95m	12 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
W2	2.20m	1.50m	0.95m	6 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
W3	2.00m	1.50m	0.95m	4 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
V1	0.60m	0.60m	1.55m	2 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER



FIRST FLOOR PLAN
SCALE A = 1:100



COVERED AREAS:-

GROUND FLOOR	= 258.9m ²
FIRST FLOOR	= 267.9m ²
MUMTY	= 67.66m ²
TOTAL COVERED	= 594.46m²

NOTES:-
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

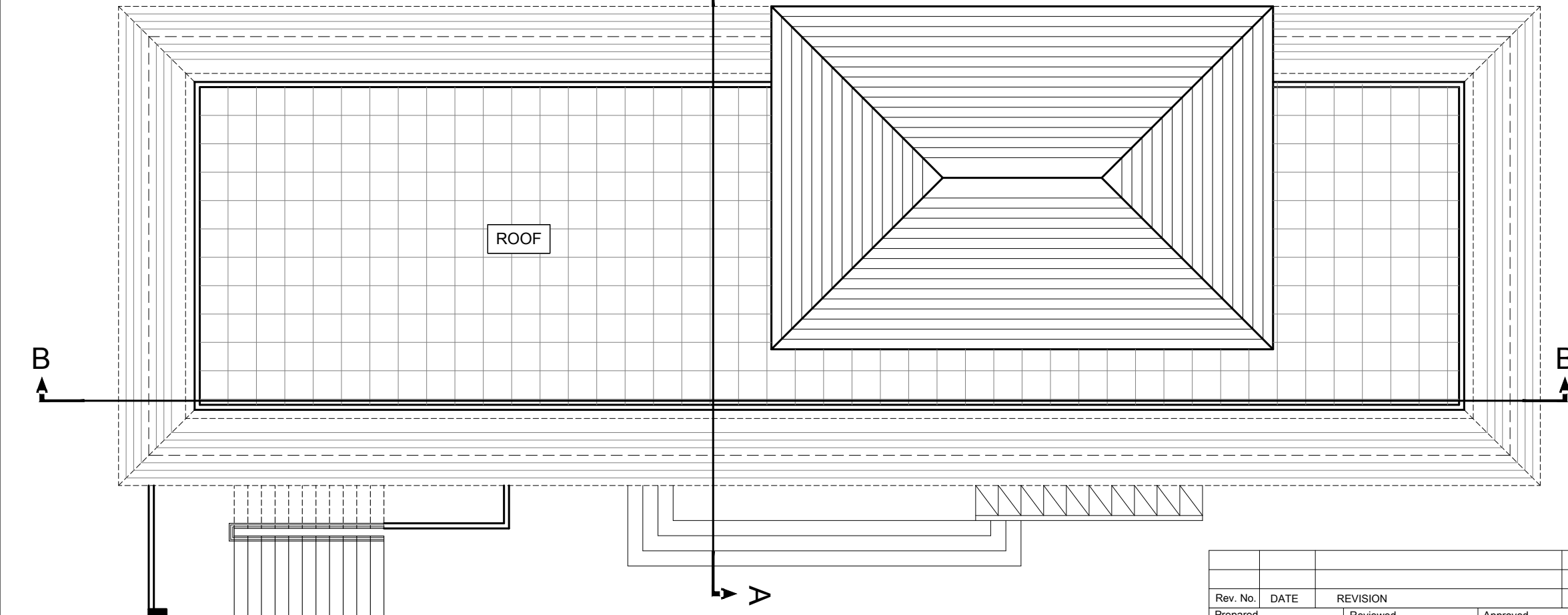
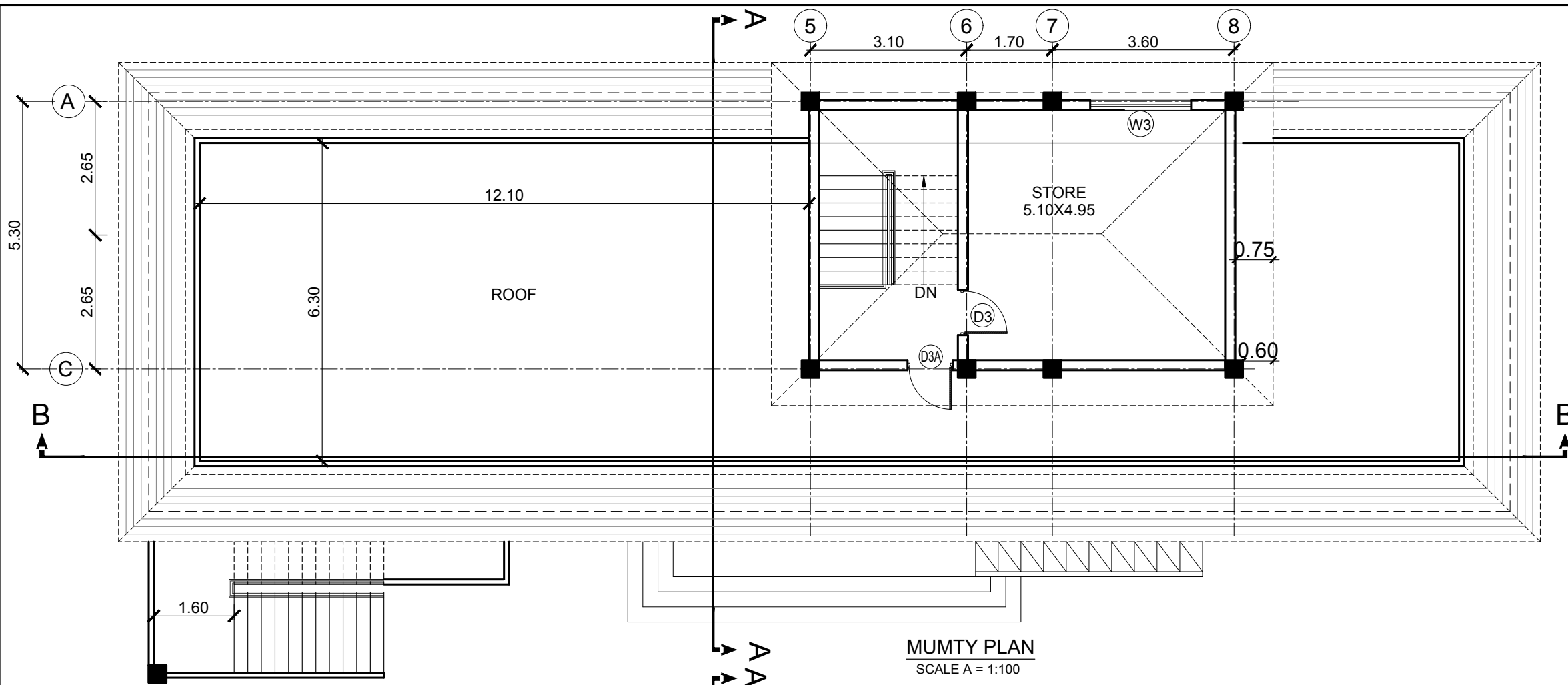
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
FIRST FLOOR PLAN
SHEET(2)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER CONSULTANTS
DATE: SEP/2024
DRAWING No. 141-041
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSTAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.



COVERED AREAS:-

GROUND FLOOR	= 258.9m ²
FIRST FLOOR	= 267.9m ²
MUMTY	= 67.66m ²
TOTAL COVERED	= 594.46m²



NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **PRIMARY SCHOOL**
MUMTY & TOP ROOF PLAN
SHEET(3)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: **SEP/2024**
DRAWING No. **141-041**



FRONT ELEVATION
SCALE A =1:100

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
PRIMARY SCHOOL
FRONT ELEVATION (SHEET-1)

SCALE: A
0 1 2 3 4 5m
SCALE A1 1:50
SCALE A3 1:100

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

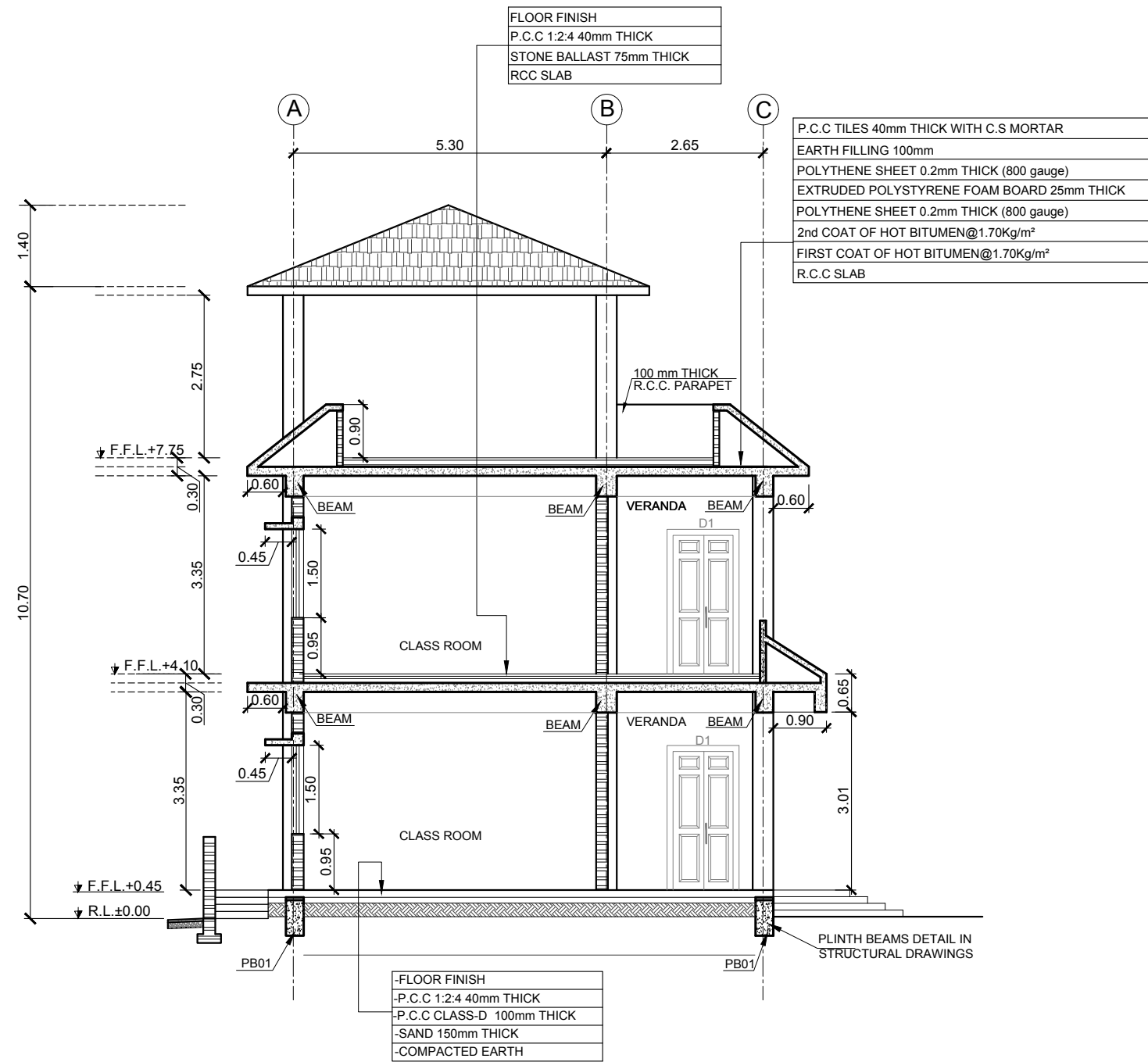
DASU HYDROPOWER CONSULTANTS

DATE: SEP/2024



JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No.
141-042



SECTION-AA
SCALE A= 1:100

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

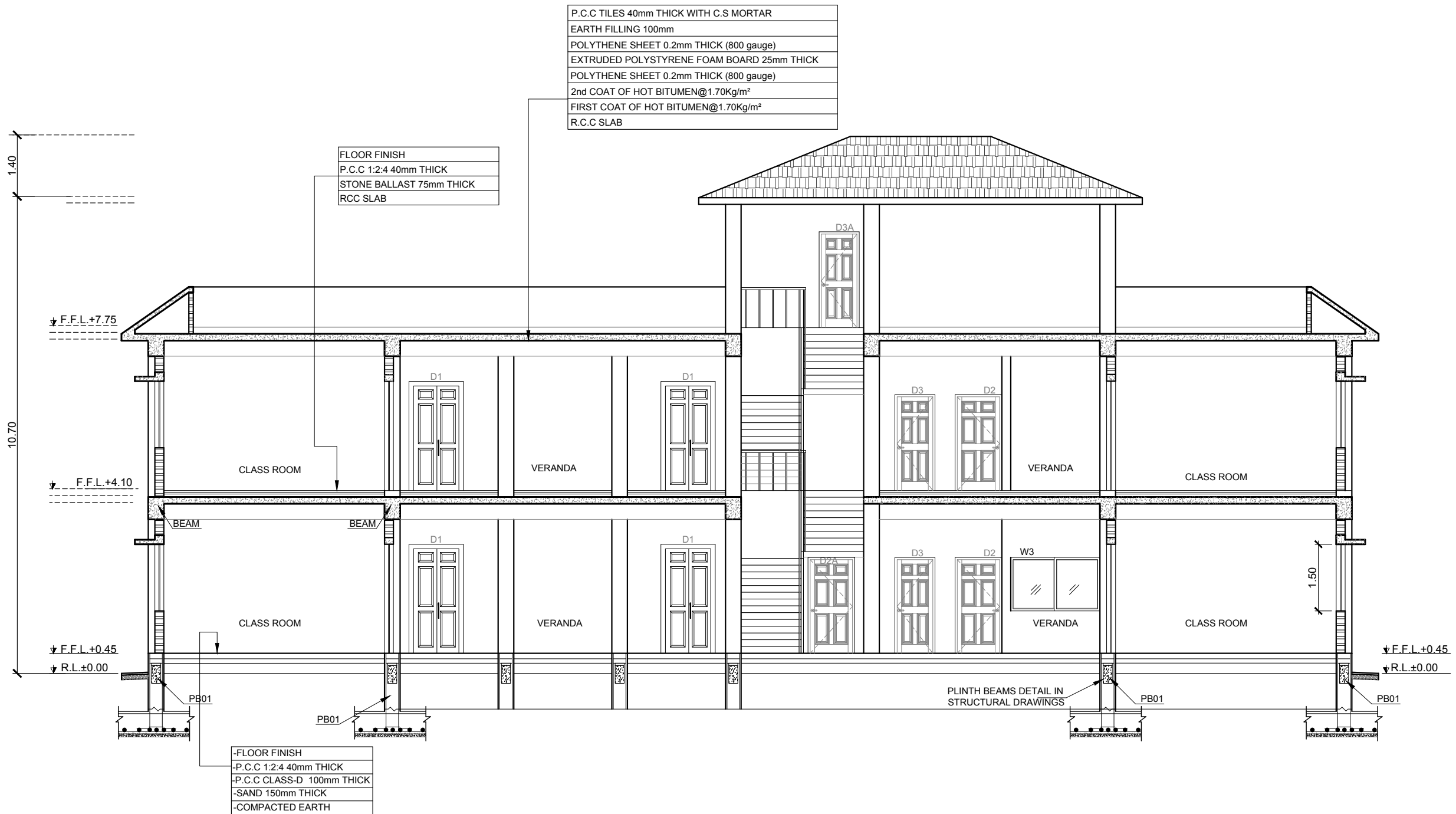
DRAWING TITLE:
PRIMARY SCHOOL
SECTION AA (SHEET-2)

DASU HYDROPOWER CONSULTANTS
DATE: SEP/2024
DRAWING No. 141-042



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DHC
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.



SECTION-BB
SCALE A= 1:100

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
PRIMARY SCHOOL
SECTION BB (SHEET-3)

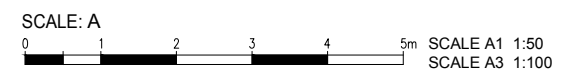
DASU HYDROPOWER CONSULTANTS

DATE: Sep 2024



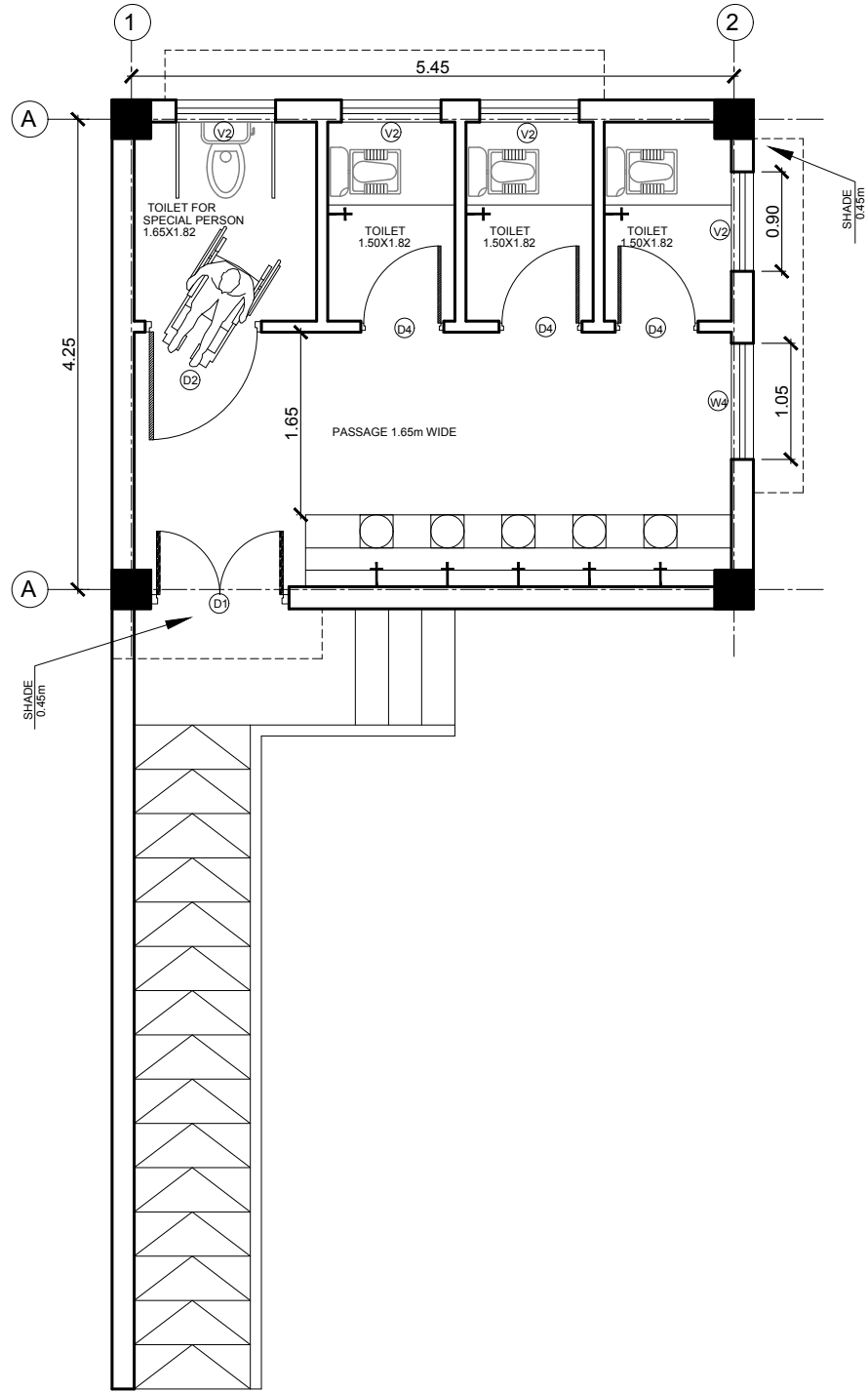
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No.
141-042

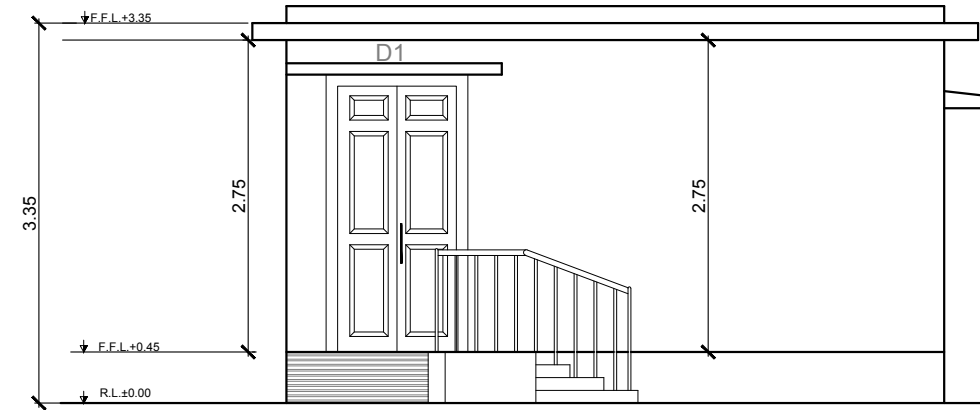


Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

SCHEDULE OF DOORS & WINDOWS						
TYPE	WIDTH	HEIGHT	SILL	QTY.	DESCRIPTION	MATERIAL
D1	1.25m	2.15m	-	1 No.	DOUBLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2	1.05m	2.15m	-	1 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D4	0.75m	2.15m	-	3 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
W4	1.05m	1.20m	0.95m	4 No.	OPENABLE WINDOW	MS.GLAZED WINDOW
V2	0.90m	0.60m	1.55m	4 No.	OPENABLE VENTILATOR	MS. GLAZED VENT

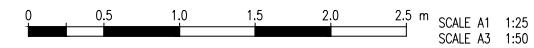


TOILET DETAIL PLAN
SCALE A =1:50



COVERED AREAS:-
 GROUND FLOOR = 27.535m²
 TOTAL COVERED = 27.535m²

NOTES:-
 All dimensions are in meters unless otherwise mentioned
 Adjacent Road Level assumed ± 0.00



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
**PRIMARY SCHOOL
TOILETS DETAIL**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER CONSULTANTS

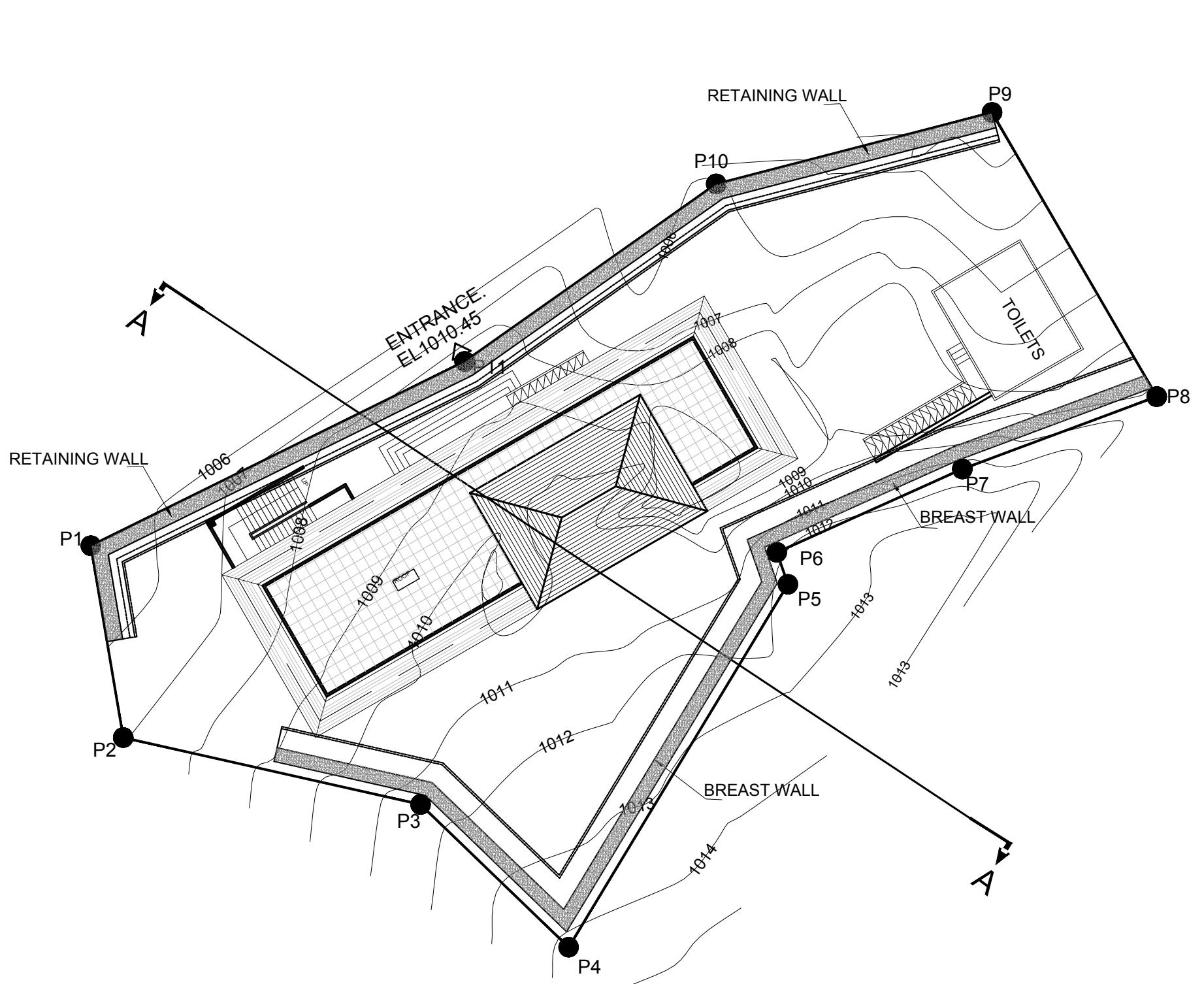


JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

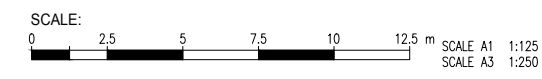
DRAWING No.
141-043

PACKAGE-2 SCHOOLS
SITE PLANS



Relocation of GPS Looter		
Point No.	Easting	Northing
P1	3222060.659	1256586.015
P2	3222062.302	1256576.306
P3	3222077.353	1256572.921
P4	3222084.847	1256565.696
P5	3222095.952	1256584.060
P6	3222095.387	1256585.679
P7	3222104.778	1256589.895
P8	3222114.619	1256593.558
P9	3222106.283	1256607.936
P10	3222092.318	1256604.319
P11	3222079.581	1256595.336
Area		
Area (m ²)	1022.7456	
Kanal(s)	Marla(s)	
2	0	

LAYOUT PLAN
SCALE A = 1:250



NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

BID DRAWING FOR No. DASU-RS-02
Relocation of Affected Schools-Dasu

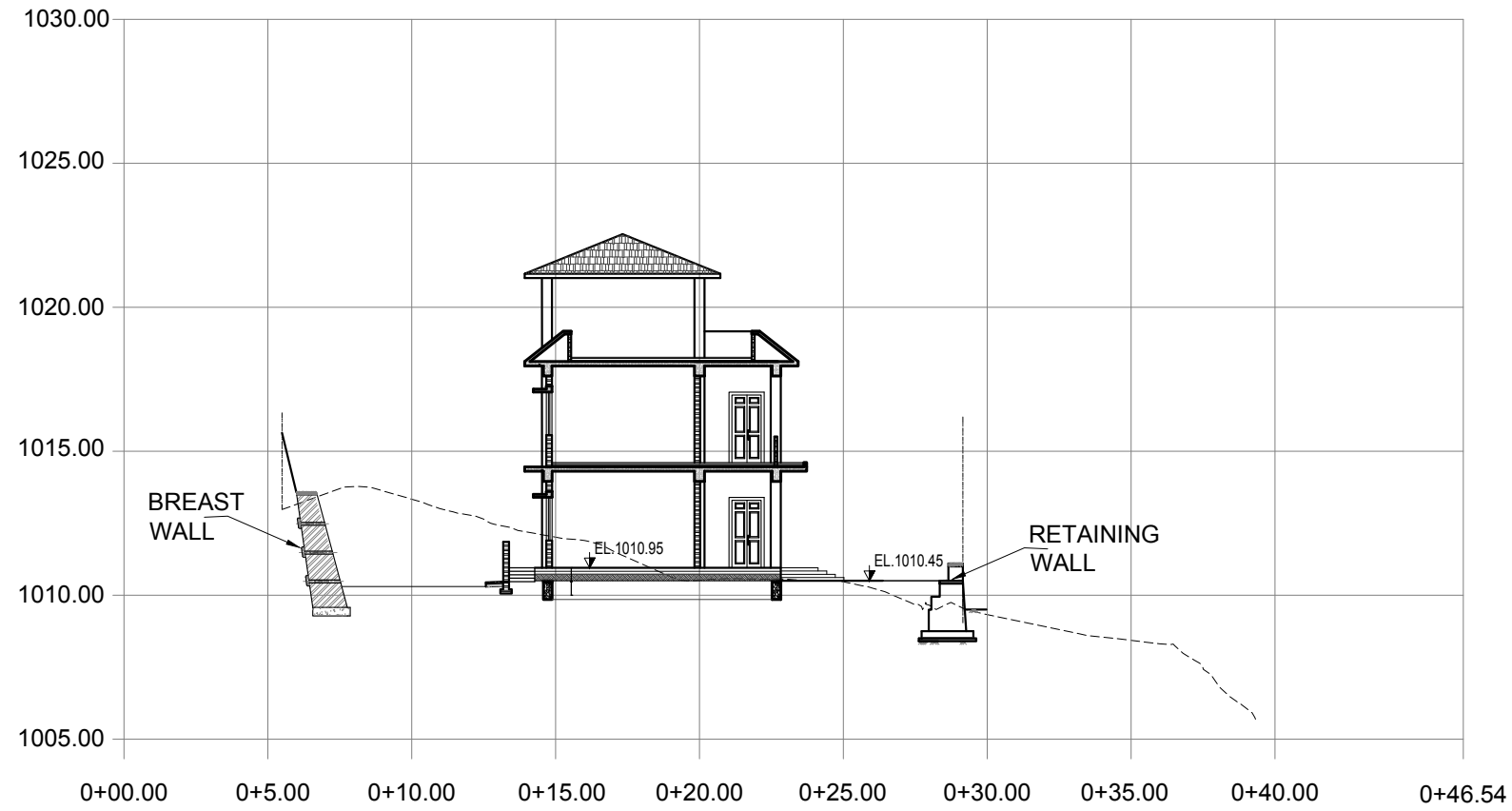
DRAWING TITLE:
GOVT. BOYS PRIMARY SCHOOL (GBPS)
RELOCATED LOOTER
LAYOUT PLAN (SHEET-1)

DASU HYDROPOWER CONSULTANTS DATE: SEP/2024

JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No. 141-051

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia Nazir		Name: Imtiaz Hussain	Name: H. Nishimia



SECTION A-A
SCALE A =1:250

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

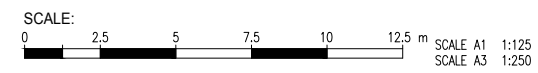
DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

BID DRAWING FOR No. DASU-RS-02
Relocation of Affected Schools-Dasu

DRAWING TITLE:
GOVT. BOYS PRIMARY SCHOOL (GBPS))
RELOCATED LOOTER
SECTION-AA (SHEET-2)



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

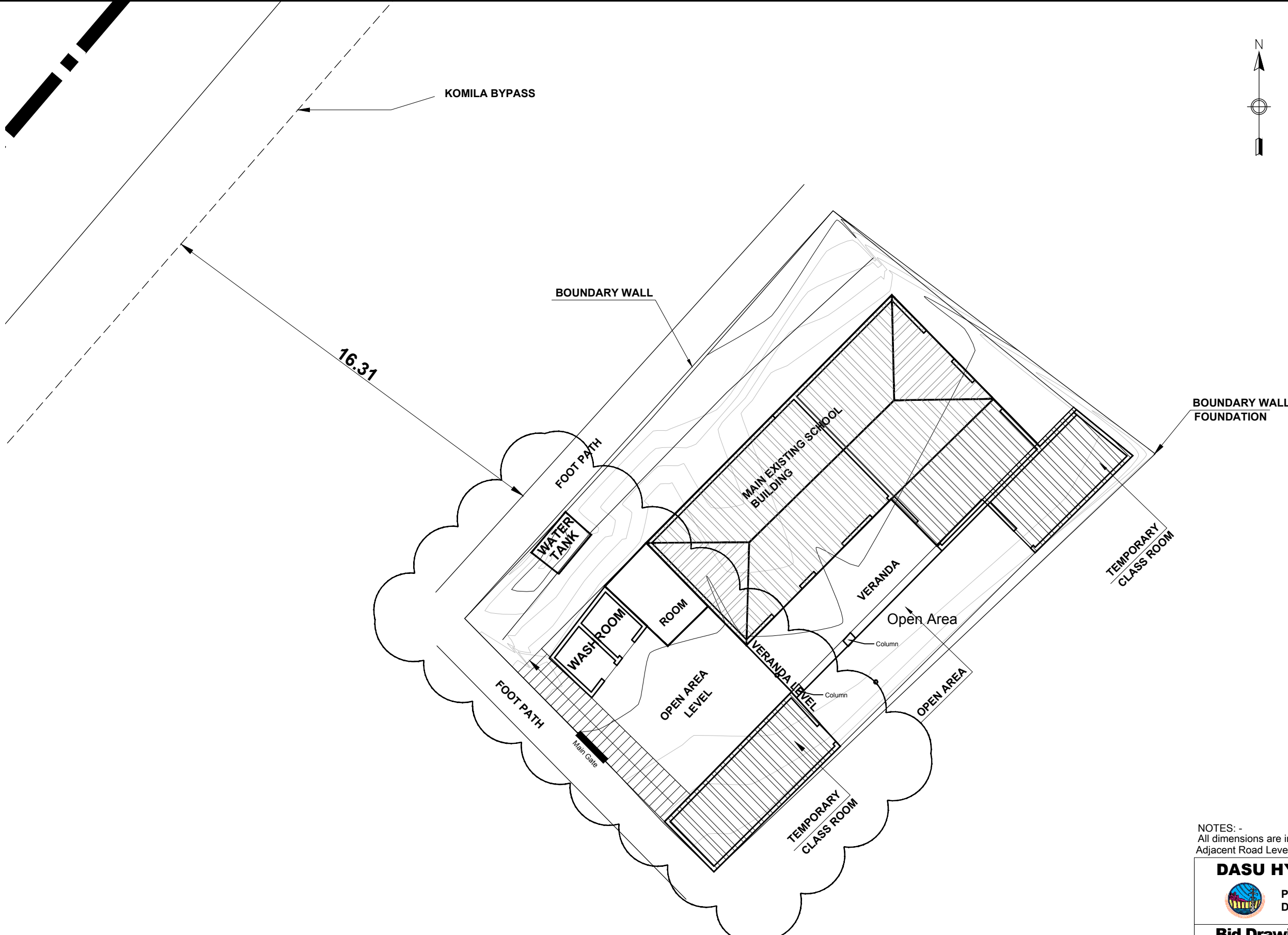
DASU HYDROPOWER CONSULTANTS



JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLGAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-051




EXISTING LAYOUT PLAN
SCALE A = 1:150



NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00


DASU HYDROPOWER PROJECT

 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA**

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**GOVT. BOYS PRIMARY SCHOOL (GBPS)
EXISTING SCHOOL AT SHAHJAHANABAD
LAYOUT PLAN (SHEET-1)**

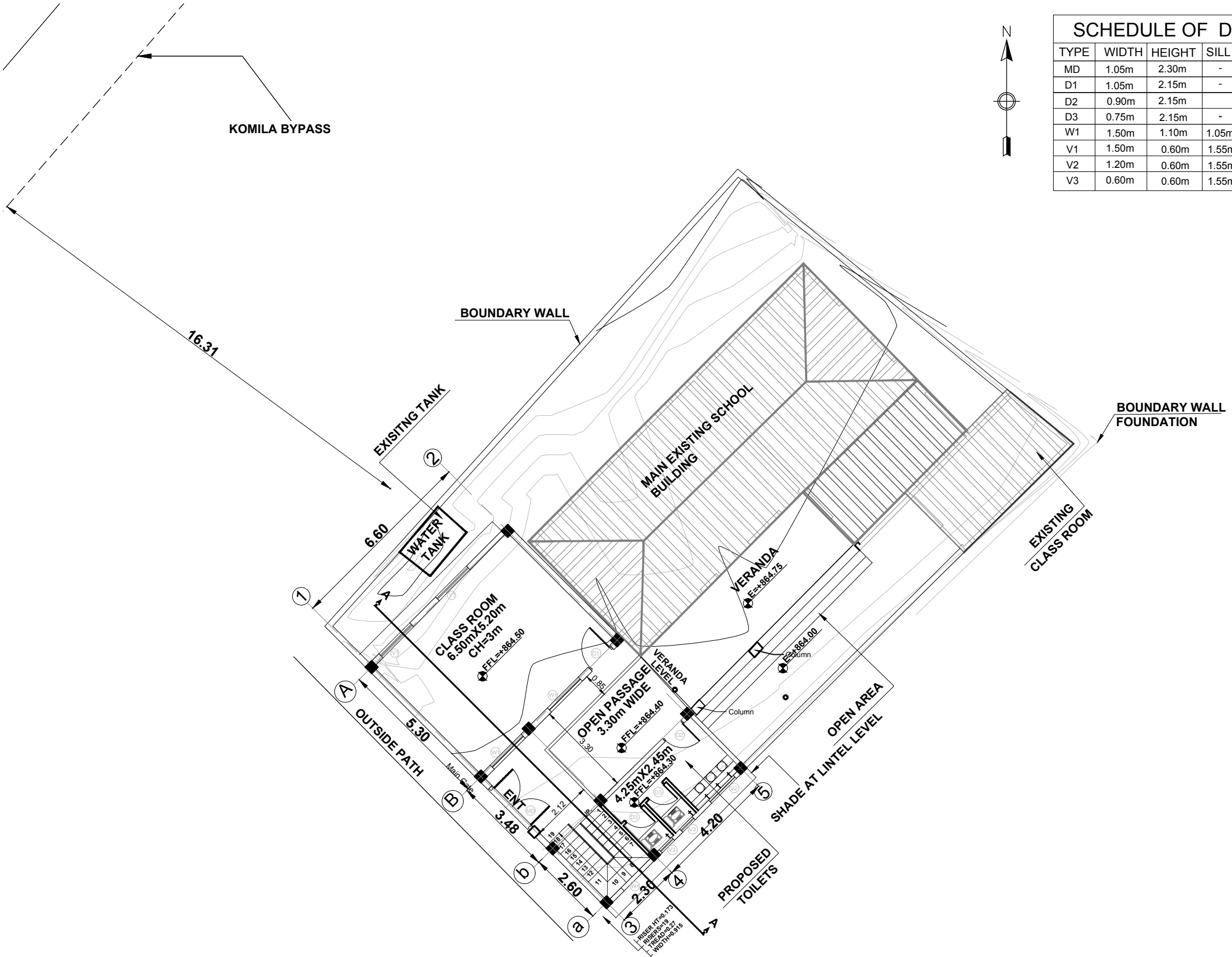
DASU HYDROPOWER CONSULTANTS

 JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: Sep 2024

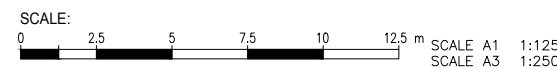
DRAWING No. **141-054**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia



SCHEDULE OF DOORS & WINDOWS						
TYPE	WIDTH	HEIGHT	SILL	QTY.	DESCRIPTION	MATERIAL
MD	1.05m	2.30m	-	1 No.	DOUBLE LEAF METAL DOOR	M.S DOOR
D1	1.05m	2.15m	-	1 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2	0.90m	2.15m	-	1 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D3	0.75m	2.15m	-	2 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
W1	1.50m	1.10m	1.05m	4 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
V1	1.50m	0.60m	1.55m	4 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER
V2	1.20m	0.60m	1.55m	1 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER
V3	0.60m	0.60m	1.55m	2 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER

GROUND FLOOR PLAN
SCALE A = 1:150



NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**GOVT. BOYS PRIMARY SCHOOL (GBPS)
RENOVATED SCHOOL AT SHAH JAHANABAD
GROUND FLOOR PLAN (SHEET-2)**

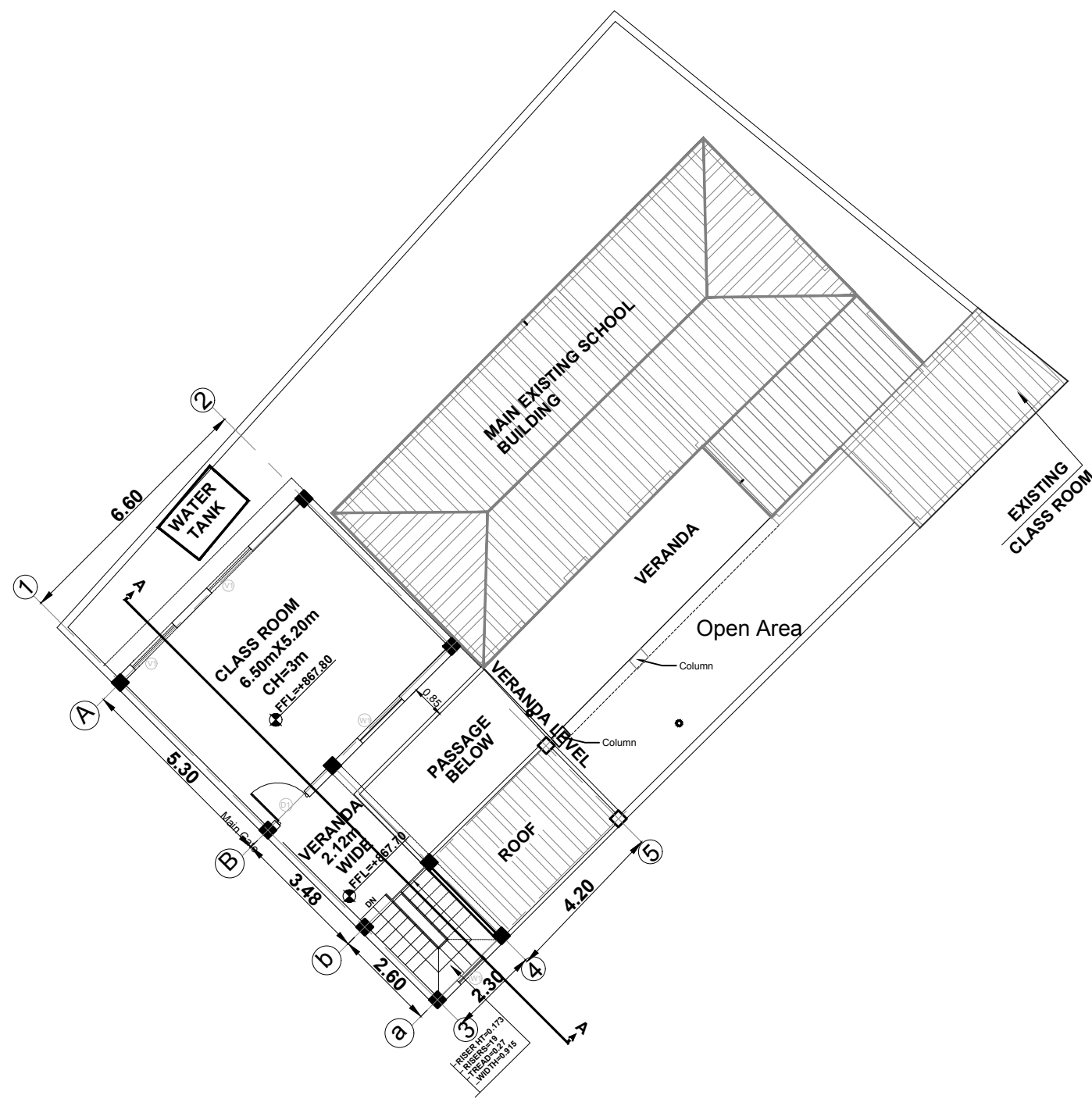
DASU HYDROPOWER CONSULTANTS

JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLSAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: Sep 2024

DRAWING No. **141-054**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia Nazir		Name: Imtiaz Hussain	Name: H. Nishimia



FIRST FLOOR PLAN
SCALE A = 1:150

SCHEDULE OF DOORS & WINDOWS						
TYPE	WIDTH	HEIGHT	SILL	QTY.	DESCRIPTION	MATERIAL
MD	1.05m	2.30m	-	1 No.	DOUBLE LEAF METAL DOOR	M.S DOOR
D1	1.05m	2.15m	-	1 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D2	0.90m	2.15m	-	1 No.	SINGLE LEAF PANELLED DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
D3	0.75m	2.15m	-	2 No.	SINGLE LEAF DOOR	SOLID WOODEN DOOR WITH METAL CHAUKAT
W1	1.50m	1.10m	1.05m	4 No.	OPENABLE WINDOW	MS. GLAZED WINDOW
V1	1.50m	0.60m	1.55m	4 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER
V2	1.20m	0.60m	1.55m	1 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER
V3	0.60m	0.60m	1.55m	2 No.	OPENABLE VENTILATOR	MS. GLAZED VENTILATER

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

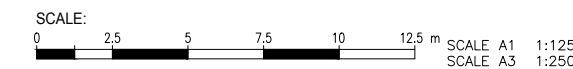
DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**GOVT. BOYS PRIMARY SCHOOL (GBPS)
RENOVATED SCHOOL AT SHAH JAHANABAD
FIRST FLOOR PLAN (SHEET-3)**

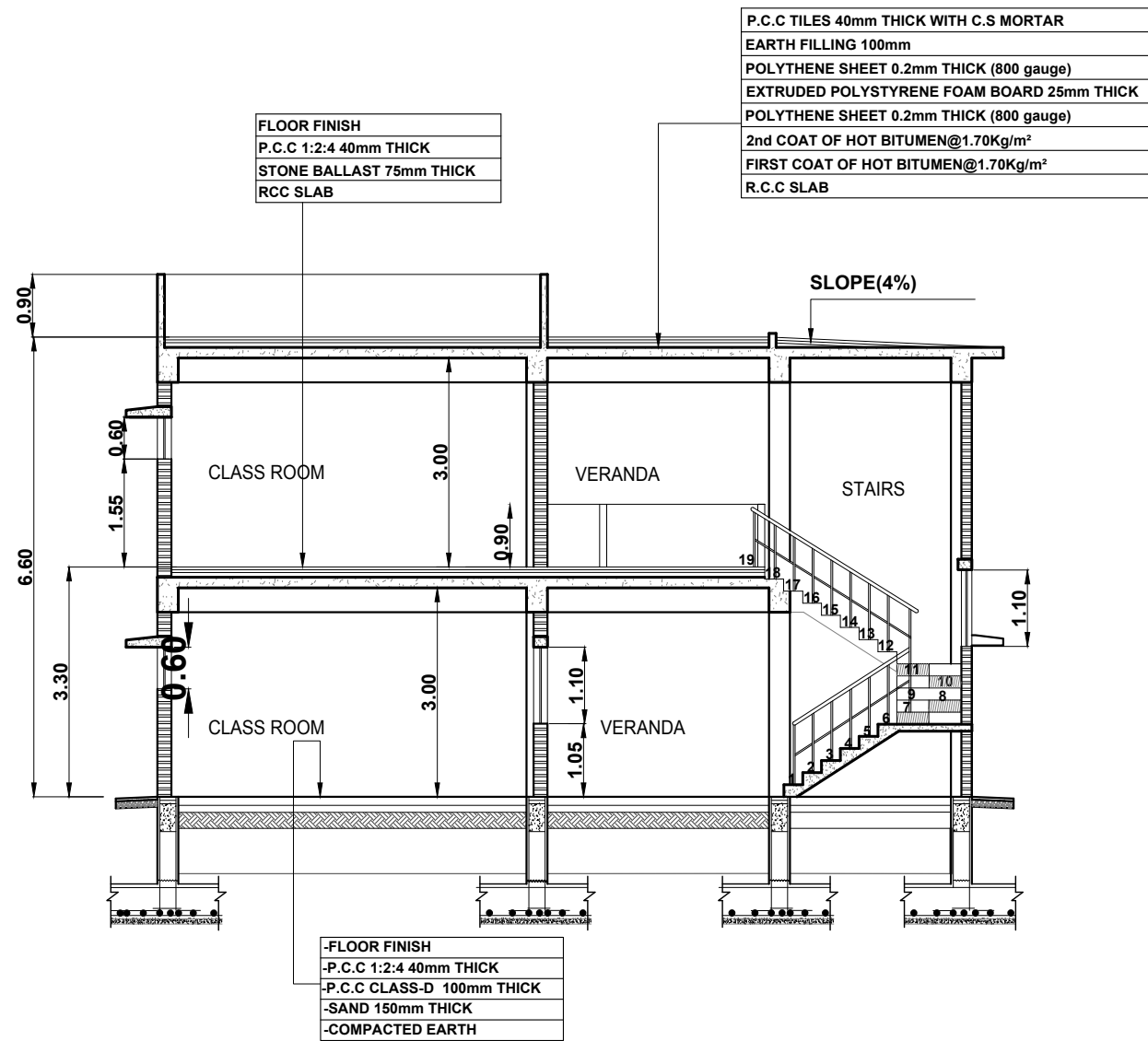


Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name: Imtiaz Hussain	Name: H.Nishimia

DASU HYDROPOWER CONSULTANTS

JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
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PAKISTAN ENGINEERING SERVICES LTD.

DATE: Sep 2024
DRAWING No. **141-054**



SECTION A-A
SCALE A =1:100

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

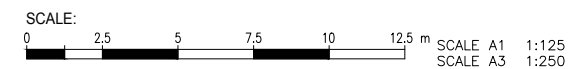
DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**GOVT. BOYS PRIMARY SCHOOL (GBPS)
RENOVATED SCHOOL AT SHAH JAHANABAD
SECTION A-A (SHEET-4)**

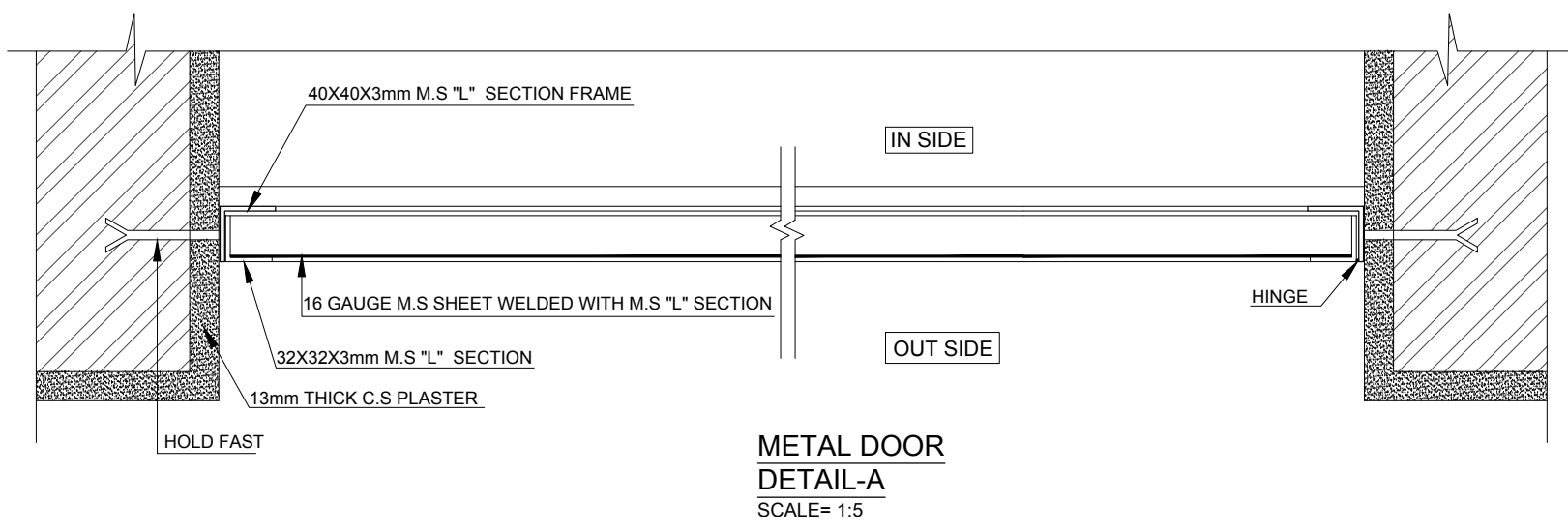
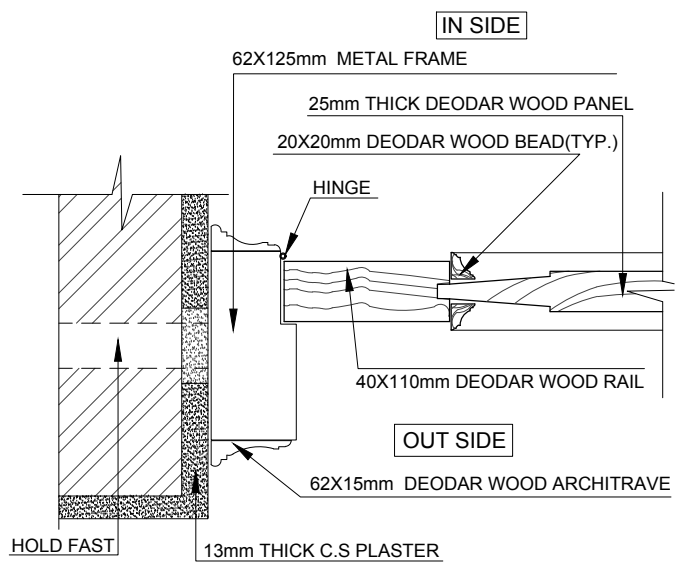
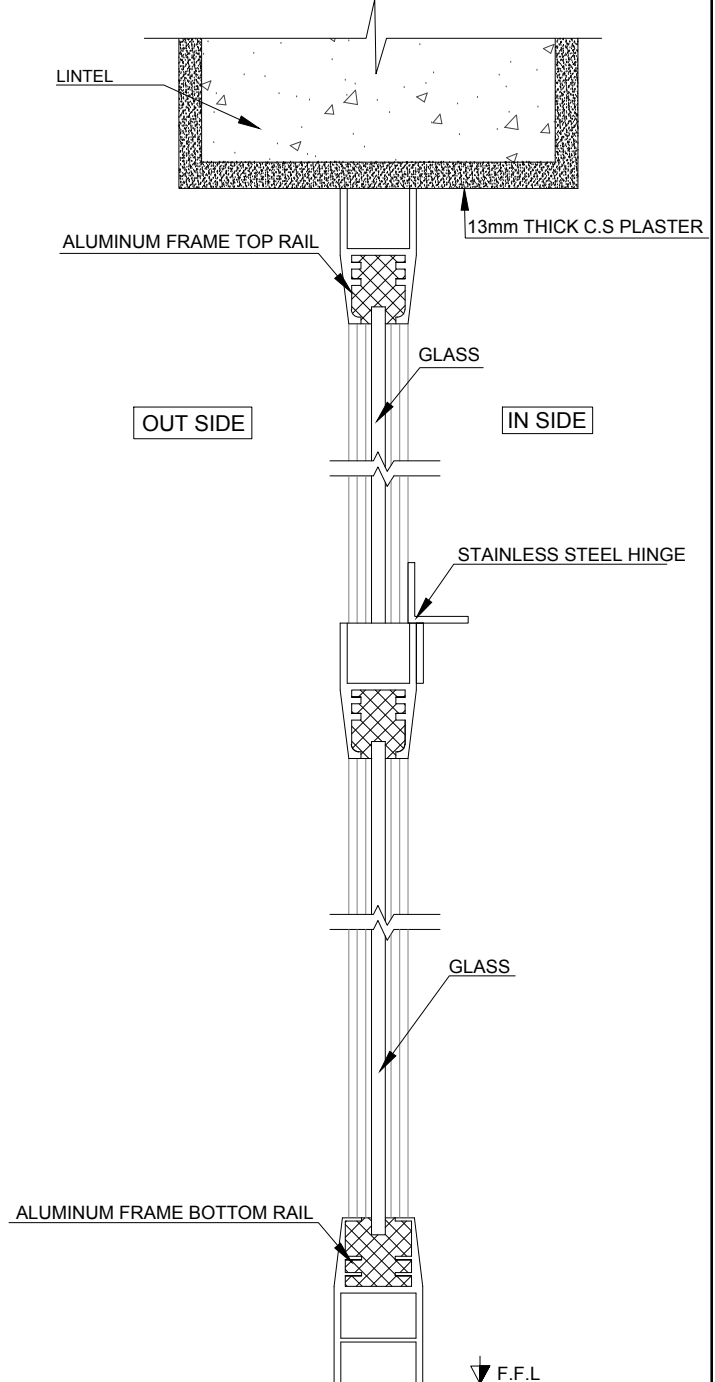
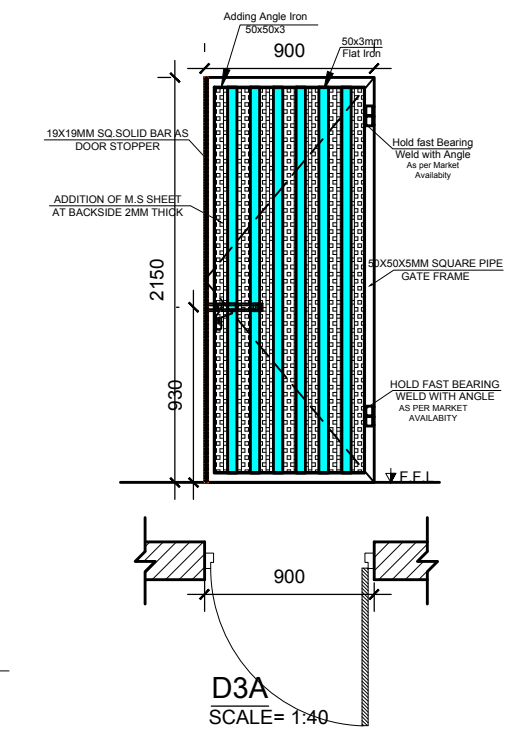
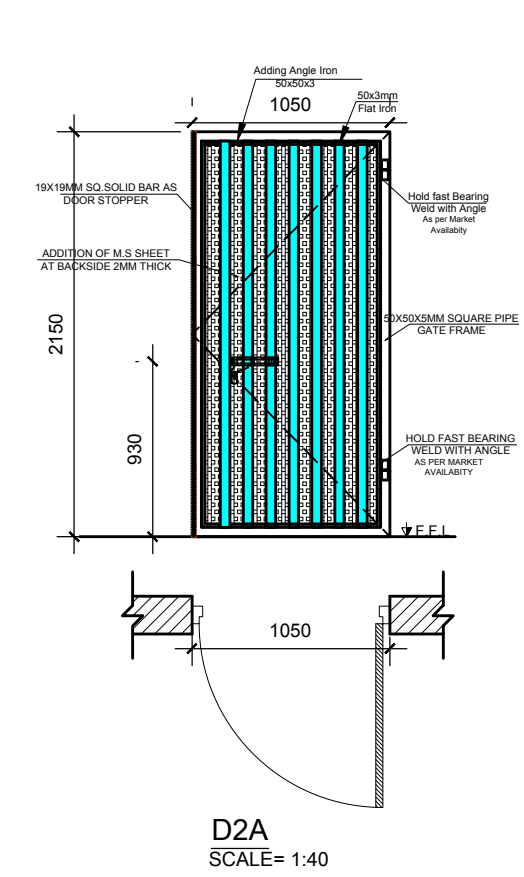
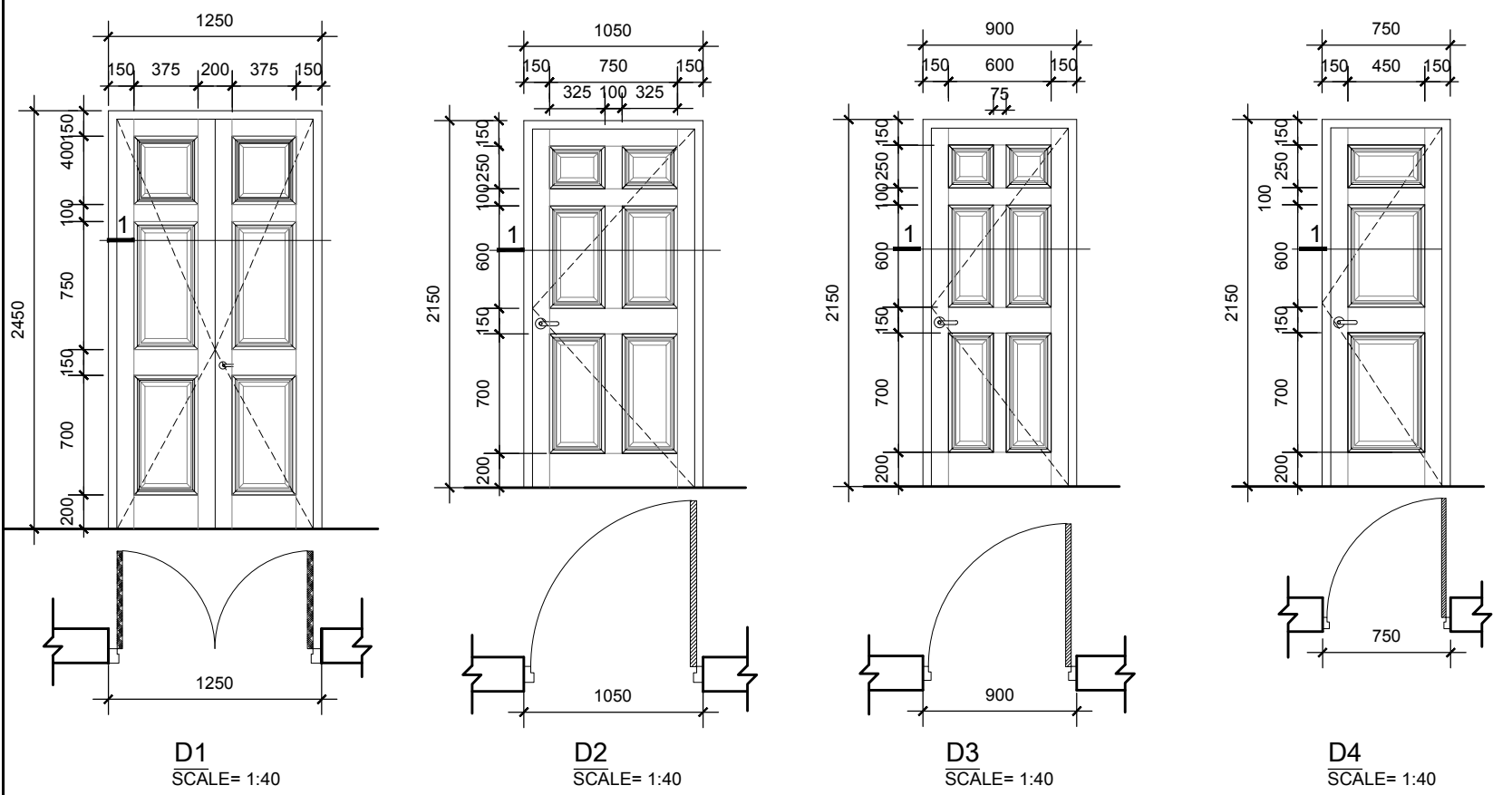


Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: Sep 2024
DRAWING No. **141-054**

TYPICAL DRAWINGS



NOTES: -
- All dimensions are in meters unless otherwise mentioned.

SCALE:
0 0.4 0.8 1.2 1.6 2.0m
SCALE A1 1:20
SCALE A3 1:40

DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

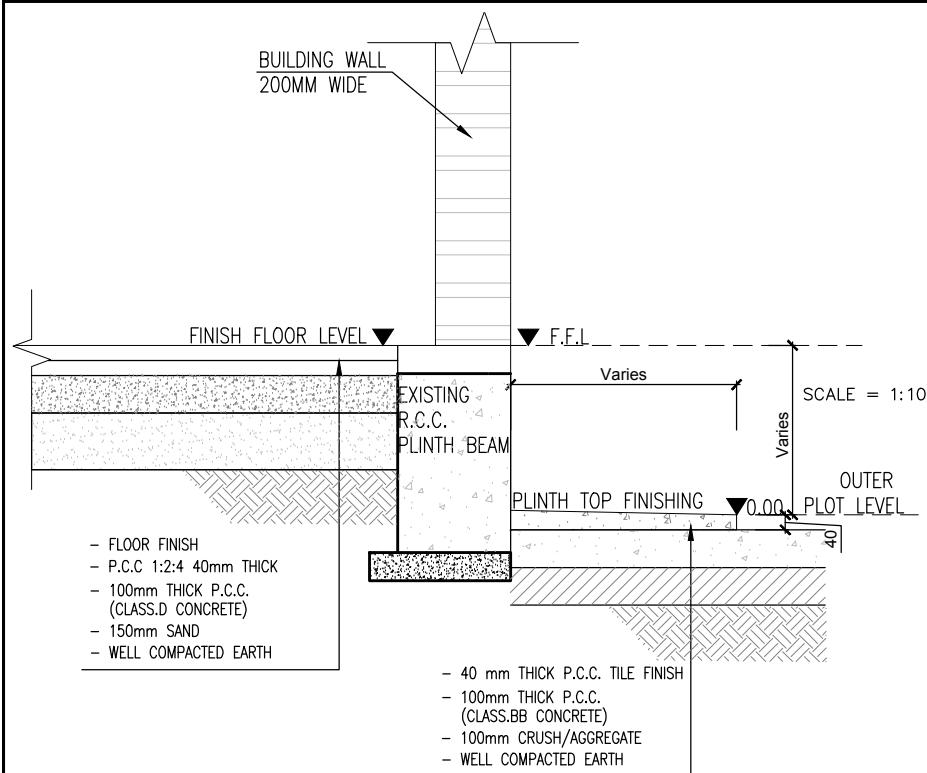
DRAWING TITLE: **DOOR ELEVATIONS AND TYPICAL DETAILS OF DOORS & WINDOWS (SHEET 1)**

DASU HYDROPOWER CONSULTANTS
DATE: SEP/2024

DRAWING No. 141-052

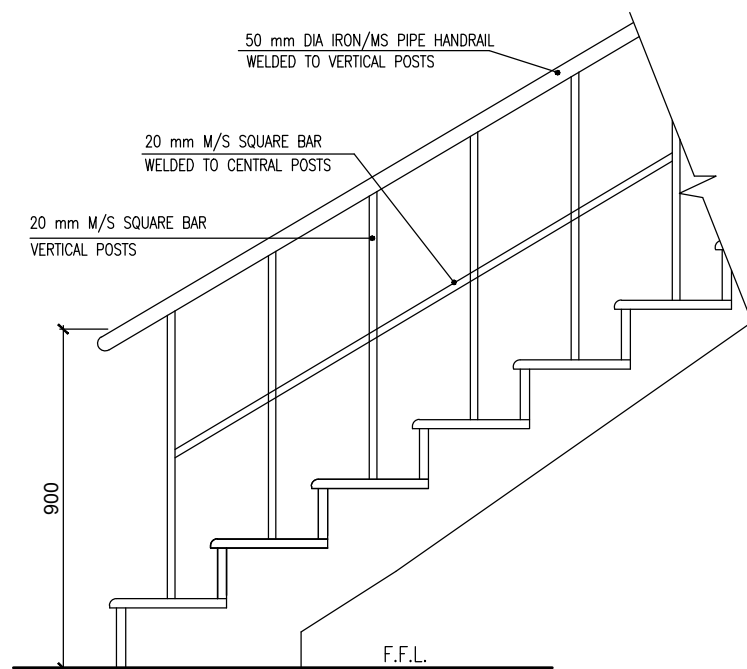
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOL-SAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir	Name:Imtiaz Hussain	Name:H.Nishimia	



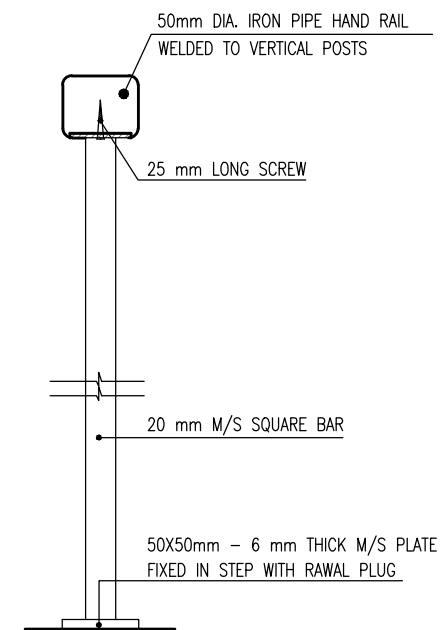
PLINTH PROTECTION & TOE WALL DETAIL (TYPICAL)

SCALE = 1:20



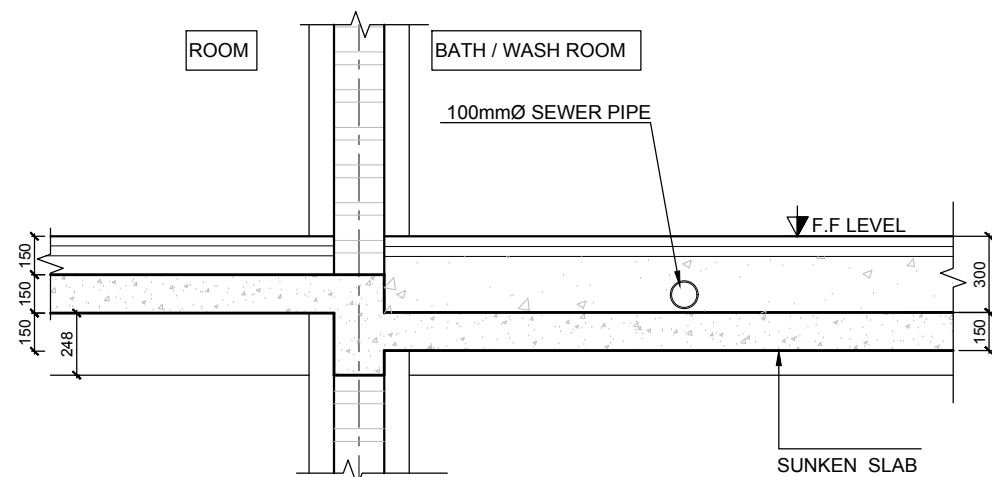
M.S STAIR RAILING DETAILS (TYPICAL)

SCALE = 1:20



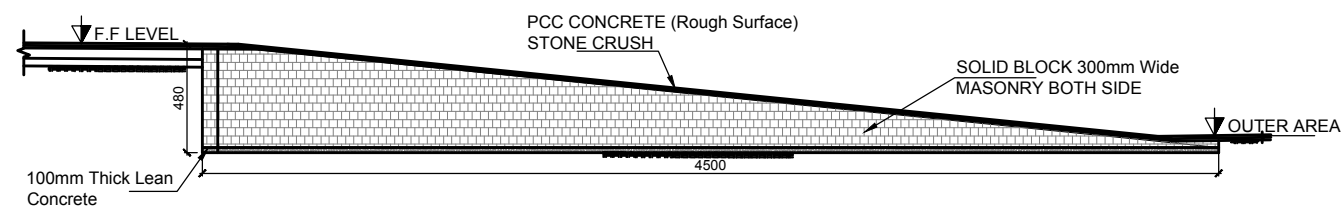
HANDRAIL DETAIL (TYPICAL FOR M.S STAIR RAILINGS)

SCALE = 1:5



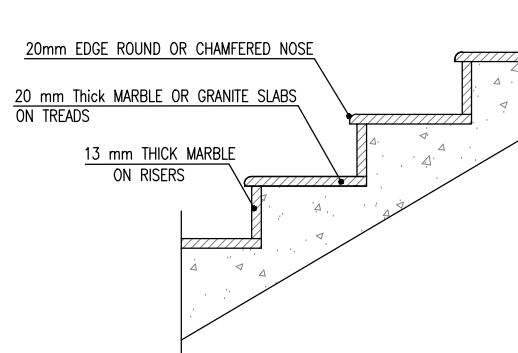
SUNKEN SLAB DETAIL

SCALE = 1:30



RAMP SLOPE DETAIL

SCALE = 1:30



MARBLE STEPS DETAIL (TYPICAL)

SCALE = 1:20

NOTES: -
All dimensions are in millimeters unless otherwise indicated.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02 Construction of Relocated Schools

DRAWING TITLE:
MISCELLANEOUS / TYPICAL DETAILS (SHEET-3)

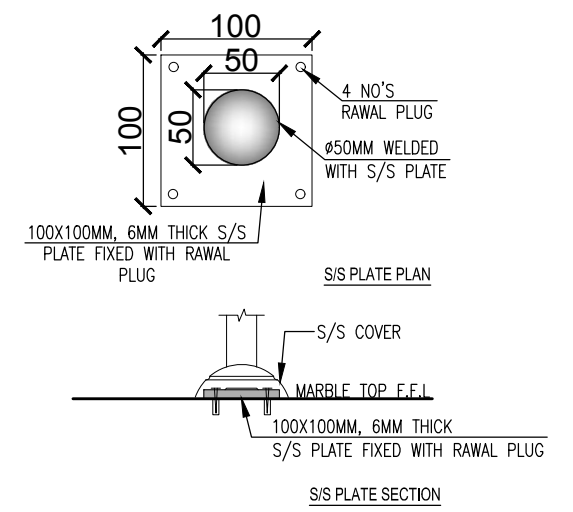
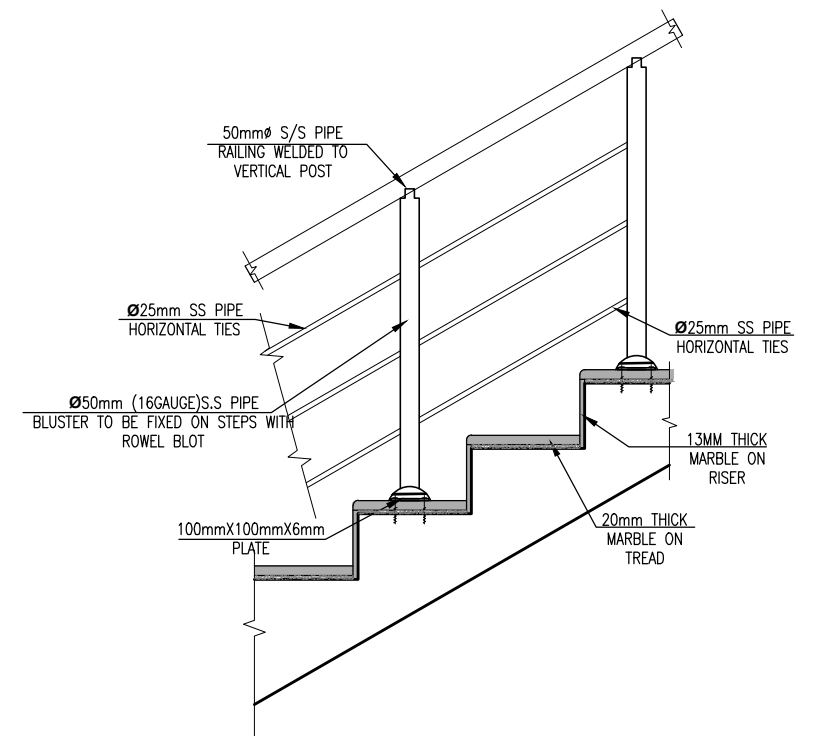
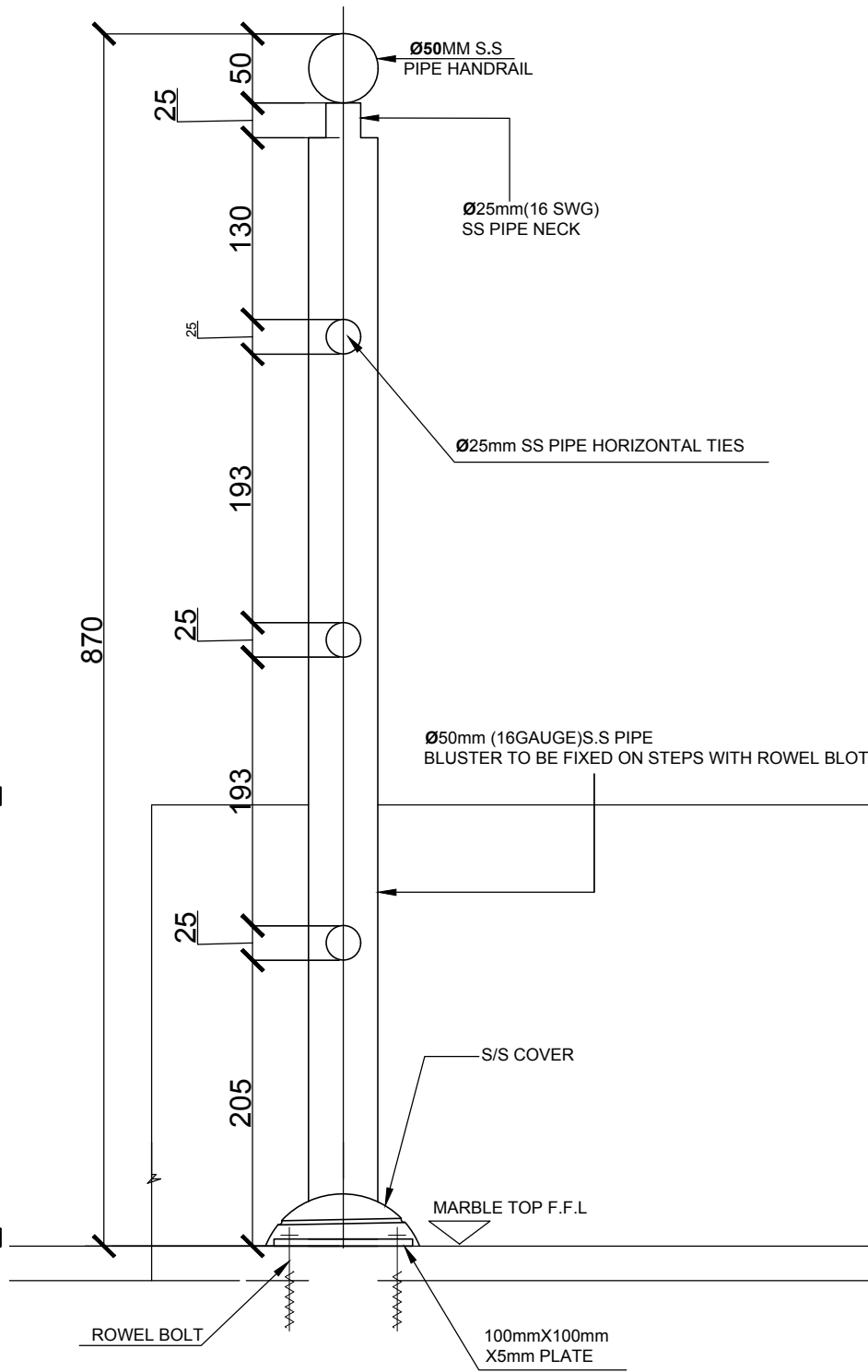
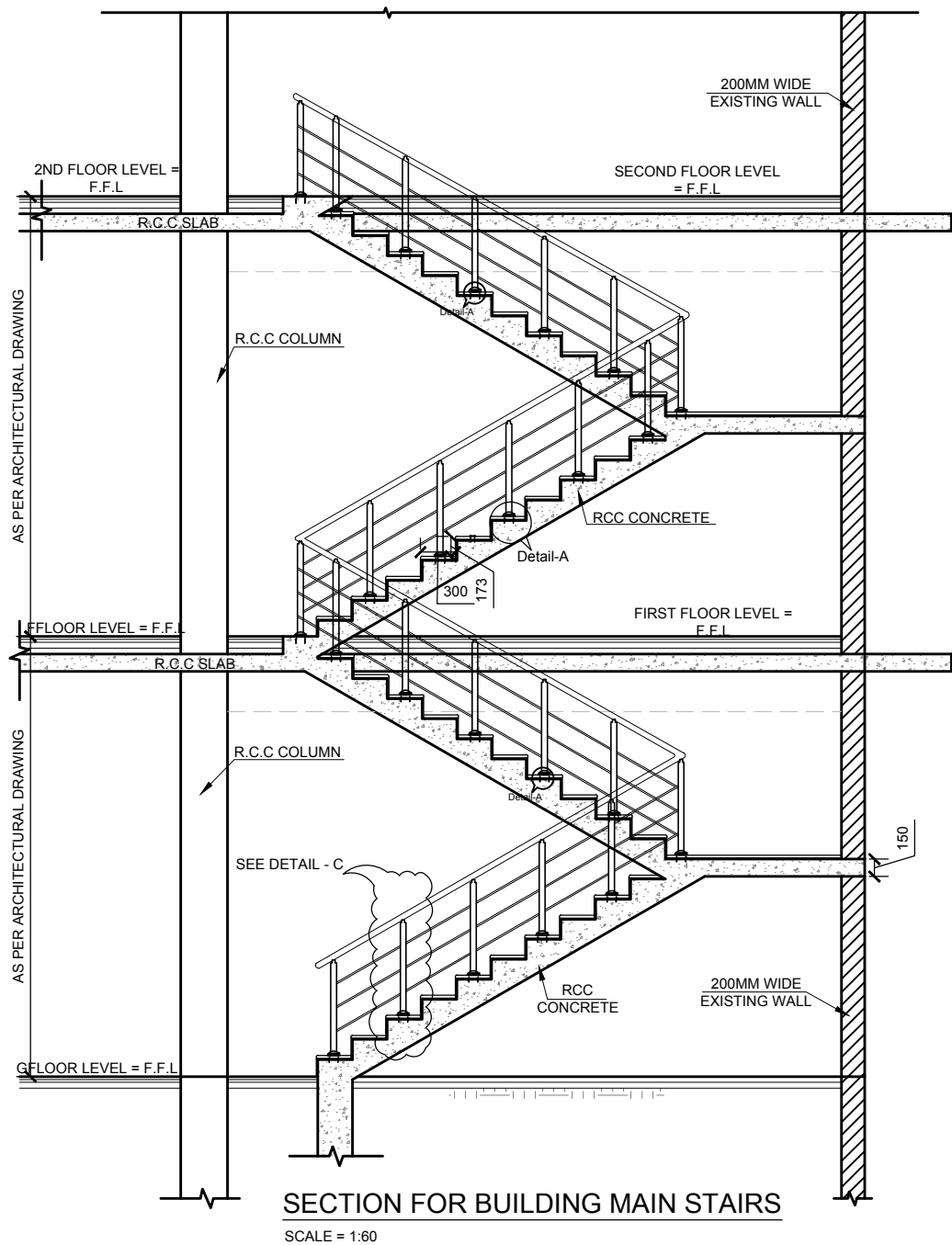
DASU HYDROPOWER CONSULTANTS

DATE: SEP/2024



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DOLSAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No.
141-052



NOTES: -
1- All dimensions are in millimeters unless otherwise mentioned
2- Stairs detail as per architectural plan of each school.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia Nazir		Name: Imtiaz Hussain	Name: H. Nishimia

NOTES: -
All dimensions are in millimeters unless otherwise indicated.

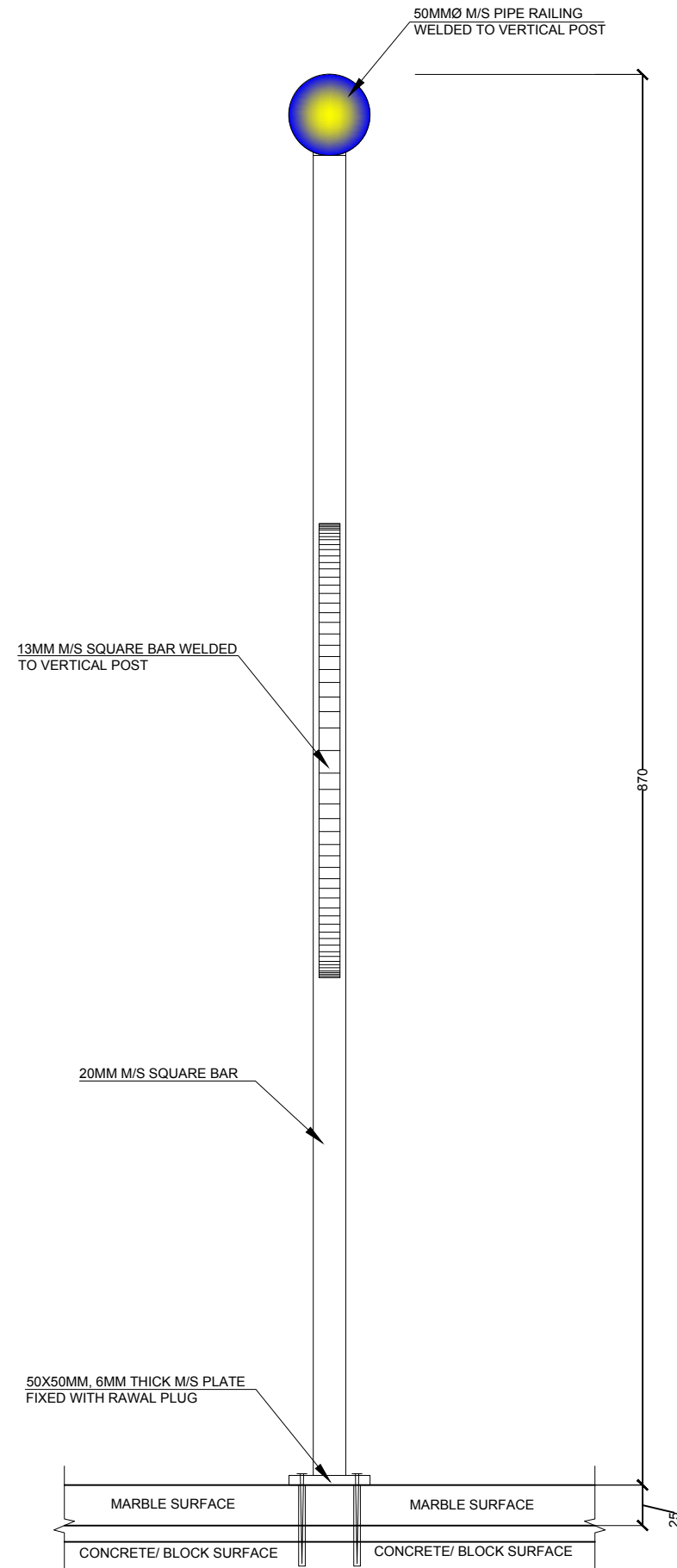
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

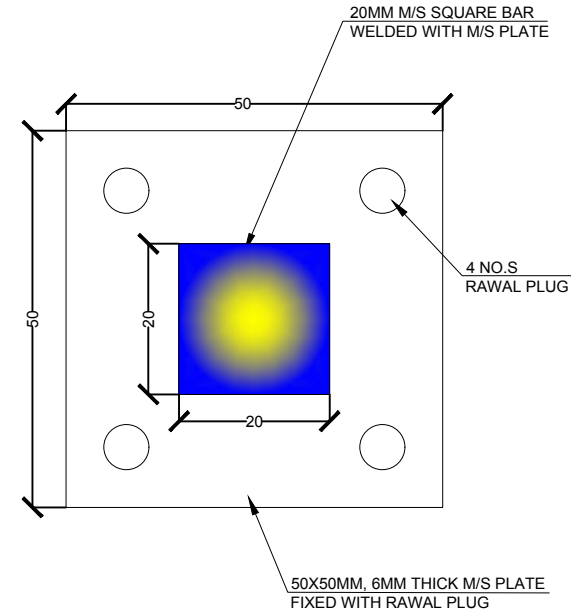
DRAWING TITLE:
MISCELLANEOUS / TYPICAL DETAILS
S.S RAILING DETAIL(SHEET-4)

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO. LTD. and DOL SAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

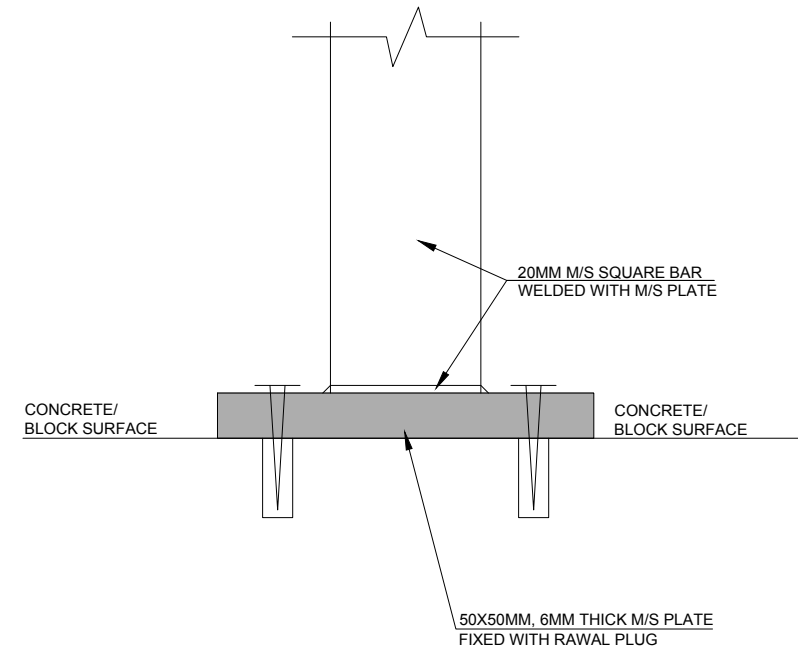
DATE: SEP/2024
DRAWING No. 141-052



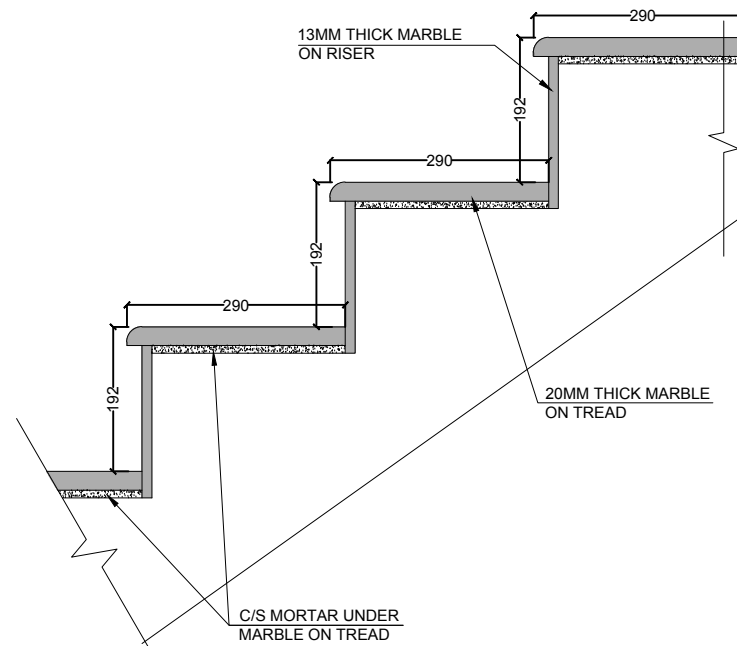
HAND RAIL DETAIL ON M/S PIPE WITH FLAT STRIP
SCALE:A = 1:4



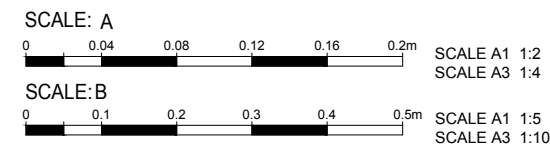
MS PLATE PLAN
SCALE = 1:1



MS PLATE SECTION
SCALE = 1:1



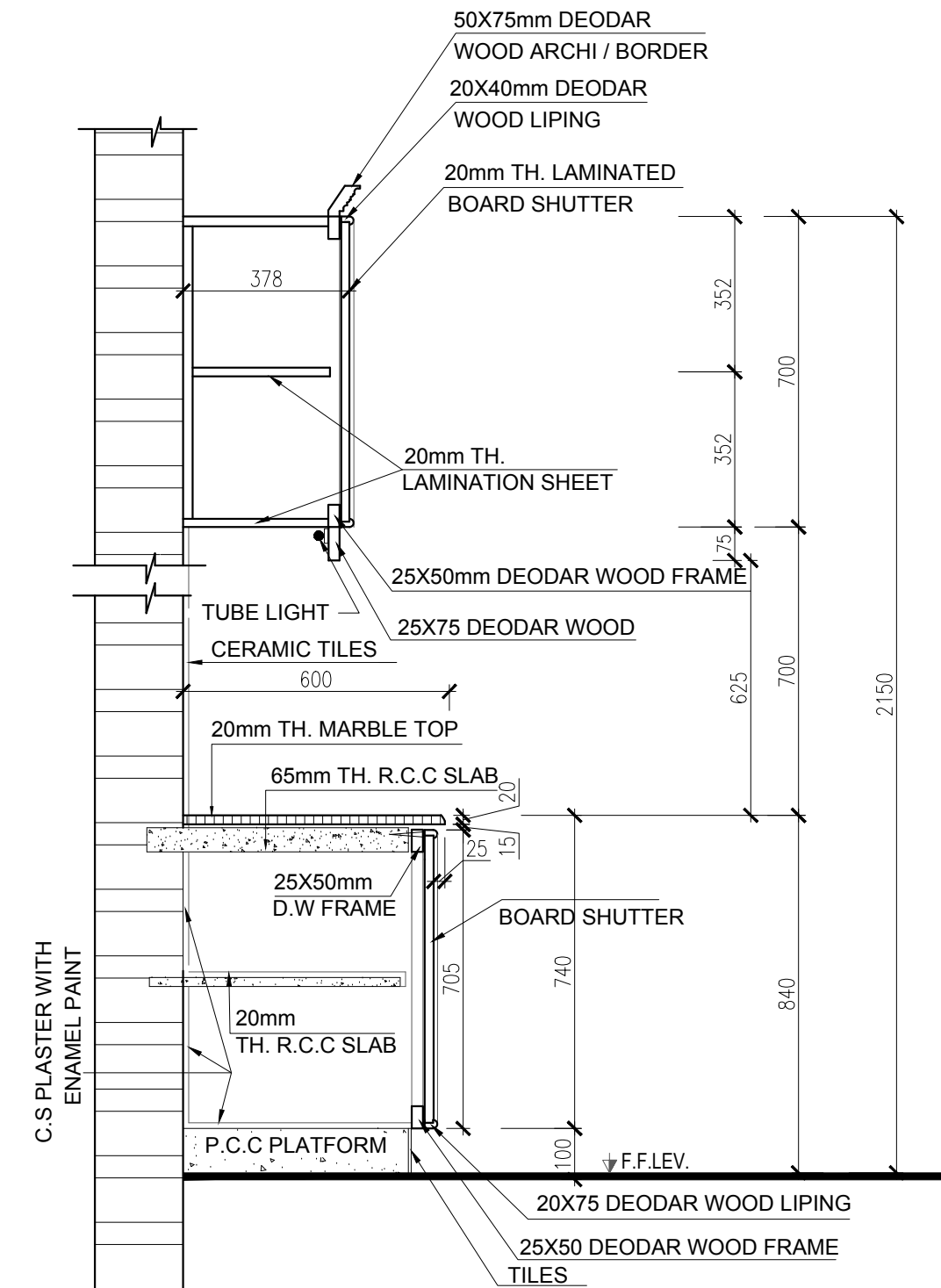
MARBLE STEP DETAIL FOR STAIRS
SCALE:B = 1:10



NOTES: -
All dimensions are in millimeters unless otherwise mentioned

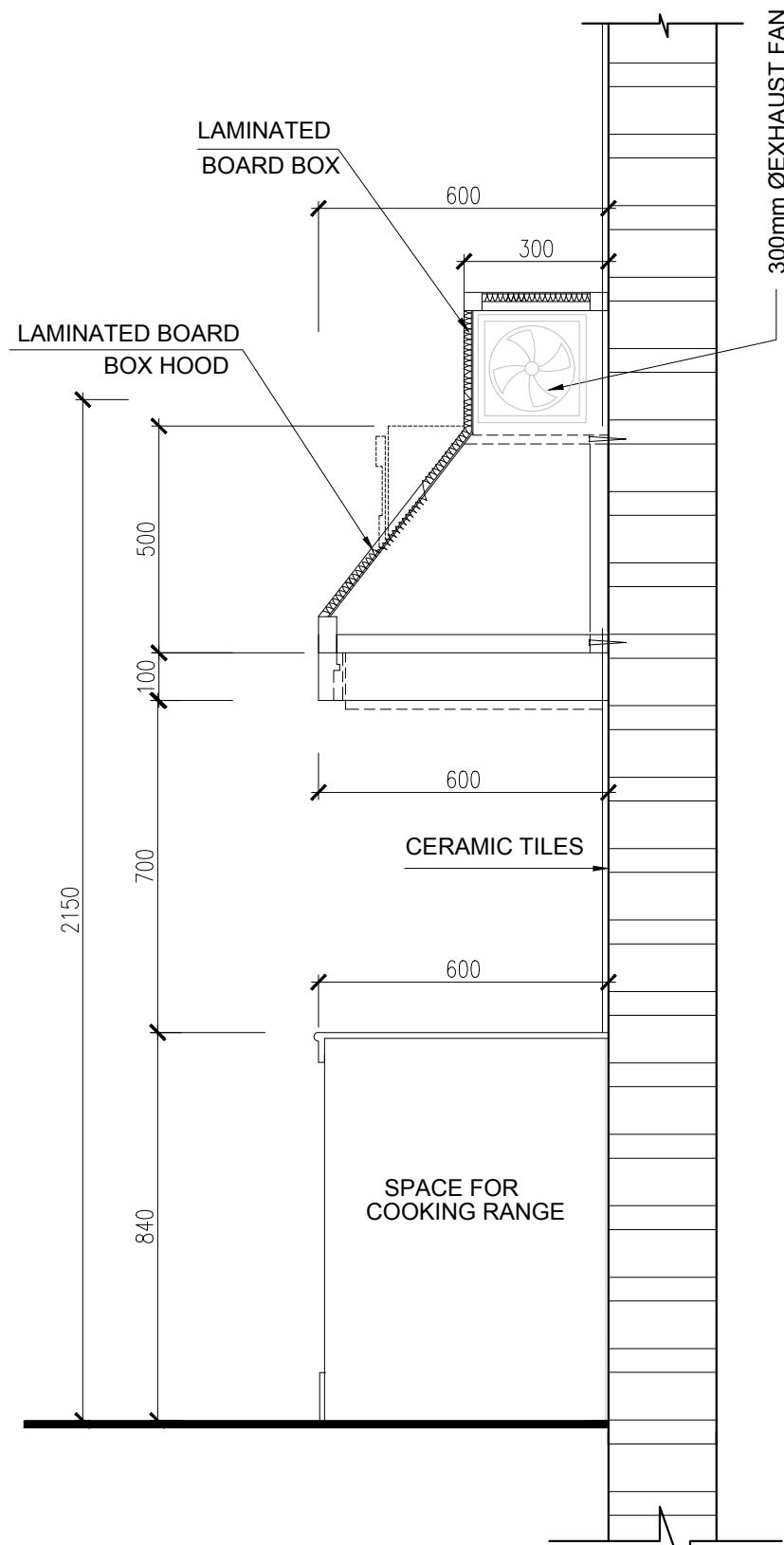
DASU HYDROPOWER PROJECT	
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA	
Bid Drawing NCB No. DASU-RS-02	
Construction of Relocated Schools	
DRAWING TITLE:	
MISCELLANEOUS / TYPICAL DETAILS	
M.S RAILING DETAIL(SHEET-6)	
DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
<small>JOINT VENTURE OF NIPPON KOEI CO. LTD. and DGLSAR ENGINEERING LIMITED In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</small>	DRAWING No. 141-052

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia



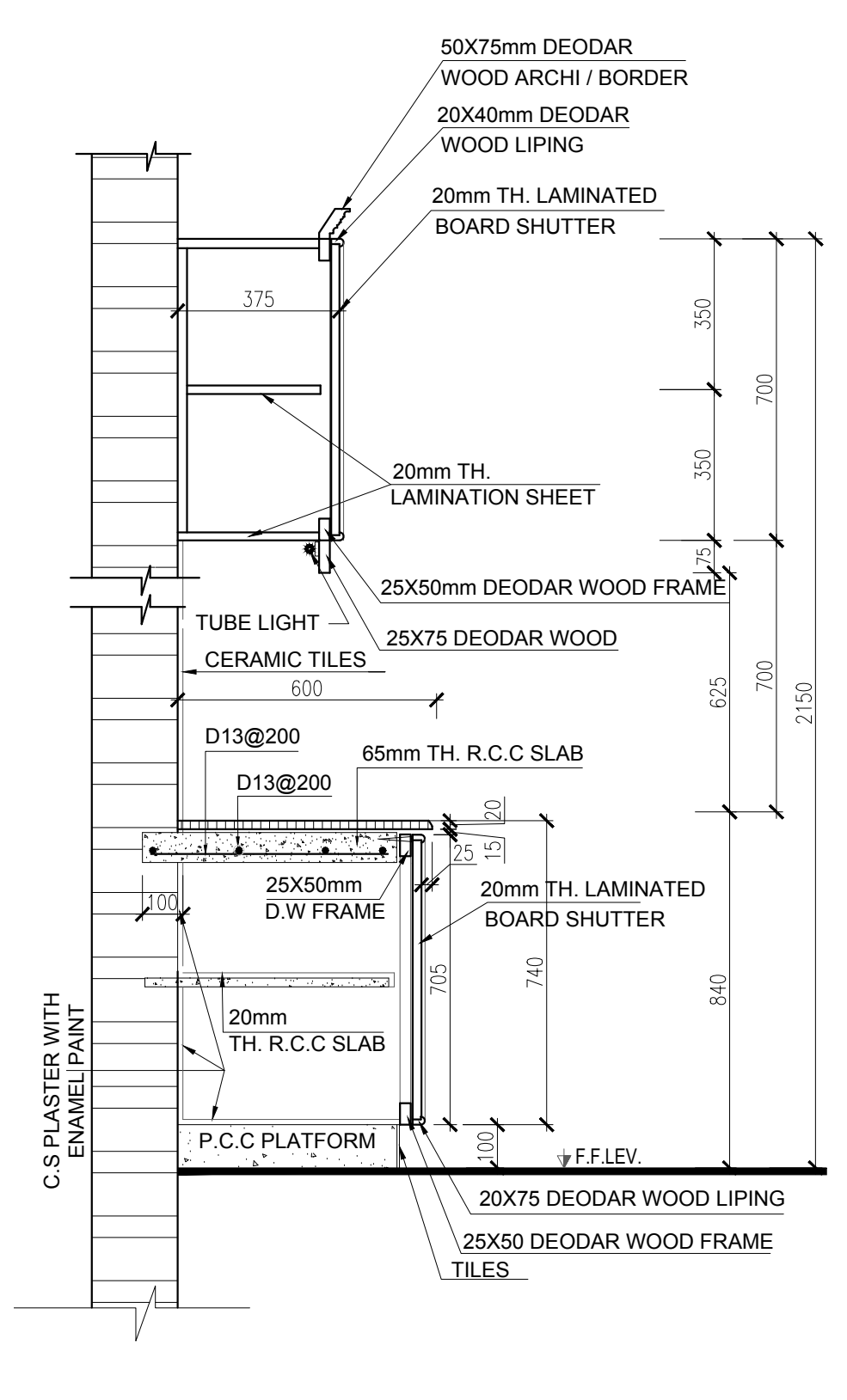
TYPICAL KITCHEN COUNTER SECTION

SCALE A =1:15



TYPICAL KITCHEN HOOD SECTION

SCALE A =1:15



TYPICAL KITCHEN COUNTER REINFORCEMENT

SCALE A =1:15

NOTES: -
All dimensions are in millimeters unless otherwise mentioned.
SCALE:
0 0.15 0.3 0.45 0.6 0.75 SCALE A1 1:7.5
SCALE A3 1:15

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

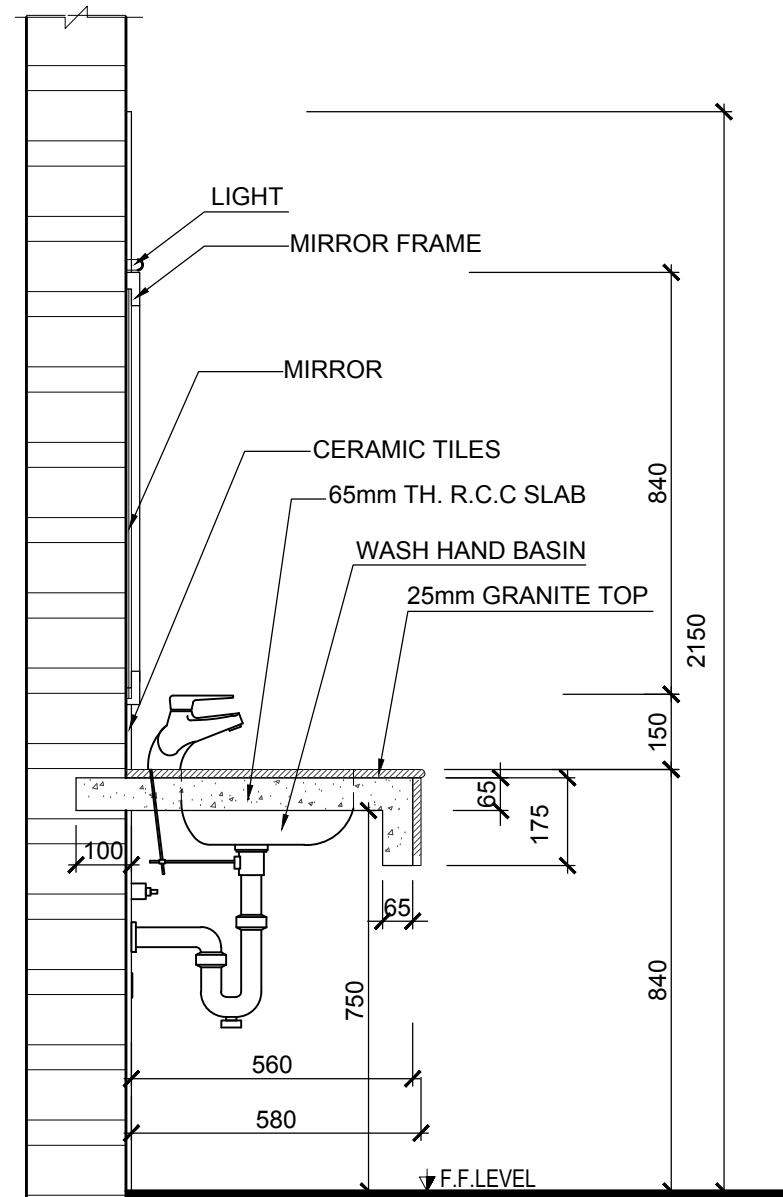
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

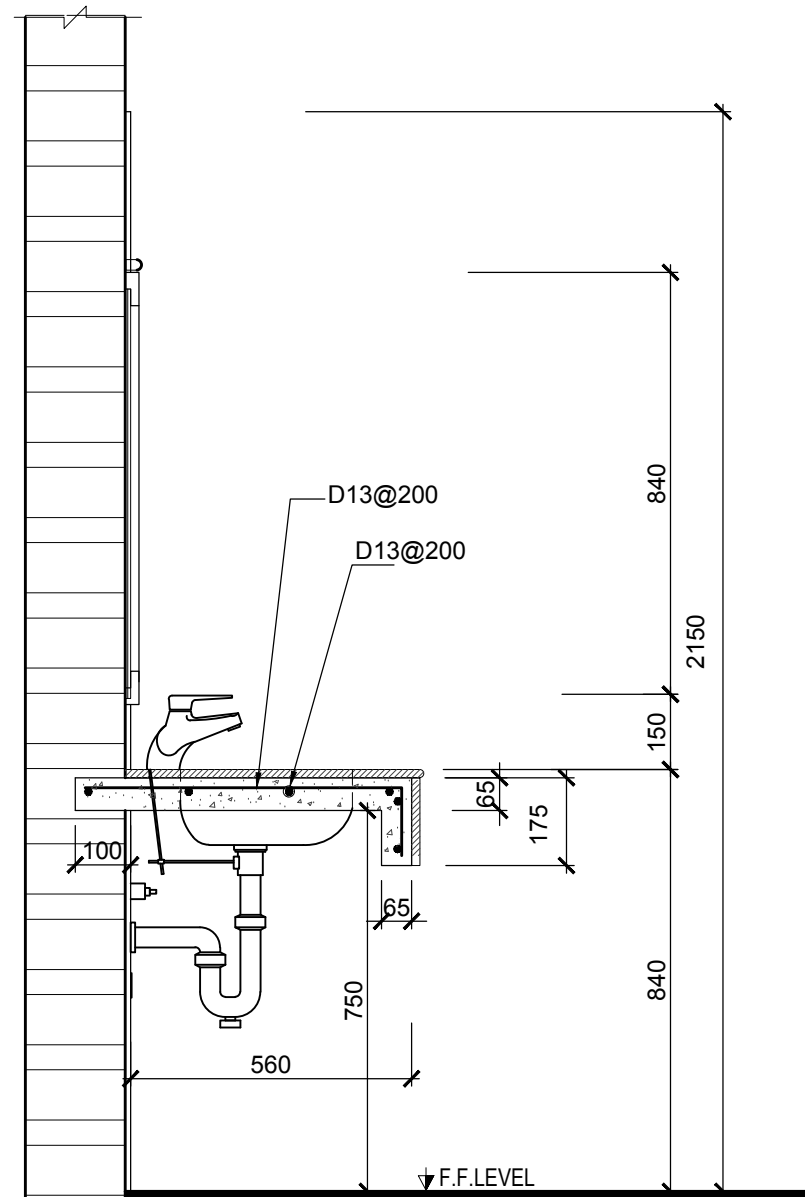
DRAWING TITLE:
TYPICAL KITCHEN CABINET AND REINFORCEMENT DETAIL(SHEET-7)

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO. LTD. and DOLAR ENGINEERING LIMITED
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DATE: SEP/ 2024
DRAWING No. 141-052



TYPICAL VANITY SECTION DETAIL
SCALE A =1:15



TYPICAL VANITY REINFORCEMENT DETAIL
SCALE A =1:15

NOTES: -
All dimensions are in millimeters unless otherwise mentioned.
For Wash Hand Basin, Type and Design should be approved by Engineer before implementation.



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

DASU HYDROPOWER PROJECT



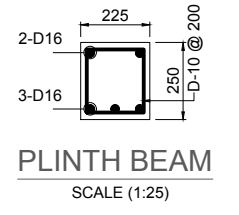
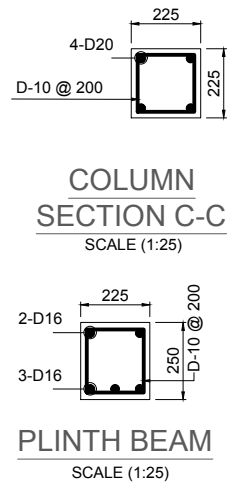
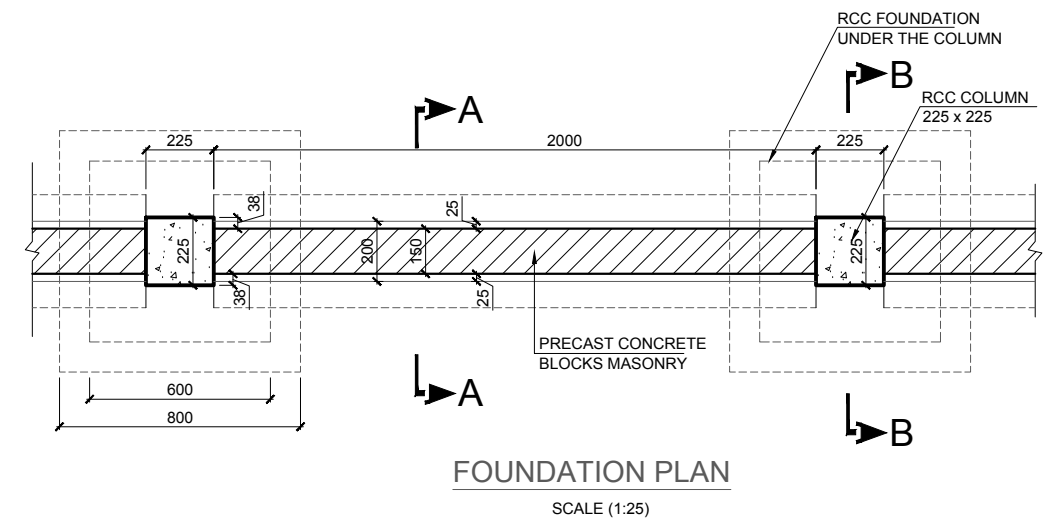
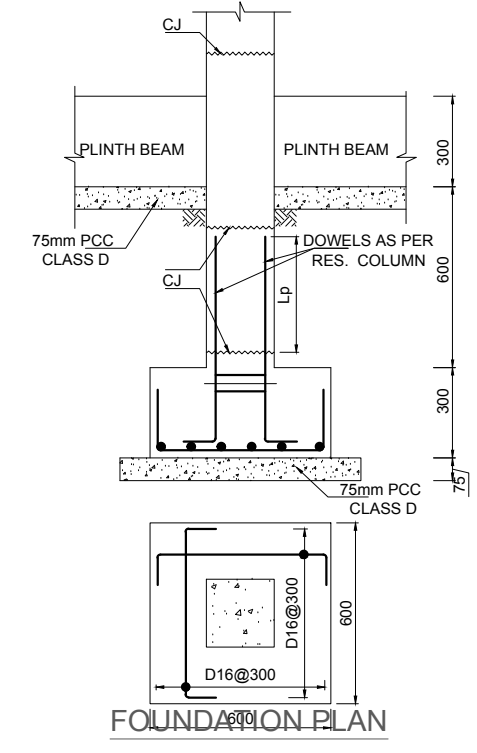
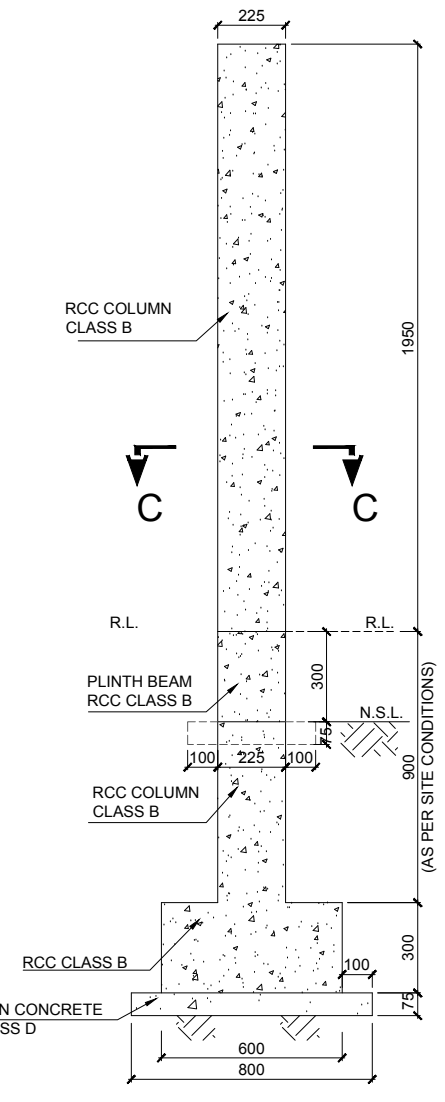
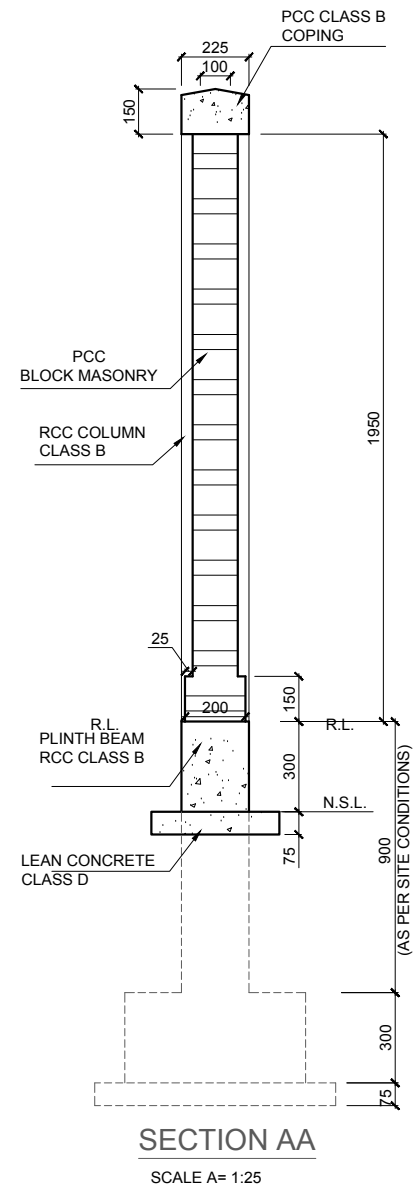
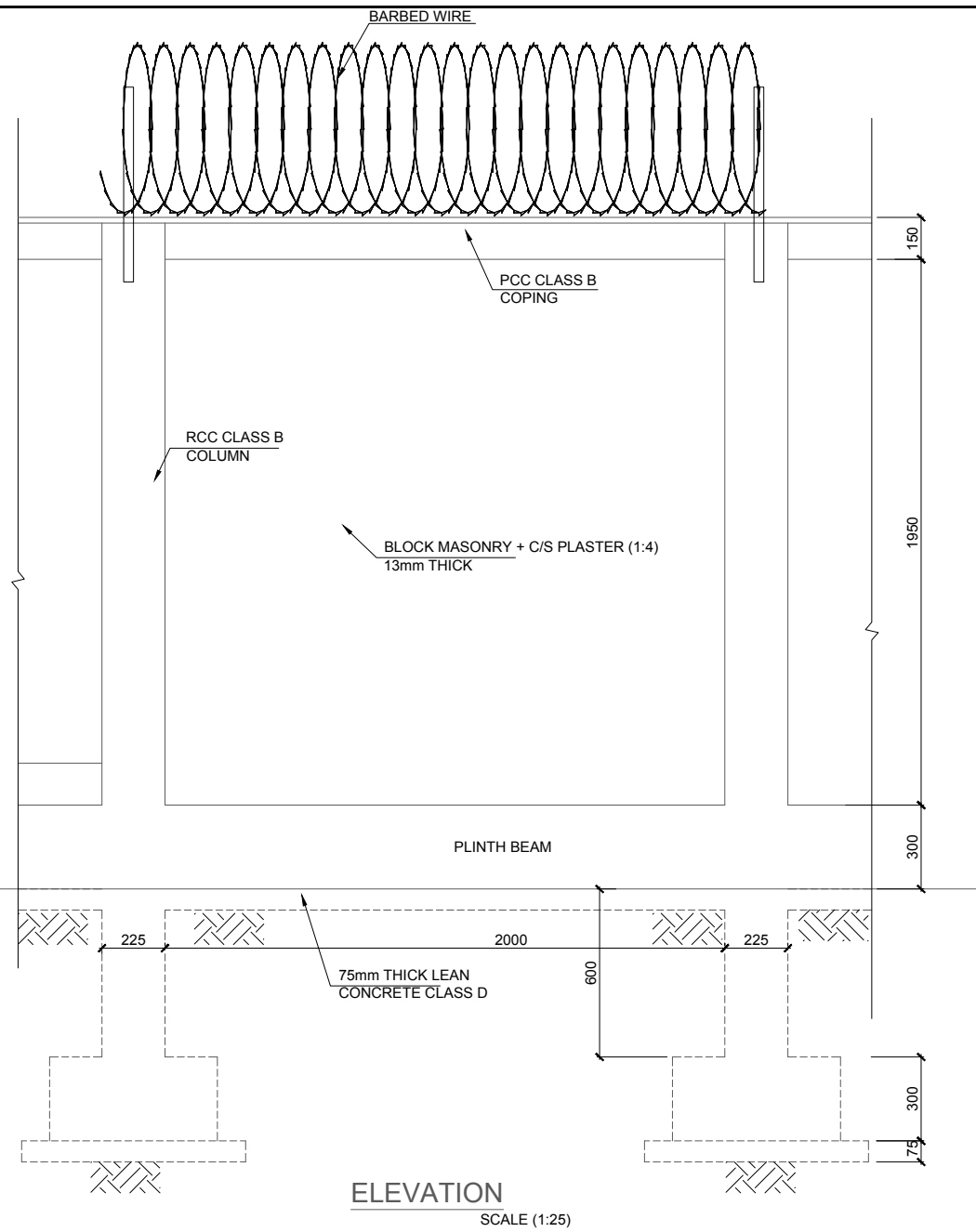
PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **TYPICAL DETAILS OF BATH
VANITY & REINFORCEMENT DETAILS**
SHEET-9

DASU HYDROPOWER CONSULTANTS
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PAKISTAN ENGINEERING SERVICES LTD.

DATE: **SEP/2024**
DRAWING No. **141-052**



GENERAL NOTES:
1. Unless otherwise noted, all dimensions are shown in millimeters except elevations which are indicated in meters.

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **BUILDING BOUNDARY WALL TYPICAL DETAILS (SHEET-10)**

DASU HYDROPOWER CONSULTANTS
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In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: **SEP/2024**
DRAWING No. **141-052**

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Miss Sobia.Nazir	Name:Imtiaz Hussain	Name:H.Nishimia	

STRUCTURE

RELOCATED PRIMARY SCHOOLS-RS-02

LIST OF DRAWINGS

2. Structural Drawings

SR.#	DWG.NO.	TITLE
1	141-071	General Notes Sheet-1
2	141-071	General Notes Sheet-2
3	141-071	Design Detailing Table Sheet-3
4	141-071	Design Data Table Sheet-4
5	141-072	Relocation Primary Schools Typical Breast Wall details
6	141-073	Typical stone masonry retaining wall elevation and section - sheet-1
7	141-073	Typical stone masonry retaining wall joint detail, tabel of dimensions-sheet-2
8	141-074	Typical Details Sheet-1
9	141-074	Typical Details Sheet-2
RELOCATED PRIMARY SCHOOLS		
10	141-075	Relocated Primary Schools Excavation Plan
11	141-076	Relocated Primary Schools Foundation Plan
12	141-077	Relocated Primary Schools Foundation detail
13	141-078	Relocated Primary Schools Foundation Wall detail
14	141-079	Relocated Primary Schools Ground Floor Column Plan
15	141-080	Relocated Primary Schools First Floor Column Plan
16	141-081	Relocated Primary Schools Column Detail
17	141-082	Relocated Primary Schools Plinth Beam Plan
18	141-083	Relocated Primary Schools Plinth Beam detail
19	141-084	Relocated Primary Schools First Floor Beam Plan
20	141-085	Relocated Primary Schools Roof Beam Plan
21	141-086	Relocated Primary Schools Beam Detail
22	141-087	Relocated Primary Schools First Floor Slab Plan
23	141-088	Relocated Primary Schools First Floor Slab Plan
24	141-089	Relocated Primary Schools Roof Slab Plan
25	141-090	Relocated Primary Schools Roof Slab Plan
26	141-091	Relocated Primary Schools Stairs Reinforcement Details

SR. #	DWG.NO.	TITLE
27	141-092	Relocated Primary Schools Mumty Details
28	141-093	Relocated Primary Schools Boundary Wall and Column Details
29	141-094	Relocated Primary Schools Main Gate and Column Details
30	141-095	Relocated Primary Schools Toilet Plan Slab and Details
REHABILITATION PRIMARY SCHOOL		
31	141-096	Rehabilitation Govt. Boys Primary School Shah Jahanabad Excavation Plan
32	141-097	Rehabilitation Govt. Boys Primary School Shah Jahanabad Foundation Plan
33	141-098	Rehabilitation Govt. Boys Primary School Shah Jahanabad Foundation Details
34	141-099	Rehabilitation Govt. Boys Primary School Shah Jahanabad Ground Floor Column plan
35	141-100	Rehabilitation Govt. Boys Primary School Shah Jahanabad Column Details
36	141-101	Rehabilitation Govt. Boys Primary School Shah Jahanabad Plinth Beam Plan
37	141-102	Rehabilitation Govt. Boys Primary School Shah Jahanabad Plinth Beam Details
38	141-103	Rehabilitation Govt. Boys Primary School Shah Jahanabad Plinth Beam Details
39	141-104	Rehabilitation Govt. Boys Primary School Shah Jahanabad First Floor Beam Plan
40	141-105	Rehabilitation Govt. Boys Primary School Shah Jahanabad First Floor Slab Plan
41	141-106	Rehabilitation Govt. Boys Primary School Shah Jahanabad First Floor Slab Plan
42	141-107	Rehabilitation Govt. Boys Primary School Shah Jahanabad Stair Reinforcement Detail
43	141-108	Rehabilitation Govt. Boys Primary School Shah Jahanabad Roof Slab Plan
44	141-109	Rehabilitation Govt. Boys Primary School Shah Jahanabad Roof Slab Plan

Codes & Standards:

- ACI 318-14 Building Code Requirements for Structural Concrete
- BCP-SP-SP07 Building Code of Pakistan-Seismic Provisions 2007
- UBC-97 Uniform Building Code 1997
- ASCE 7-10 Minimum Design Loads for Buildings and other Structures
- ACI 117-10 Specification for Tolerances for Concrete Construction and materials
- ACI 301-10 Specification for Structural Concrete
- ACI 350.5-12 Specification for Environmental Concrete Structures
- ASTM C150-18 Standard Specification for Ordinary Portland Cement
- ASTM C33-18 Standard Specification for Concrete Aggregates
- ASTM C1602-12 Standard Specification for Mixing Water Used in the Production of Concrete
- ASTM A615-16 Standard Specification for Deformed and Plain Carbon-Steel Bars For Concrete Reinforcement
- ASTM C62-17 Standard Specification for Building Brick
- Engineering judgement is used where code does not satisfy local requirements.

Loads:

Dead Load: Dead load consist of the self-weight of structural elements and the superimposed dead load.Both area described below:

- Unit weight of the Reinforced Cement Concrete = 2,400kg/m³
- Unit weight of the Plain Cement Concrete = 2,240kg/m³
- Unit weight of brick masonry = 1,920 kg/m³
- Unit weight of steel = 7,850kg/m³

Superimposed Dead Load: SDL Consist of 225kg/m² for 100mm thick PCC for all floors and roof. Dead load of masonry has been Considered in the design of beams where they support masonry infill walls.

Live Load: The Live load has been Considered on the floor & roof according to Table 4-1 of ASCE 7-10

Earthquake Load: Earthquake loads have been calculated using BC-97 recommendations. The earthquake load parameters pertaining to the location and structural system of the building are shown in table 2.

Seismic Zone:

- Dasu area is considered as Zone 3 in design.

Bearing:

- Bearing Capacity: 160 KN/m² ; however the Contractor shall be responsible to carryout the bearing capacity test at site to ensure the given bearing capacity.

.Design:

Strength reduction factors,Ø for concrete Members:(UBC 1909.3.2)

Flexure and tension = 0.90

Shear and torsion = 0.85

Axial Compression (for tied column) = 0.70

Axial Compression (for spiral Column) = 0.75

Load Combinations: Load Combinations used in the design consist of the following:

U= 1.4 DL = (UBC 1612.2.1)

U= 1.4 DL+1.7LL = (UBC 1909.2.1)

U= 1.1 (1.2DL+0.5 LL±1.0 EL) = (UBC 1612.2.1)

U= 1.1 (0.9 DL±1.0EL) = (UBC 1612.2.1)

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: GENERAL NOTES SHEET(1)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name:Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS




JOINT VENTURE OF
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DATE: SEP/2024
 DRAWING No. 141-071

GENERAL NOTES

- All structural drawings should be read in conjunction with architectural drawings.
- All dimensions are to be read, not to be measured.
- All the general notes, design report and complete drawings must be read and understood carefully before the execution is started. Contact the consultant for any query.
- The field supervisory staff shall follow the quality control protocols to ensure that variation in strength of material are within the permissible limits of ACI 301-10 and ACI 318-14, sections 26.12.3 & 26.12.4.
- The field supervisory staff shall follow the allowable tolerances to ensure that variation in sizes of structural members are within the permissible limits of ACI 117-10.
- The structural drawings and specifications represent the finished structure. They do not indicate the method of construction. The stability of a structure depends on proper analysis and design of the superstructure, the foundation and the execution of work according to the specified materials and structural drawings. It is the responsibility of field supervisory staff to design, erect and inspect temporary shores and braces etc. to support the structure against all anticipated loads including gravity, wind and lateral earth pressure until its completion. Observation visits (if any) to the site by the structural engineer shall not include inspection of these methods of construction.
- Construction material may be permitted to be placed on framed floors and roof provided that design live loads are not exceeded.
- According to ACI 301-10 sections 2.3.2 and 2.3.4, unless otherwise specified, if the load on the structure at the time of removal of formwork is equal to the design load, formwork shall not be removed until concrete has reached the specified compressive strength, ' . However, if structure supports only its self weight, the formwork can be removed after 14 days.
- According to ACI 301-10 section 5.3.6, concrete shall be cured in accordance with 5.3.6.2 for a minimum of 7 days after placement. Ponding or continuous sprinkling may be used for curing concrete.
- Ordinary Portland Cement conforming to ASTM C150-18 shall be used in all parts of the building.
- Fine aggregate/sand conforming to ASTM C33-18 shall be used in cement sand mortar and concrete works.
- Coarse aggregate conforming to ASTM C33-18 shall be used in concrete works.
- Water conforming to ASTM C1602-12 shall be used in cement sand mortar^{1ar} and concrete works.
- Minimum 28 days cylinder crushing strength of concrete used in all the members shall not be less than 21 Mpa.
- Steel reinforcement of Grade 60 (conforming to ASTM A615-16) shall be used in all structural members.
- The ratio of ultimate strength to the yield strength of the steel used in all members shall not be less then 1.25.

- All blocks shall be laid such that no vertical joint forms in masonry.
- Thickness of the mortar in the masonry shall be around 13mm.
- The location of infill masonry walls shall not be changed without the approval of consultant.
- Clear spacing between the longitudinal bars in the beams shall be 38mm or the diameter of the bar used, whichever is greater.
- Clear spacing between the two layers/rows of longitudinal bars in the beams shall be 38mm or the diameter of the bar used, whichever is greater.
- Lap splice in the longitudinal reinforcement of the column, if required, shall be provided in the center of column as per typical detail given on sheet.
- Lap splice in the longitudinal reinforcement of the beam, if required, shall be provided, as per typical detail of beam given on sheet).
- In the case of edge column, the longitudinal reinforcement of beam should be extended to the far end of column with the standard hook at the end as per typical detail given on sheet.
- In the case of end column, the longitudinal reinforcement of the column should be extended to the top of the floor beam with the standard hook at the end, as per detail given on sheet.
- The stirrups in the beams and ties in the columns shall be provided with 135° hook and with an extension of 6db or 3 inches, whichever is greater as per typical detail given on sheet.
- The hooks in the column ties and beam stirrups shall be provided consecutively at alternate corners as per typical detail given on sheet.
- In beams, first stirrup shall be placed at a distance of 50mm from the face of the support as per typical detail given on sheet.
- The ties of columns shall continue into the beam column joint, as per typical detail given on sheet.
- All footings shall be provided 1m below the Natural Surface Level (NSL).
- For proper drainage of rain water, slab level can be appropriately raised as per site requirements.

DASU HYDROPOWER PROJECT					
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA					
Bid Drawing NCB No. DASU-RS-02					
Construction of Relocated Schools					
DRAWING TITLE:					
GENERAL NOTES SHEET(2)					
DASU HYDROPOWER CONSULTANTS <table border="1" style="float: right; margin-left: 20px;"> <tr> <td>DATE:</td> <td>SEP/2024</td> </tr> <tr> <td>DRAWING No.</td> <td>141-071</td> </tr> </table>		DATE:	SEP/2024	DRAWING No.	141-071
DATE:	SEP/2024				
DRAWING No.	141-071				
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.					

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

DESIGN DETAILING TABLES

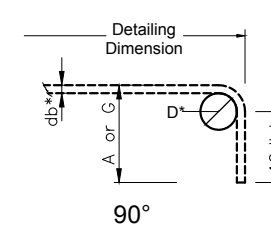
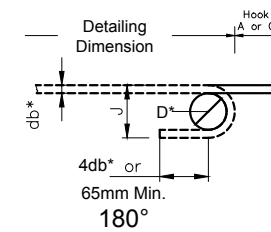
DEVELOPMENT LENGTH (ACI 318-14, SECTION 25.4.2.2 fc' = 21 Mpa AND f = 415 Mpa)		
BAR DIA (db)	STRAIGHT BARS	WITH STANDARD HOOK (mm)
6	300	150
10	450	200
13	560	250
16	710	300
19	860	350
25	1420	450

LAP SPLICE (ACI 318-14, SECTION 25.5.2.1) CLASS B SPLICE	
fc' = 21 Mpa AND ify = 415 Mpa	
6	350
10	556
13	735
16	910
19	1090
25	1820

MINIMUM CLEAR COVER (ACI 318-14)		
Sr.No.	LOCATION	CLEAR COVER
1	FOOTING	75
2	COLUMN	38
3	BEAM	38
4	SLAB	20
5	WATER RETAINING STRUCTURE	75

RECOMMENDED END HOOKS, ALL GRADES				
BAR SIZE	FINISHED BEND DIAMETER D, mm.	180-deg HOOKS		90-deg HOOKS
		A or G, mm.	J, mm.	A or G, mm.
D10	60	125	80	155
D12	80	155	105	200
D16	95	180	130	251
D20	115	205	155	300
D25	155	275	205	425



BAR CONVERSION (EQUIVALANT BARS)		
4-D10	2-D12	1-D20
6-D10	3-D12	-
8-D10	4-D12	2-D20
-	5-D12	-
-	6-D12	3-D20
-	9-D12	4-D20



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT	
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA	
Bid Drawing NCB No. DASU-RS-02	
Construction of Relocated Schools	
DRAWING TITLE:	
DESIGN DETAILING TABLE SHEET(3)	
DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
 <small>JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</small>	DRAWING No. 141-071



DESIGN INPUT DATA TABLES

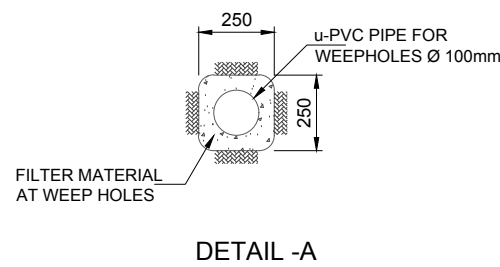
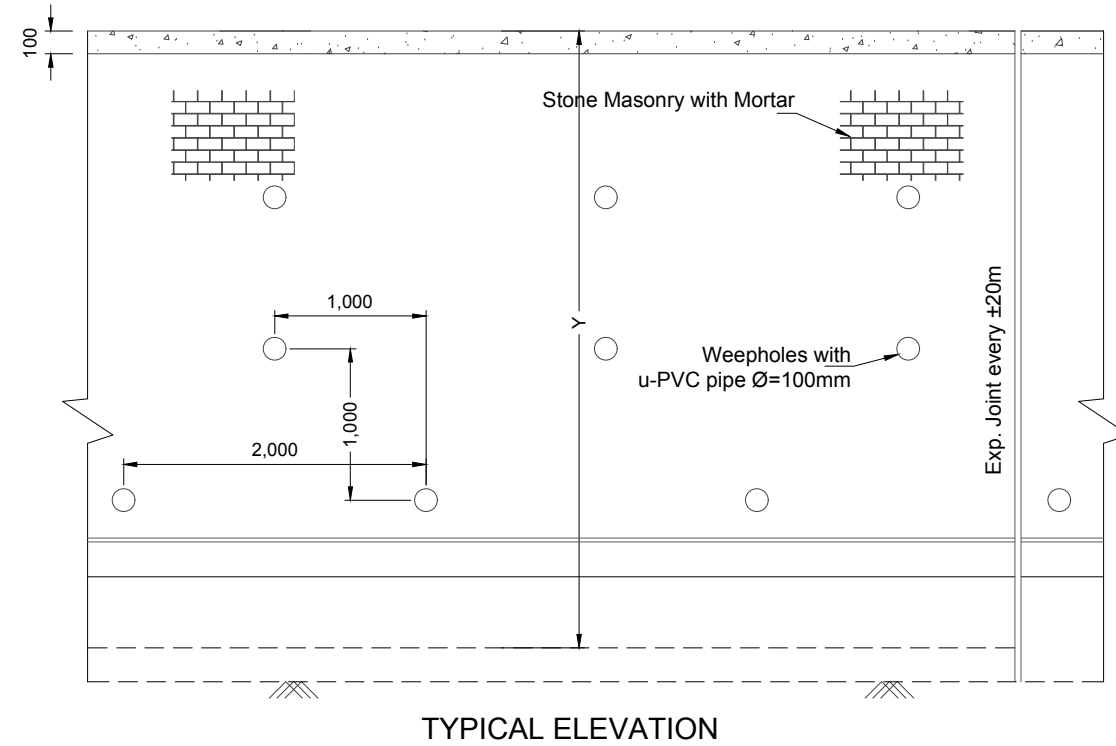
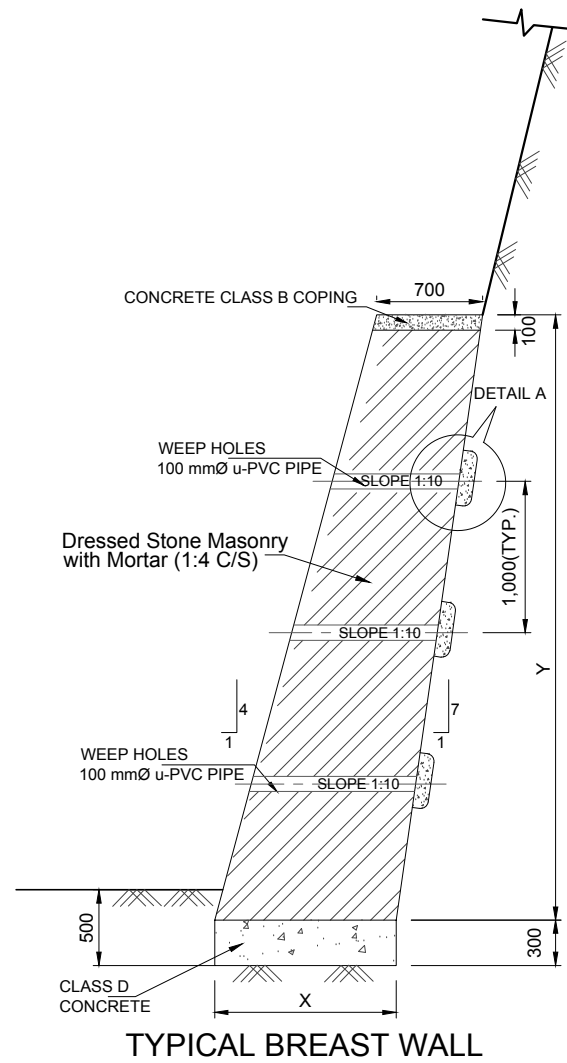
TABLE 1: MATERIAL PROPERTIES		
MATERIAL DESCRIPTION	MATERIAL PROPERTY	REMARKS
CONCRETE USED IN REINFORCED CONCRETE MEMBERS	COMPRESSIVE STRENGTH = 21Mpa FOR ALL STRUCTURAL MEMBERS MODULUS OF ELASTICITY = 21.52 Mpa POISSON'S RATIO = 0.20 <u>NOTE:</u> CONCRETE SHOULD HAVE ADEQUATE WORKABILITY WITH A SLUMP OF AT LEAST 50 TO 75mm INCHES AND MUST BE COMPACTED FOR AROUND 15-30 SECONDS BY USING STANDARD VIBRATORS.	28-DAYS COMPRESSIVE CYLINDER STRENGTH
REINFORCEMENT STEEL USED IN REINFORCED CONCRETE MEMBERS	REBAR YIELD STRENGTH = 415 Mpa MODULUS OF ELASTICITY = 20000 Mpa POISSON'S RATIO = 0.30 (YIELD STRENGTH OBTAINED FROM TEST) -fy (SPECIFIED STRENGTH = 415 Mpa) ≤ 124Mpa fu / fy ≥ 1.25 fy: ULTIMATE STRENGTH OBTAINED FROM TEST fu: ULTIMATE STRENGTH OBTAINED FROM TEST	GRADE-60 DEFORMED ROUND BARS CONFORMING TO ASTM A615

TABLE 2 : EARTHQUAKE LOAD PARAMETERS			
SEISMIC ZONE	2B	3	4
SEISMIC ZONE FACTOR	0.2	0.3	0.4
SEISMIC SOURCE TYPE	-	-	A
DISTANCE TO SOURCE	(km)-	->	15
SOIL TYPE	TYPE-D		
IMPORTANCE FACTOR	EDUCATION : 1.00 & HEALTH : 1.25		
RESPONSE MODIFICATION FACTOR, R	8.5		
MASS SOURCE	SELF - WEIGHT + SUPER IMPOSED DEAD LOADS		

TABLE 3 : STRUCTURAL MODELING ELEMENTS		
Sr.No.	STRUCTURAL ELEMENT	MODELING ELEMENT
1	BEAM	LINE ELEMENT
2	COLUMN	LINE ELEMENT
3	SLAB & RC WALL	SHELL ELEMENT
4	SOIL TYPE	TYPE-D
5	INFILL PANEL	NON- LINEAR LINE ELEMENT

Rev. No.	DATE	REVISION				Appr.	
Prepared	Reviewed	Approved					
Name: Anwar		Name: M. Rasheed		Name: Imtiaz Hussain			

DASU HYDROPOWER PROJECT	
	PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA
Bid Drawing NCB No. DASU-RS-02 Construction of Relocated Schools	
DRAWING TITLE: DESIGN DATA TABLE SHEET(4)	
DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
 <small>JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOL-SAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</small>	DRAWING No. 141-071

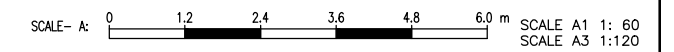


NOTES:

1. All Dimensions are in Millimeters unless otherwise indicated.
2. The Slope of Weep holes shall be into from back of the masonry to the out face of wall
3. The Base (X) of Breast Wall Shall be decided on the given Height (Y) as per below formula:

$$X = \frac{3Y}{28} + 700$$

SCALE: A



DASU HYDROPOWER PROJECT



**PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA**

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
**RELOCATION PRIMARY SCHOOLS
TYPICAL BREAST WALL DETAILS**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER CONSULTANTS

DATE: SEP/2024

DRAWING No. **141-072**

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NIPPON KOEI CO. LTD. and
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H	h	B	a	b	c	d	Max. Toe Bearing Pressure Under Seismic
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kPa)
2000	1000	1800	250	1300	250	250	100
3000	1000	2550	300	1950	300	300	130
4000	1000	3400	400	2600	400	400	190
5000	1500	4250	500	3250	500	500	270
6000	1500	5100	600	3900	600	600	300
7000	1500	5950	700	4550	700	700	390
7500	1500	6380	750	4880	750	750	425

**TABLE OF DIMENSIONS
(FOR ALLUVIUM STRATA UNDER FOUNDATION)**

- ANGLE OF INTERNAL FRICTION OF BACKFILL MATERIAL (ϕ) = 35°
- FRICTION ANGLE BETWEEN CONCRETE FOUNDATION & SOIL UNDERNEATH (ϕ) = 35°

H	h	B	a	b	c	d	Max. Toe Bearing Pressure Under Seismic
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kPa)
2000	1000	1500	250	1000	250	250	100
3000	1000	2100	300	1500	300	300	160
4000	1000	2800	400	2000	400	400	230
5000	1000	3500	500	2500	500	500	300
6000	1000	4200	600	3000	600	600	355
7000	1000	4900	700	3500	700	700	420
7500	1000	5250	750	3750	750	750	450

**TABLE OF DIMENSIONS
(FOR ROCK STRATA UNDER FOUNDATION)**

- ANGLE OF INTERNAL FRICTION OF BACKFILL MATERIAL (ϕ) = 35°
- FRICTION ANGLE BETWEEN CONCRETE FOUNDATION & SOIL UNDERNEATH (ϕ) = 45°

NOTES:

1. All Dimensions are in Meters unless otherwise indicated.

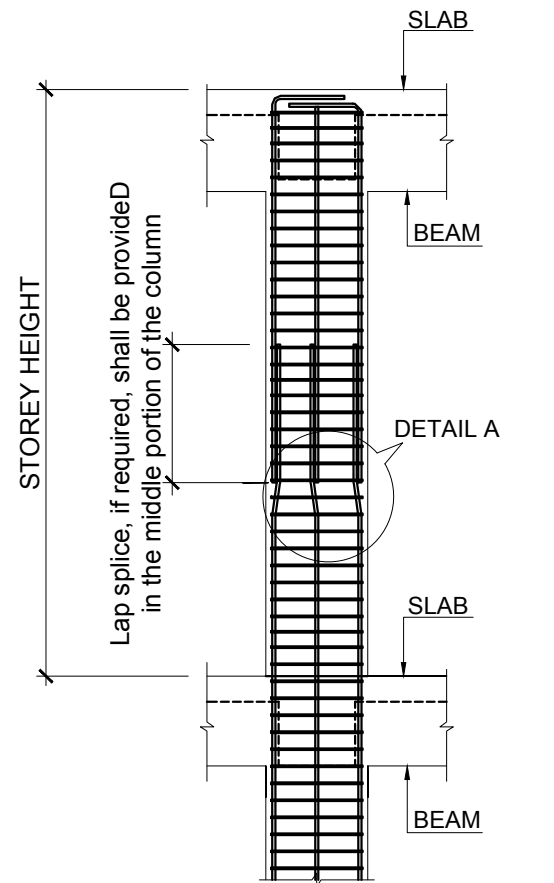
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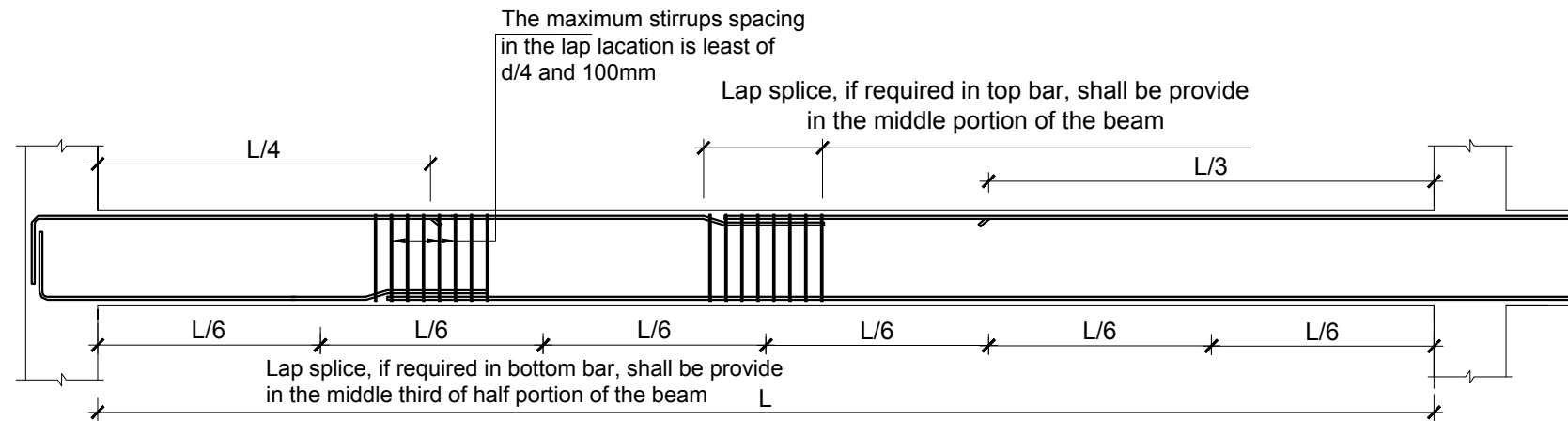
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

 DASU HYDROPOWER PROJECT PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA	
Bid Drawing NCB No. DASU-RS-02 Construction of Relocated Schools	
DRAWING TITLE:	
TYPICAL STONE MASONRY RETAINING WALL JOINT DETAIL, LABEL OF DIMENSIONS-SHEET-2	
DASU HYDROPOWER CONSULTANTS <small>JOINT VENTURE OF NIPPON KOEI CO., LTD. and DOLSAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</small>	DATE: SEP/2024 DRAWING No. 141-073

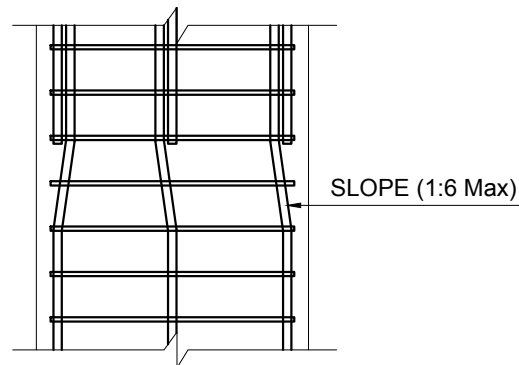
TYPICAL REINFORCEMENT DETAILS



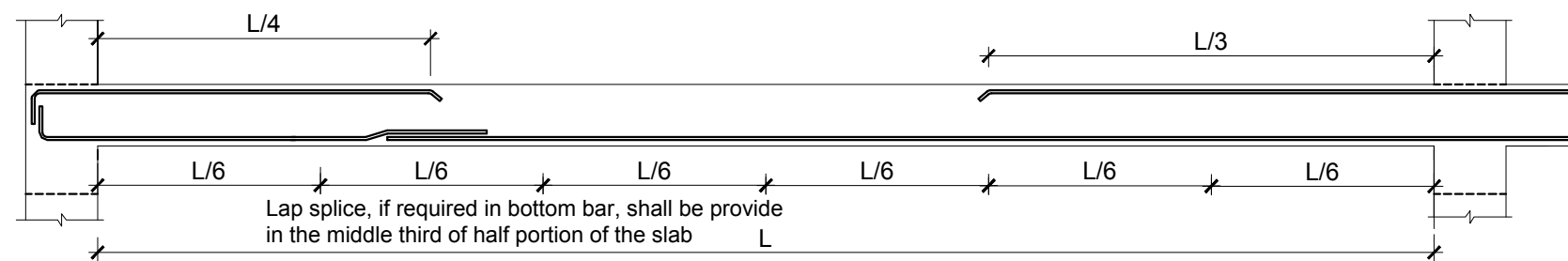
TYPICAL COLUMN DETAILS



TYPICAL LAP BEAM DETAILS



DETAILS A



TYPICAL LAP DETAILS IN SLAB

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Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

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 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

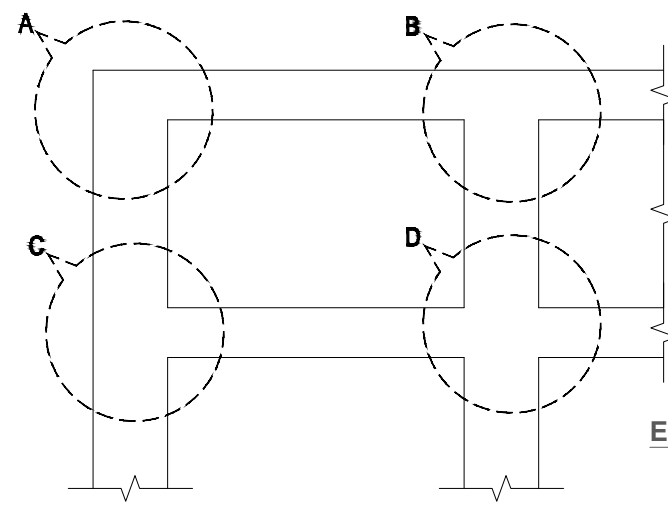
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
TYPICAL DETAIL SHEET(1)

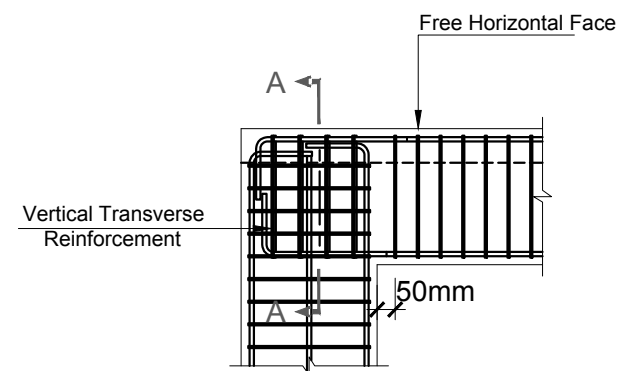
DASU HYDROPOWER CONSULTANTS
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DATE: SEP/2024
 DRAWING No. 141-074

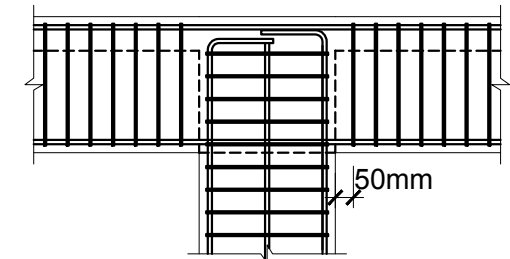
TYPICAL CONNECTION DETAILS



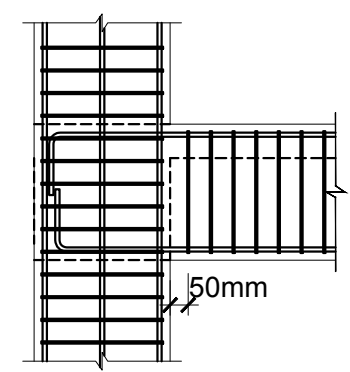
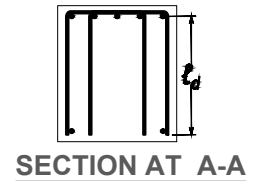
LOCATION OF JOINTS



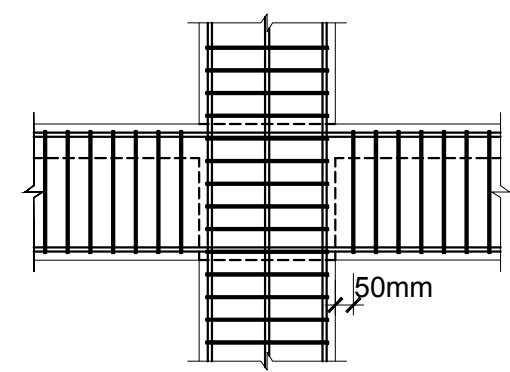
**DETAIL A
EXTERIOR BEAM - COLUMN JOINT (ROOF LEVEL)**



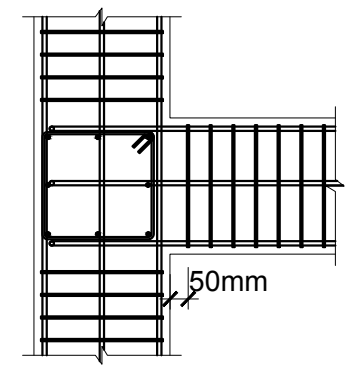
**DETAIL B
BEAM - COLUMN JOINT (ROOF LEVEL)**



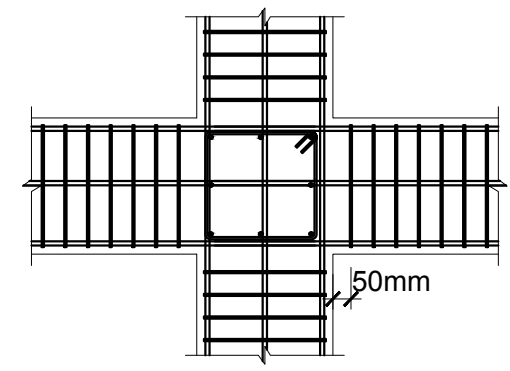
**DETAIL C
EXTERIOR BEAM - COLUMN JOINT (INTERMEDIATE LEVEL)**



**DETAIL D
EXTERIOR - COLUMN JOINT (INTERMEDIATE LEVEL)**



**DETAIL C
EXTERIOR BEAM - COLUMN JOINT
PLAN VIEW**



**DETAIL D
INTERIOR BEAM - COLUMN JOINT
PLAN VIEW**

DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

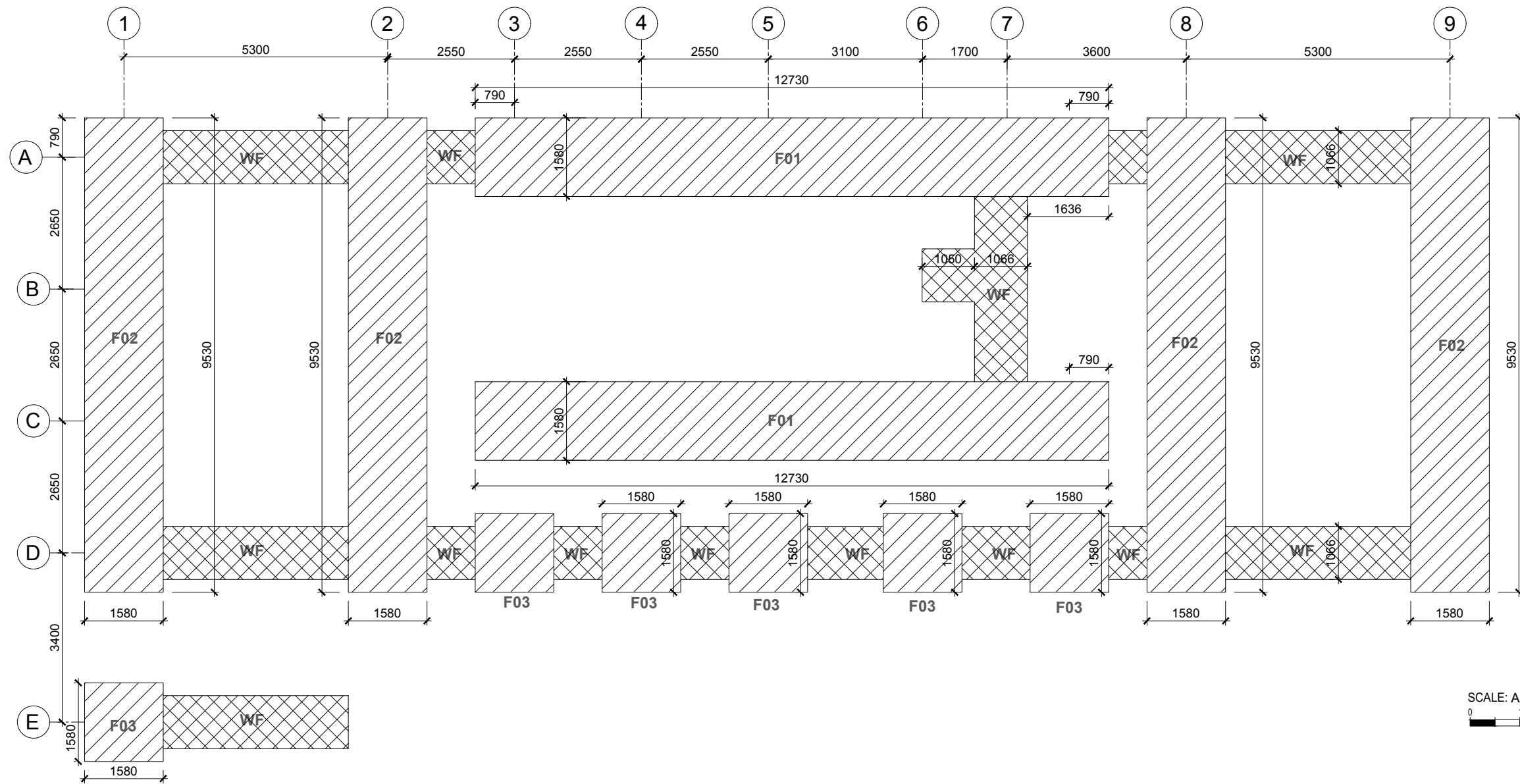
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
TYPICAL DETAIL SHEET(2)

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Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

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DATE: SEP/2024
 DRAWING No. **141-074**



EXCAVATION PLAN
SCALE A =1:100

SCALE: A
0 1 2 3 4 5m
SCALE A1 1:50
SCALE A3 1:100

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

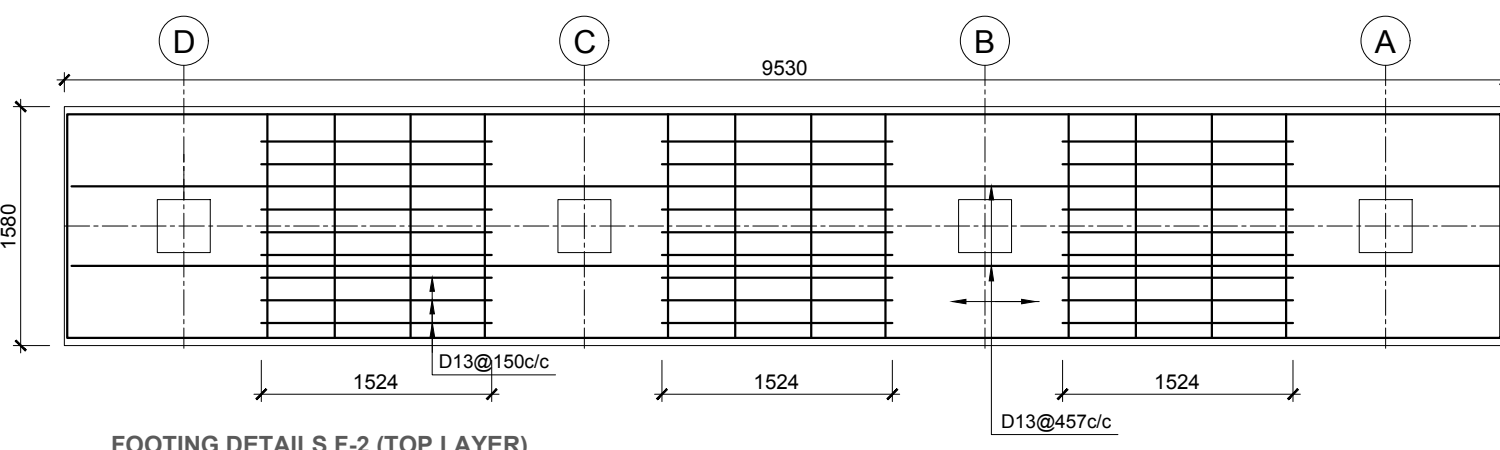
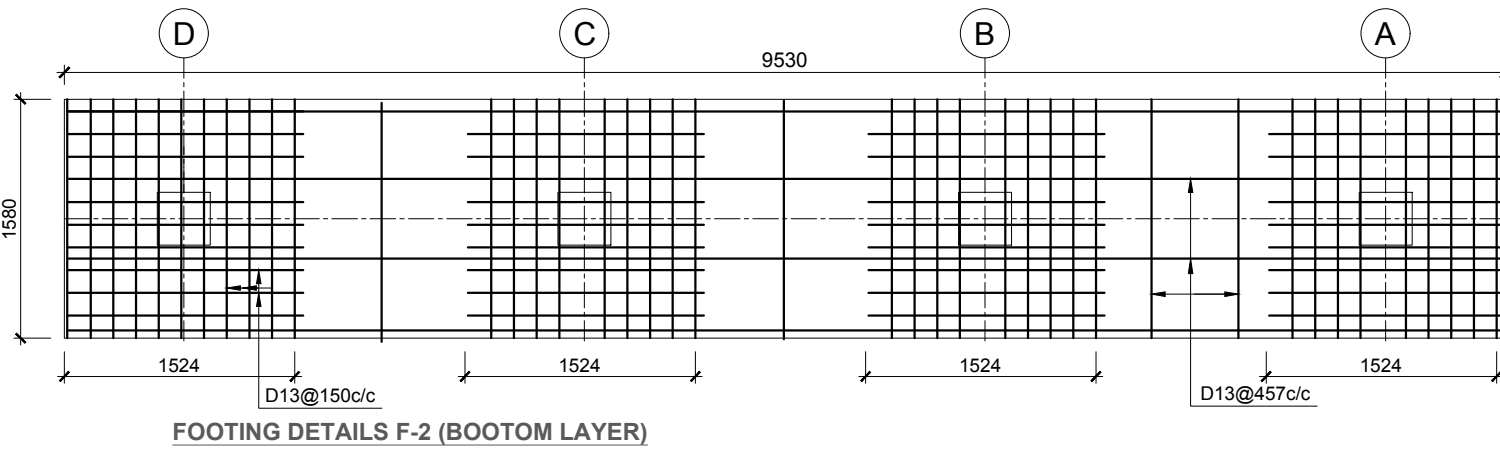
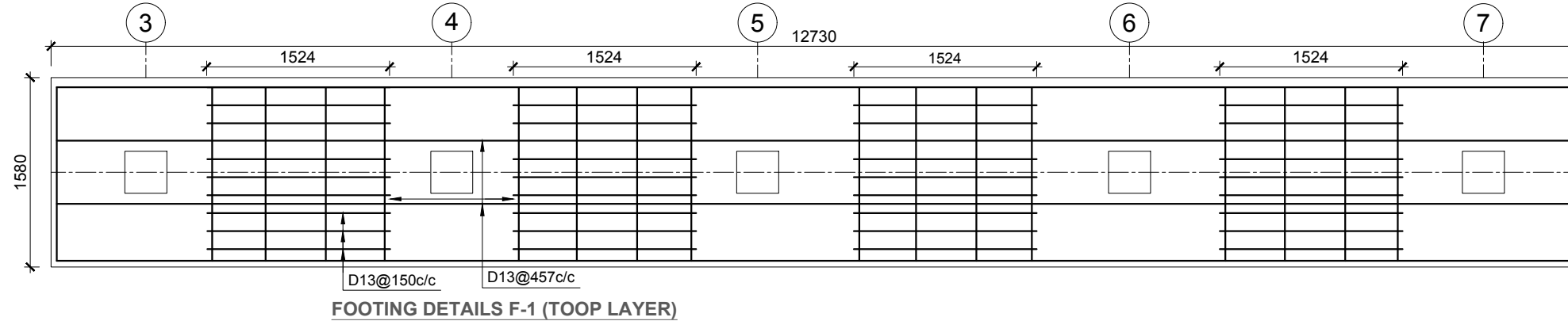
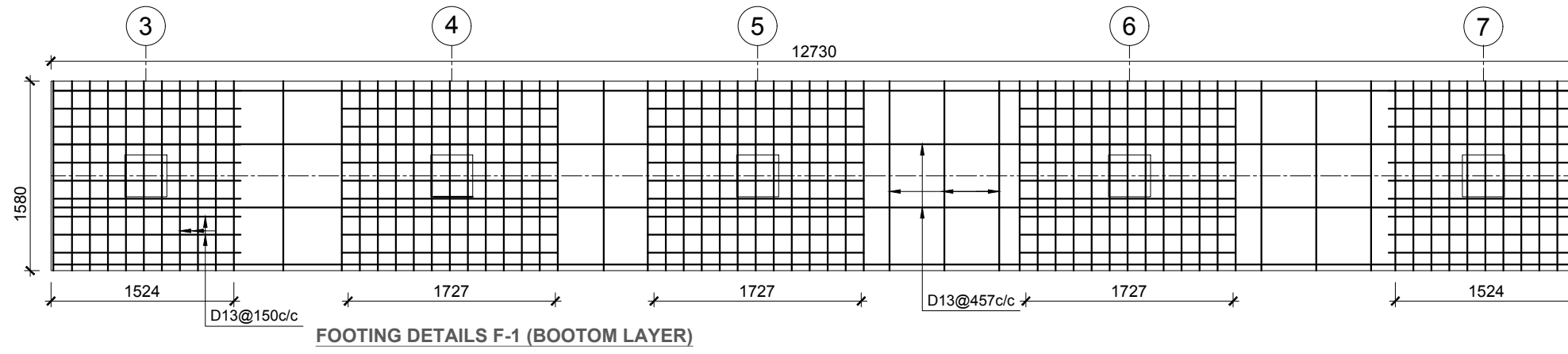
**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
**RELOCATED PRIMARY SCHOOL
EXCAVATION PLAN**

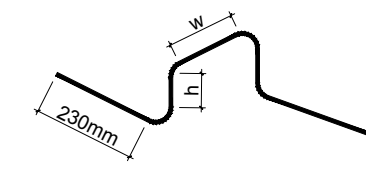
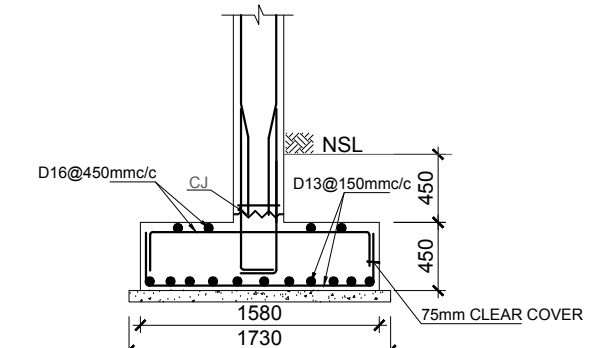
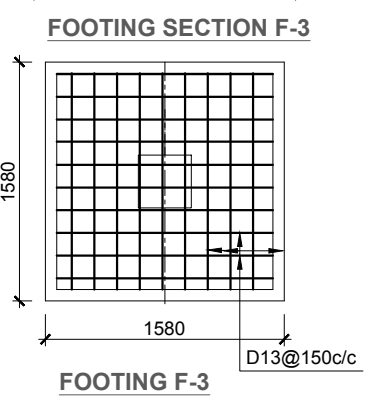
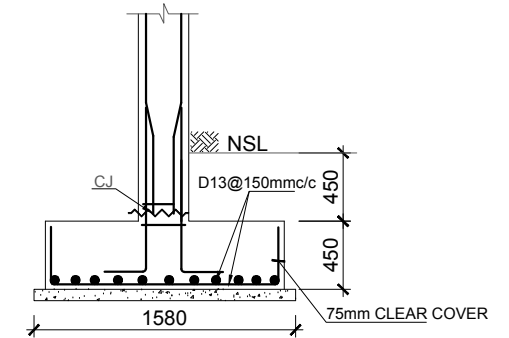
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JOINT VENTURE OF
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in Association with
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DATE: SEP/2024
DRAWING No. 141-075




FOUNDATION PLAN
SCALE A = 1:100




NOTE:
CLEAR COVER FOR FOOTING = 75mm

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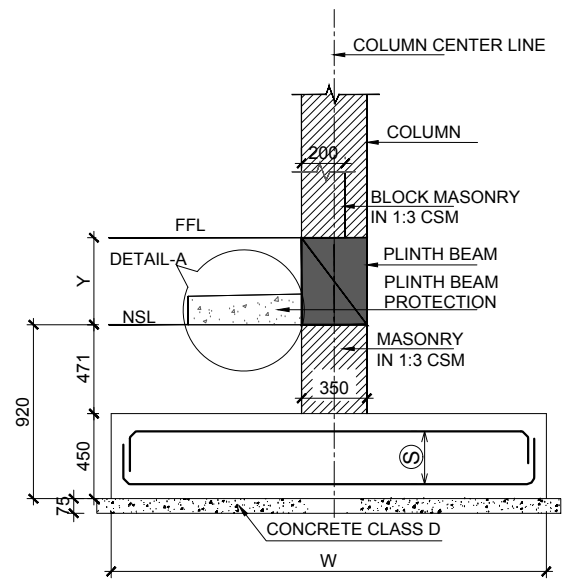
DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL FOUNDATION DETAIL

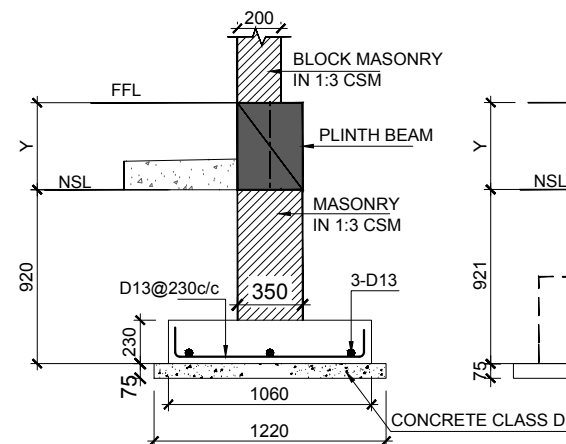
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 in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. 141-077

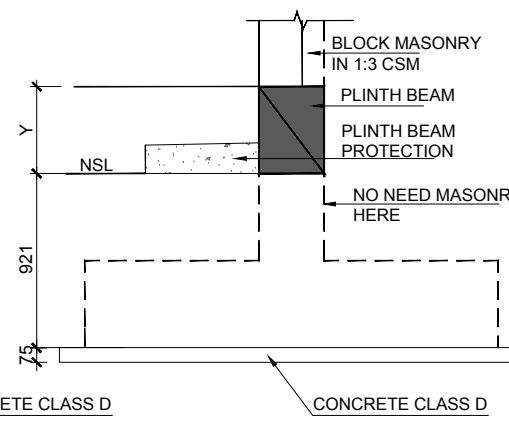


TYPICAL 9" EXTERIOR WALL WITH R.C.C. STRIP FOOTING DETAIL

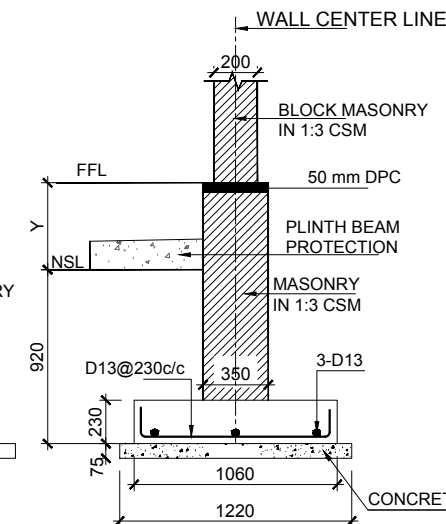
For width (W), thickness (T) and reinforcement (S) details of R.C.C strip footing, please see pages SF-1 to SF-3



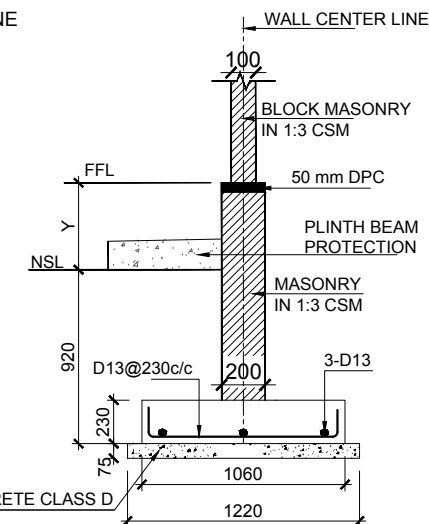
200 EXTERIOR WALL R.C.C. FOOTING DETAIL (WF DETAIL)



INTERNAL WALL DETAIL CLEAR COVER FOR FOOTING = 75mm



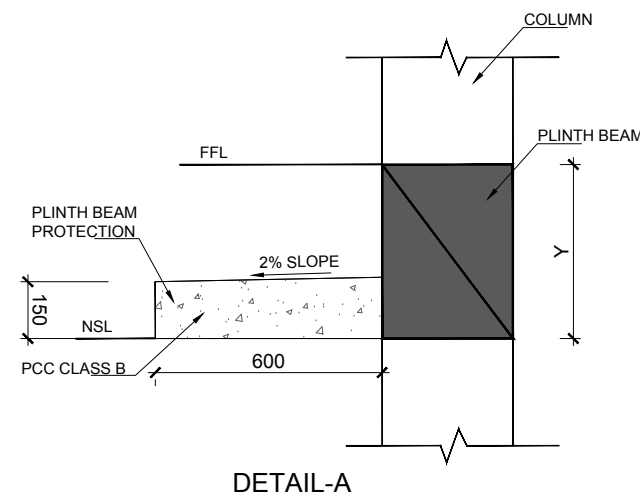
200mm WALL R.C.C. FOOTING DETAIL (WF DETAIL) NOTE: THE FOOTING PAD IS SYMMETRIC ABOUT WALL CENTER LINE



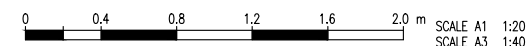
100mm WALL R.C.C. FOOTING (WF DETAIL) NOTE: THE FOOTING PAD IS SYMMETRIC ABOUT WALL CENTER LINE

- Note: 1. NSL refers to natural surface level and not made-up ground or fill level.
 2. The foundation pad shall be kept on firm strata at least 1m below NSL.
 3. The distance "y" above NSL up to FFL is variable. The site engineer shall decide this distance based on ground conditions and recommendation of geotechnical engineer. In any case the distance "y" shall not be more than 3m. If more than 3m excavation is required, the consultant shall be informed to make appropriate revision in

4. No masonry is required below the Plinth beam where the plinth beam is supporting internal walls as shown in the typical detail of internal wall.
 5. External walls below the plinth beam can be used to retain fill material upto 3m depth. For larger depths, proper retaining wall shall be used.



DETAIL-A



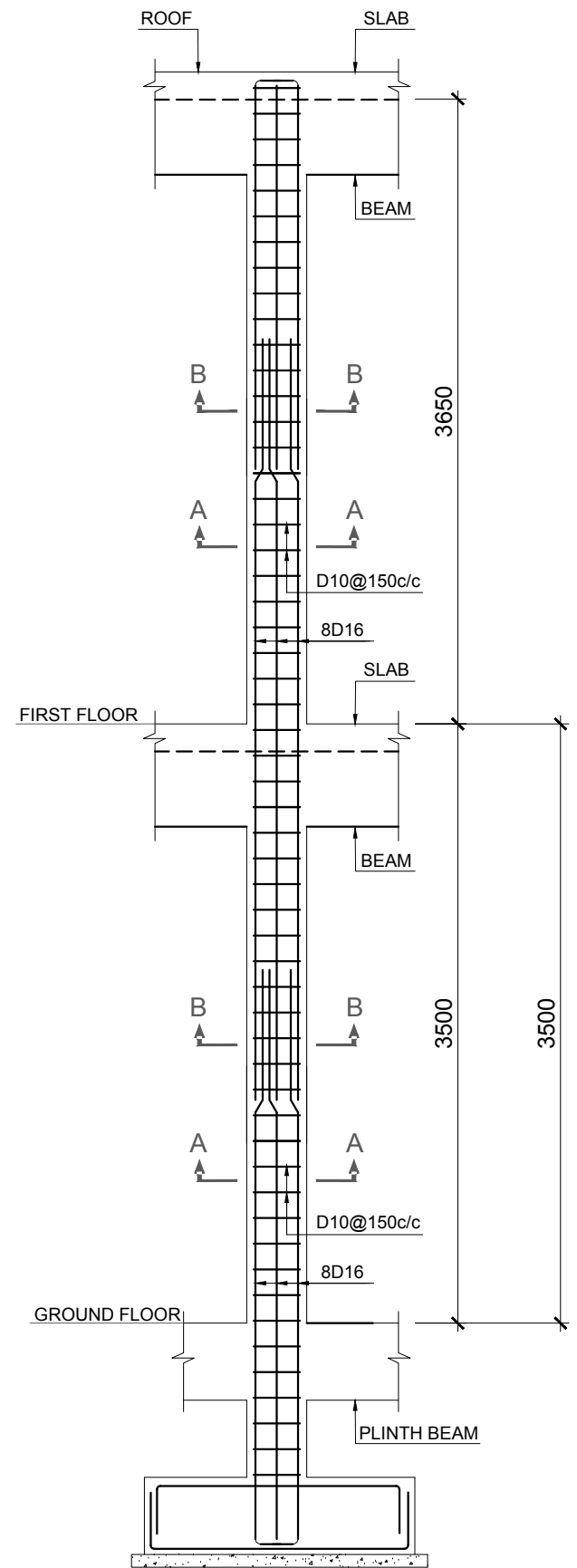
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Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

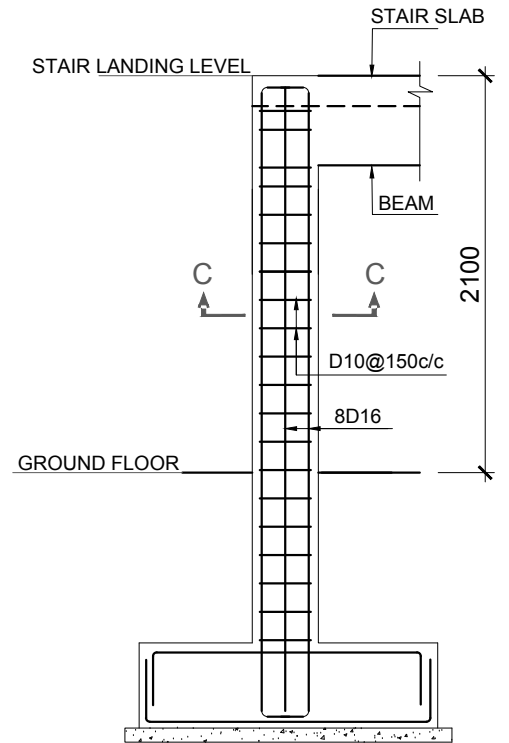
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
 RELOCATED PRIMARY SCHOOL
 FOUNDATION WALL DETAIL

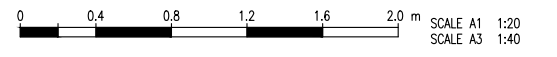
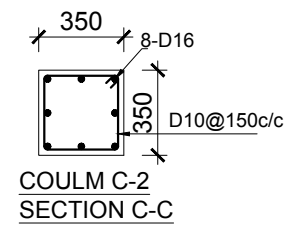
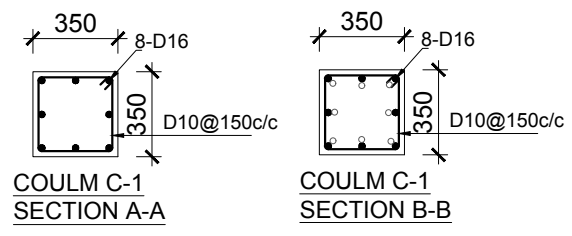
DASU HYDROPOWER CONSULTANTS DATE: SEP/2024
 JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSTAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD. DRAWING No. 141-078



COLUMN C1 DETAIL
SCALE A = 1:50




COLUMN C2 DETAIL
SCALE A = 1:50




NOTE:
CLEAR COVER FOR COLUMN = 38mm

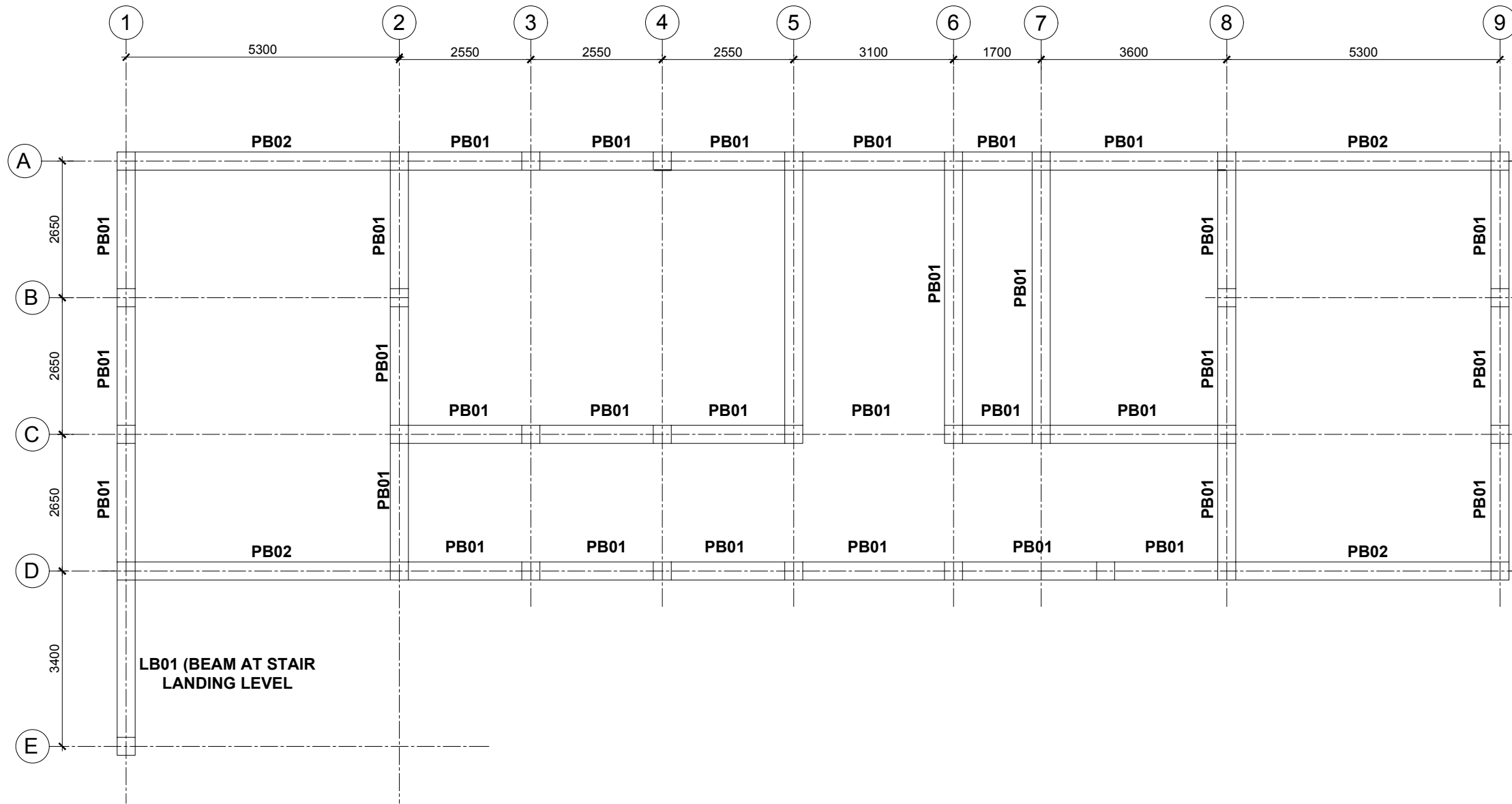
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Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL COLUMN DETAIL

DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
 JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSTAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.	DRAWING No. 141-081



PLINTH BEAM PLAN
SCALE A =1:100



NOTE:
ALL PLINTH BEAM ARE 350X450 EXCEPT LB1

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Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT

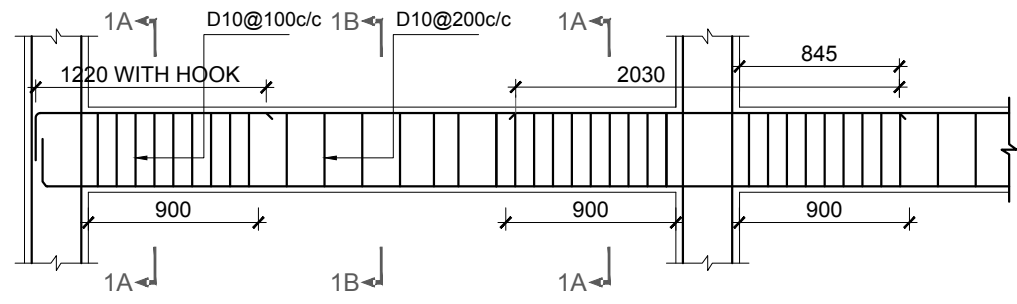
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

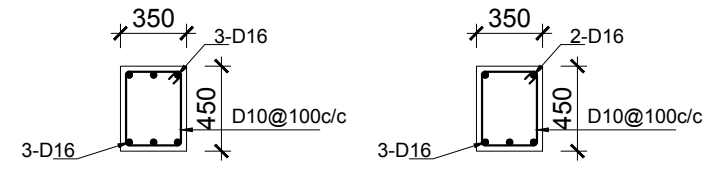
DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
PLINTH BEAM PLAN

DASU HYDROPOWER CONSULTANTS
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DATE: SEP/2024
DRAWING No. 141-082

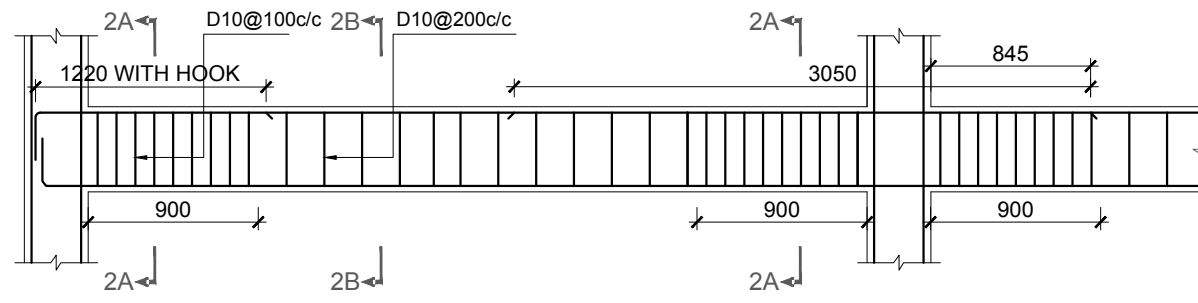


PLINTH BEAM PB01

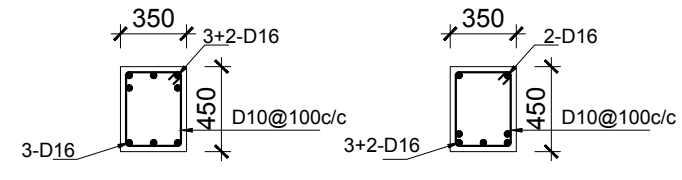


SECTION 1A

SECTION 1B

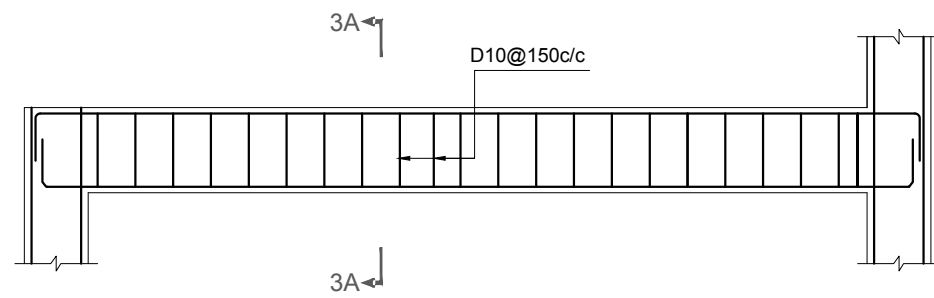


PLINTH BEAM PB02

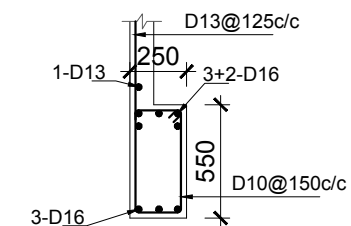


SECTION 2A

SECTION 2B



LANDING LEVEL BEAM LB1



SECTION 3A



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
**RELOCATED PRIMARY SCHOOL
PLINTH BEAM DETAIL**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

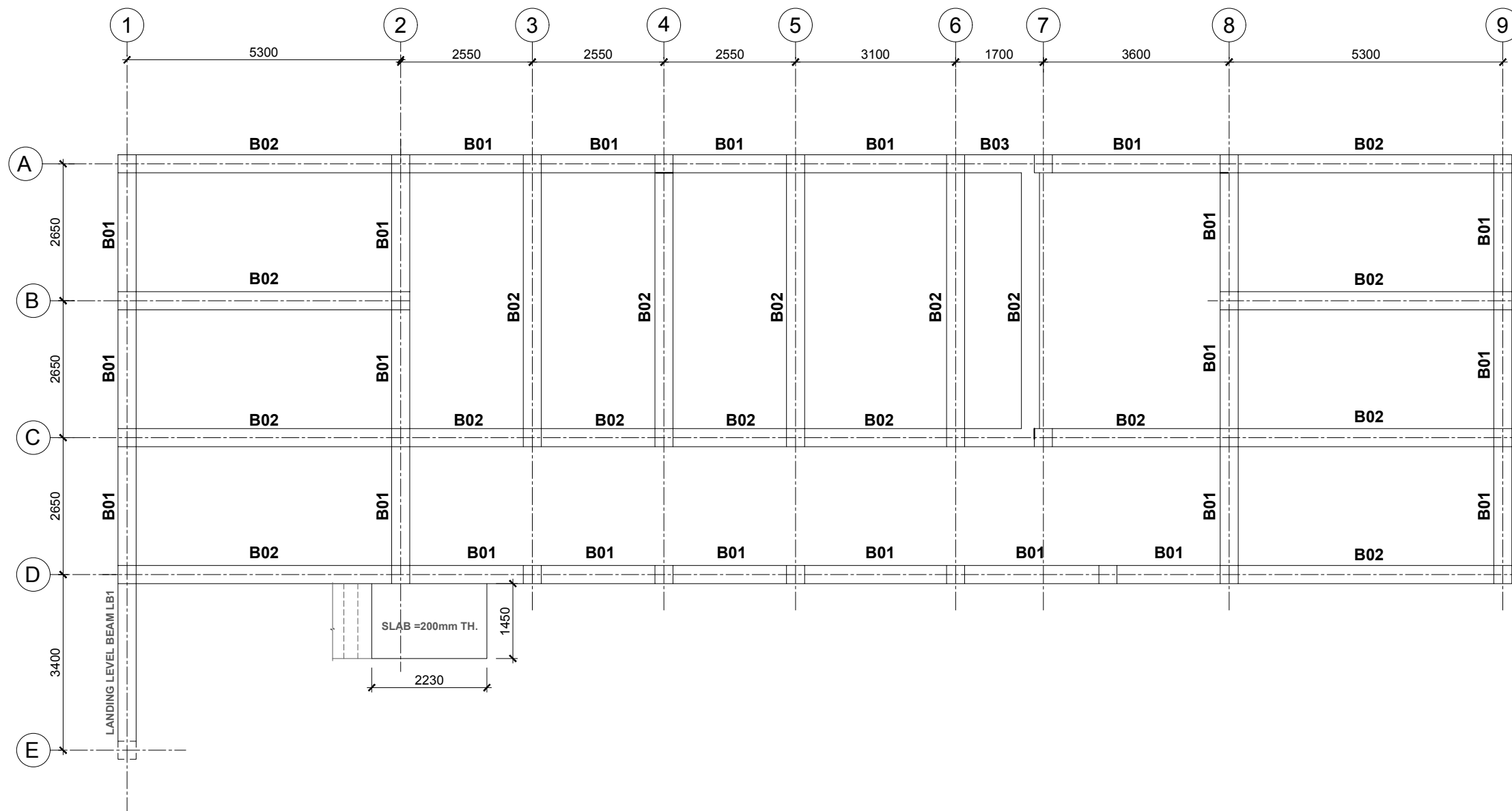
DASU HYDROPOWER CONSULTANTS



JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOL-SAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-083




BEAM PLAN
SCALE A =1:100

SIZE OF STRUCTURAL MEMBERS	
B1,B2 & B3	350 X 450
SLAB	150 THICK

NOTES: -
All dimensions are in millimeters unless otherwise mentioned


SCALE: A
0 1 2 3 4 5m
SCALE A1 1:50
SCALE A3 1:100

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

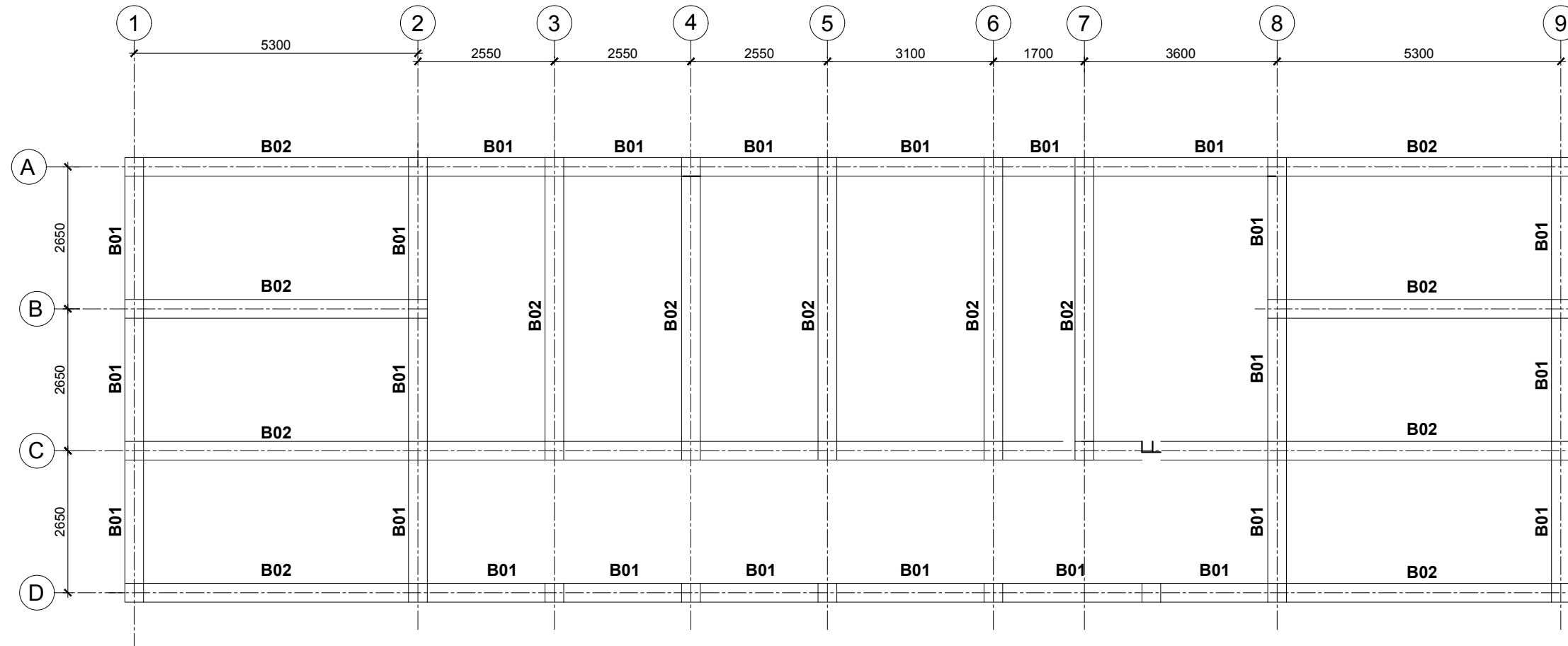
DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
FIRST FLOOR BEAM PLAN

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF
 NIPPON KOEI CO.,LTD. and
 DOLAR ENGINEERING LIMITED
 in Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. 141-084




ROOF BEAM PLAN
SCALE A =1:100



SIZE OF STRUCTURAL MEMBERS	
B1,B2 & B3	350 X 450
SLAB	150 THICK


NOTES: -
All dimensions are in millimeters unless otherwise mentioned

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

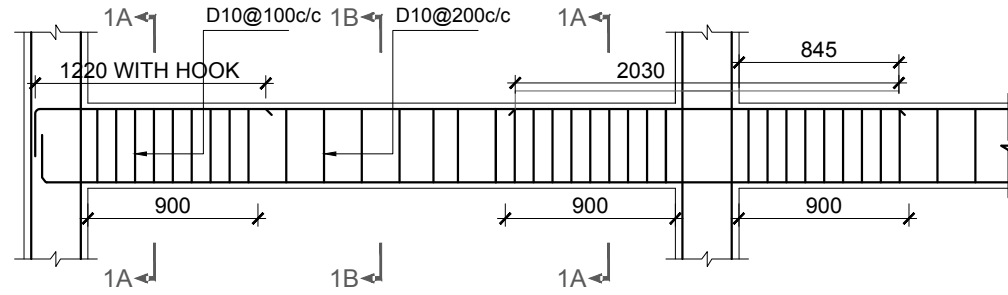
DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

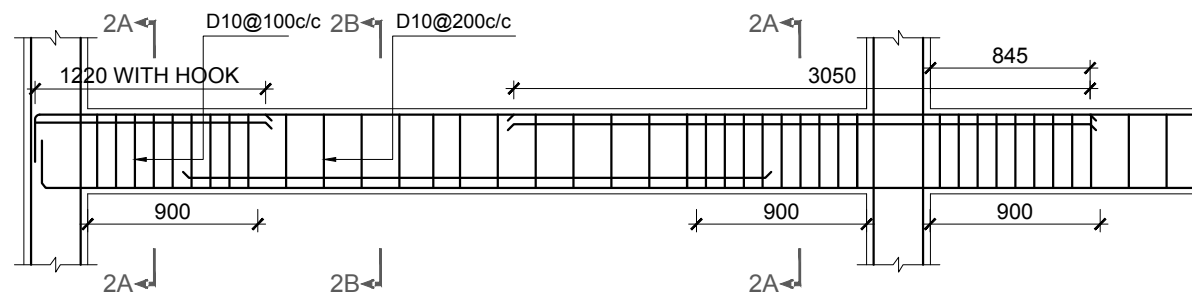
DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
ROOF BEAM PLAN

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSR ENGINEERING LIMITED
 in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

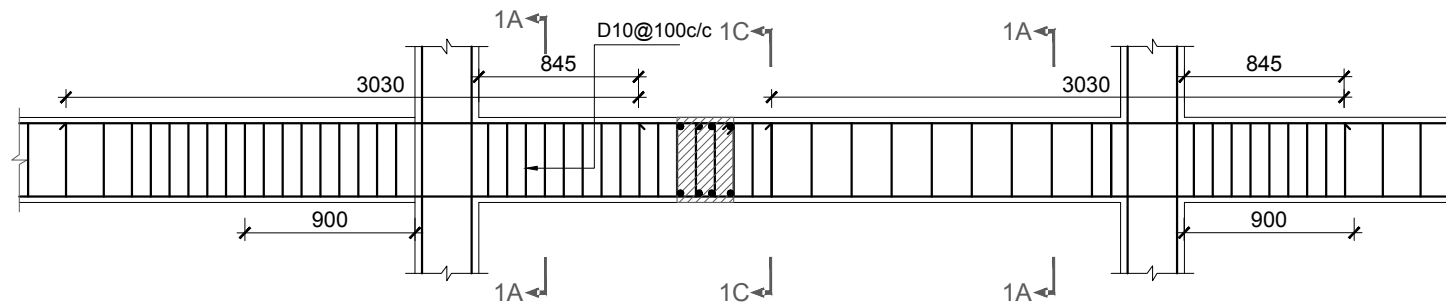
DATE: SEP/2024
 DRAWING No. 141-085



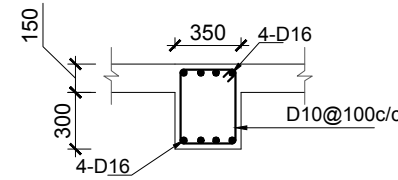
BEAM B01



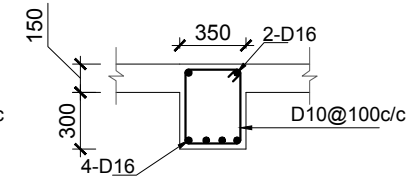
BEAM B02



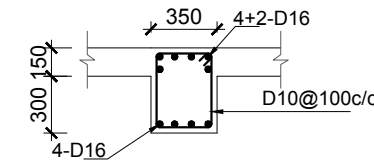
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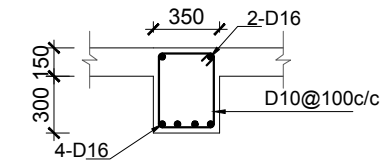
SECTION 1A



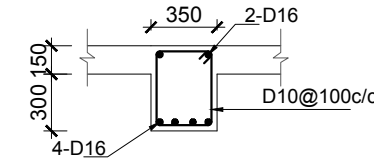
SECTION 1B



SECTION 2A



SECTION 2B



SECTION 1C



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
**RELOCATED PRIMARY SCHOOL
BEAM DETAIL**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

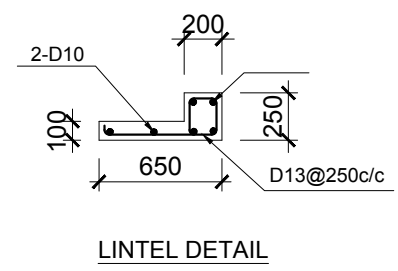
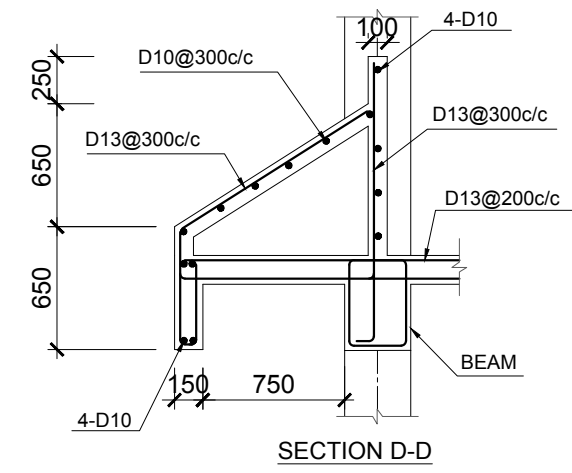
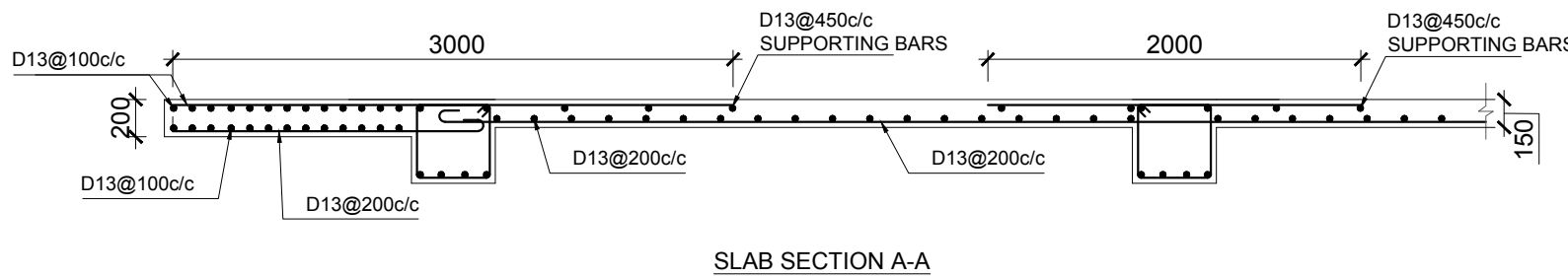
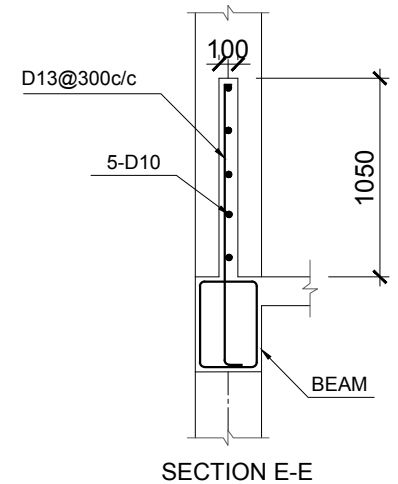
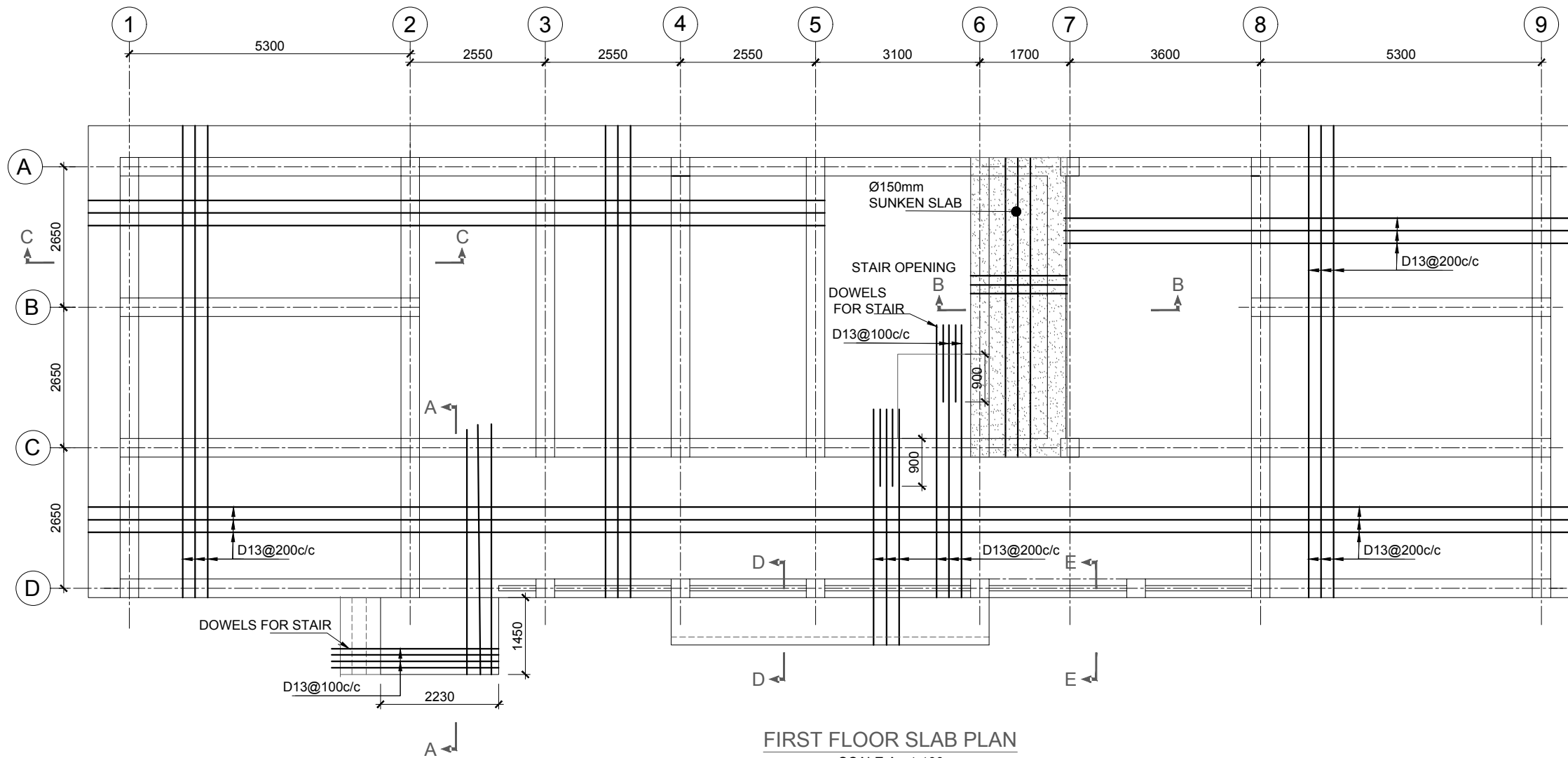
DASU HYDROPOWER CONSULTANTS



JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-086



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.

0 0.8 1.6 2.4 3.2 4.0 m SCALE A1 1:40 SCALE A3 1:80

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

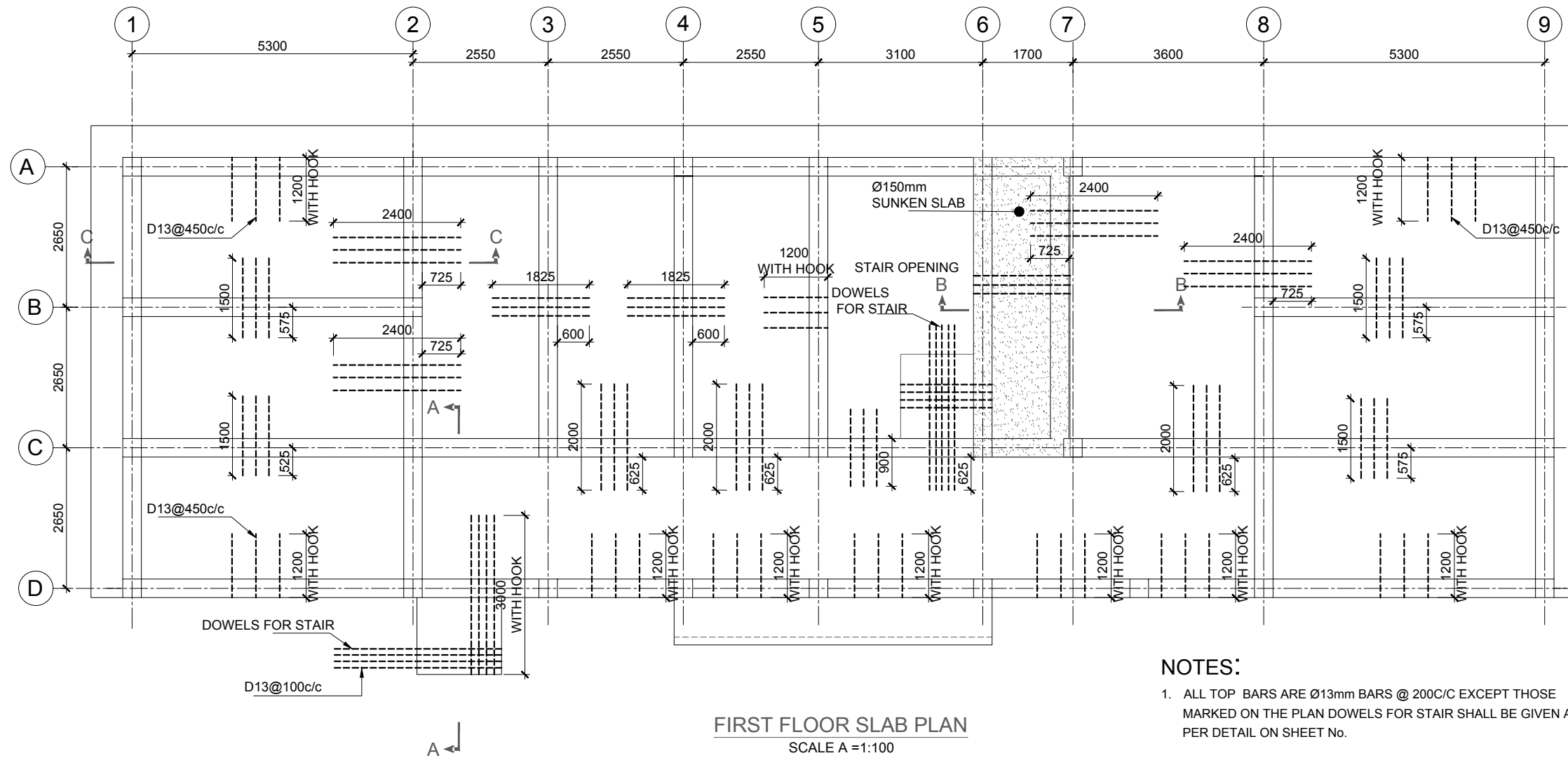
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
FIRST FLOOR SLAB PLAN

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

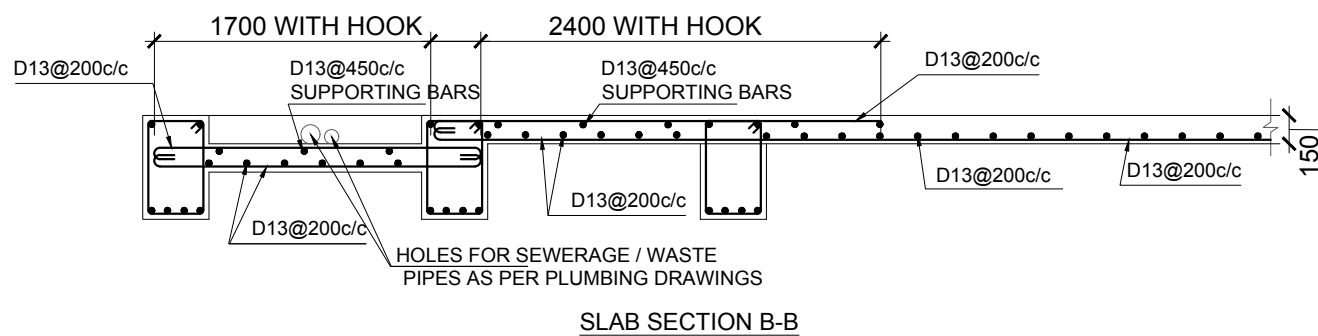
DATE: SEP/2024
DRAWING No. 141-087



FIRST FLOOR SLAB PLAN
SCALE A = 1:100

NOTES:

1. ALL TOP BARS ARE Ø13mm BARS @ 200C/C EXCEPT THOSE MARKED ON THE PLAN DOWELS FOR STAIR SHALL BE GIVEN AS PER DETAIL ON SHEET No.



SLAB SECTION B-B

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
FIRST FLOOR SLAB PLAN

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER CONSULTANTS

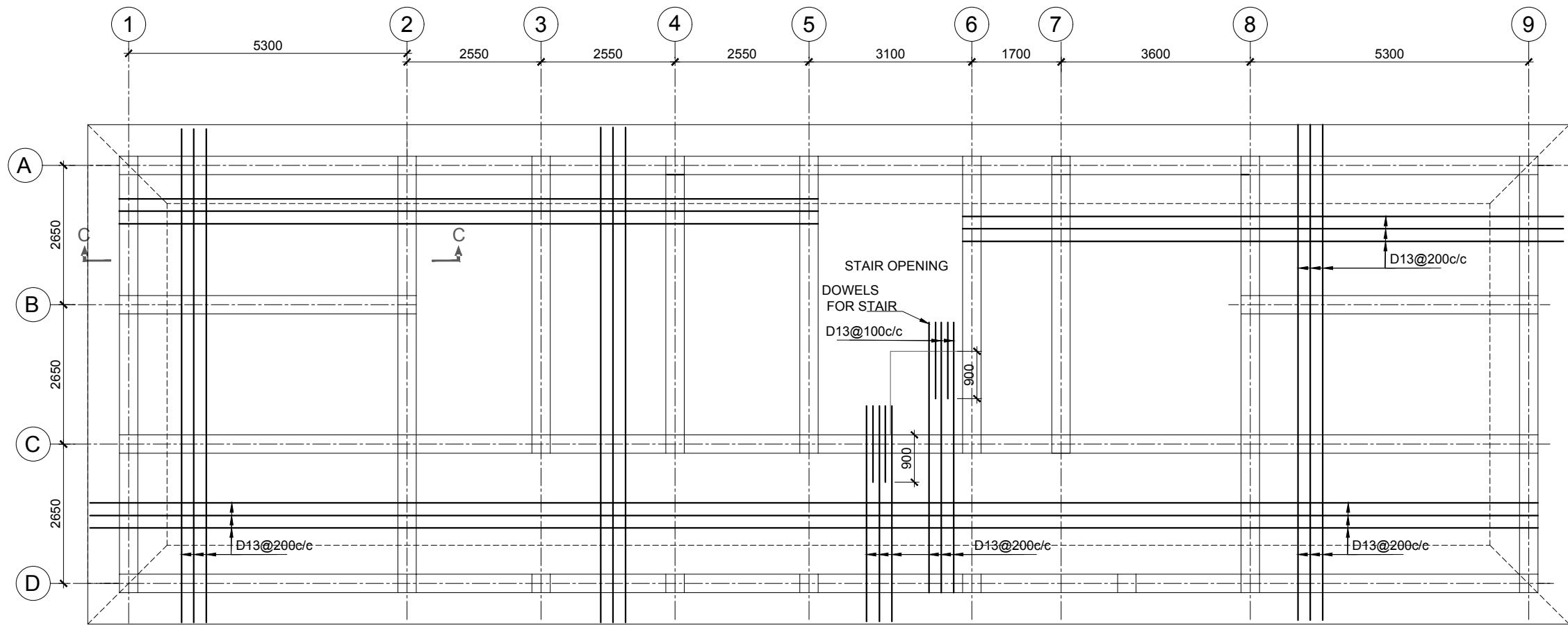


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DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

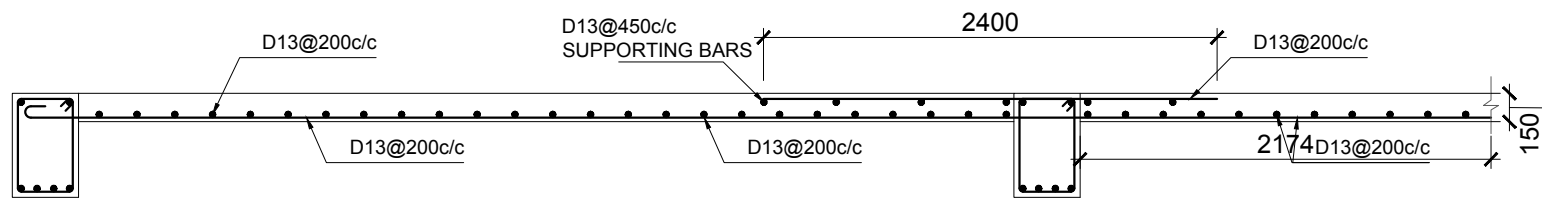
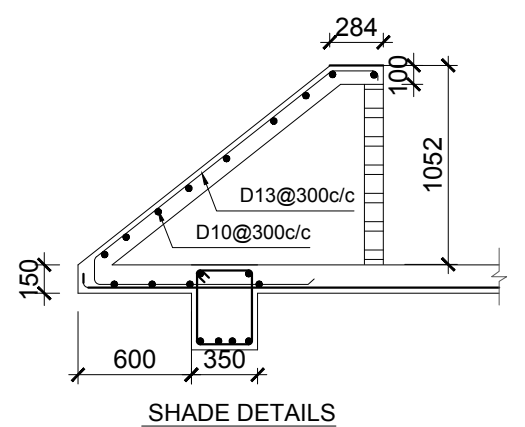
DRAWING No.

141-088



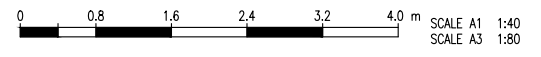
NOTES:
 1. ALL TOP BARS ARE Ø13mm BARS @ 200C/C EXCEPT FOR DOWELS OF STAIR.

ROOF SLAB PLAN
 SCALE A = 1:100



SLAB SECTION C-C

NOTES:
 1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.



DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

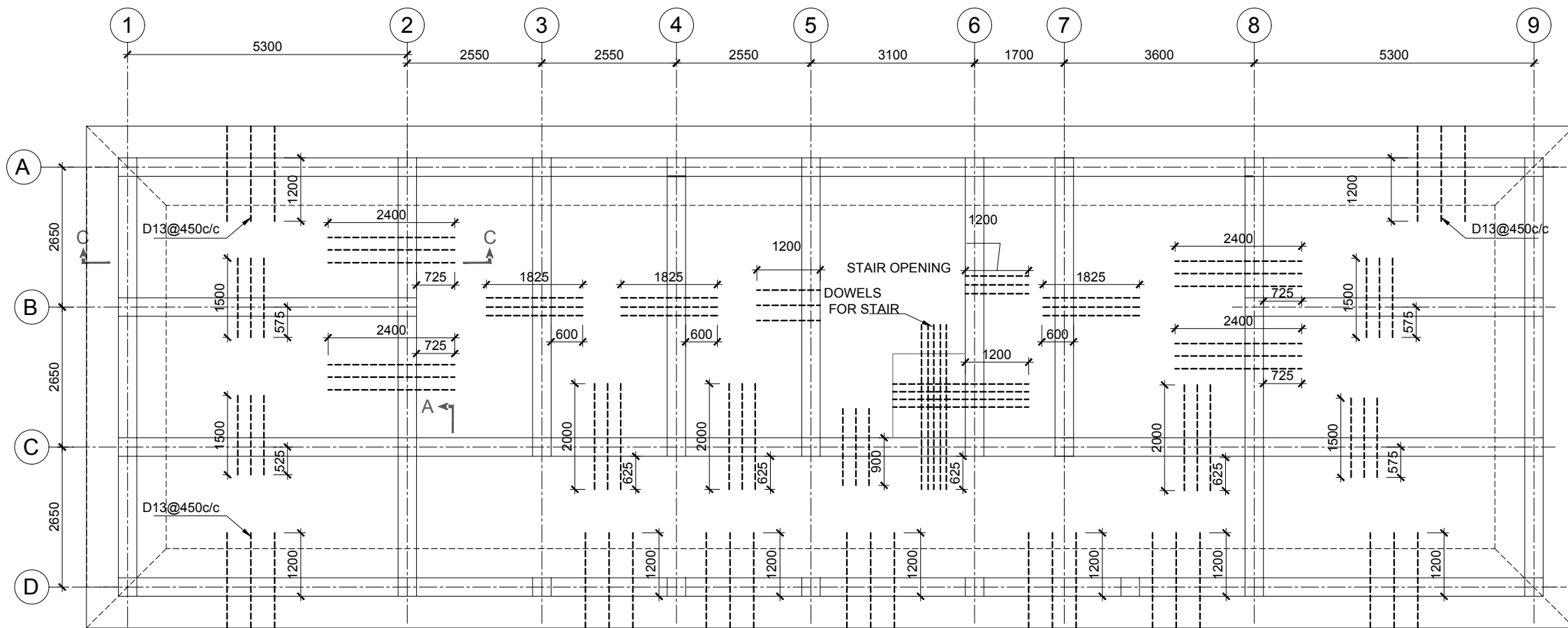
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
ROOF SLAB PLAN

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF
 NIPPON KOEI CO., LTD. and
 DOL/SAR ENGINEERING LIMITED
 in Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. 141-089



NOTES:

1. ALL TOP BARS ARE Ø13mm BARS @ 200C/C EXCEPT FOR DOWELS OF STAIR.

ROOF SLAB PLAN
SCALE A = 1:100

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
ROOF SLAB PLAN

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

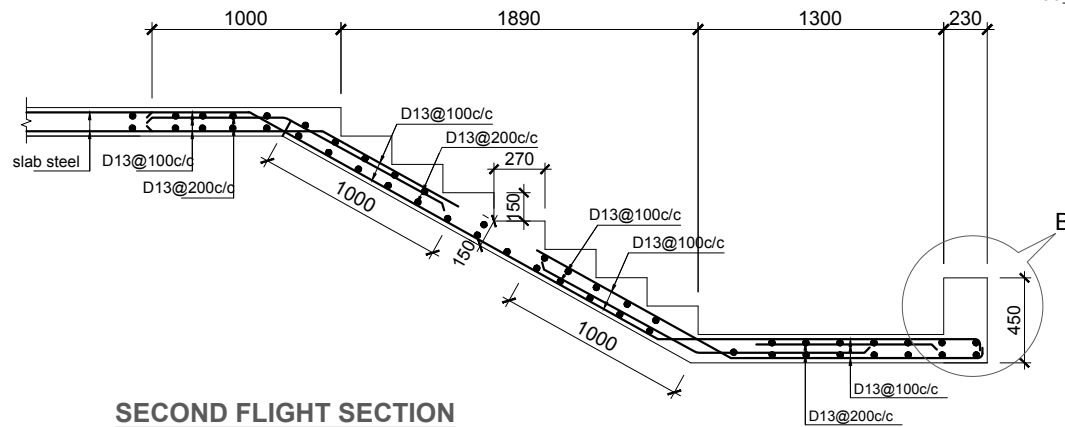
DASU HYDROPOWER CONSULTANTS



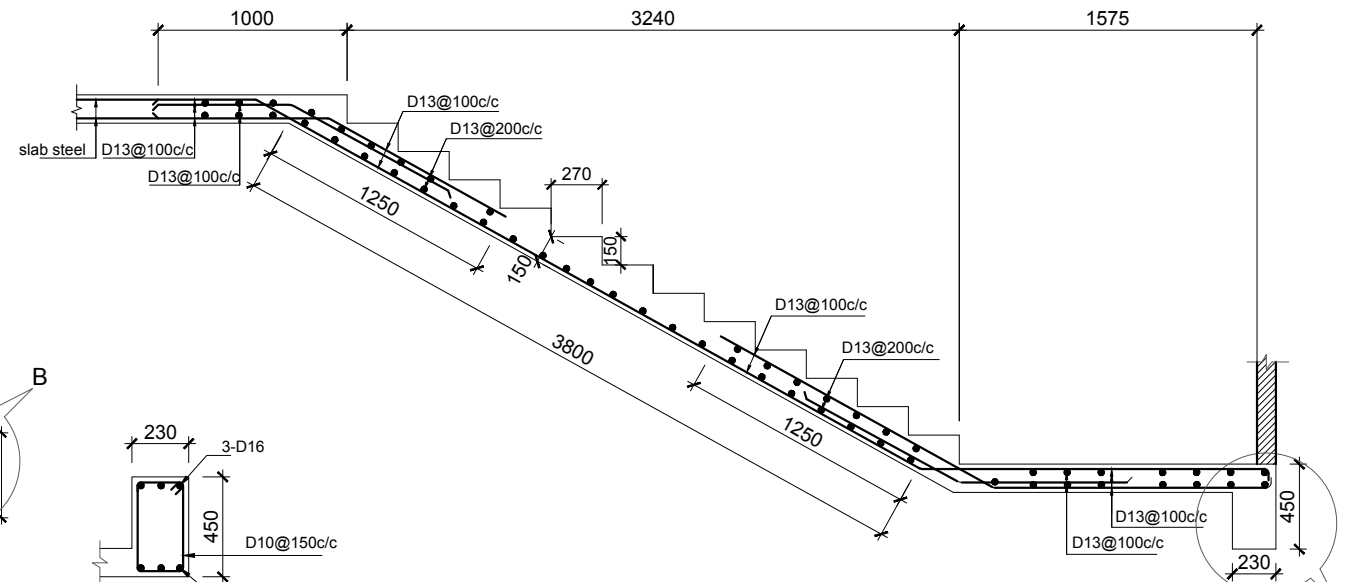
JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

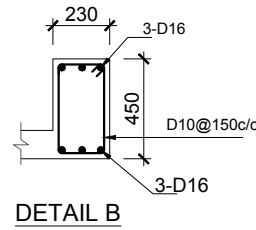
DRAWING No.
141-090



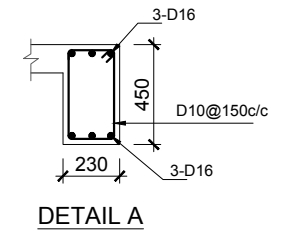
SECOND FLIGHT SECTION



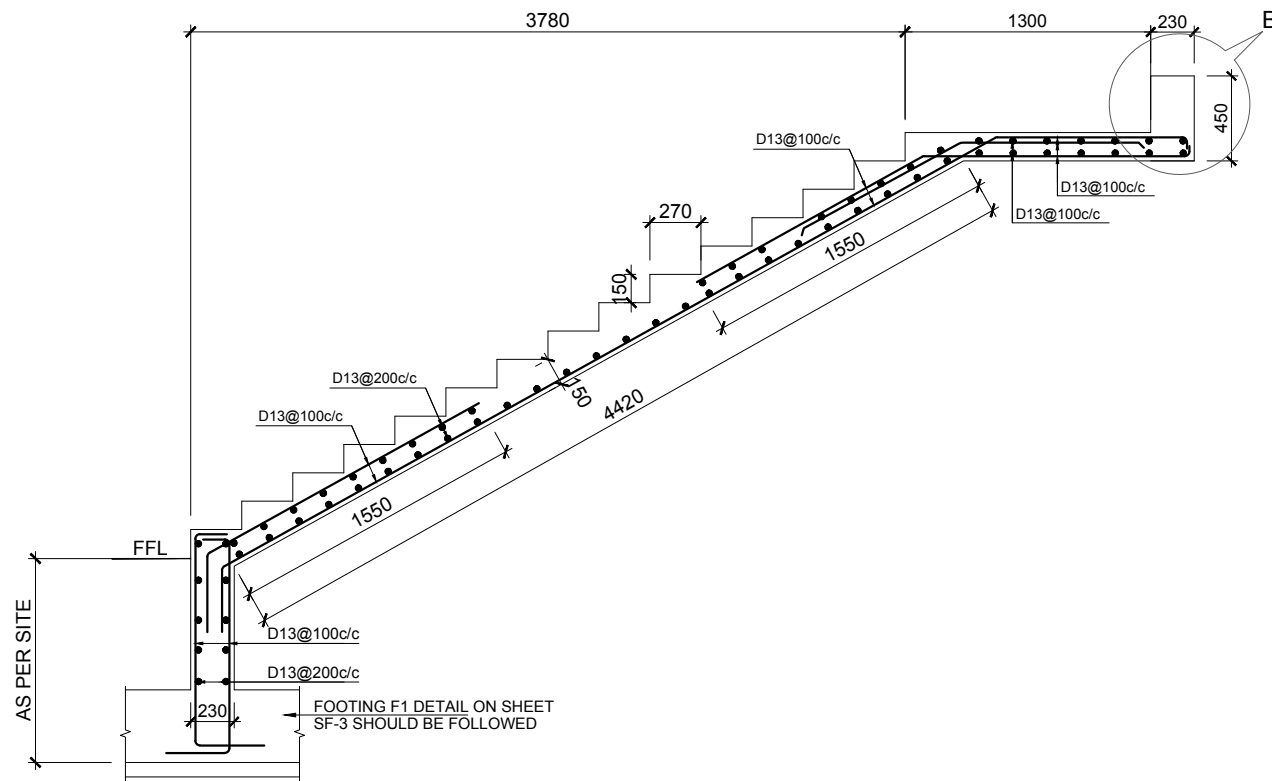
SECOND FLIGHT SECTION



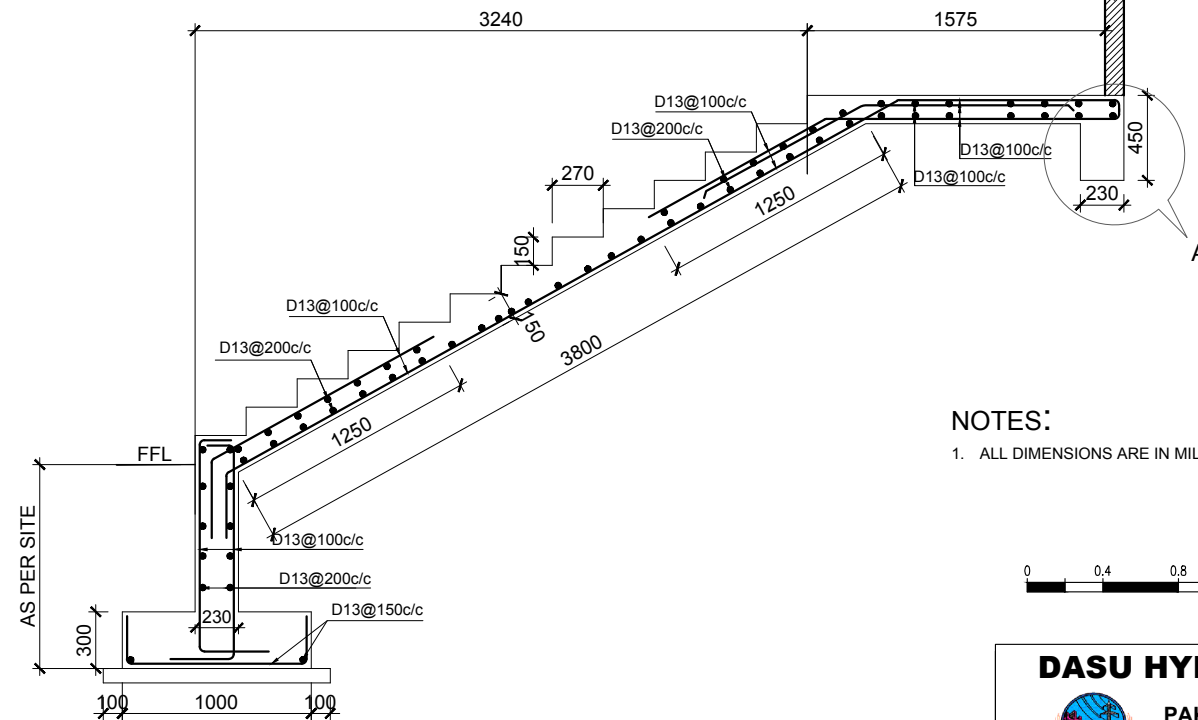
DETAIL B



DETAIL A

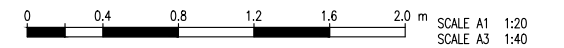


FIRST FLIGHT SECTION




FIRST FLIGHT SECTION

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.




STAIR REINFORCEMENT DETAILS
SCALE A = 1:40

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

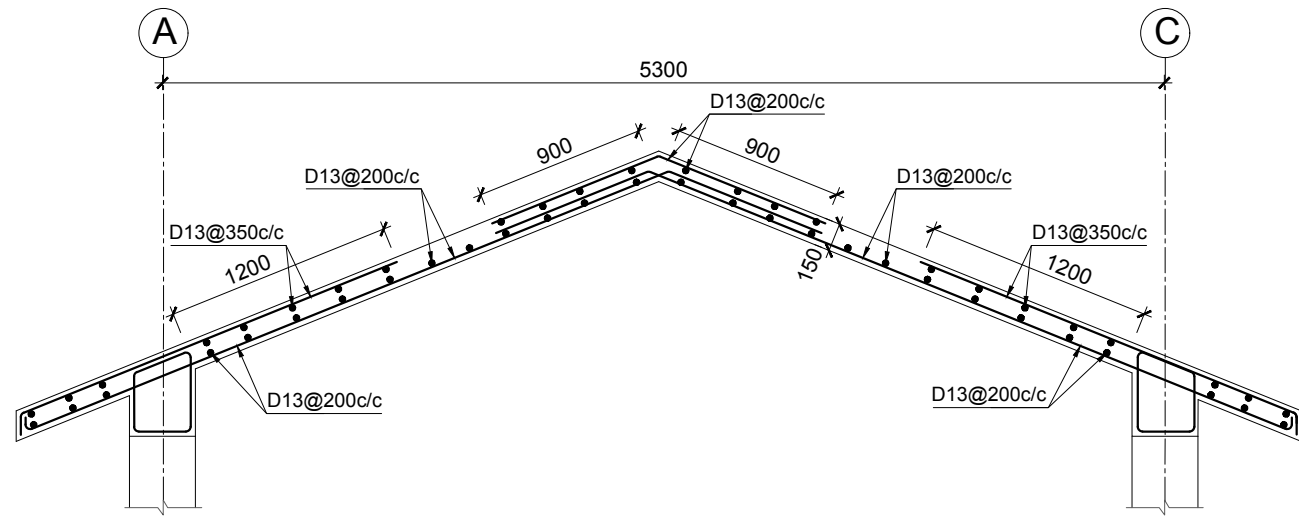
DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

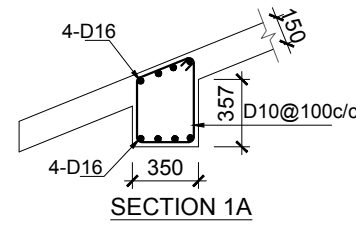
DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
STAIR REINFORCEMENT DETAIL

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOEI CO., LTD. and DOLMAR ENGINEERING LIMITED
 in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

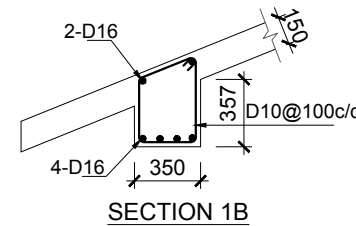
DATE: SEP/2024
 DRAWING No. 141-091



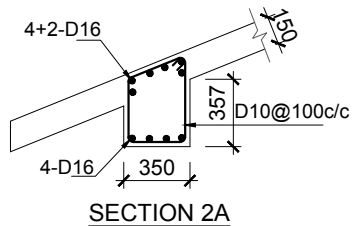
SECTION A-A
SCALE A = 1:50



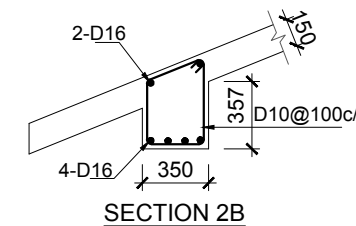
SECTION 1A



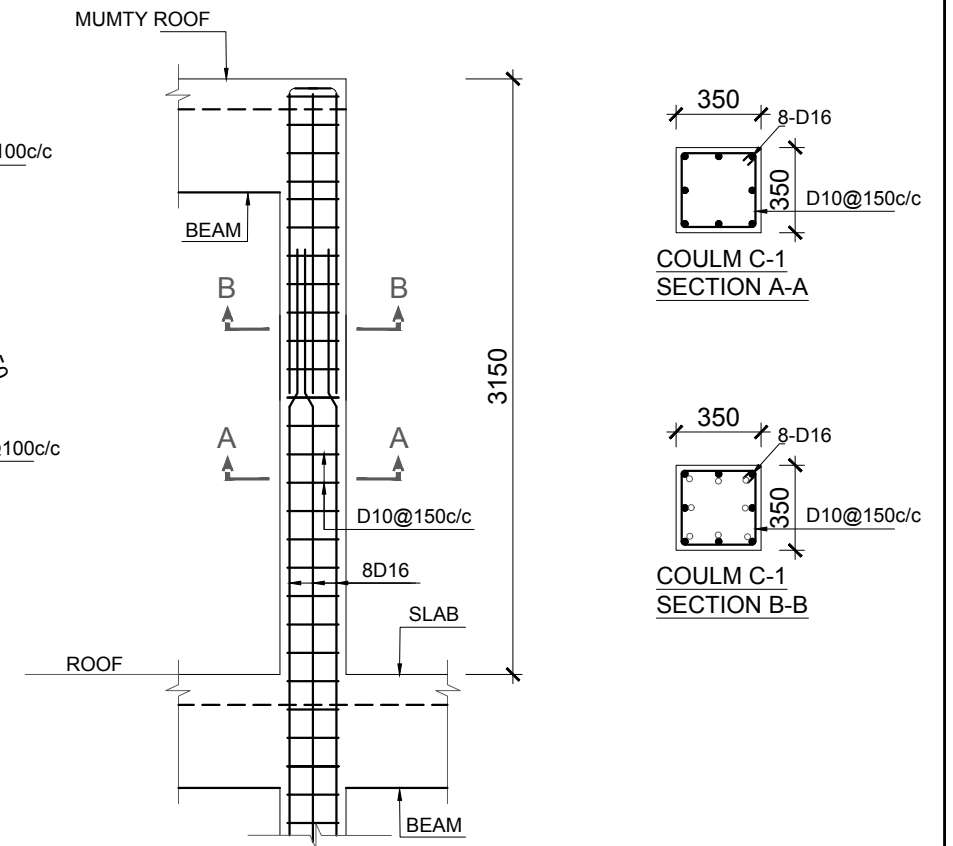
SECTION 1B



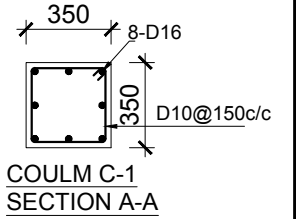
SECTION 2A



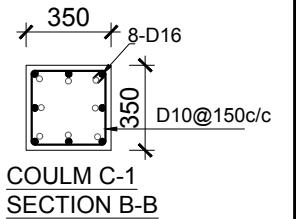
SECTION 2B



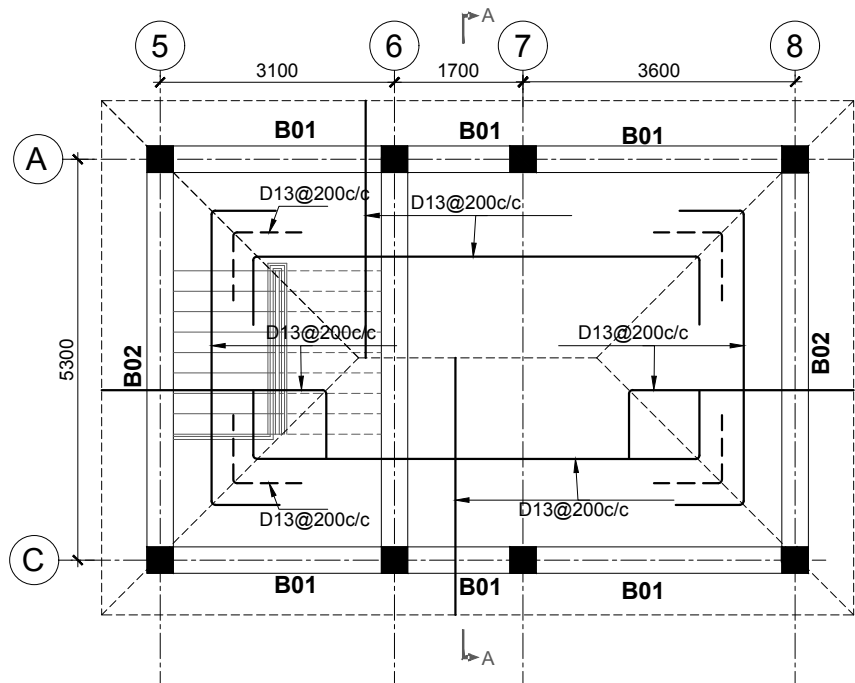
COLUMN C1 DETAIL



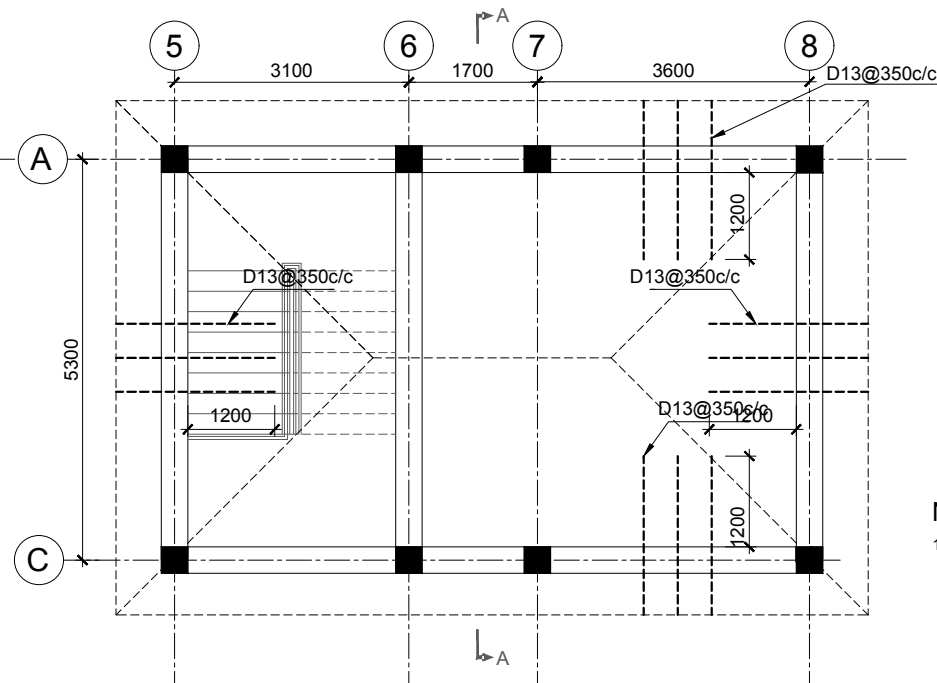
COULM C-1 SECTION A-A



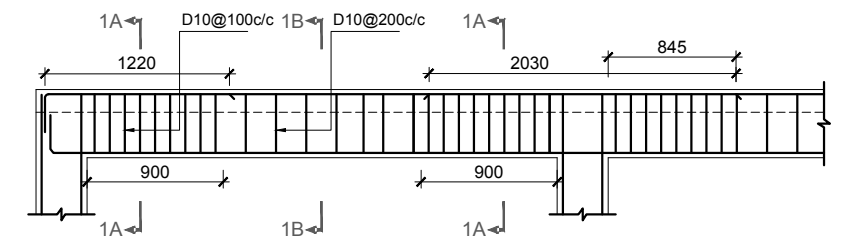
COULM C-1 SECTION B-B



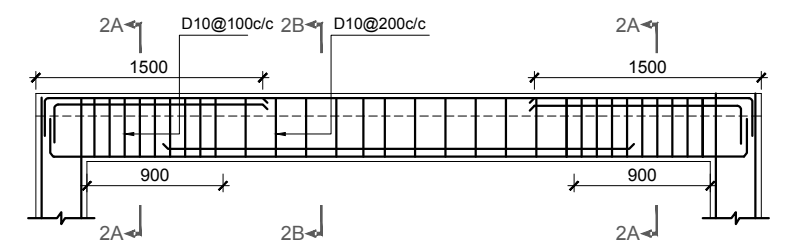
MUMTY SLAB PLAN
SCALE A = 1:100



MUMTY SLAB PLAN TOP EXTRA REINFORCEMENT
SCALE A = 1:100



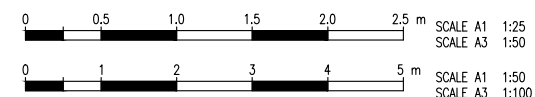
BEAM B01
SCALE A = 1:50



BEAM B02
SCALE A = 1:50

NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
RELOCATED PRIMARY SCHOOL
MUMTY DETAIL

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: Rasheed	Name: M. Rasheed

DASU HYDROPOWER CONSULTANTS

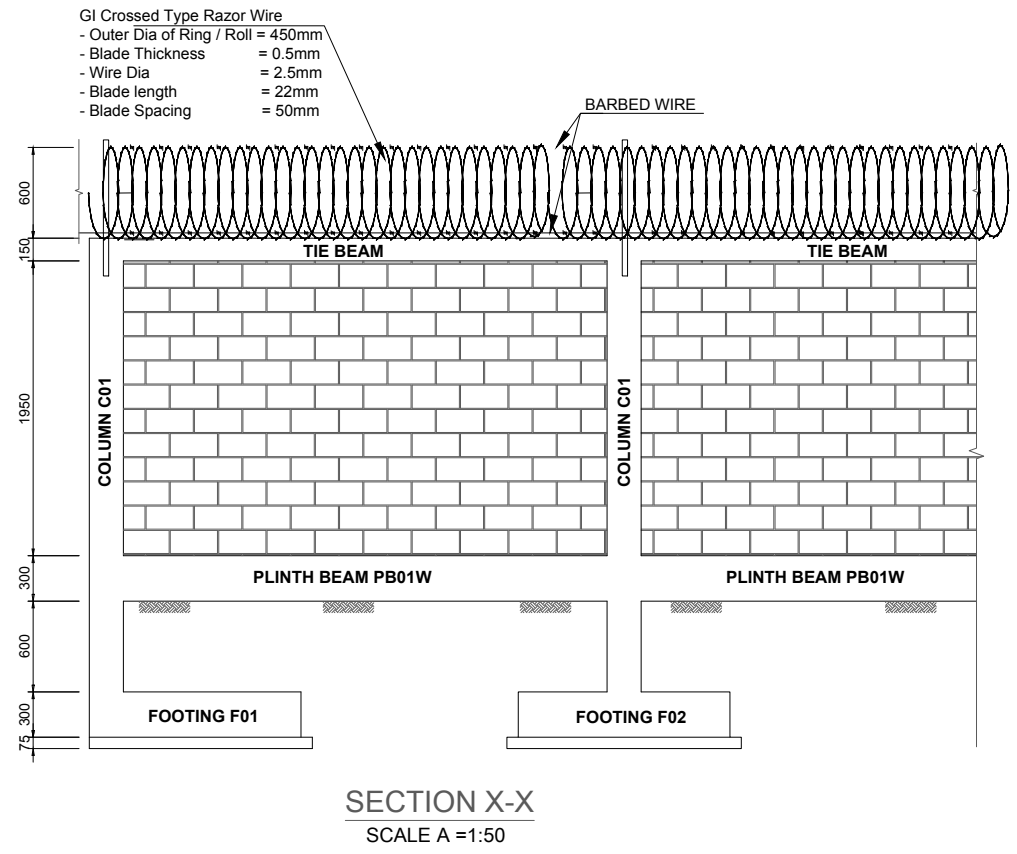


JOINT VENTURE OF
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PAKISTAN ENGINEERING SERVICES LTD.

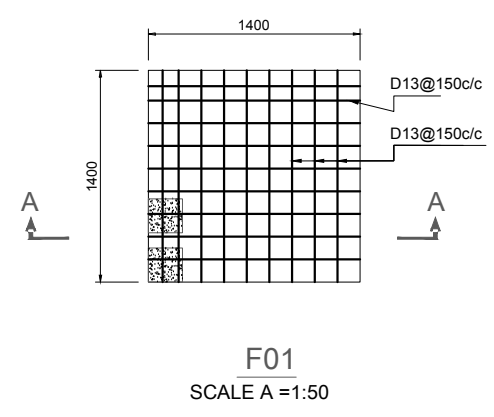
DATE: SEP/2024

DRAWING No.

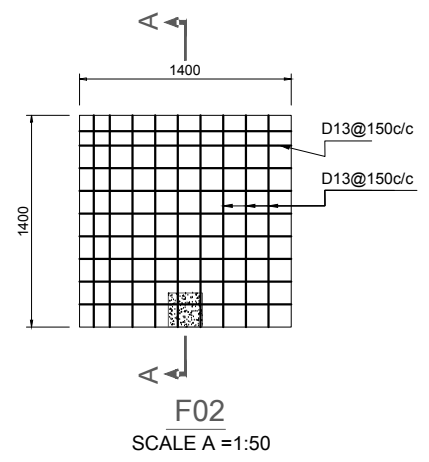
141-092



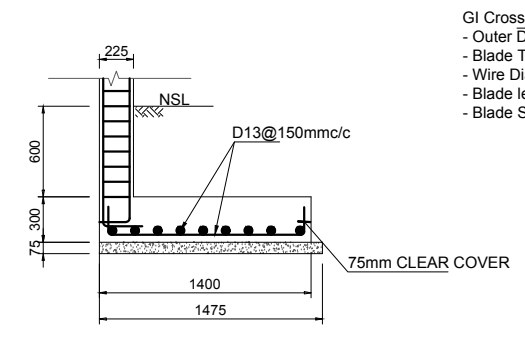
SECTION X-X
SCALE A = 1:50



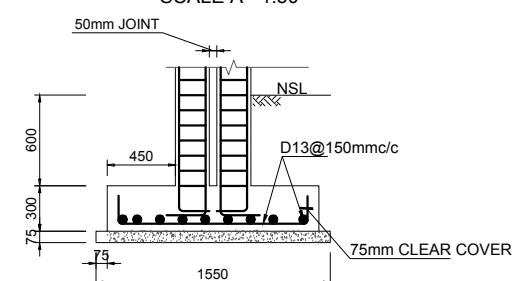
F01
SCALE A = 1:50



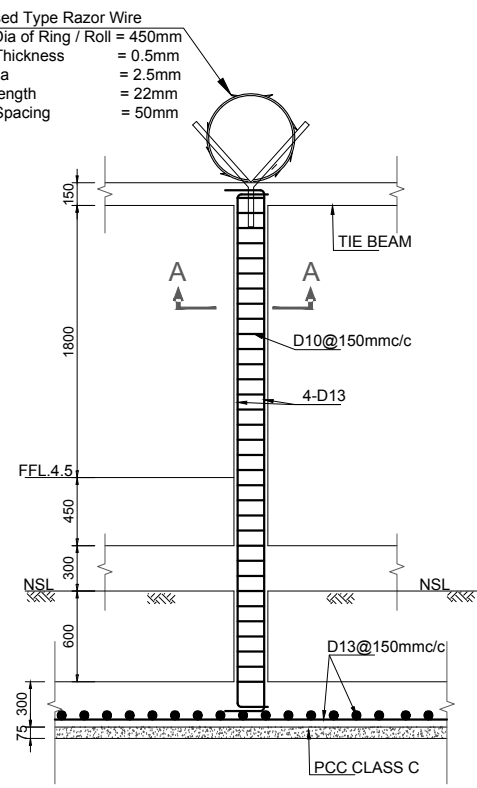
F02
SCALE A = 1:50



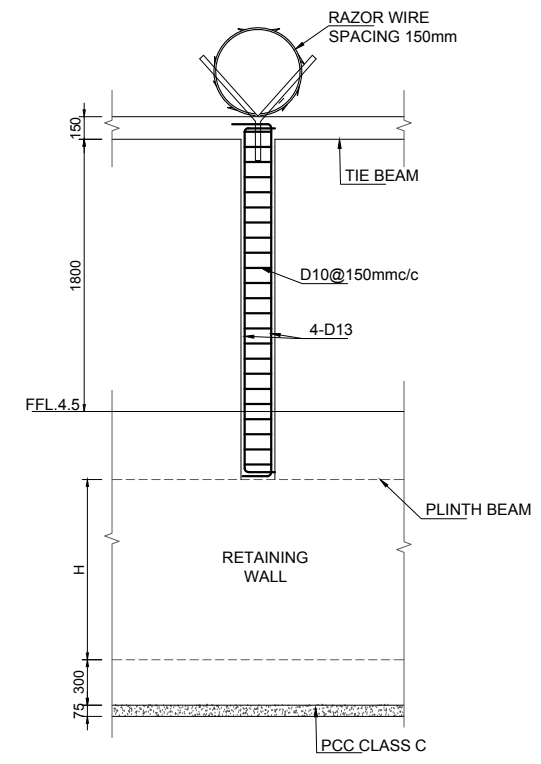
FOOTING
SECTION A-A
SCALE A = 1:50



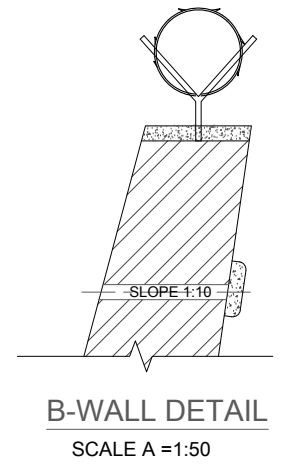
EXPANSION JOINT DETAIL
SCALE A = 1:50



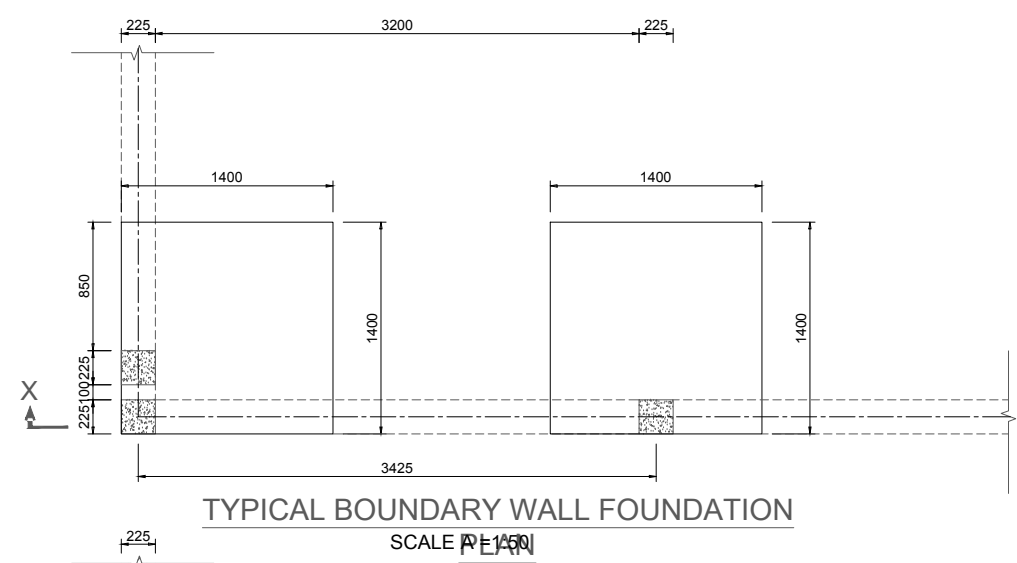
COLUMN C01 DETAIL
SCALE A = 1:50



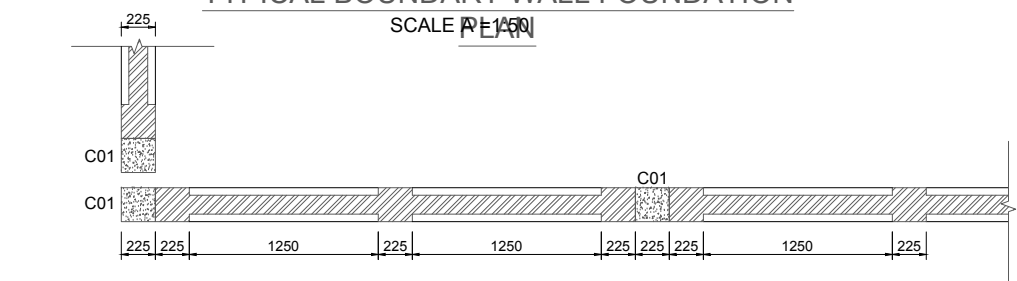
RW DETAIL-A
SCALE A = 1:50



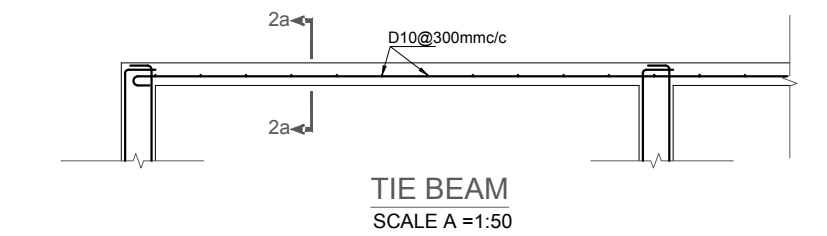
B-WALL DETAIL
SCALE A = 1:50



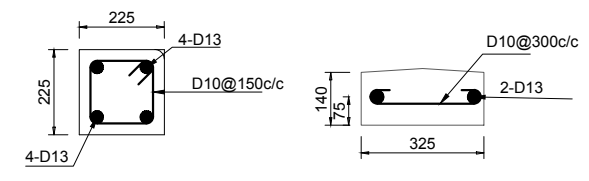
TYPICAL BOUNDARY WALL FOUNDATION
SCALE A = 1:50



TYPICAL BOUNDARY WALL PLAN
SCALE A = 1:50



TIE BEAM
SCALE A = 1:50



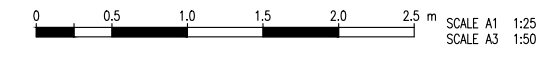
SECTION A-A

TIE BEAM
SECTION 2a-2a

NOTES:

1. THE FOUNDATION PAS SHALL BE KEPT ON FIRM STRATA AT LEAST 900mm BELOW NSL.
2. THE DISTANCE "Y" SHALL NOT BE MORE THAN 450mm. IF MORE THAN 450mm FILL IS REQUIRED, THEN APPROPRIATE RETAINING WALL ALONG WITH BOUNDARY WALL SHALL BE PROVIDED AS SHOWN IN RW DETAILS A & B.
3. AS THE DESIGN OF RETAINING WALL WILL VARY WITH HEIGHT, THE DETAILS OF RETAINING WALL FOR VARIOUS HEIGHTS "H" HAS BEEN PROVIDED SEPARATELY.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain



DASU HYDROPOWER PROJECT



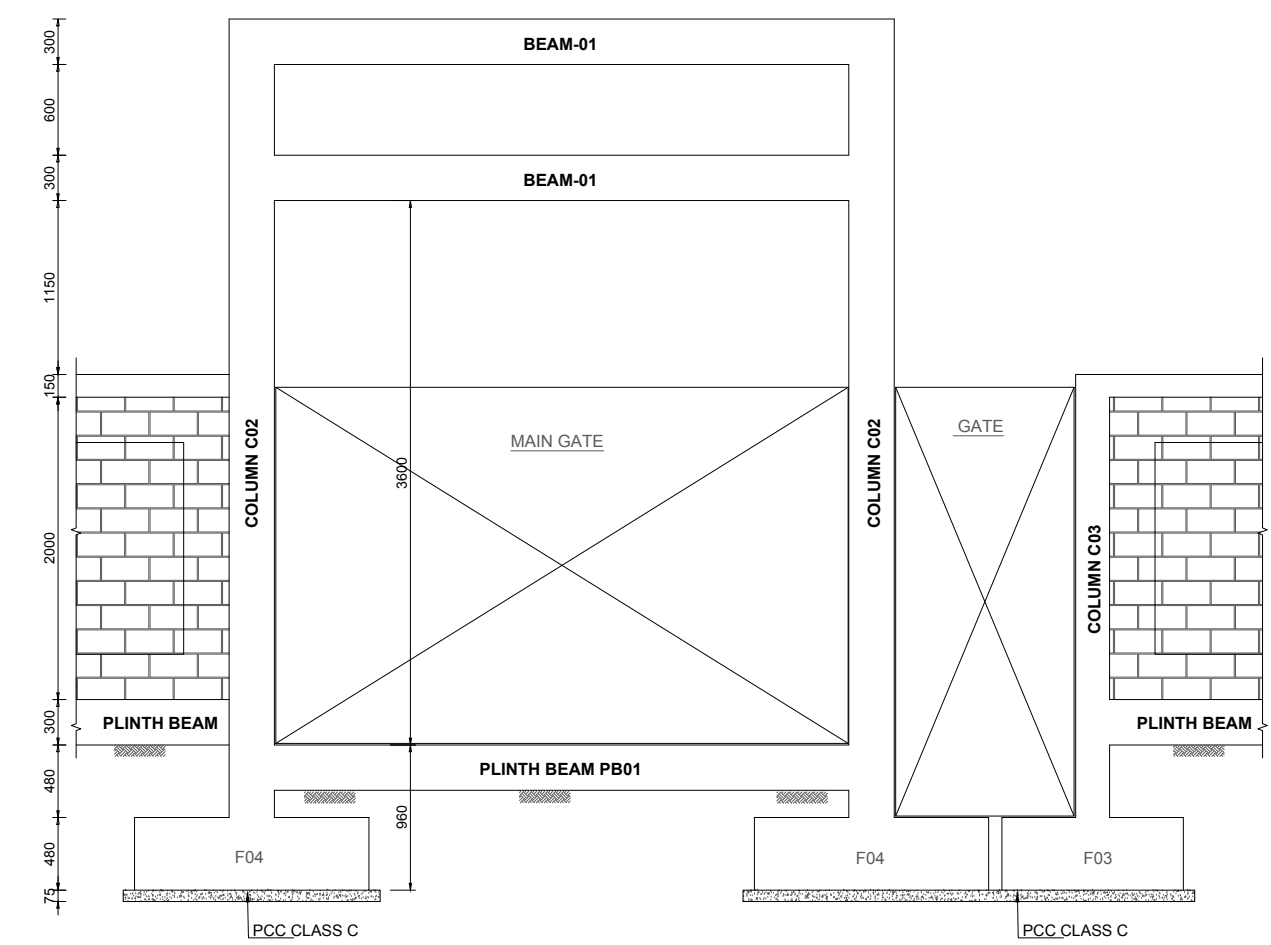
PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

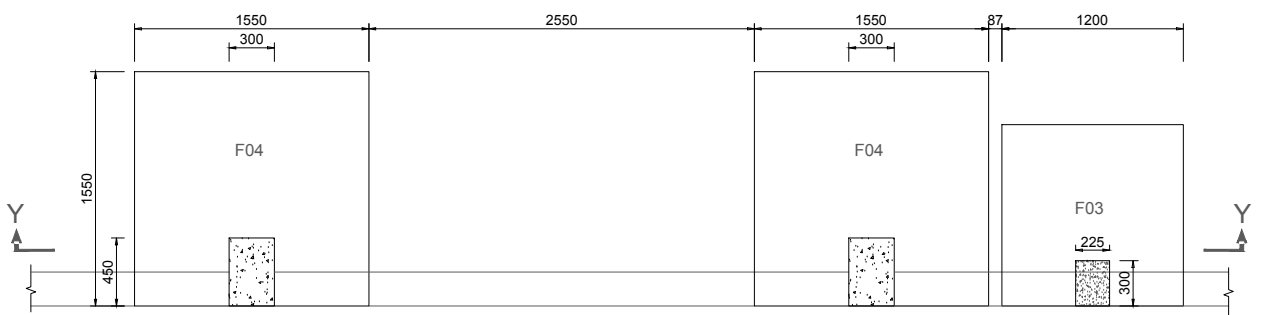
DRAWING TITLE:
BOUNDARY WALL & COLUMNS DETAILS

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLSTAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

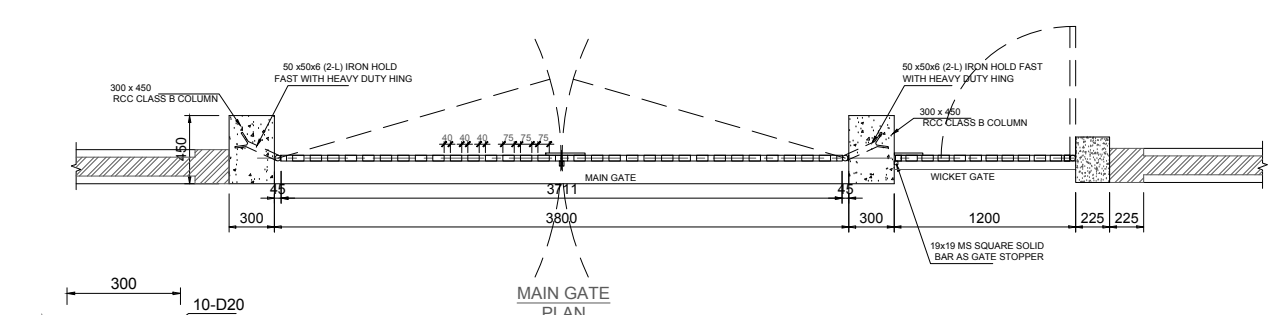
DATE: SEP/2024
DRAWING No. 141-093



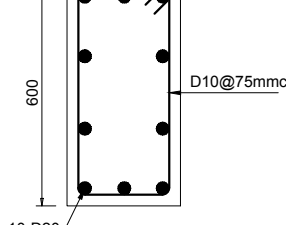
SECTION Y-Y



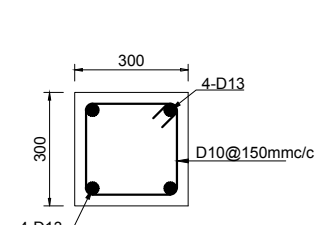
MAIN GATE FOUNDATION PLAN



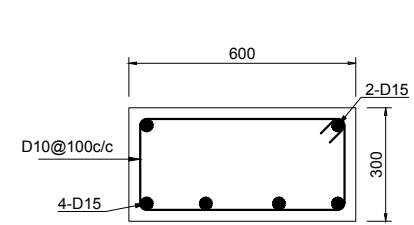
MAIN GATE PLAN



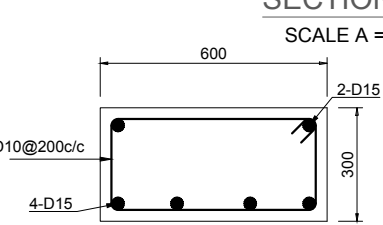
SECTION 1-1



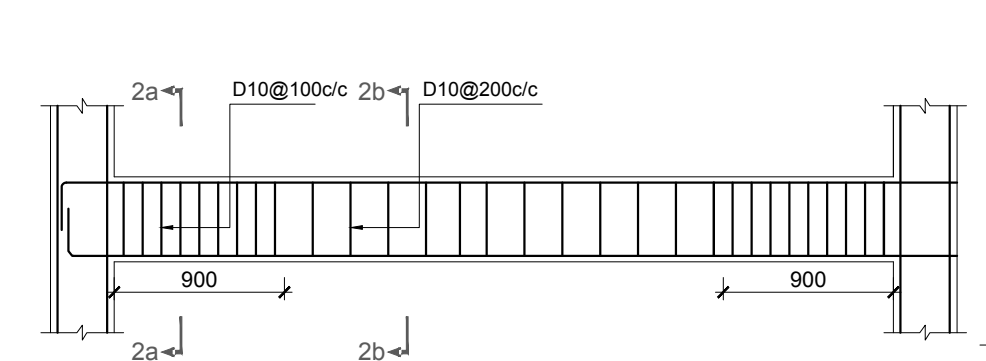
SECTION 2-2



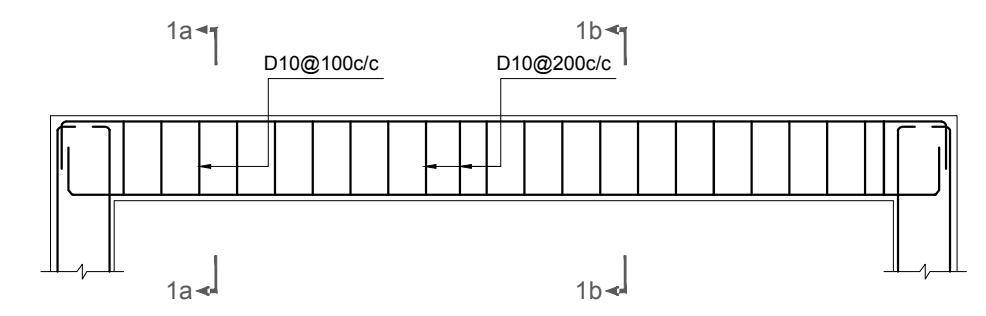
SECTION 1a



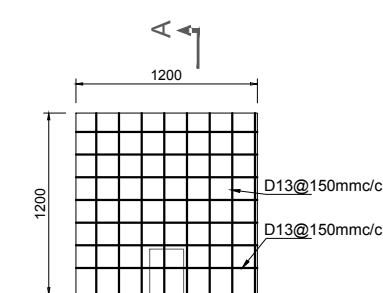
SECTION 1b



PLINTH BEAM PB02

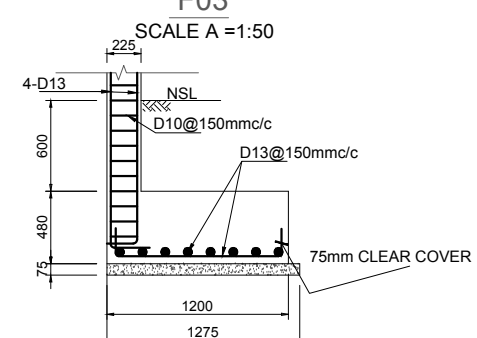


LANDING LEVEL BEAM LB1



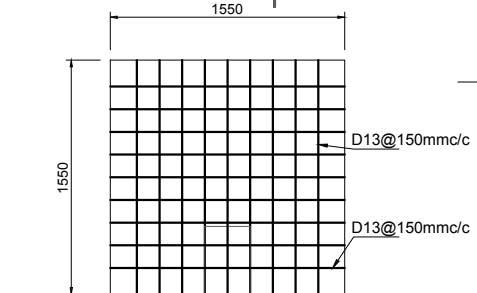
F03

SCALE A = 1:50



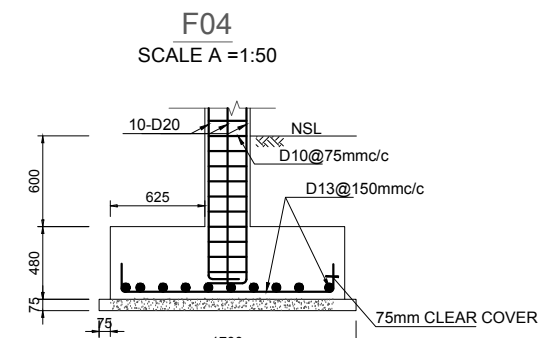
F03 SECTION A-A

SCALE A = 1:50



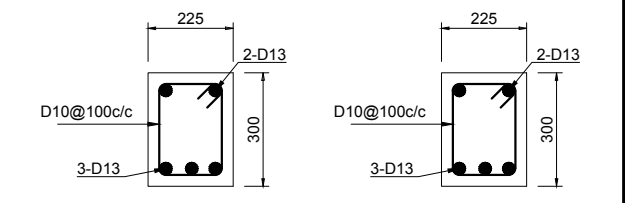
F04

SCALE A = 1:50



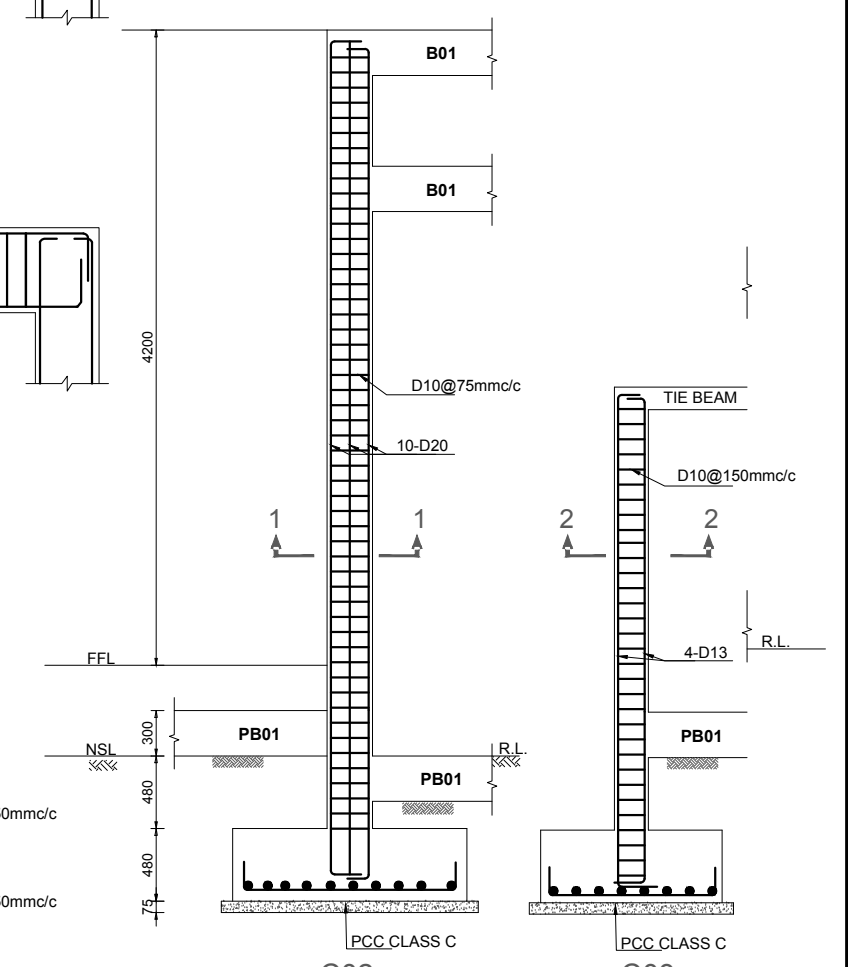
F04 SECTION B-B

SCALE A = 1:50



SECTION 2a

SECTION 2b



C02

SCALE A = 1:50

C03

SCALE A = 1:50

NOTES.

1. THE FOUNDATION PAS SHALL BE KEPT ON FIRM STRATA AT LEAST 900mm BELOW NSL.
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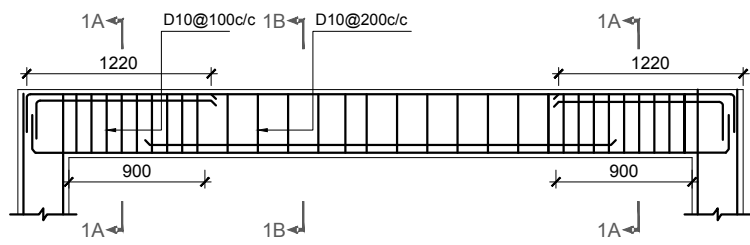
DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

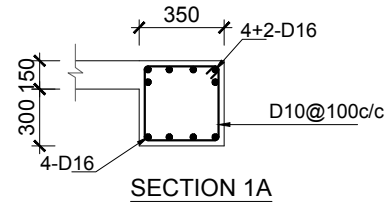
DRAWING TITLE:
MAIN GATE & COLUMNS DETAILS

SCALE A = 1:50			
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

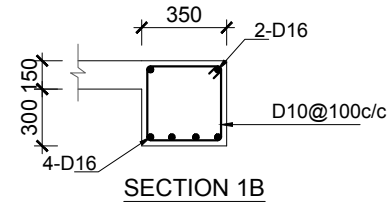
DASU HYDROPOWER CONSULTANTS
 DATE: SEP/2024
 DRAWING No. 141-094



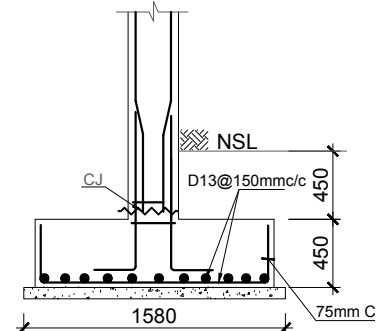
BEAM B01
SCALE A = 1:50



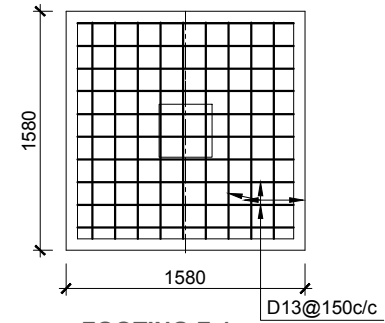
SECTION 1A



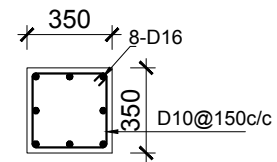
SECTION 1B



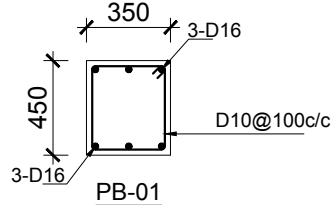
FOOTING SECTION F-3



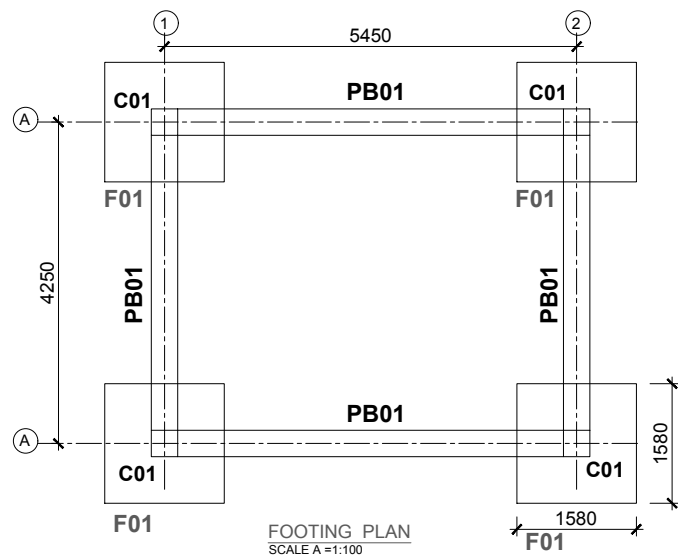
FOOTING F-1



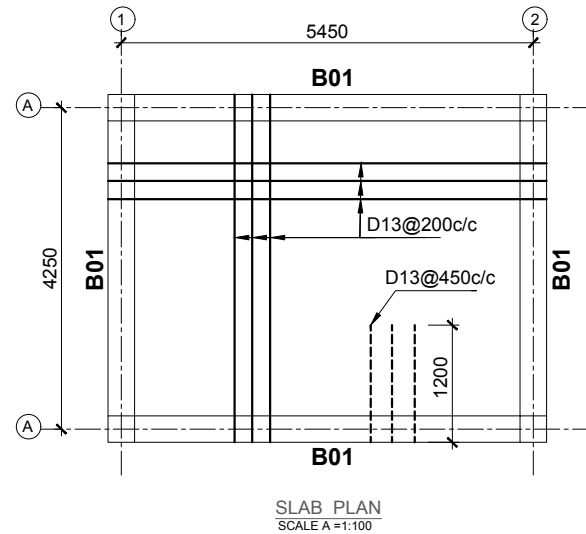
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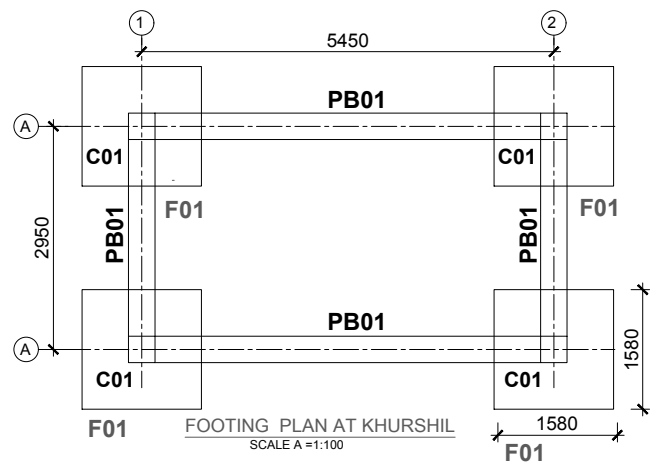
PB-01



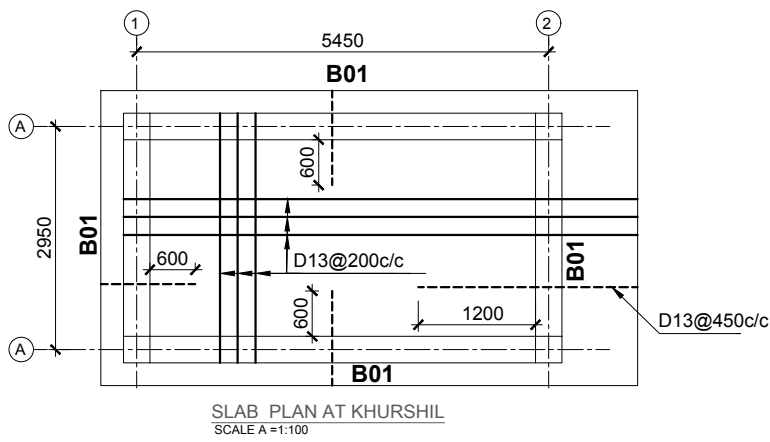
FOOTING PLAN
SCALE A = 1:100



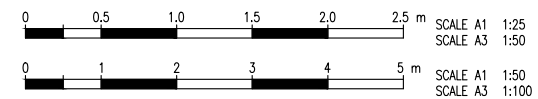
SLAB PLAN
SCALE A = 1:100



FOOTING PLAN AT KHURSHIL
SCALE A = 1:100



SLAB PLAN AT KHURSHIL
SCALE A = 1:100



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
**RELOCATED PRIMARY SCHOOL
TOILETS SLAB PLAN & DETAILS**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

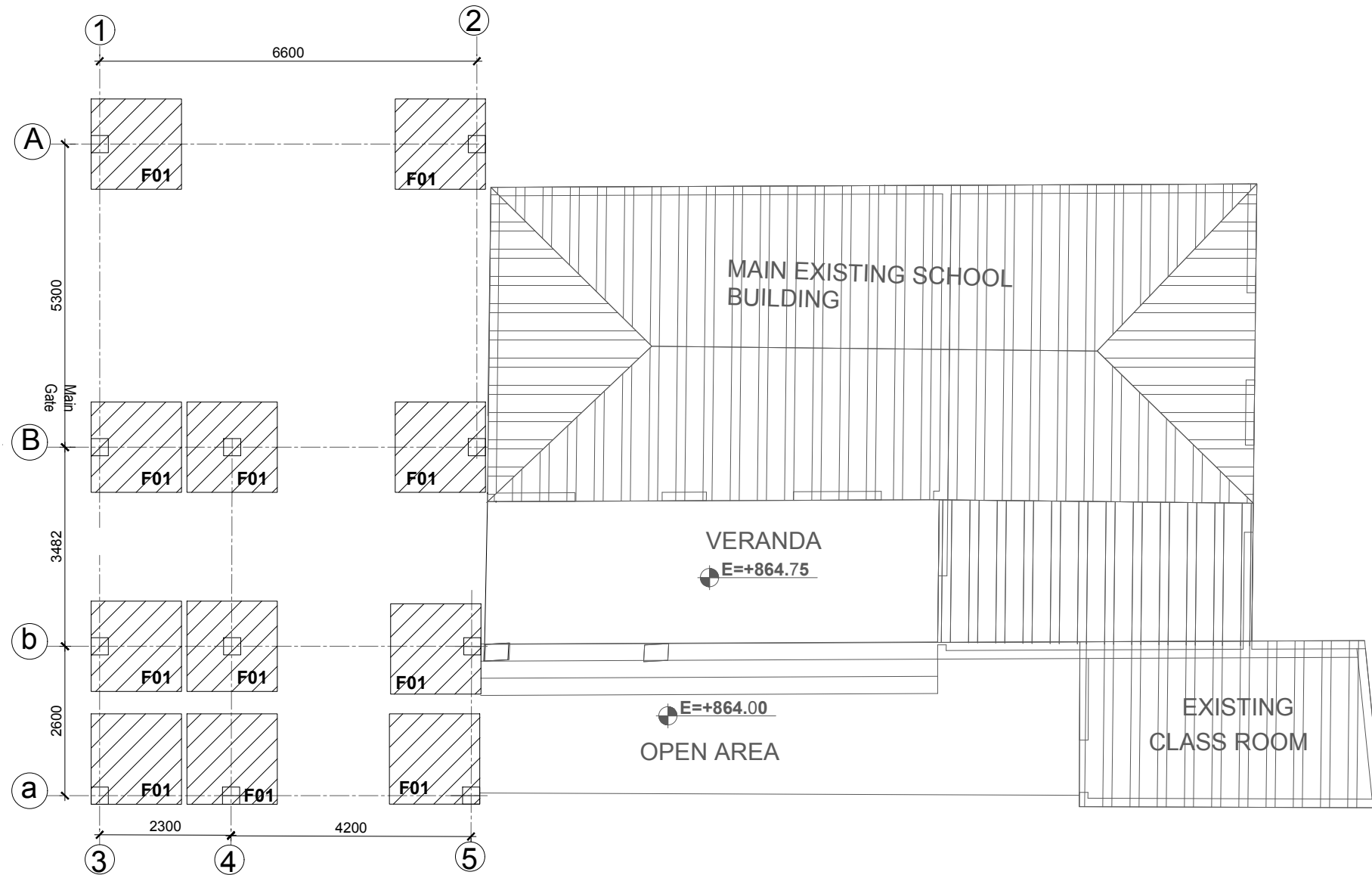
DASU HYDROPOWER CONSULTANTS



JOINT VENTURE OF
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DOLAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-095



EXCAVATION PLAN
SCALE A =1:100



DASU HYDROPOWER PROJECT




PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

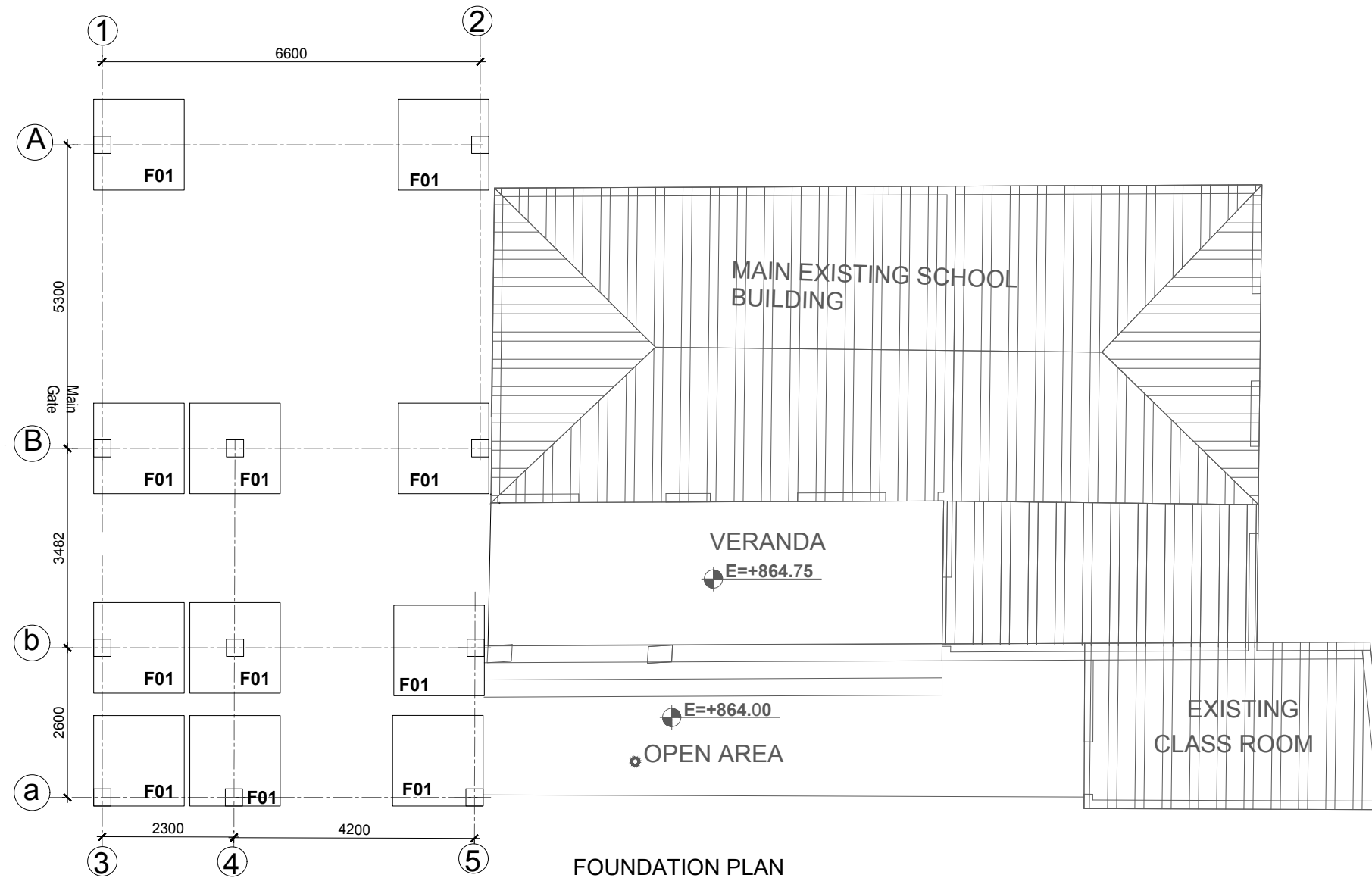
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
EXCAVATION PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER CONSULTANTS

 JOINT VENTURE OF
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DATE: SEP/2024
DRAWING No. 141-096



FOUNDATION PLAN
SCALE A = 1:100



DASU HYDROPOWER PROJECT




PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

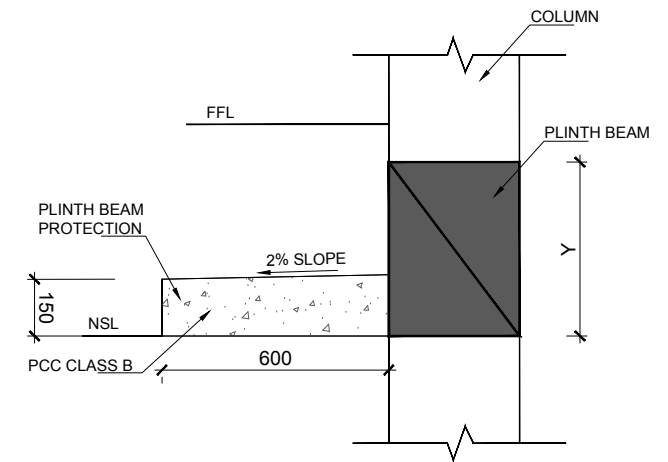
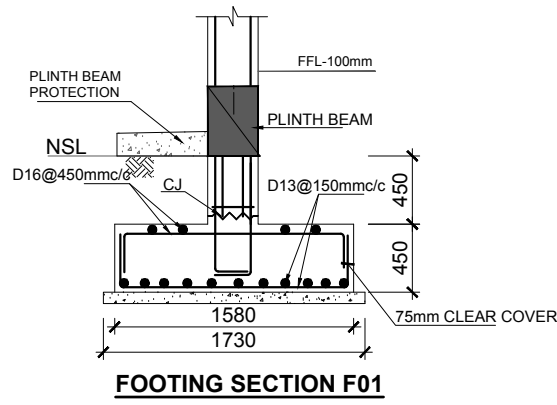
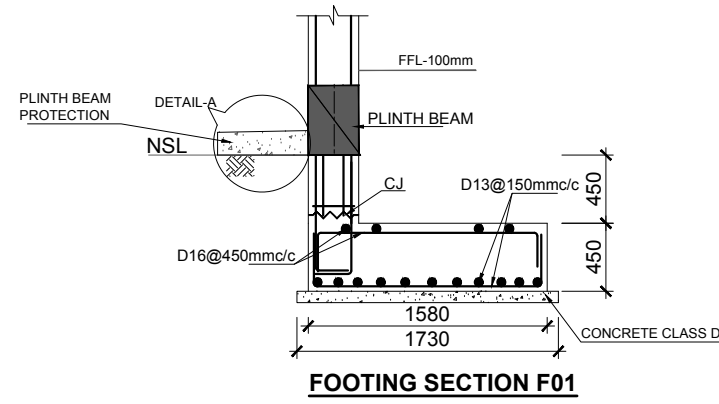
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DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
FOUNDATION PLAN**

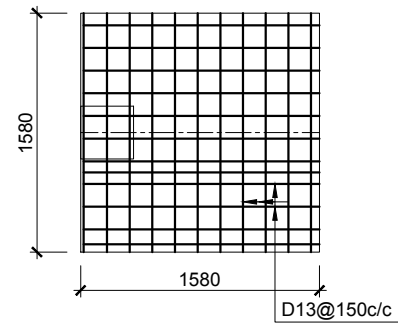
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS

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 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

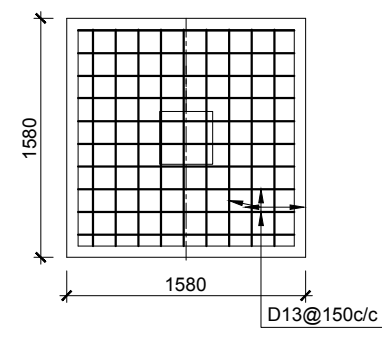
DATE: SEP/2024
 DRAWING No. 141-097



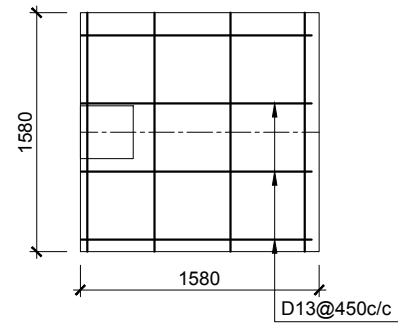
DETAIL-A



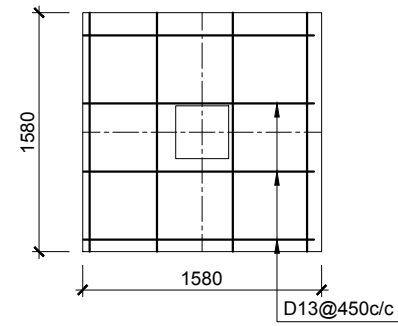
FOOTING DETAILS F-1 (BOTTOM LAYER)



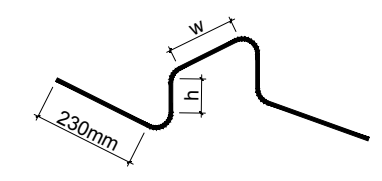
FOOTING DETAILS F-1 (BOTTOM LAYER)



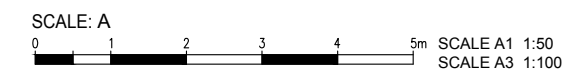
FOOTING DETAILS F-1 (TOP LAYER)



FOOTING DETAILS F-1 (TOP LAYER)



TYPICAL DETAIL OF STEEL CHAIR FOR TOP REINFORCEMENT LAYER IN FOUNDATION AND SLAB



FOUNDATION PLAN
SCALE A = 1:100

NOTE:
CLEAR COVER FOR FOOTING = 75mm

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

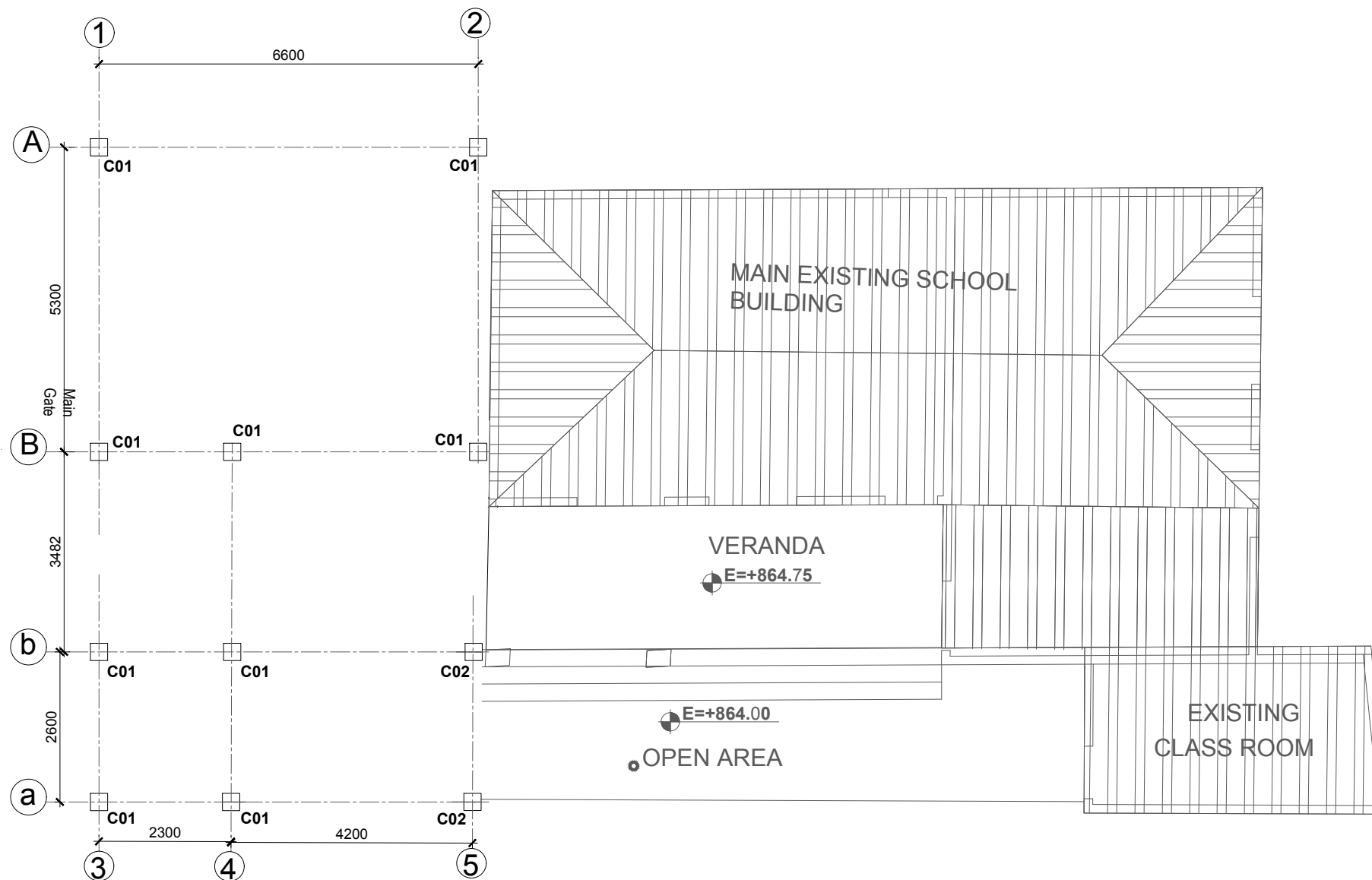
DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD FOUNDATION DETAILS

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 JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLGAR ENGINEERING LIMITED
 in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. 141-098



GROUND FLOOR COLUMN PLAN
SCALE A =1:100



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

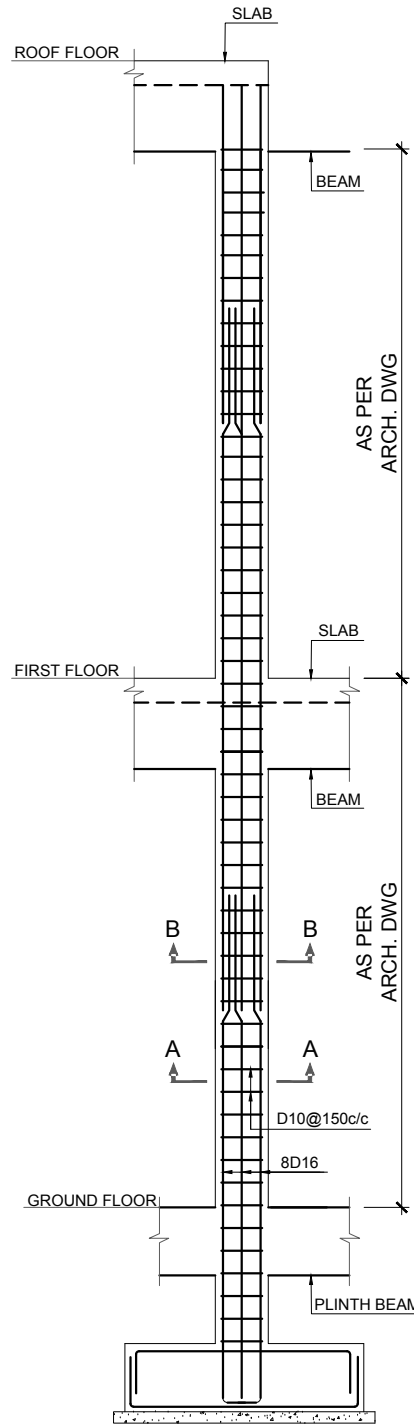
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
GROUND FLOOR COLUMN PLAN**

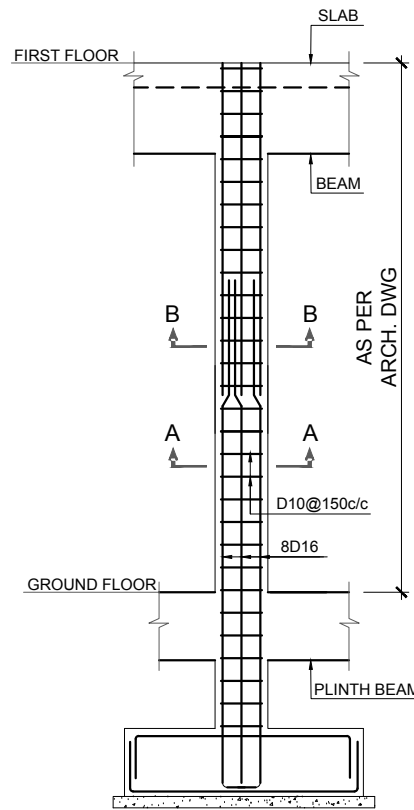
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
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DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

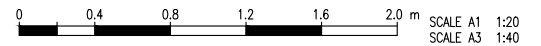
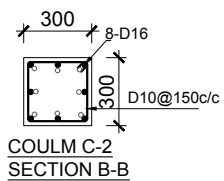
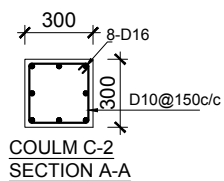
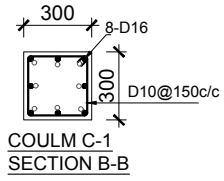
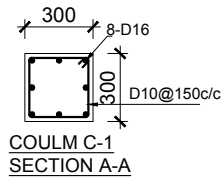
DATE: SEP/2024
DRAWING No. 141-099



COLUMN C01 DETAIL
SCALE A =1:50



COLUMN C02 DETAIL
SCALE A =1:50



NOTE:
CLEAR COVER FOR COLUMN = 38mm

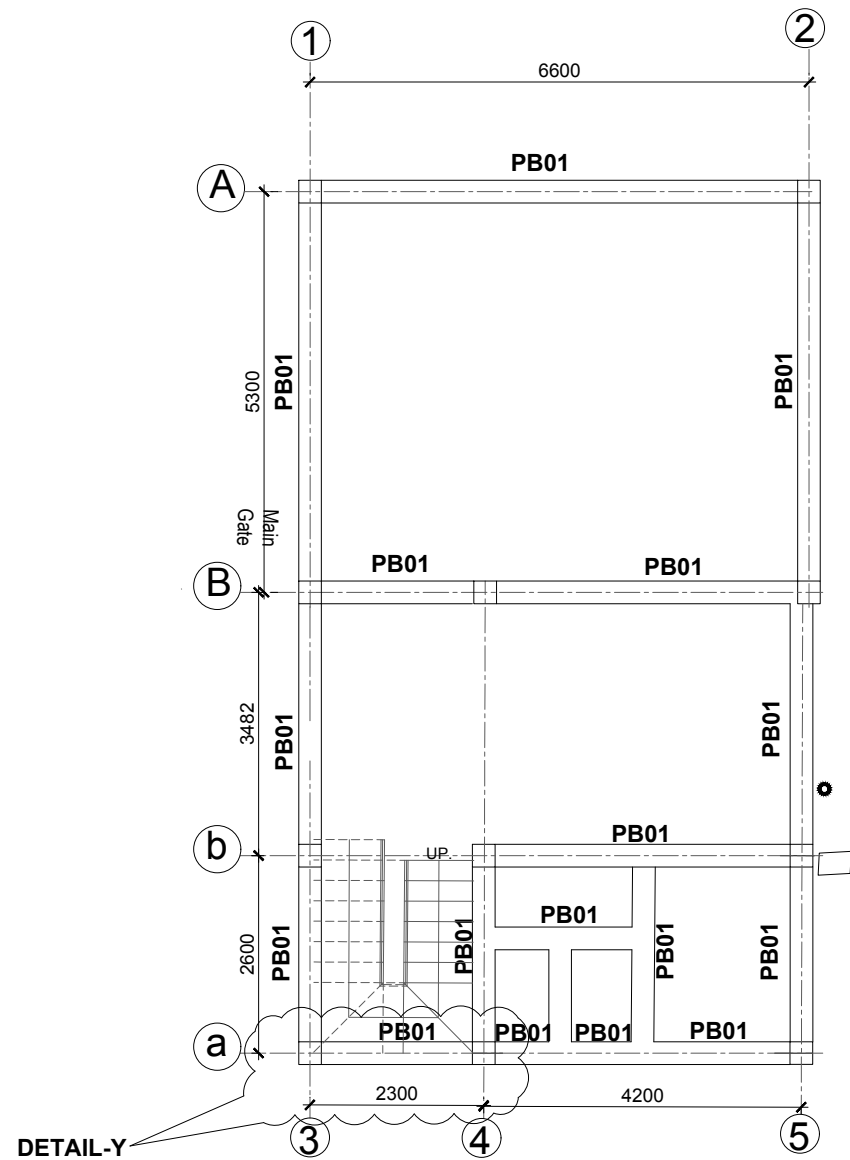
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

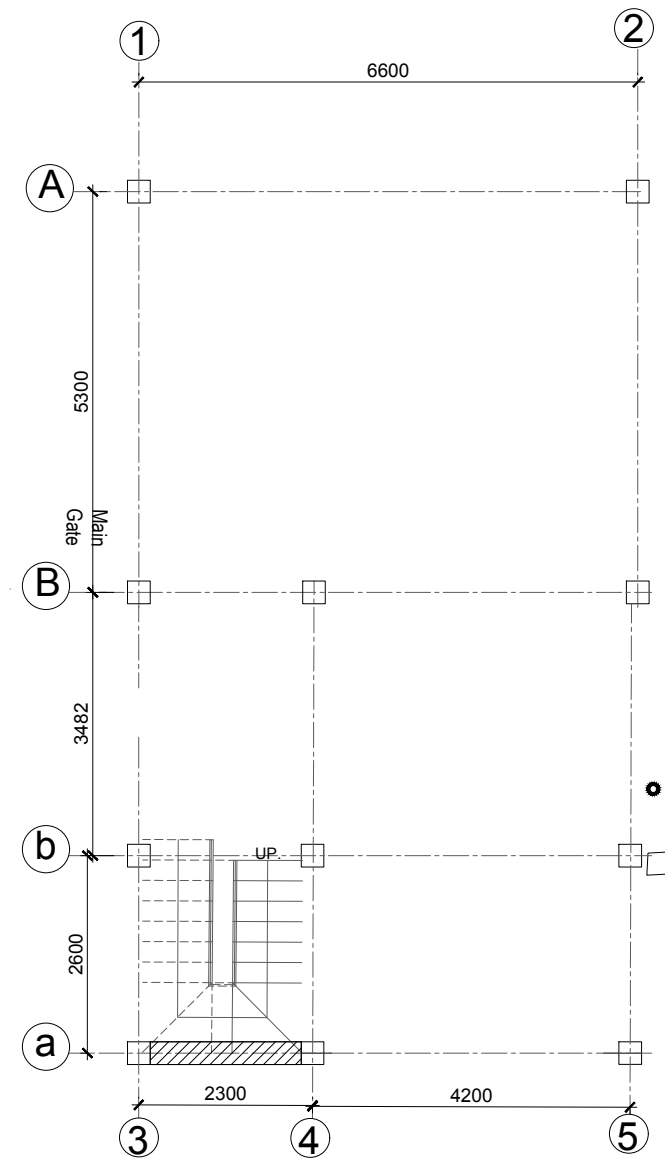
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD COLUMN DETAILS

DASU HYDROPOWER CONSULTANTS <small>JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</small>	DATE: SEP/2024
	DRAWING No. 141-100



PLINTH BEAM PLAN
SCALE A =1:100



DETAIL-Y
LB1

SCALE A =1:100



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

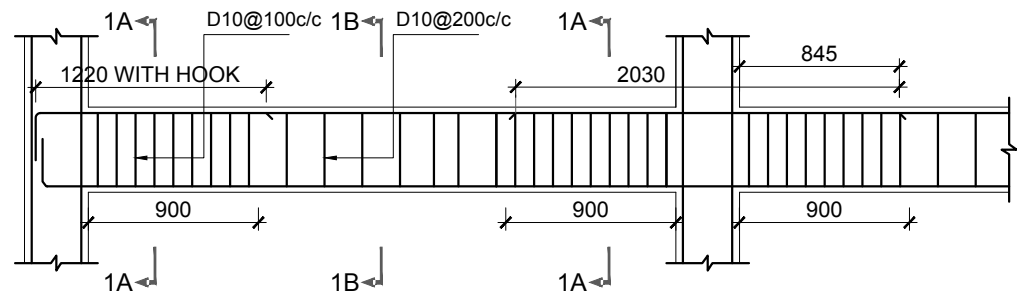
DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
PLINTH BEAM PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

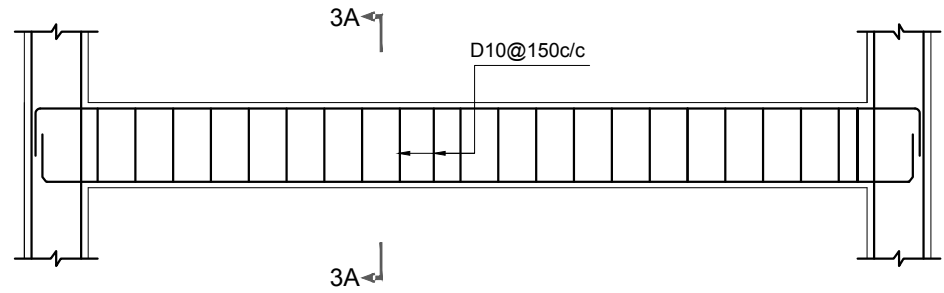
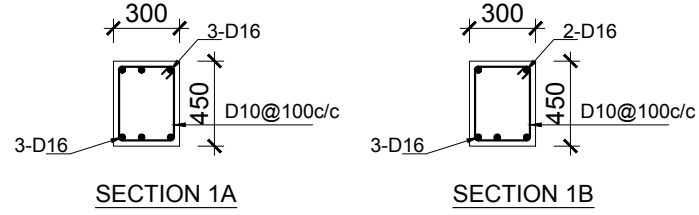
DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLGAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

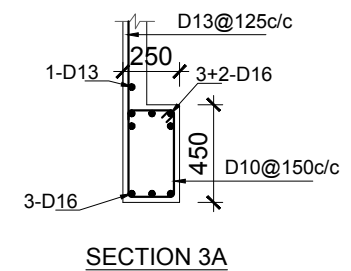
DRAWING No.
141-101



PLINTH BEAM PB01



LANDING LEVEL BEAM LB1



NOTE:
CLEAR COVER FOR COLUMN = 38mm

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT

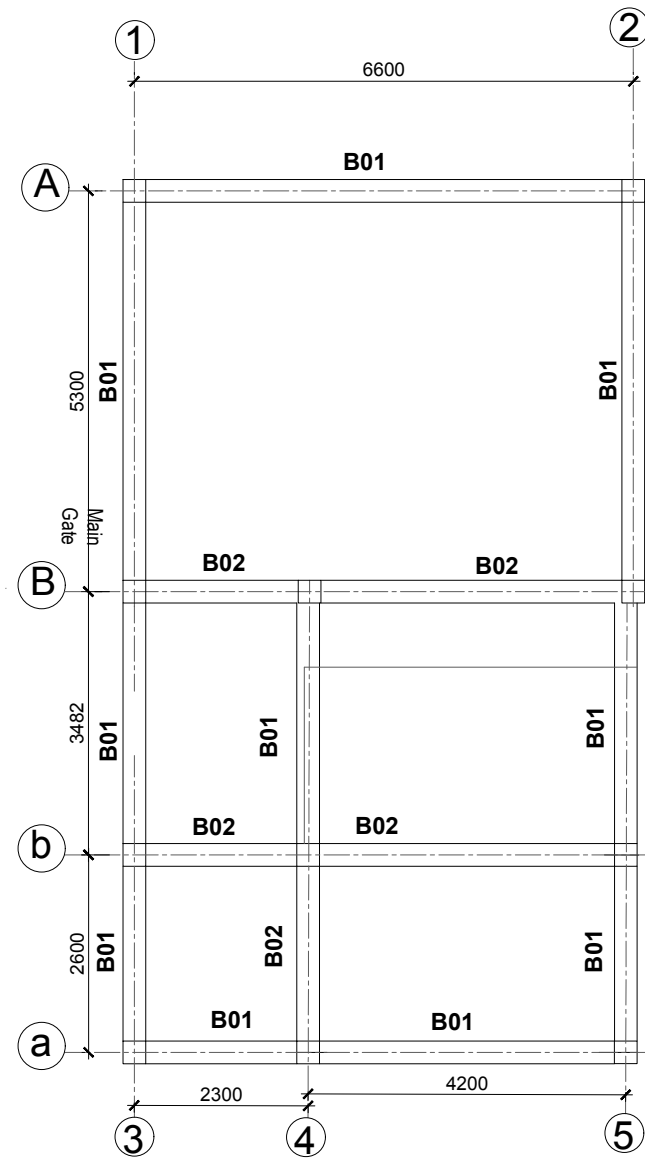
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

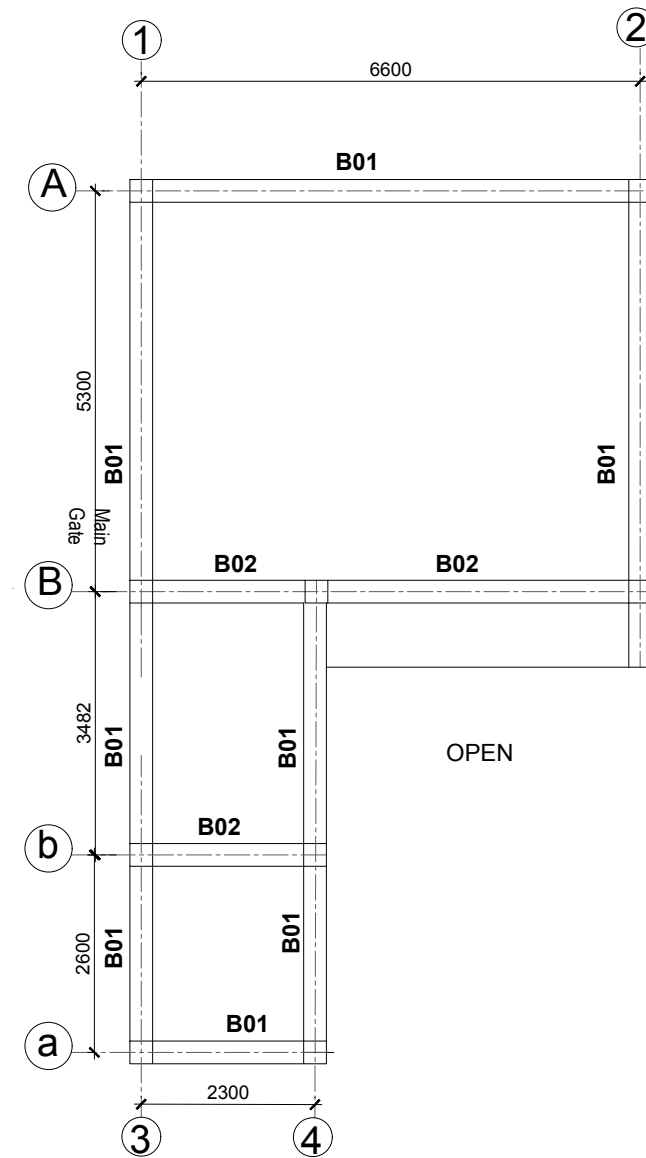
DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD PLINTH BEAM DETAIL

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
DRAWING No. 141-102



FIRST FLOOR BEAM PLAN
SCALE A =1:100



ROOF BEAM PLAN
SCALE A =1:100



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

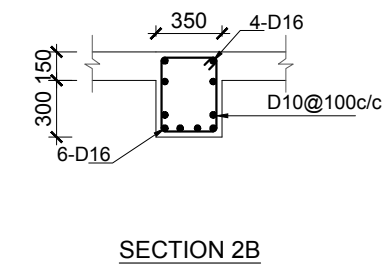
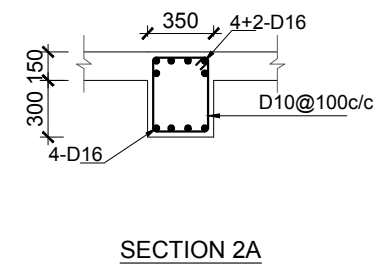
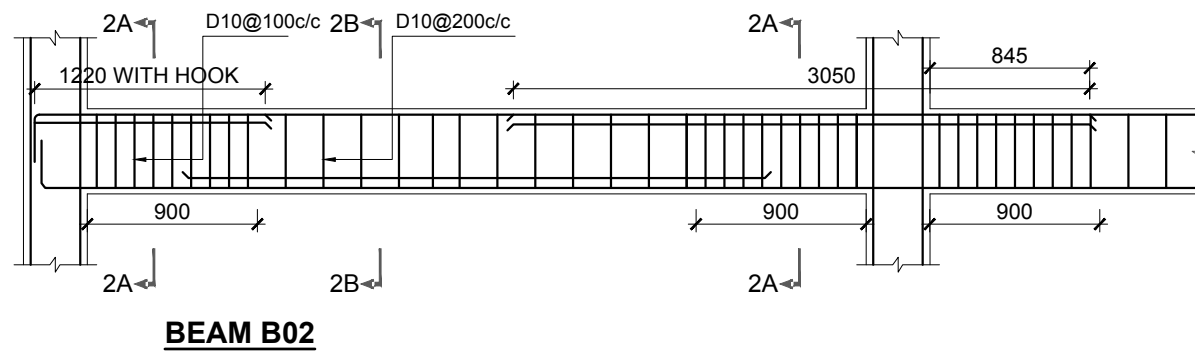
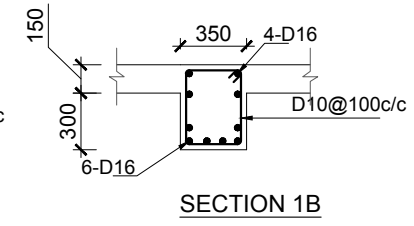
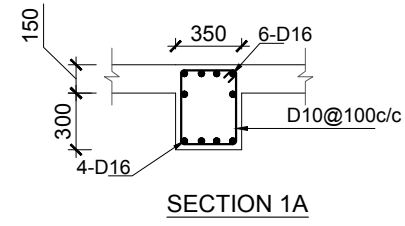
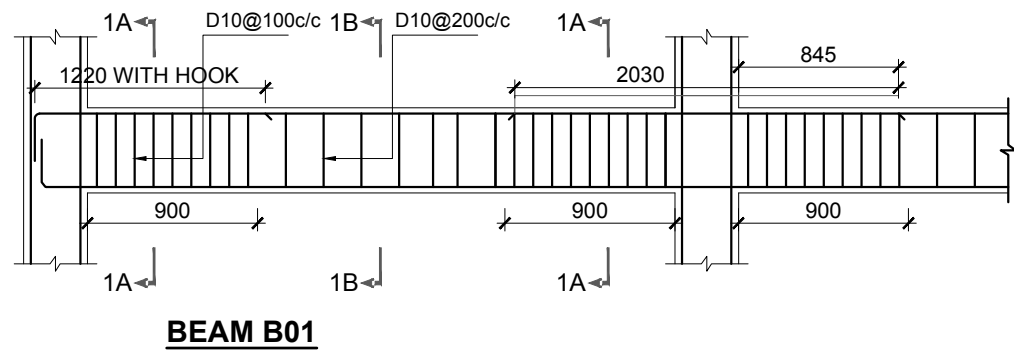
DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
FIRST FLOOR BEAM PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLGAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-103



BEAM DETAILS
SCALE A =1:100



NOTE:
CLEAR COVER FOR COLUMN = 38mm

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT

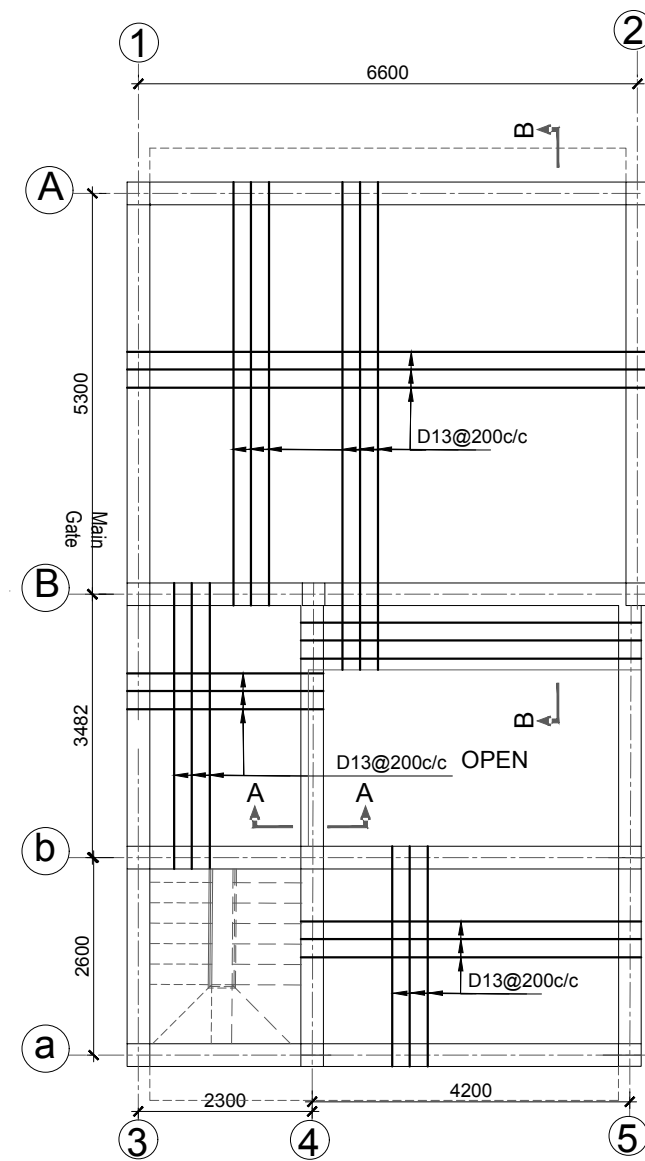
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

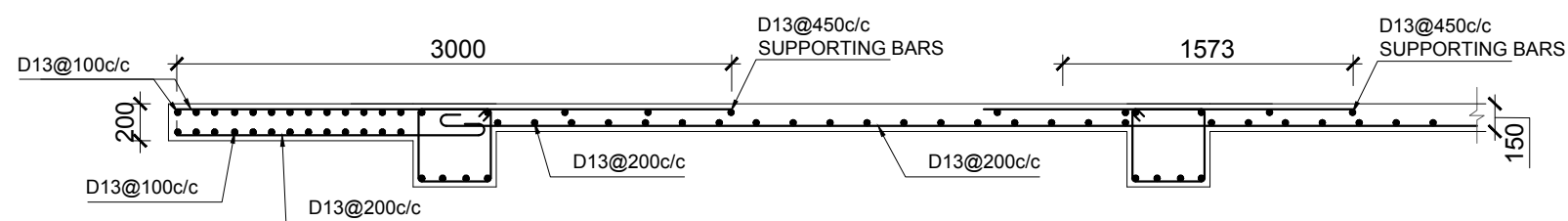
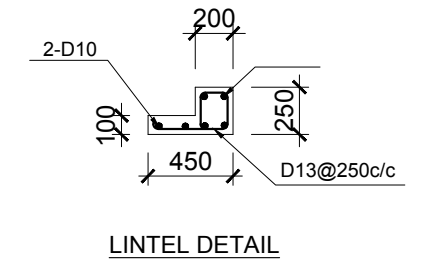
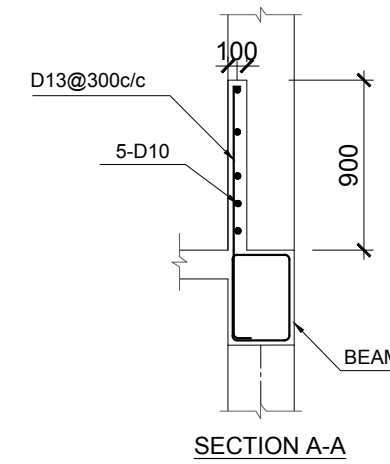
DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD BEAM DETAILS

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
DRAWING No. 141-104




FIRST FLOOR SLAB PLAN
SCALE A = 1:100




SLAB SECTION B-B

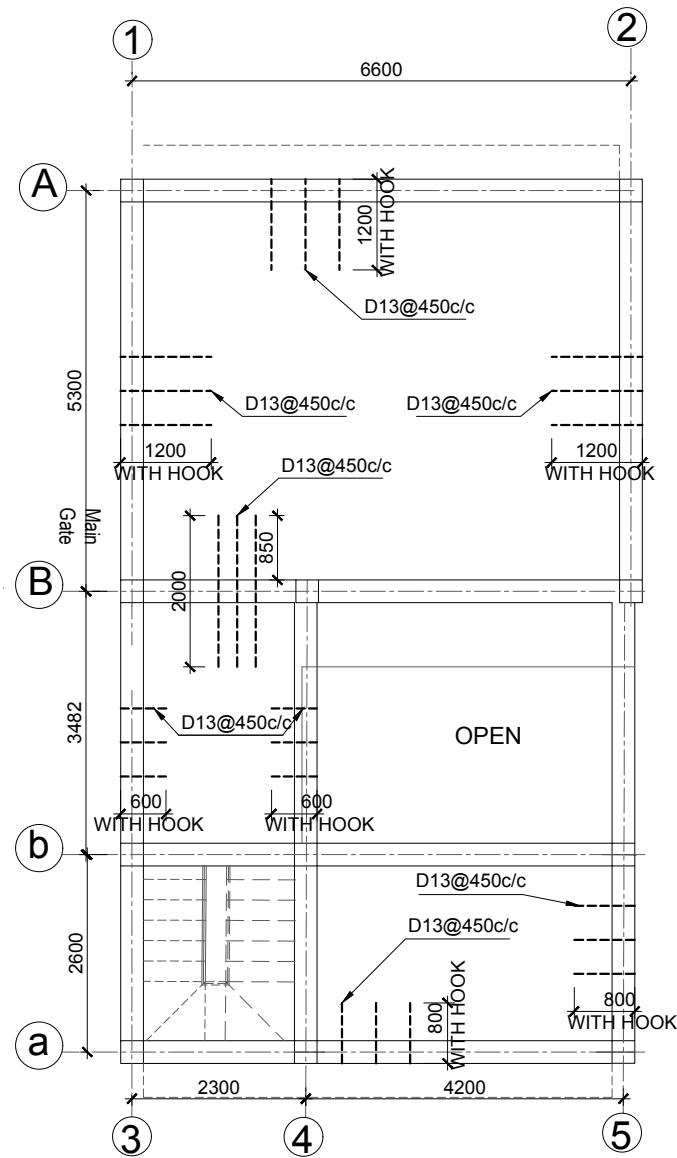
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtaiz Hussain

DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD FIRST FLOOR SLAB PLAN

DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
 JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLGAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.	DRAWING No. 141-105



FIRST FLOOR SLAB PLAN
SCALE A =1:100



DASU HYDROPOWER PROJECT




PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

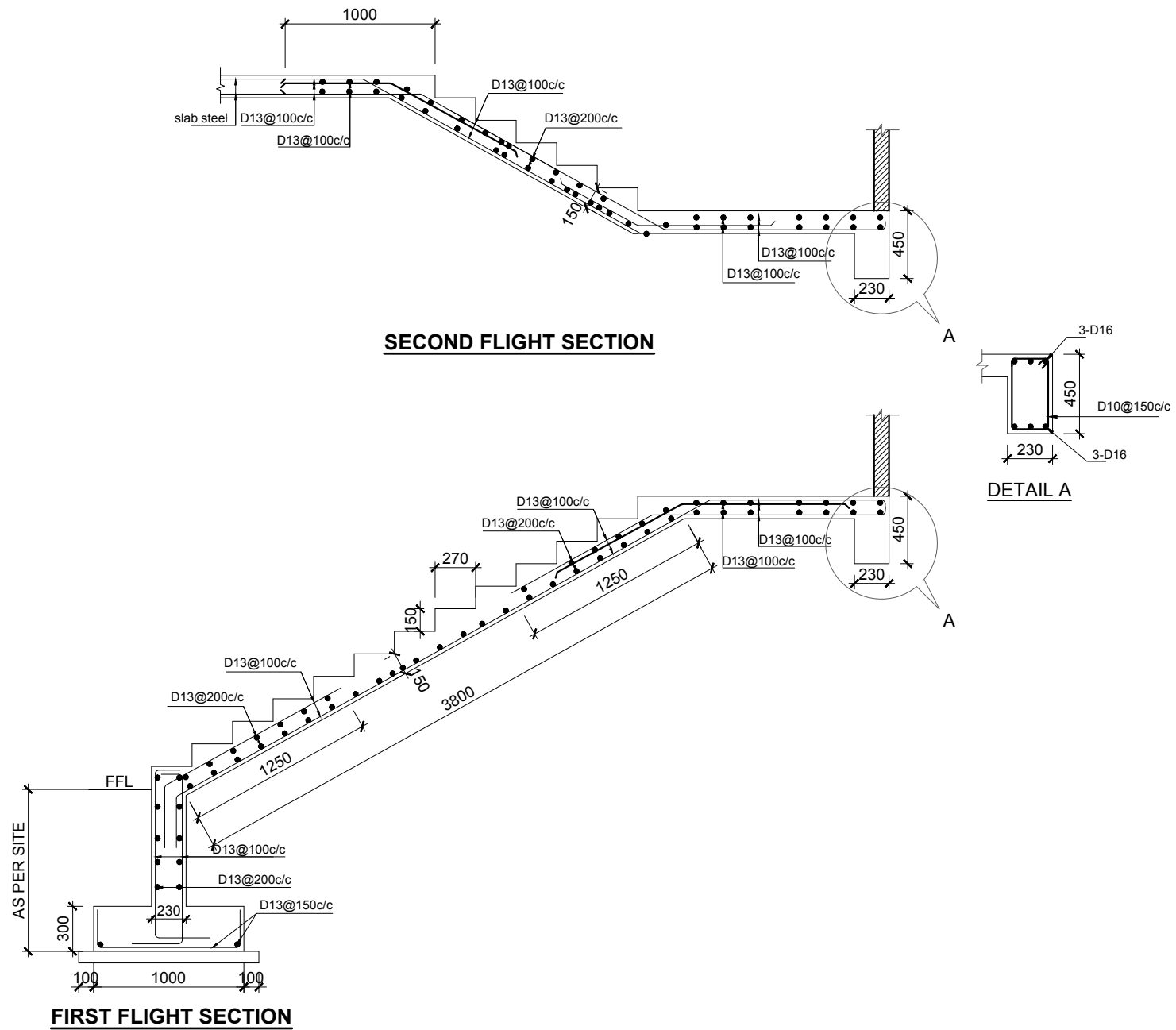
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
FIRST FLOOR SLAB PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtiaz Hussain	

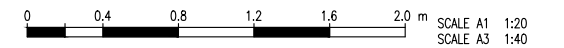
DASU HYDROPOWER CONSULTANTS

 JOINT VENTURE OF
 NIPPON KOEI CO.,LTD. and
 DOLSAF ENGINEERING LIMITED
 in Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No.
141-106



STAIR REINFORCEMENT DETAILS
SCALE A = 1:40

- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE.
 2. CLEAR COVER FOR SLAB = 19mm,



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

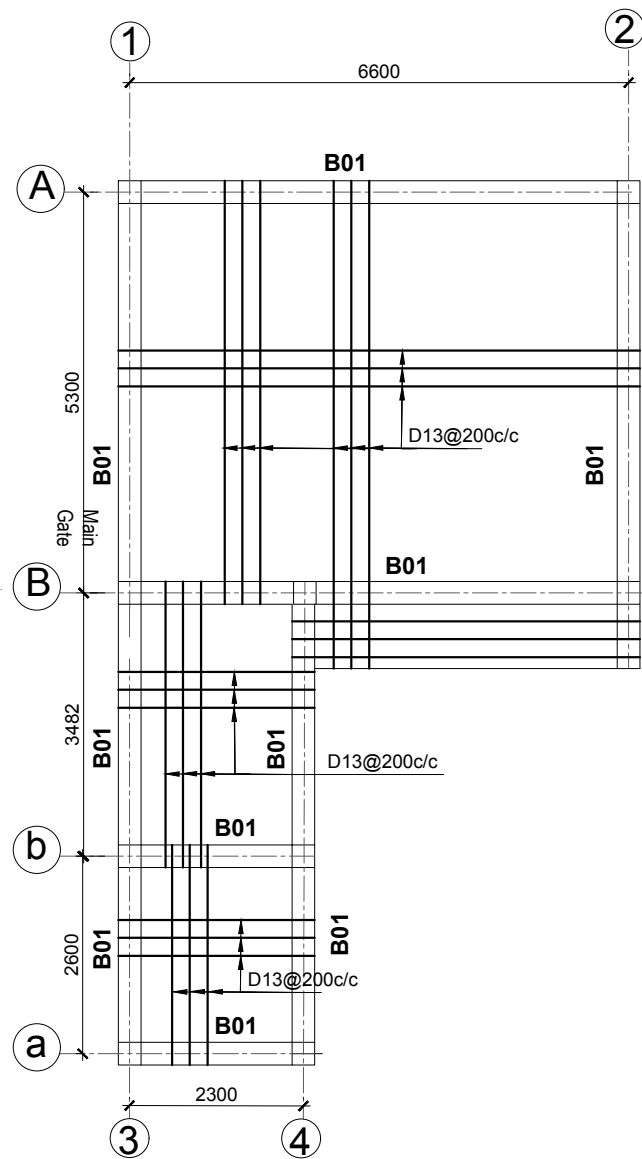
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
STAIR REINFORCEMENT DETAIL**

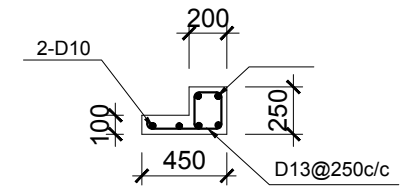
Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOLAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
DRAWING No. **141-107**



ROOF SLAB PLAN
SCALE A =1:100



LINTEL DETAIL



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

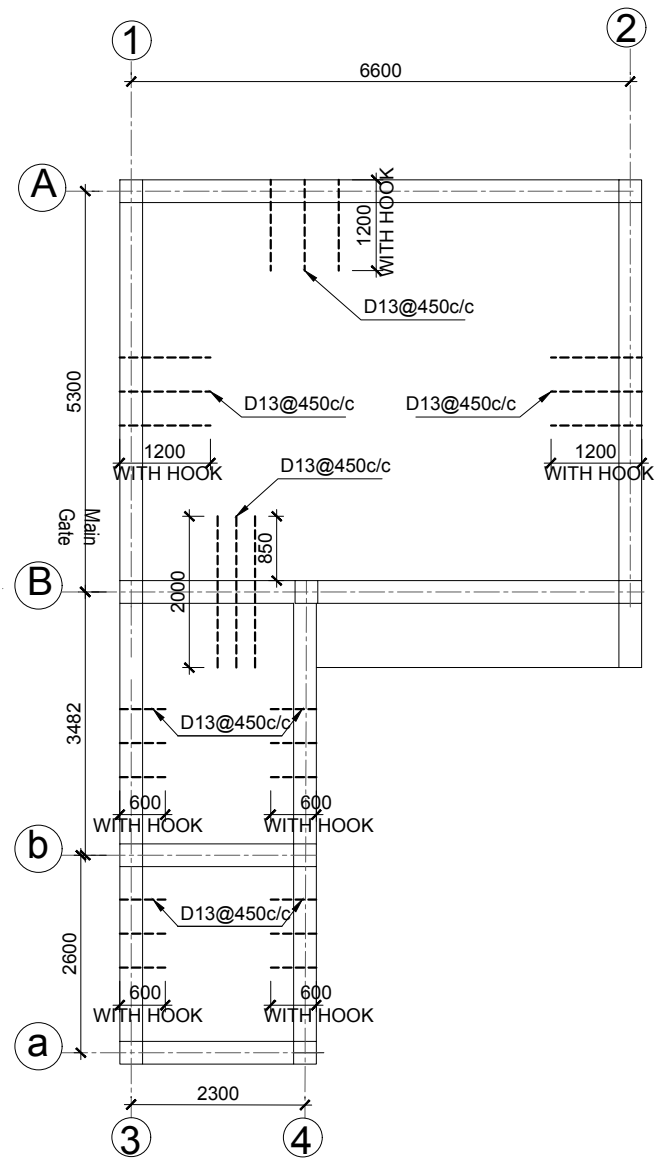
DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
ROOF SLAB PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No.
141-108



ROOF SLAB PLAN
SCALE A = 1:100



DASU HYDROPOWER PROJECT




PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
ROOF FLOOR SLAB PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Anwar	Name: M. Rasheed	Name: Imtaiz Hussain	

DASU HYDROPOWER CONSULTANTS

 JOINT VENTURE OF
 NIPPON KOEI CO., LTD. and
 DOLSAK ENGINEERING LIMITED
 in Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

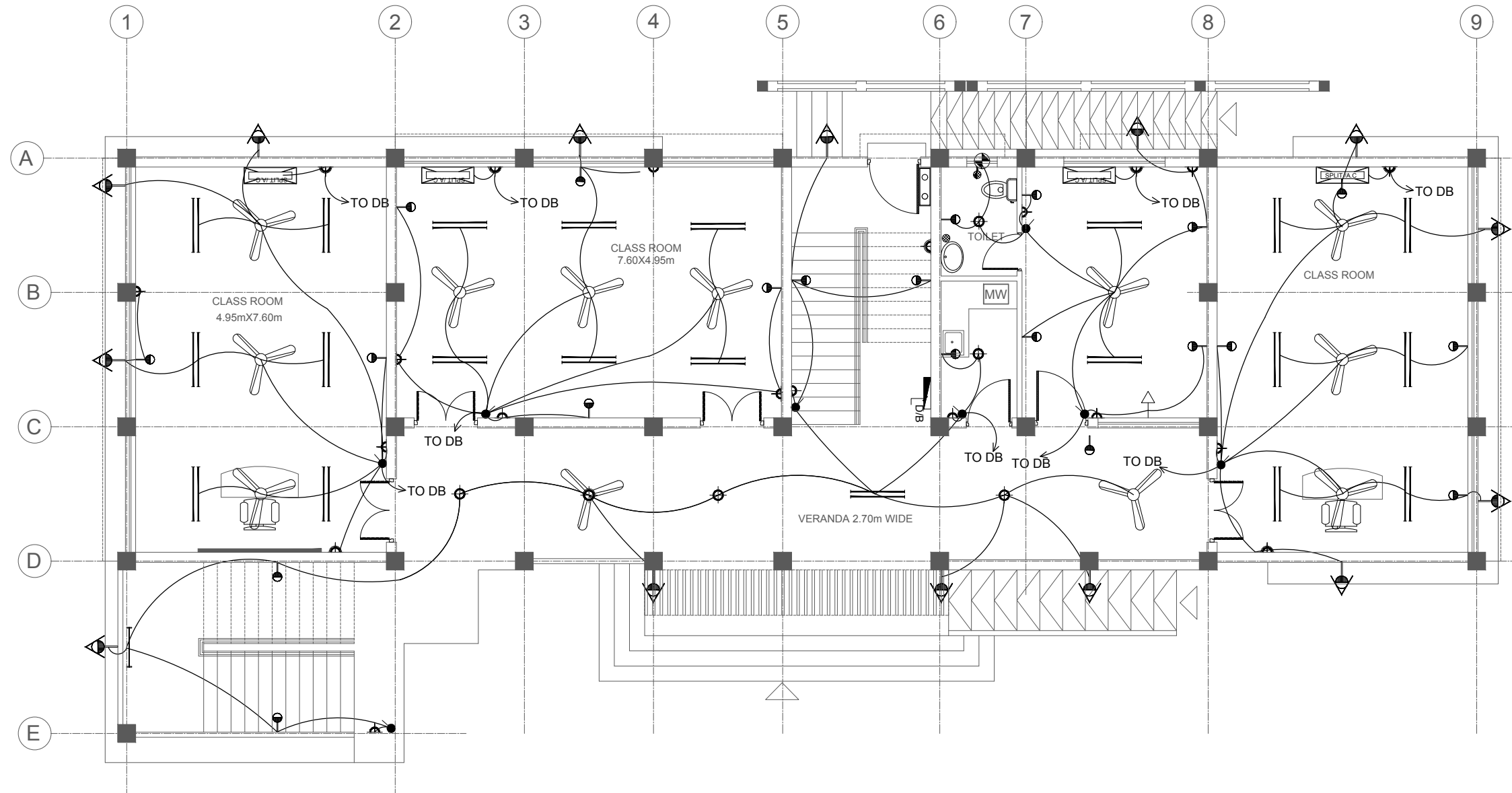
DATE: SEP/2024
 DRAWING No.
141-109

INTERNAL ELECTRIFICATION

RELOCATED PRIMARY SCHOOLS-DASU-RS-02 DRAWINGS

LIST OF DRAWINGS

3. Electrification Drawings					
SR. #	DWG. NO.	TITLE	SR. #	DWG. NO.	TITLE
INTERNAL ELECTRIFICATION			11	141-171B	Rehabilitation GBPS Shahjahanabad Electrification Ground Floor Plan (S1)
RELOCATED PRIMARY SCHOOL			12	141-171B	Rehabilitation GBPS Shahjahanabad Electrification First Floor Plan (S2)
1	141-167	Electrical Relocated Primary School Ground Floor Plan	13	141-171B	Rehabilitation GBPS Shahjahanabad Electrification Single Line Diagram -DB-1- (S3)
2	141-168	Electrical Relocated Primary School First Floor Plan			
3	141-169	Electrical Relocated Primary School Toilets Detail Plan			
4	141-170	Electrical Relocated Primary School Mumty & Top Roof Plan			
5	141-171	Single line Diagram DB-1			
6	141-171A	Lightening protection Plan & Earthing system Ground Floor (S1)			
7	141-171A	Lightening protection Plan & Earthing system First Floor (S2)			
8	141-171A	Lightening protection Plan & Earthing system Roof Floor (S3)			
9	141-171A	Lightening protection Plan & Earthing system Front Elevation (S4)			
10	141-171A	Lightening protection Plan & Earthing system Typical Details (S5)			



GROUND FLOOR PLAN
SCALE A = 1:100

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	TELEPHONE	250mm/AS REQ
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	LED LIGHT SINGLE BATTEN 16/18W	2150mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

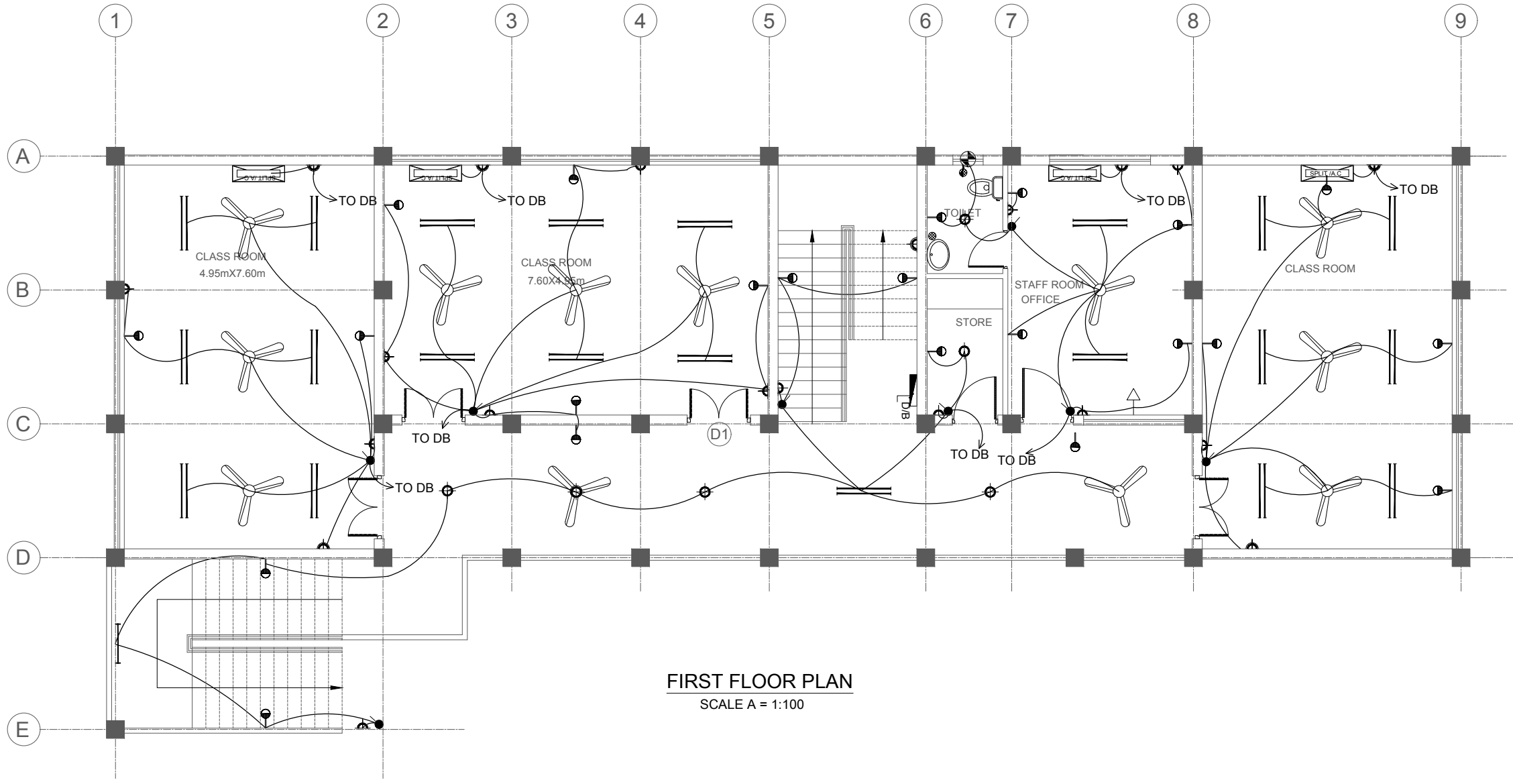
DRAWING TITLE: ELECTRIFICATION
RELOCATED PRIMARY SCHOOL
GROUND FLOOR PLAN

DASU HYDROPOWER CONSULTANTS DATE: SEP/2024

DHC JOINT VENTURE OF NIPPON KOGI CO. LTD. and DOKSAN ENGINEERING LIMITED
In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No. **141-167**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain



FIRST FLOOR PLAN
SCALE A = 1:100

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	TELEPHONE	250mm/AS REQ
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	LED LIGHT SINGLE BATTEN 16/18W	2150mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

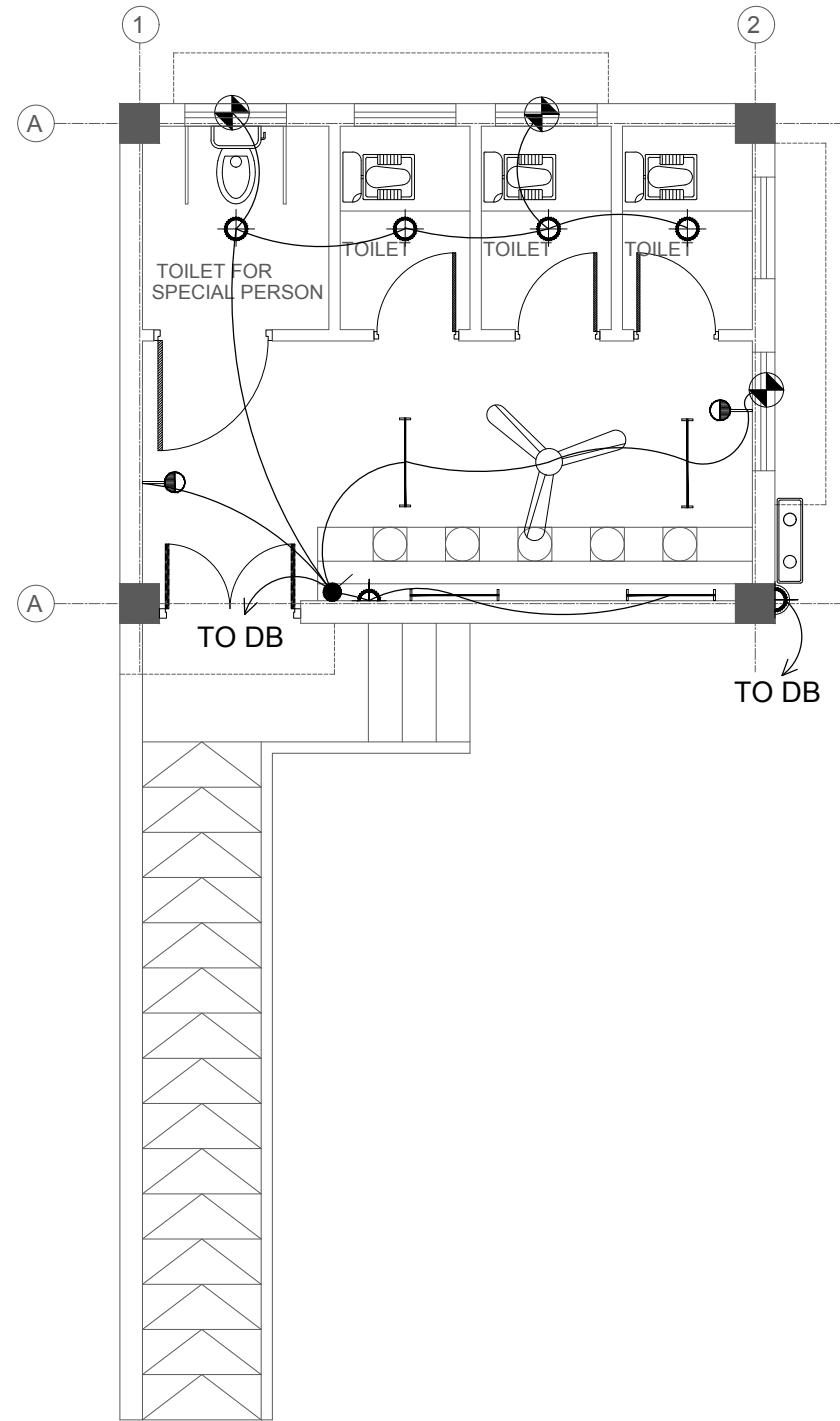
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **ELECTRIFICATION**
RELOCATED PRIMARY SCHOOL
FIRST FLOOR PLAN

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOEI CO. LTD. and DOL/SAR ENGINEERING LIMITED
 In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. **141-168**

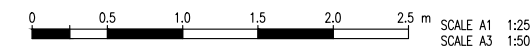


TOILET DETAIL PLAN
SCALE A =1:50

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	TELEPHONE	250mm/AS REQ
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	LED LIGHT SINGLE BATTEN 16/18W	2150mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



Rev. No.	DATE	REVISION	Appr.
Prepared	Reviewed	Approved	
Name: Wajid Abbasi	Name: M.Rasheed	Name: Imtiaz Hussain	

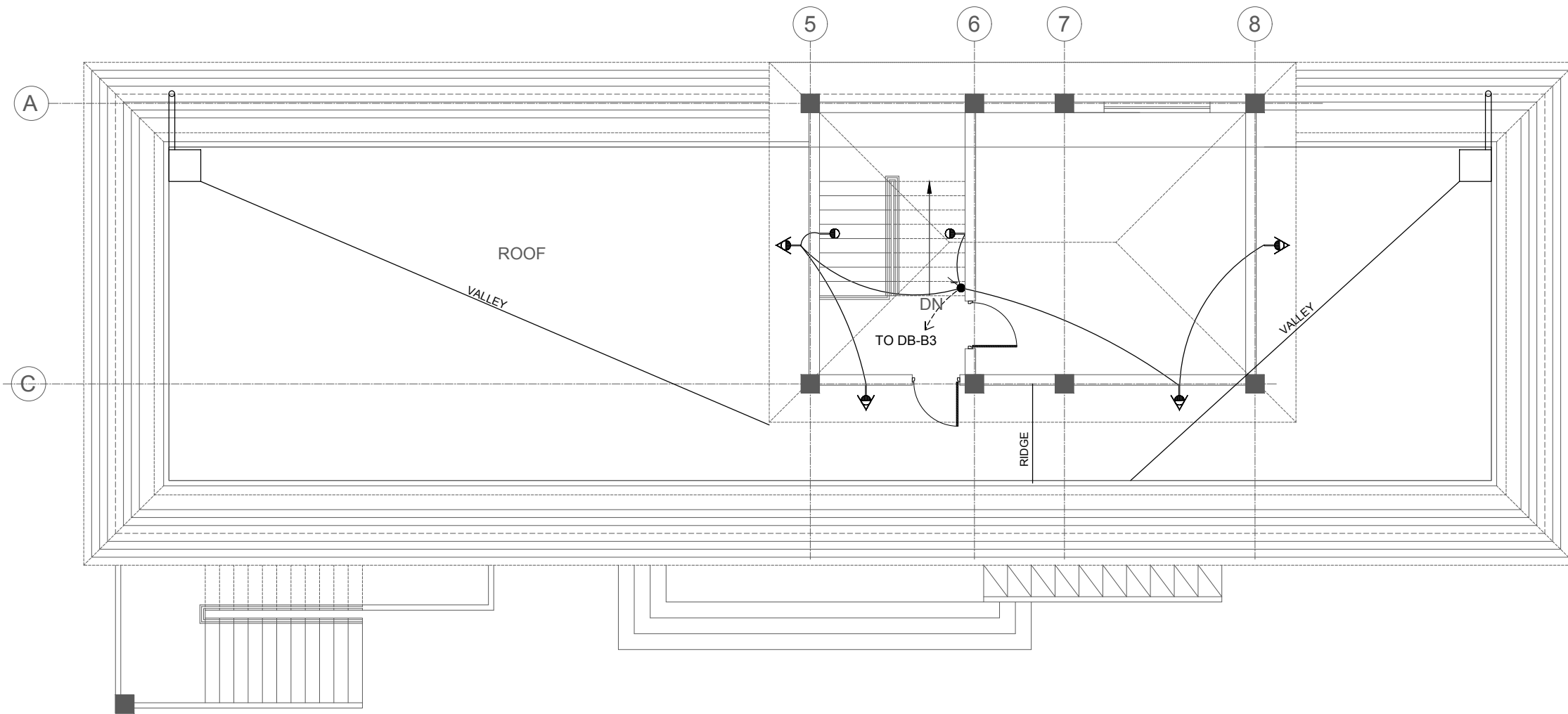
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **ELECTRIFICATION
PRIMARY SCHOOL
TOILETS DETAIL**

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO. LTD. and
DGLSAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
DRAWING No. 141-169

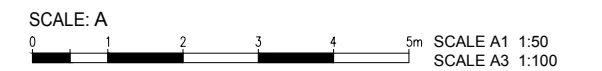


MUMTY PLAN
SCALE A = 1:100

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	TELEPHONE	250mm/AS REQ
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	LED LIGHT SINGLE BATTEN 16/18W	2150mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **ELECTRIFICATION**
PRIMARY SCHOOL
MUMTY & TOP ROOF PLAN

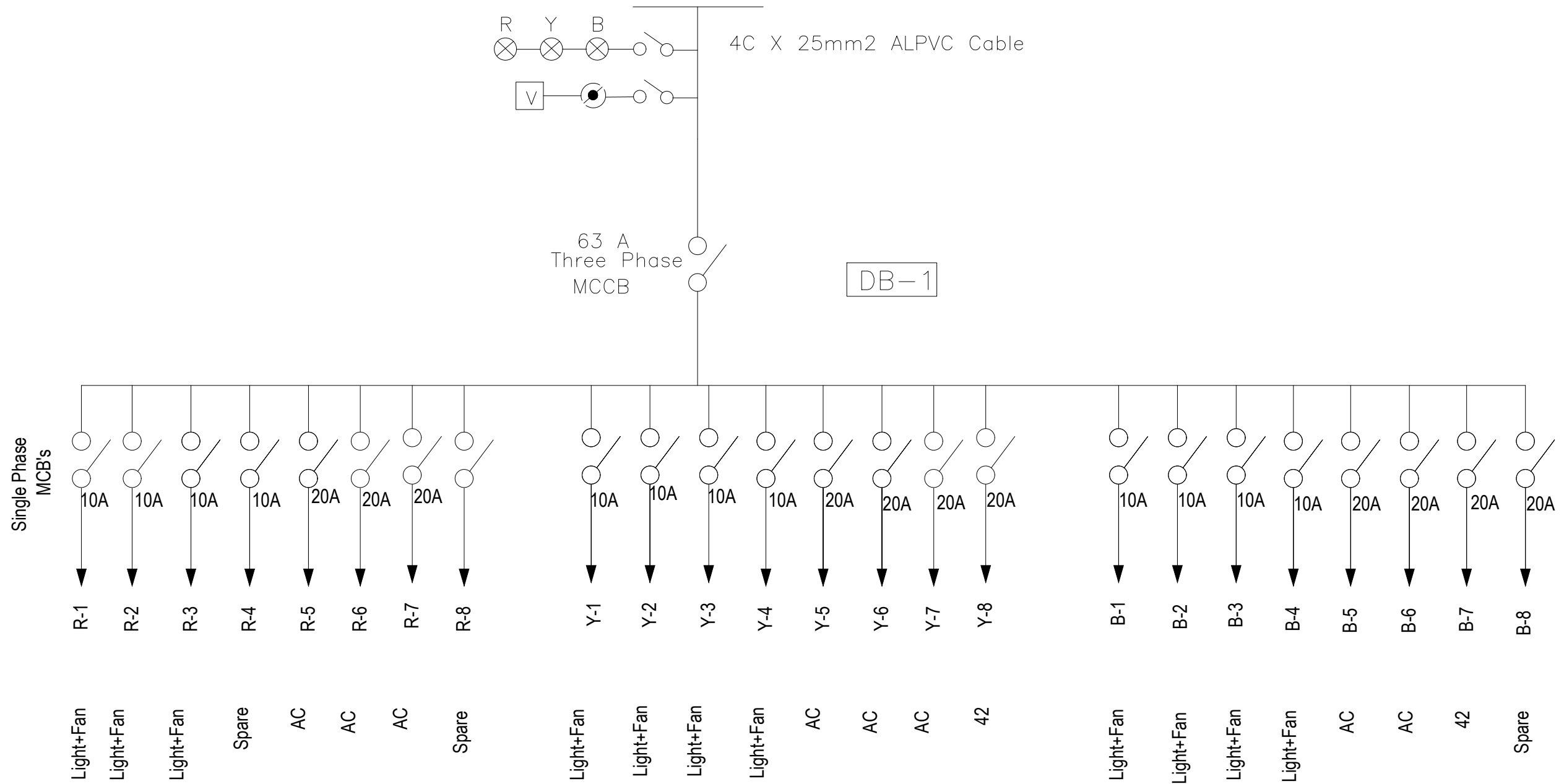
DASU HYDROPOWER CONSULTANTS

DHC JOINT VENTURE OF NIPPON KOEI CO. LTD. and DGLSAR ENGINEERING LIMITED
In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: **SEP/2024**

DRAWING No. **141-170**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

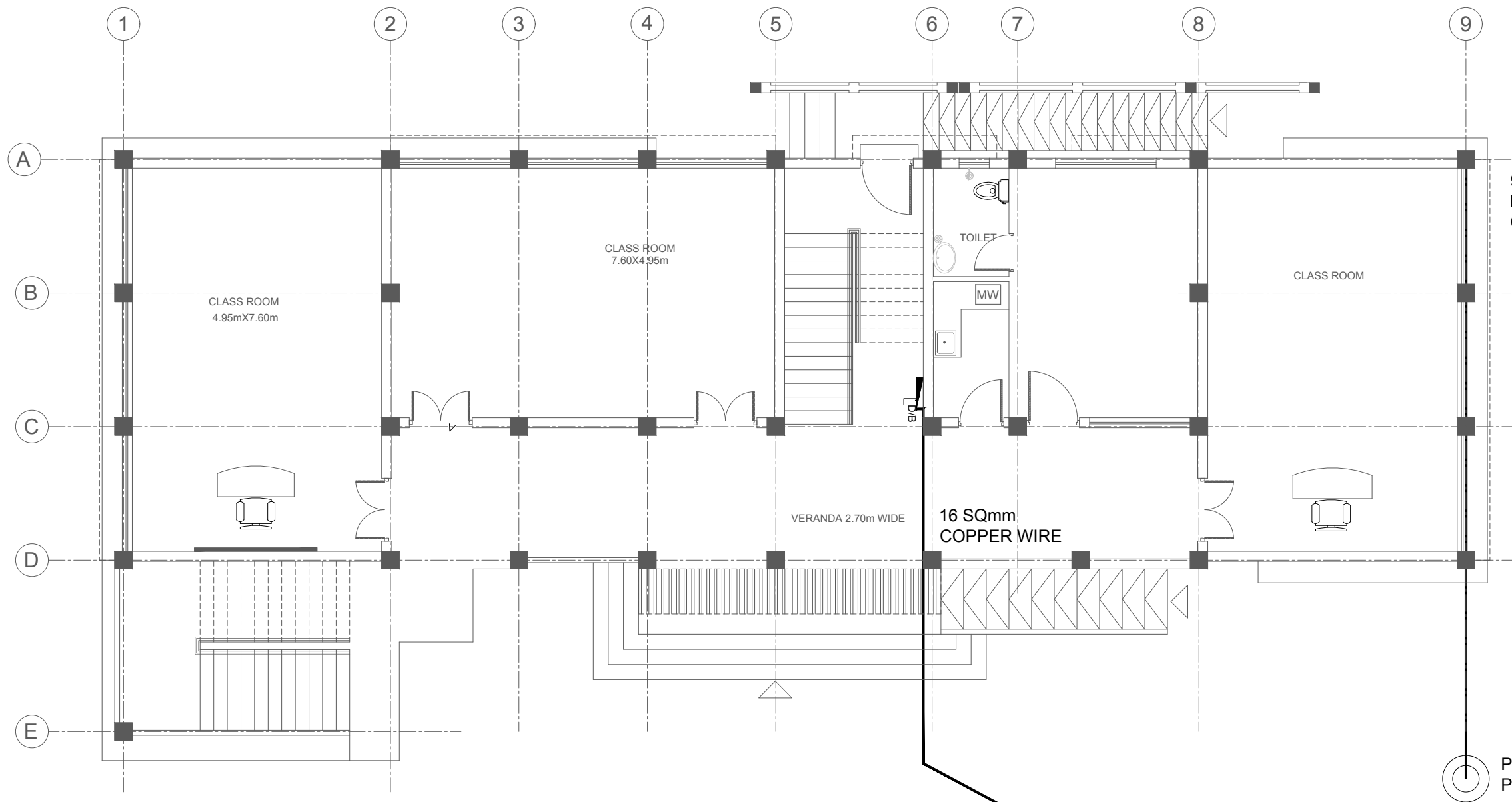
DRAWING TITLE: ELECTRIFICATION
PRIMARY SCHOOL
SINGLE LINE DIAGRAM DB-1

DASU HYDROPOWER CONSULTANTS

JOINT VENTURE OF
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DGLSAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No. 141-171



95 SQmm COPPER WIRE
DOWN THROUGH
COLUMN TO GROUND

16 SQmm
COPPER WIRE

PIT FOR LIGHTNING
PROTECTION

PIT FOR
EARTHING SYSTEM

NOTE:

- 1) ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY OTHER TRADES TO THE NEARBY EARTH CONNECTING POINT.
- 2) THE OVERALL RESISTANT FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL BE INSPECTOR'S REQUIREMENT.
- 3) EARTH ELECTRODE PLATE SHALL BE INSTALLED 5 METERS APART FROM THE BUILDING.

SCALE: A
0 1 2 3 4 5m SCALE A1 1:50
SCALE A3 1:100

GROUND FLOOR LIGHT
PROTECTION PLAN
AND EARTHING SYSTEM

DASU HYDROPOWER PROJECT
**PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA**

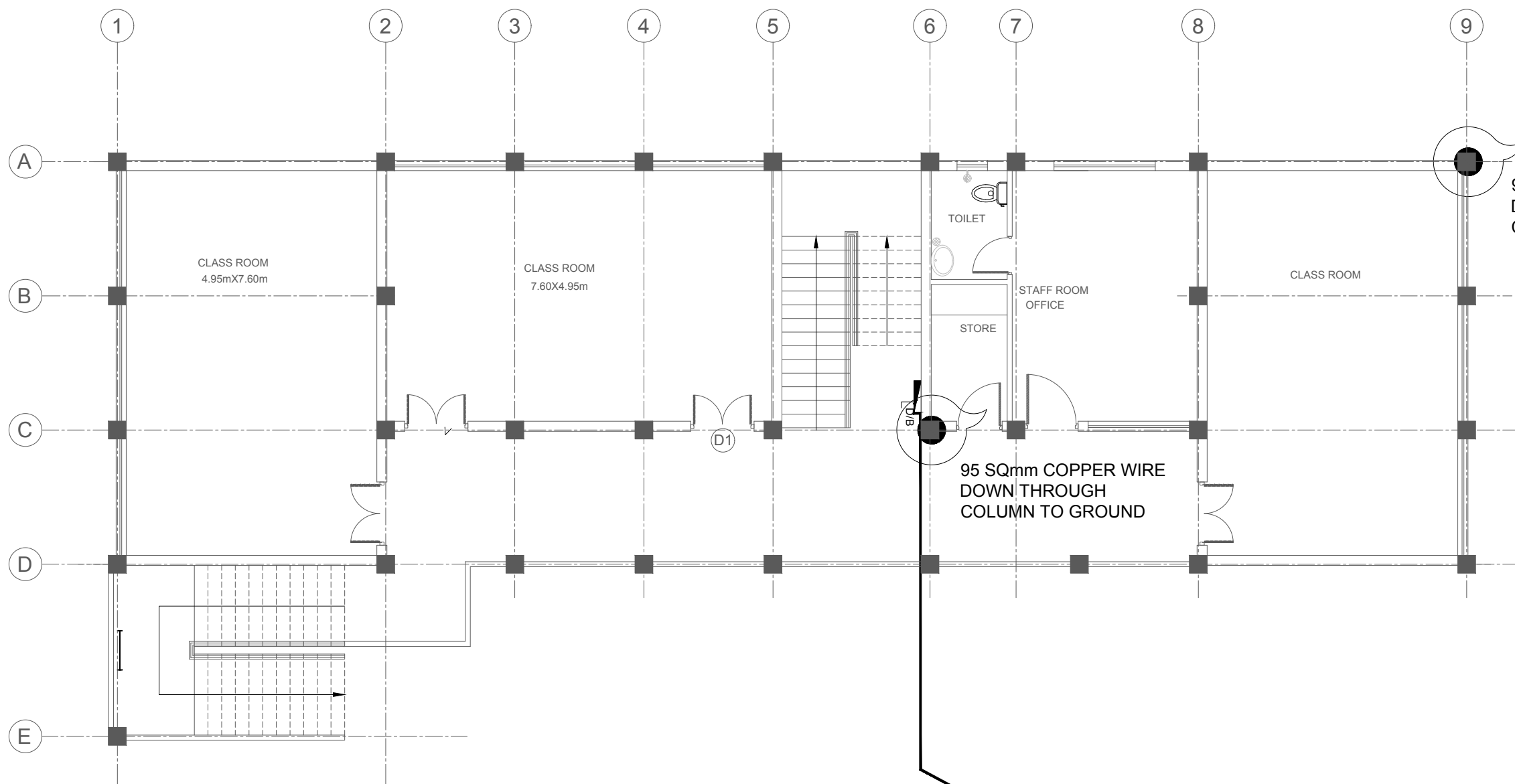
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
 LIGHTNING PROTECTION PLAN AND EARTHING SYSTEM
 RELOCATED PRIMARY SCHOOL
 GROUND FLOOR PLAN
 (SHEET 1)

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF
 NIPPON KOEI CO.,LTD. and
 DOLGAR ENGINEERING LIMITED
 in Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
 NATIONAL DEVELOPMENT CONSULTANTS LTD. and
 PAKISTAN ENGINEERING SERVICES LTD.

DATE:
 SEP/2024
 DRAWING No.
 141-171A

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain



FIRST FLOOR LIGHT PROTECTION PLAN AND EARTHING SYSTEM

95 SQmm COPPER WIRE DOWN THROUGH COLUMN TO GROUND

95 SQmm COPPER WIRE DOWN THROUGH COLUMN TO GROUND

PIT FOR EARTHING SYSTEM

NOTE:

- 1) ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY OTHER TRADES TO THE NEARBY EARTH CONNECTING POINT.
- 2) THE OVERALL RESISTANT FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL BE INSPECTOR'S REQUIREMENT.
- 3) EARTH ELECTRODE PLATE SHALL BE INSTALLED 5 METERS APART FROM THE BUILDING.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
LIGHTNING PROTECTION PLAN AND EARTHING SYSTEM
RELOCATED PRIMARY SCHOOL
FIRST FLOOR PLAN
(SHEET 2)

DASU HYDROPOWER CONSULTANTS

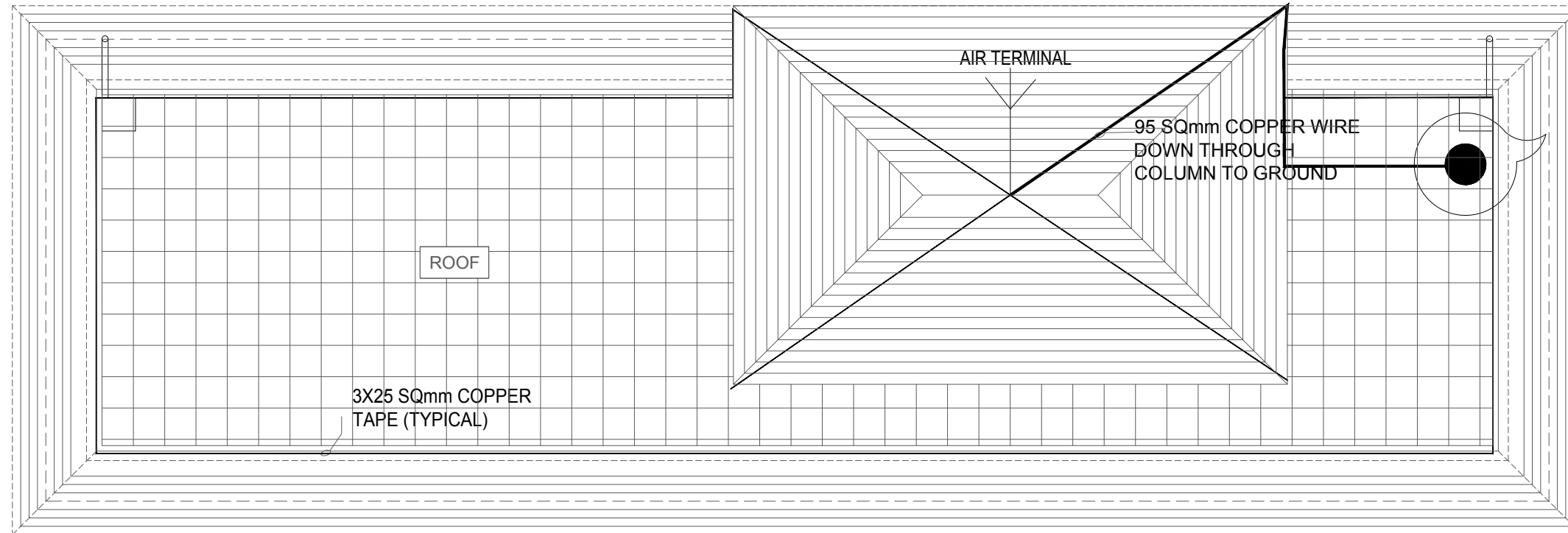


JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAK ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024

DRAWING No.
141-171A

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain



95 SQmm COPPER WIRE
DOWN THROUGH
COLUMN TO GROUND

ROOF

3X25 SQmm COPPER
TAPE (TYPICAL)

AIR TERMINAL

95 SQmm COPPER WIRE
DOWN THROUGH
COLUMN TO GROUND

ROOF FLOOR LIGHT
PROTECTION PLAN
AND EARTHING SYSTEM

NOTE:

- 1) ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY OTHER TRADES TO THE NEARBY EARTH CONNECTING POINT.
- 2) THE OVERALL RESISTANT FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL BE INSPECTOR'S REQUIREMENT.
- 3) EARTH ELECTRODE PLATE SHALL BE INSTALLED 5 METERS APART FROM THE BUILDING.

SCALE: A
0 1 2 3 4 5m SCALE A1 1:50
SCALE A3 1:100

NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
LIGHTNING PROTECTION PLAN AND EARTHING SYSTEM
RELOCATED PRIMARY SCHOOL
ROOF FLOOR PLAN
(SHEET 3)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAR ENGINEERING LIMITED
in Association with
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PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024
DRAWING No.
141-171A



ELEVATION
LIGHT PROTECTION PLAN
AND EARTHING SYSTEM

95 SQmm COPPER
WIRE
DOWN THROUGH
COLUMN TO
GROUND

NOTE:

- 1) ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY OTHER TRADES TO THE NEARBY EARTH CONNECTING POINT.
- 2) THE OVERALL RESISTANT FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL BE INSPECTOR'S REQUIREMENT.
- 3) EARTH ELECTRODE PLATE SHALL BE INSTALLED 5 METERS APART FROM THE BUILDING.



NOTES: -
All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
LIGHTNING PROTECTION PLAN AND EARTHING SYSTEM
RELOCATED PRIMARY SCHOOL
FRONT ELEVATION
(SHEET 4)

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
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in Association with
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NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024
DRAWING No.
141-171A

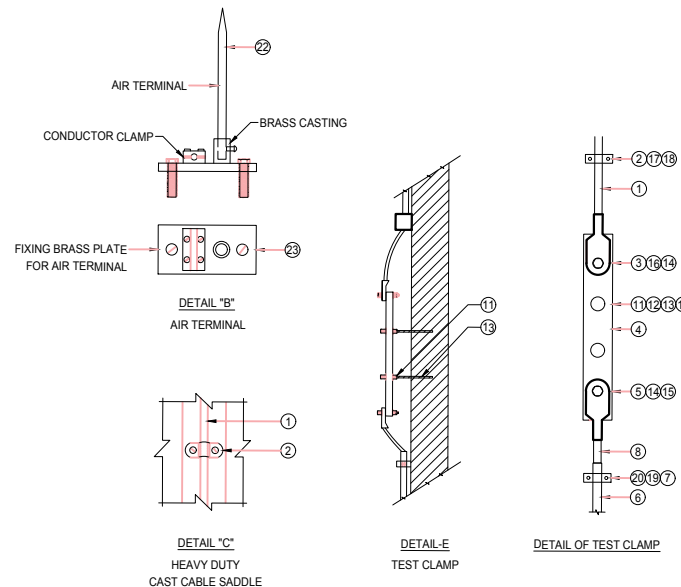
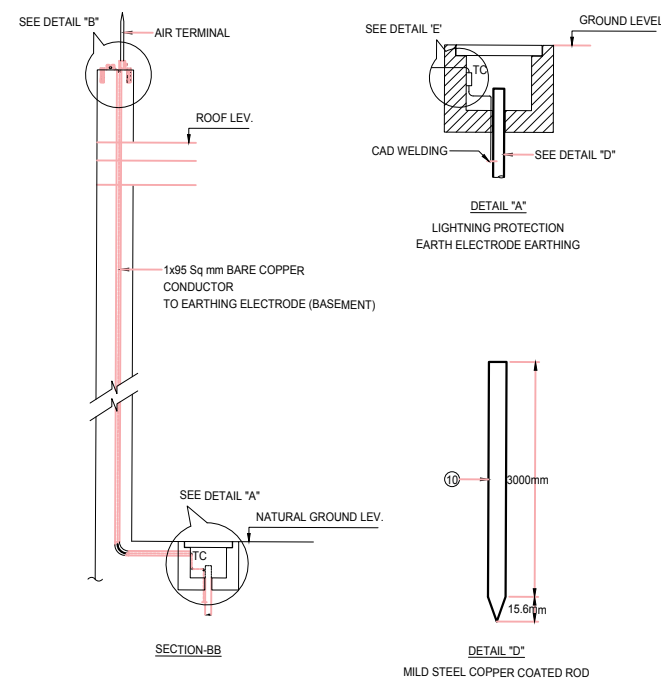
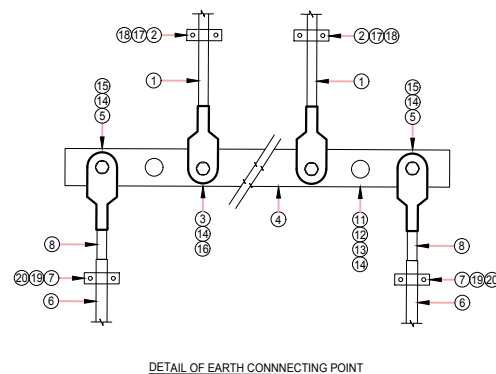
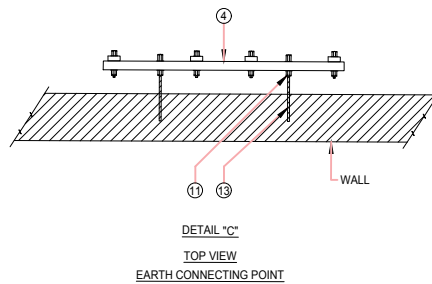
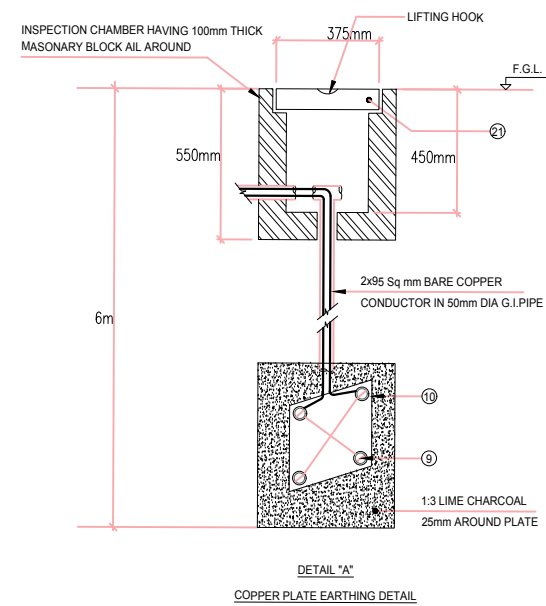
SCALE: A
0 1 2 3 4 5m SCALE A1 1:50
SCALE A3 1:100

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

EARTHING MATERIAL		
S.NO	MATERIAL DESCRIPTION	MATERIAL SPECIFICATION
1	MAIN CONDUCTOR	16 Sq mm COPPER CONDUCTOR
2	TWO HOLE STRAP FOR CONDUCTOR	3.125mm THICK COPPER
3	CABLE LUGS	95 Sq mm STRANDED TINNED COPPER CONDUCTOR
4	EARTH CONNECTING POINT	100mm WIDE, 9.375mm THICK AND SUITABLE LENGTH HIGH CONDUCTIVITY TINNED COPPER BAR
5	CABLE LUGS	FOR 95 Sq mm CONDUCTOR TINNED COPPER
6	PIPE	25mm DIA GI PIPE
7	TWO HOLE CLAMP WITH PROJECT OFFICE SADDLE TYPE BASE	FOR 25mm DIA GI PIPE CAST IRON GALVANIZED
8	EARTHING CONDUCTOR	95 Sq mm BARE STRANDED COPPER CONDUCTOR
9	NUT BOLT AND WASHER	18.75mm DIA COPPER/BRASS
10	ELECTROLYTIC COPPER EARTH PLAT	50mm x 50mm x 3.125mm
11	BOLT (HEX HEAD)	12.5 DIA 87.5mm LONG STEEL GALVANIZED
12	NUT (HEXAGON)	12.5mm DIA STEEL GALVANIZED
13	ANCHOR (HILTI DROP-IN TYPE)	12.5mm DIA STEEL GALVANIZED
14	PLAIN WASHER	FOR 25mm DIA BOLT STEEL GALVANIZED
15	BOLT HEX HEAD WITH NUT	25mm LONG FOR 95 Sq mm CABLE LUGS
16	BOLT HEX HEAD WITH NUT	25mm LONG FOR 95 Sq mm CABLE LUGS
17	SHEET METAL SCREW	6.25mm DIA, 25mm LONG STEEL GALVANIZED
18	ANCHORS FOR ABOVE SHEET METAL DUCT	PVC/NYLON
19	SHEET METAL SCREW	6.25mm DIA 25mm LONG STEEL GALVANIZED
20	ANCHORS FOR ABOVE SHEET METAL DUCT	PVC/NYLON
21	375 x 375mm HEAVY DUTY COVER	CAST IRON

NOTES:-

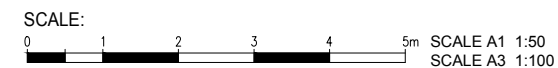
- * ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY OTHER TRADES TO THE NEARBY EARTH CONNECTING POINT.
- * THE OVERALL RESISTANT FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL BE LESS THAN 1 OHM. AND IN ANY CASE SHALL COMPLY WITH ELECTRICAL INSPECTOR'S REQUIREMENT.
- * EARTH ELECTRODE PLATE SHALL BE INSTALLED 5 METERS APART FROM THE BUILDING.



NOTES:-

- * WHERE EVER REQUIRED JOINTING OF COPPER CONDUCTOR SHALL BE CARRIED OUT BY EXOTHERMIC WELD. (CAD WELD)
- * CONTRACTOR MUST ENSURE THAT THE RESISTANCE TO EARTH OF ANY EARTH CONNECTION SHALL NOT BE MORE THAN TEN (10) OHMS IF THIS RESULT IS NOT ACHIEVED THEN THE CONTRACTOR HAS TO INSTALL ADDITIONAL COPPER RODS TO GET THE REQUIRED RESULT.

LIGHTNING PROTECTION MATERIAL		
S.NO	MATERIAL DESCRIPTION	MATERIAL SPECIFICATION
1	MAIN CONDUCTOR	95 Sq mm STRANDED COPPER CONDUCTOR
2	TWO HOLE STRAP FOR CONDUCTOR	3.25mm THICK COPPER
3	CABLE LUGS	95 Sq mm STRANDED TINNED COPPER CONDUCTOR
4	EARTH CONNECTING TEST POINT	250 X 75 X 6.25 mm TINNED COPPER
5	CABLE LUGS	FOR 95 Sq mm CONDUCTOR TINNED COPPER
6	PVC PIPE	25mm DIA CLASS D TYPE PVC
7	TWO HOLE CLAMP WITH PROJECT OFFICE SADDLE TYPE BASE	FOR 25mm DIA PVC PIPE CAST IRON GALVANIZED
8	EARTHING CONDUCTOR	95 Sq mm BARE STRANDED COPPER CONDUCTOR
9	EARTH ROD CLAMP	BRONZE
10	EARTH ROD	18.75 DIA 10 FT LONG COPPER CLAD CARBON STEEL ROD
11	BOLT (HEX HEAD)	12.5mm DIA 87.5mm LONG STEEL GALVANIZED
12	NUT (HEXAGON)	12.5mm DIA STEEL GALVANIZED
13	ANCHOR (HILTI DROP-IN TYPE)	12.5mm DIA STEEL GALVANIZED
14	PLAIN WASHER	FOR 12.5mm DIA BOLT STEEL GALVANIZED
15	BOLT HEX HEAD WITH NUT	25mm LONG FOR 70 Sq mm CABLE LUGS
16	BOLT HEX HEAD WITH NUT	25mm LONG FOR 70 Sq mm CABLE LUGS
17	SHEET METAL SCREW	6.25mm DIA, 25mm LONG STEEL GALVANIZED
18	ANCHORS FOR ABOVE SHEET METAL DUCT	PVC/NYLON
19	SHEET METAL SCREW	6.25 DIA 25mm LONG STEEL GALVANIZED
20	ANCHORS FOR ABOVE SHEET METAL DUCT	PVC/NYLON
21	375 X375 HEAVY DUTY COVER	CAST IRON
22	AIR TERMINAL	450mm LONG 18.75mm DIA COPPER
23	FIXING BASE FOR AIR TERMINAL	BRASS



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT



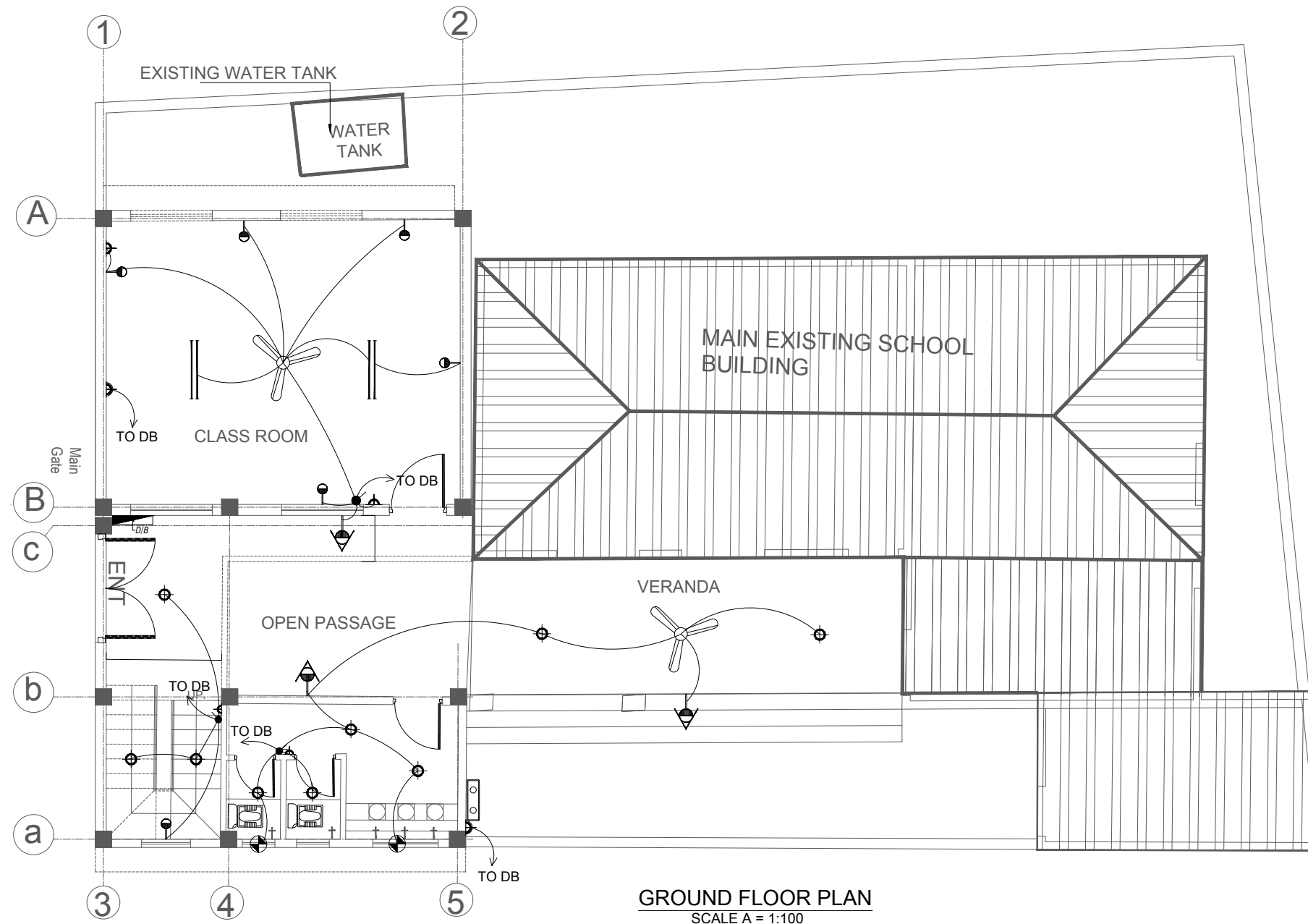
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
LIGHTNING PROTECTION PLAN AND EARTHING SYSTEM
RELOCATED PRIMARY SCHOOL
TYPICAL DETAILS
(SHEET 5)

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO.,LTD. and
DOLSAR ENGINEERING LIMITED
in Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024
DRAWING No.
141-171A



GROUND FLOOR PLAN
SCALE A = 1:100

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

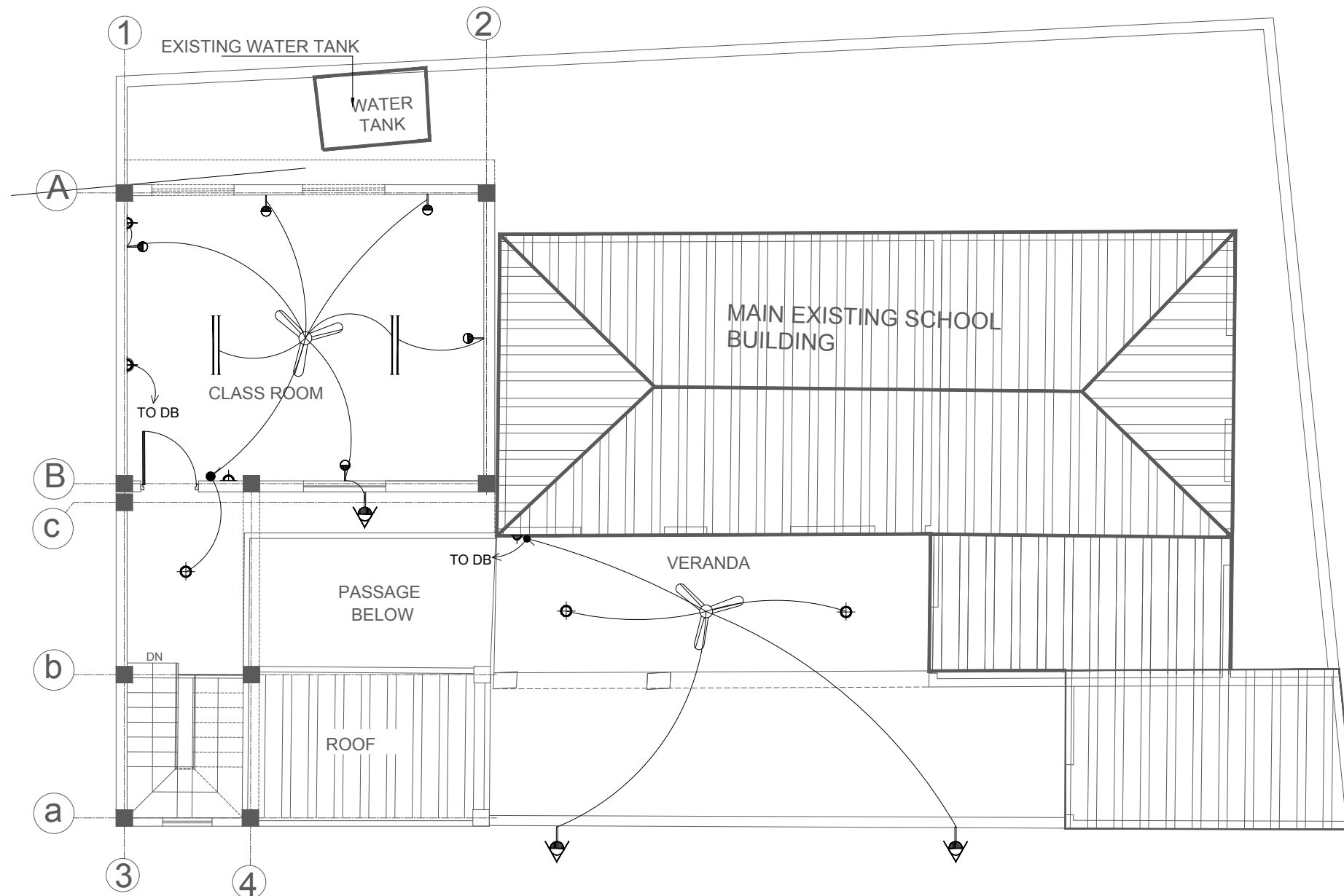
Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD ELECTRIFICATION
GROUND FLOOR PLAN (SHEET-1)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOEI CO. LTD. and DOL-SAR ENGINEERING LIMITED
 In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: OCT/2024
 DRAWING No. **141-171B**



FIRST FLOOR PLAN
SCALE A = 1:100

LEGEND		
SYMBOLS	DESCRIPTION	HEIGHT
	MAIN BOARD 1350mm	1350mm
	SWITCH BOARD (ONE WAY)	1250mm
	SWITCH BOARD (TWO WAY)	1250mm
	CEILING LIGHT	ON CEILING
	WALL LIGHT WITH HOLDER	2150mm
	WALL BRACKET WATER TIGHT LIGHT	SUITABLE HT
	EXHAUST FAN ABOVE WINDOW	2450mm/AS REQ
	3 PIN, 5AMP. SOCKET	250mm/AS REQ
	3 PIN, 15AMP. SOCKET AC/LEVEL	250mm/AS REQ
	2X16/18W LED LIGHT SINGLE BATTEN	ON CEILING OR 2150mm/AS REQ
	56" SWEEP CEILING FAN	ON CEILING
	ELECTRIC WATER HEATER	ON FLOOR
	SPLIT AIR-CONDITIONER (POINT ONLY)	ABOVE WINDOW

NOTE:

- 1) DB's SHALL BE WALL RECESSED.
- 2) POWER PLUG SHALL BE INSTALLED AC LEVEL.
- 3) THE ELECTRIC CONDUITS SHOULD BE 60MM APART FROM EACH OTHER WHILE PASSING THROUGH THE BEAM.



DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD ELECTRIFICATION
FIRST FLOOR PLAN (SHEET-2)

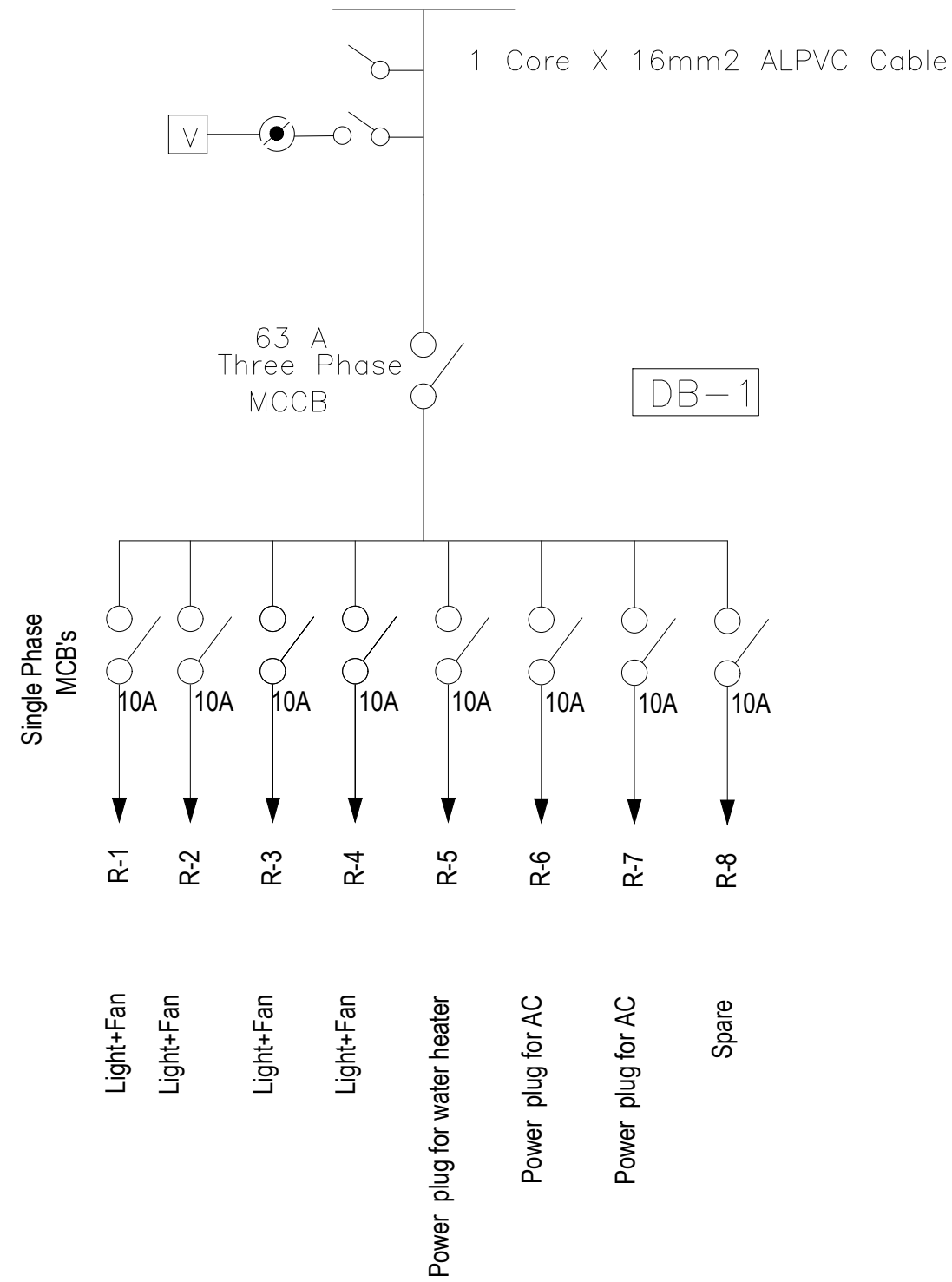
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS

JOINT VENTURE OF
NIPPON KOEI CO. LTD. and
DOL-SAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: OCT/2024

DRAWING No. **141-171B**



DASU HYDROPOWER PROJECT




PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02

DRAWING TITLE:
REHABILITATION GBPS SHAH JAHANABAD
ELECTRIFICATION
SINGLE LINE DIAGRAM DB-1 (SHEET-3)

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Wajid Abbasi		Name: M.Rasheed	Name: Imtiaz Hussain

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 JOINT VENTURE OF
 NIPPON KOEI CO. LTD. and
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 In Association with
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DATE: OCT/2024
 DRAWING No. 141-171B

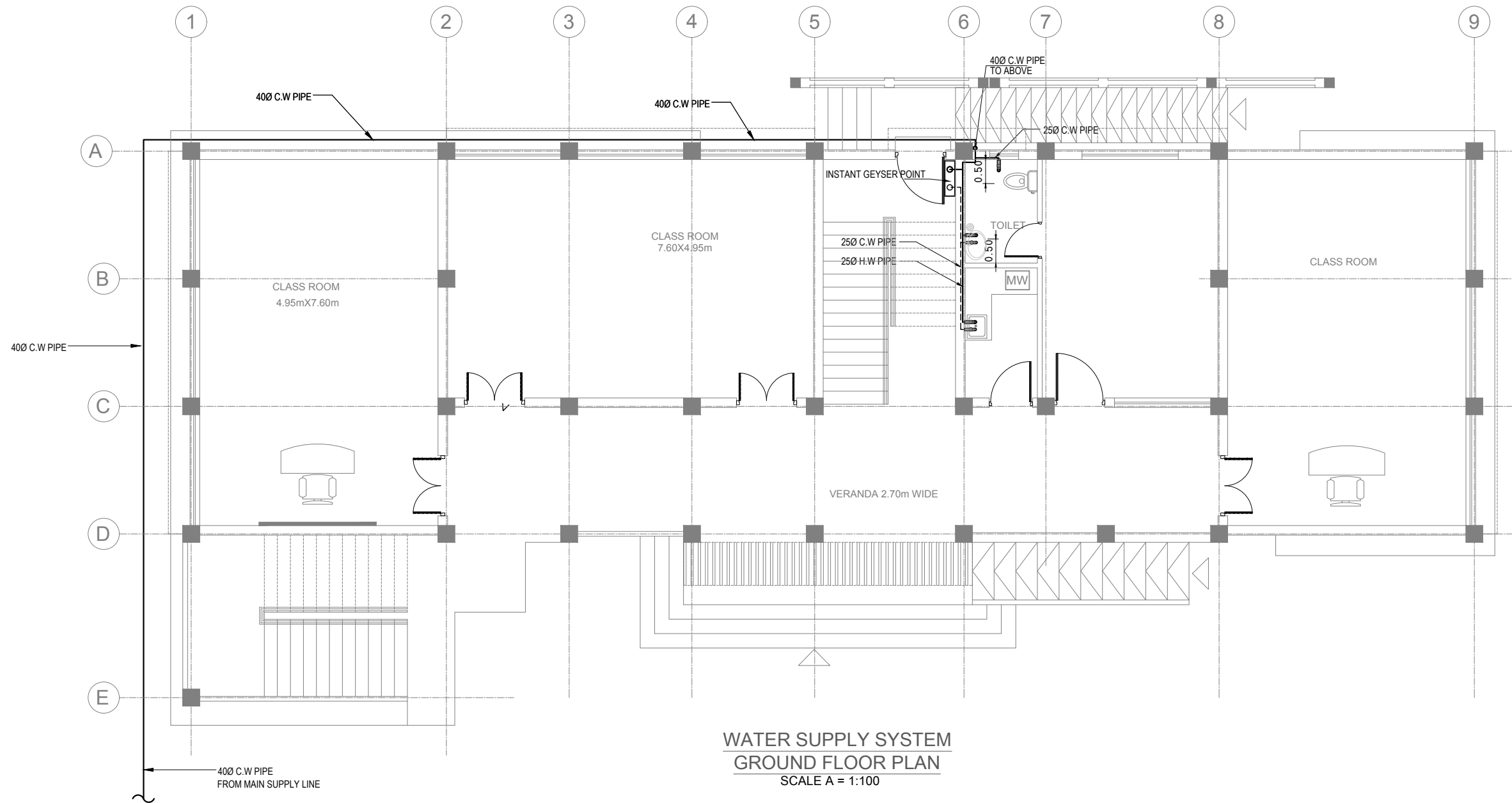
WATER SUPPLY & SEWERAGE

RELOCATED PRIMARY SCHOOLS-RS-2

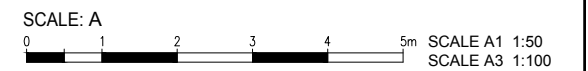
LIST OF DRAWINGS

4. Water Supply & Sewerage Network

SR.#	DWG.NO.	TITLE	SR. #	DWG.NO.	TITLE
WATER SUPPLY & SEWERAGE SYSTEM					
1	141-187	Water Supply System Relocation Primary School Ground Floor Plan	13	141-229	Over Head Water Tank Plan, Section & Detail (Sheet 2 of 3)
2	141-188	Water Supply System Relocation Primary School First Floor Plan	14	141-229	Over Head Water Tank Beams & Columns Detail (Sheet 3 of 3)
3	141-189	Water Supply System Relocation Primary School Toilets Details Plan	15	141-230	Relocated Primary School Toilets with Over Head Water Details
4	141-190	Sewerage System Relocation Primary School Ground Floor Plan	16	141-231	Sewerage system Typical Block Masonry Septic Tank (for Length < 4m) Plan, Section, Details & Reinforcement
5	141-191	Sewerage System Relocation Primary School First Floor Plan	17	141-232	Sewerage system Soakage Pit Plan, Section, Details & Reinforcement
6	141-192	Sewerage System Relocation Primary School Toilets Details Plan	18	141-233	Govt. Boy Primary School Relocation Shah Jahanabad Water supply System (GBPS)
7	141-193	Relocation Primary School Mumty & Top Roof Plan	19	141-234	Govt. Boy Primary School Relocation Shah Jahanabad Sewerage System (GBPS)
10	141-227	Govt. Boys Primary School Relocation Looter Water Supply & Sewerage System (GBPS)	20	141-235	Govt. Boy Primary School Relocation Shah Jahanabad Water Supply & Sewerage System (GBPS)
11	141-228	Miscellaneous Plumbing Details			
12	141-229	Over Head Water Tank Foundation Plan, Section & Detail (Sheet 1 of 3)			



**WATER SUPPLY SYSTEM
GROUND FLOOR PLAN**
SCALE A = 1:100



LEGEND :-

- COLD WATER (C.W) PIPE
- HOT WATER (H.W) PIPE
- WATER MIXTURE
- MUSLIM SHOWER
- INSTANT GEYSER POINT

NOTES :-

- 1:- ALL WATER SUPPLY PIPES ARE PPR PIPES OTHERWISE MENTIONED.
- 2:- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
- 3:- PLACE ALL WATER SUPPLY PIPES WITHIN THE WALLS.
- 4:- ALL DRAIN PIPES ARE uPVC PIPES OTHERWISE MENTIONED.

DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

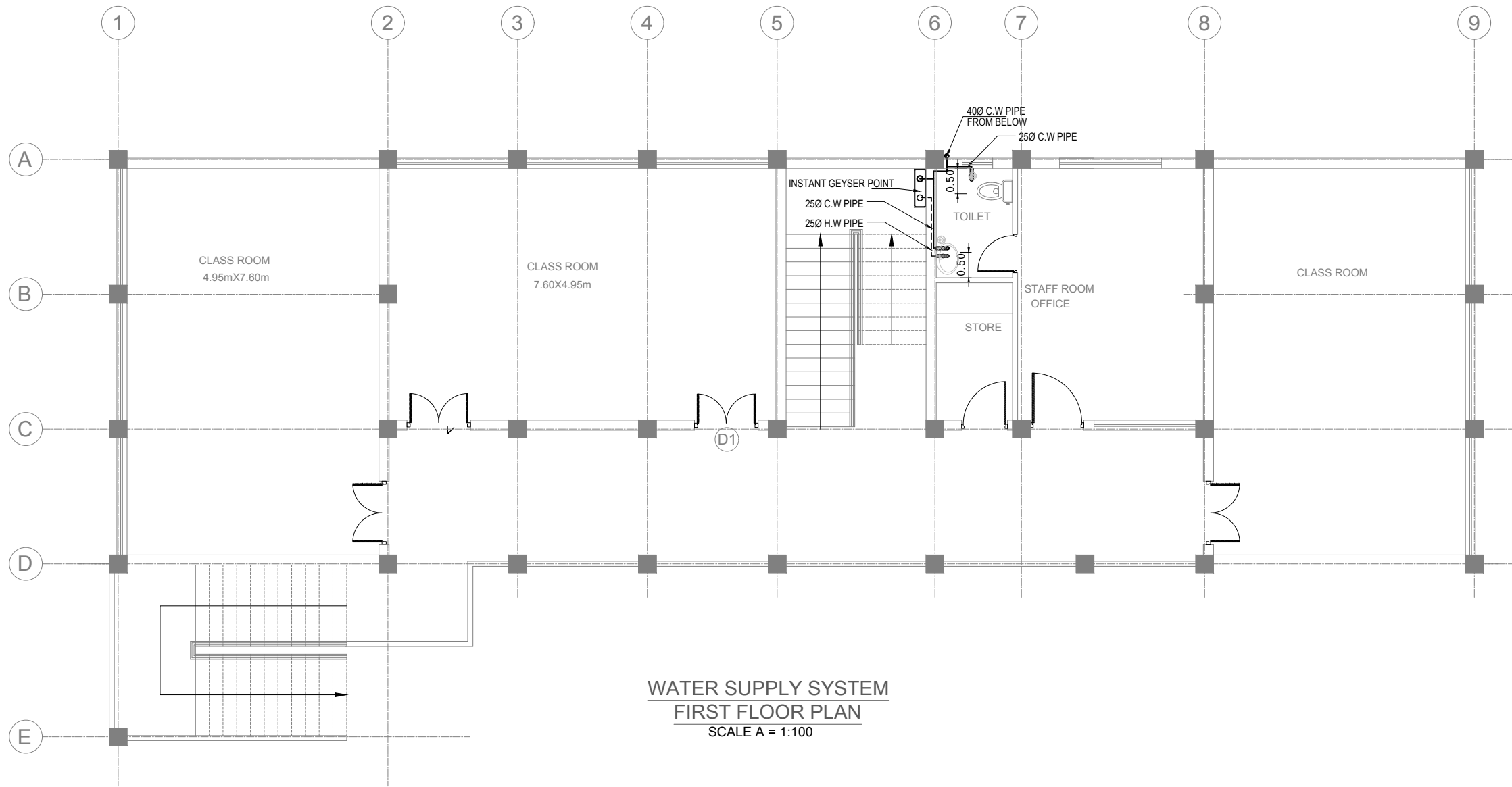
DRAWING TITLE:
**WATER SUPPLY SYSTEM
 RELOCATION PRIMARY SCHOOL
 GROUND FLOOR PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

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
 JOINT VENTURE OF
 NIPPON KOEI CO. LTD. and
 DOL-SAR ENGINEERING LIMITED
 In Association with
 DEVELOPMENT & MANAGEMENT CONSULTANTS,
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DATE: SEP/2024
 DRAWING No. 141-187



**WATER SUPPLY SYSTEM
FIRST FLOOR PLAN**
SCALE A = 1:100


LEGEND :-

-  COLD WATER (C.W) PIPE
-  HOT WATER (H.W) PIPE
-  WATER MIXTURE
-  MUSLIM SHOWER
-  INSTANT GEYSER POINT

NOTES :-

- 1- ALL WATER SUPPLY PIPES ARE PPR PIPES OTHERWISE MENTIONED.
- 2- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
- 3- PLACE ALL WATER SUPPLY PIPES WITHIN THE WALLS.
- 4- ALL DRAIN PIPES ARE uPVC PIPES OTHERWISE MENTIONED.

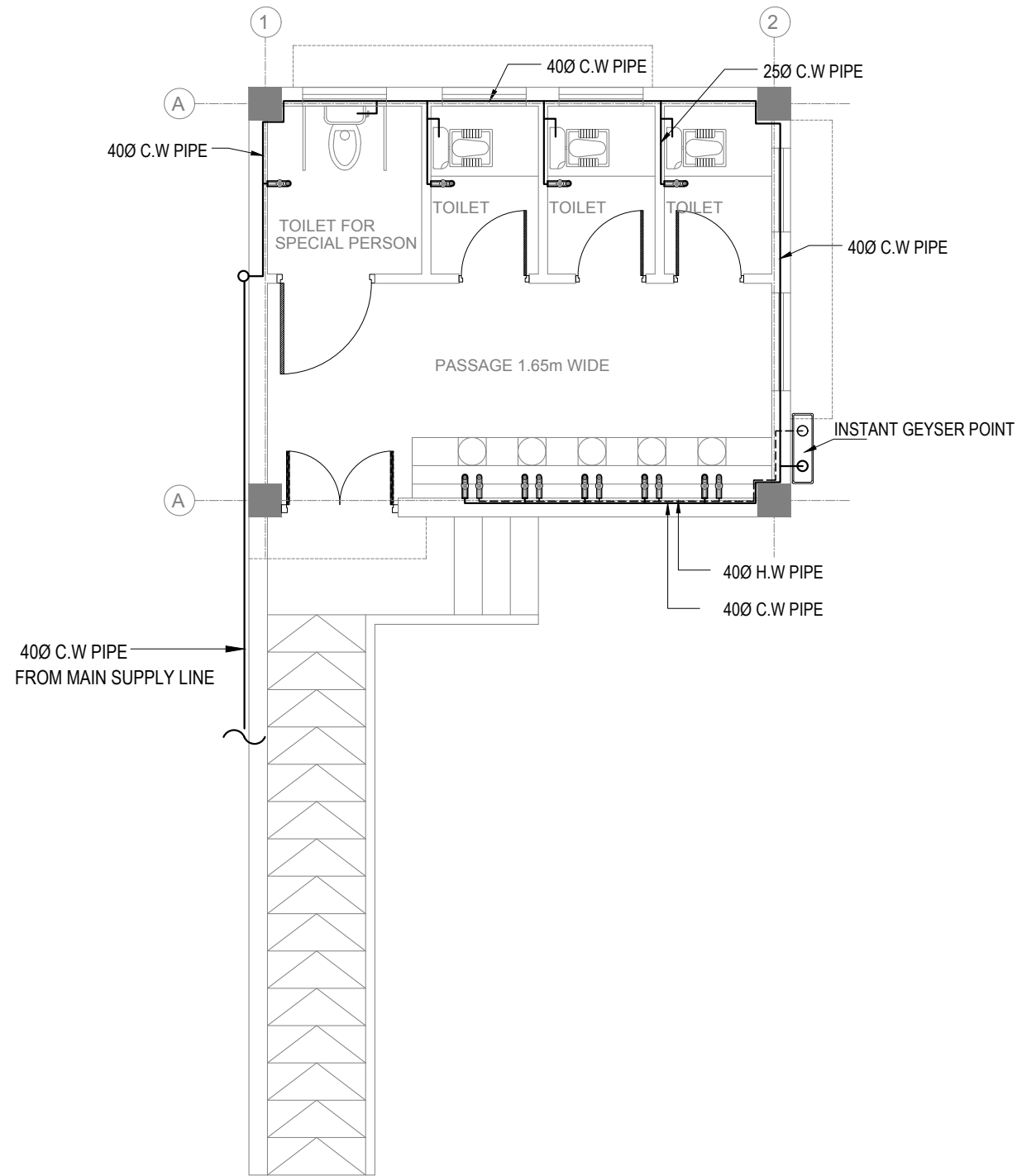


DASU HYDROPOWER PROJECT
 **PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA**
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **WATER SUPPLY SYSTEM
RELOCATION PRIMARY SCHOOL
FIRST FLOOR PLAN**

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS DATE: **SEP/2024**
 JOINT VENTURE OF NIPPON KOEI CO. LTD. and DOLAR ENGINEERING LIMITED
In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.
DRAWING No. **141-188**



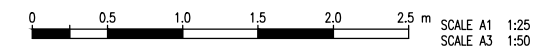
TOILET DETAIL PLAN
SCALE A = 1:50

LEGEND :-

- COLD WATER (C.W) PIPE
- HOT WATER (H.W) PIPE
- WATER MIXTURE
- MUSLIM SHOWER
- INSTANT GEYSER POINT

NOTES :-

- 1:- ALL WATER SUPPLY PIPES ARE PPR PIPES OTHERWISE MENTIONED.
- 2:- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
- 3:- PLACE ALL WATER SUPPLY PIPES WITHIN THE WALLS.
- 4:- ALL DRAIN PIPES ARE uPVC PIPES OTHERWISE MENTIONED.
- 5:- THE OVERHEAD WATER TANK CAPACITY IS = 1200 L.



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

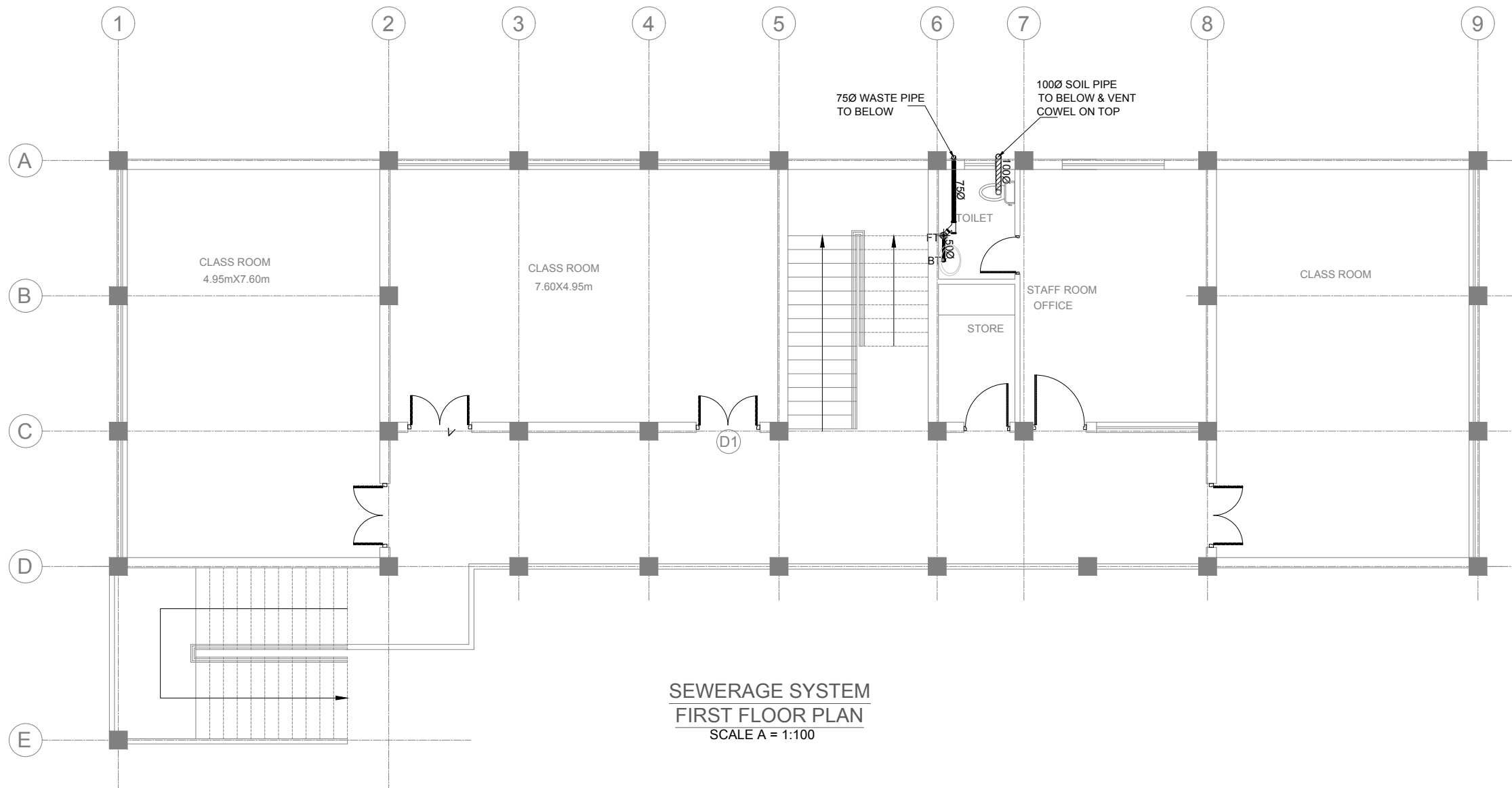
DASU HYDROPOWER PROJECT
 PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: WATER SUPPLY SYSTEM
 RELOCATION PRIMARY SCHOOL
 TOILETS DETAIL

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOEI CO. LTD. and DGLSAR ENGINEERING LIMITED
 In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
 DRAWING No. 141-189



**SEWERAGE SYSTEM
FIRST FLOOR PLAN**
SCALE A = 1:100

LEGEND :-

	WASTE PIPE
	SOIL PIPE
	uPVC PIPE
	FLOOR TRAP
	GULLY TRAP
	MANHOLE

- NOTES :-**
- 1- ALL PIPES ARE uPVC UNLESS OTHERWISE MENTIONED.
 - 2- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
 - 3- DIAMETERS OF PIPE ARE INTERNAL.
 - 4- ALL PIPING FOR INDIAN W.C SHALL BE PROVIDED WITH P-TRAP.

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

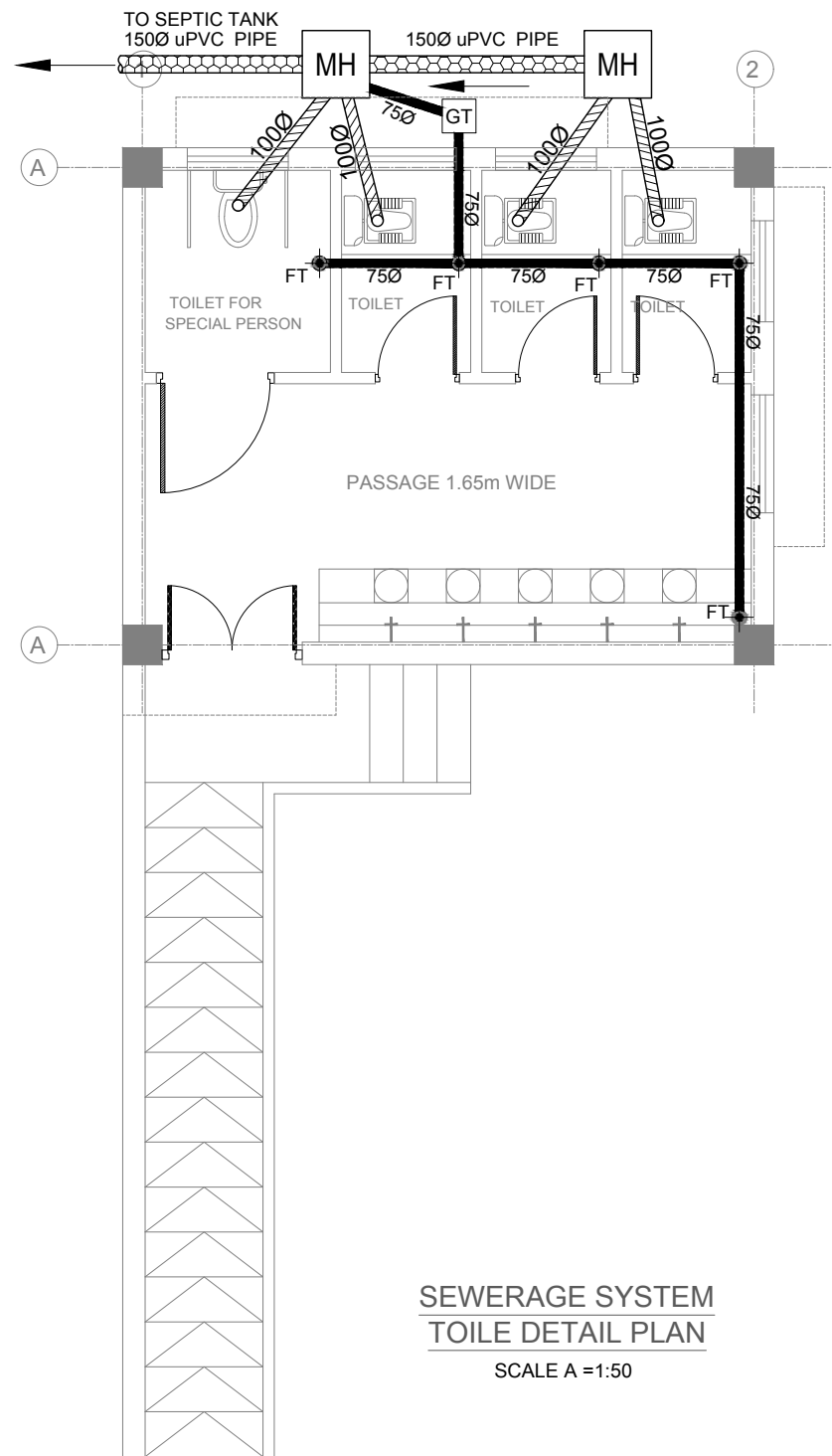
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
**SEWERAGE SYSTEM
RELOCATION PRIMARY SCHOOL
FIRST FLOOR PLAN**

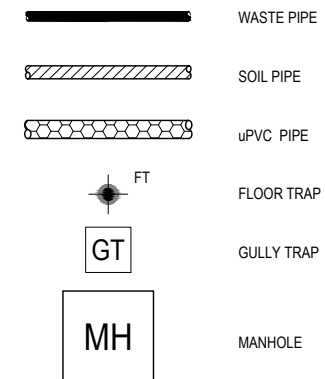
DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO. LTD. and
DOLGAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE: **SEP/2024**
DRAWING No. **141-191**



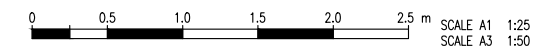
SEWERAGE SYSTEM
TOILE DETAIL PLAN
SCALE A =1:50

LEGEND :-



NOTES :-

- 1:- ALL PIPES ARE uPVC UNLESS OTHERWISE MENTIONED.
- 2:- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
- 3:- DIAMETERS OF PIPE ARE INTERNAL.
- 4:- ALL PIPING FOR INDIAN W.C SHALL BE PROVIDED WITH P-TRAP.



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

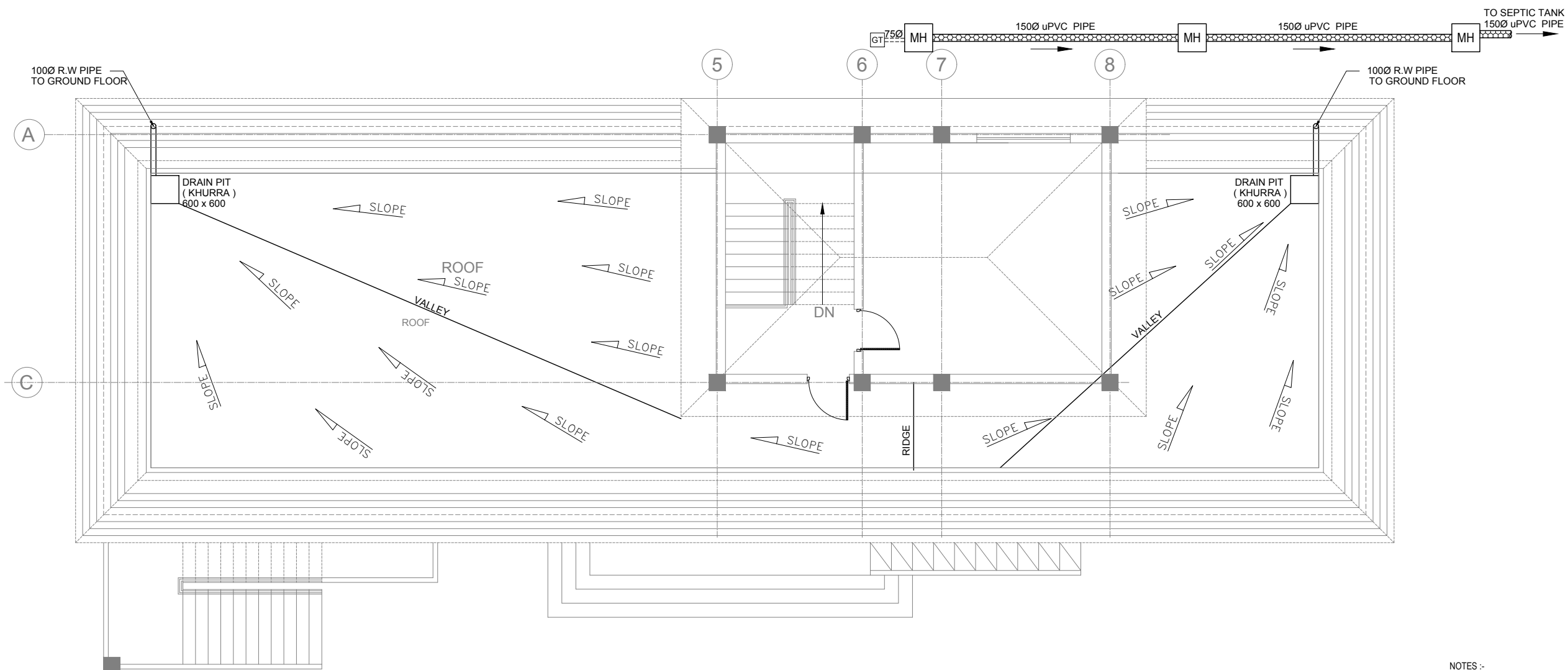
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: SEWERAGE SYSTEM
RELOCATION PRIMARY SCHOOL
TOILETS DETAIL

DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO. LTD. and
DGLSAR ENGINEERING LIMITED
In Association with
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PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024

DRAWING No. 141-192



MUMTY PLAN
SCALE A = 1:100

NOTES :-

- 1- ALL WATER SUPPLY PIPES ARE PPR PIPES OTHERWISE MENTIONED.
- 2- ALL FIXTURE DIMENSIONS ARE IN METERS & PIPES DIAMETER ARE IN MILLIMETERS.
- 3- PLACE ALL WATER SUPPLY PIPES WITHIN THE WALLS.
- 4- ALL DRAIN PIPES ARE uPVC PIPES OTHERWISE MENTIONED.



DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: PRIMARY SCHOOL
MUMTY & TOP ROOF PLAN

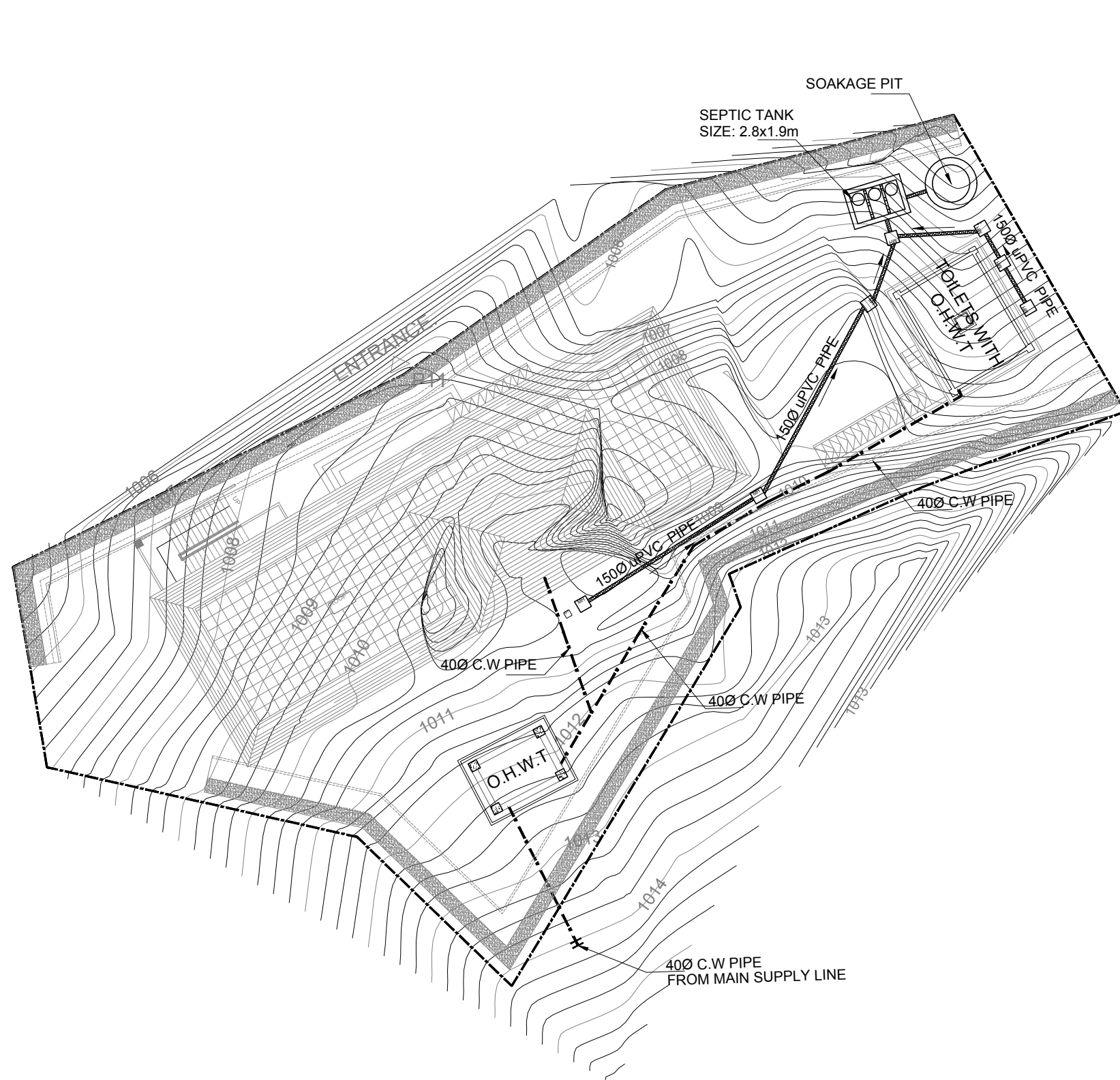
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER CONSULTANTS

DATE: SEP/2024

DRAWING No. 141-193

DHC
JOINT VENTURE OF
NIPPON KOEI CO. LTD. and
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In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.



LEGEND

- BOUNDARY WALL
- WATER SUPPLY PIPE LINE
- SEWER uPVC PIPE
- MANHOLE
- RETAINING WALL
- BREAST WALL

NOTES: -
 All dimensions are in meters unless otherwise mentioned
 Adjacent Road Level assumed ± 0.00

LAYOUT PLAN
 SCALE A =1:250

SCALE:
 0 2.5 5 7.5 10 12.5 m SCALE A1 1:125
 SCALE A3 1:250

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M.Rasheed	Name: Imtiaz Hussain

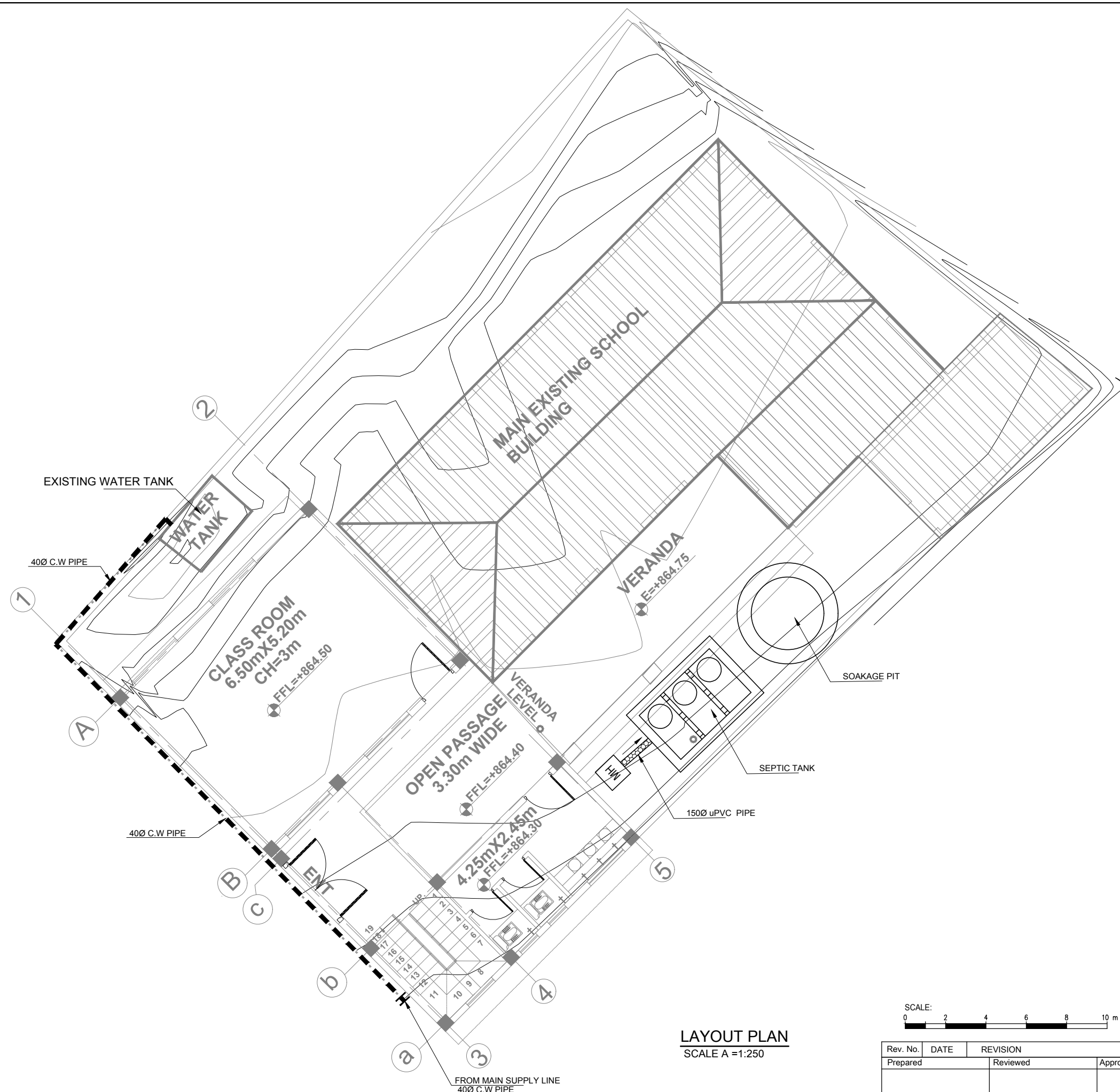
DASU HYDROPOWER PROJECT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY- WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
GOVT. BOYS PRIMARY SCHOOL (GBPS)
RELOCATION LOOTER
WATER SUPPLY & SEWERAGE SYSTEM

DASU HYDROPOWER CONSULTANTS	DATE: SEP/2024
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSTAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.	DRAWING No. 141-227



LEGEND

	BOUNDARY WALL
	WATER SUPPLY PIPE LINE
	SEWER uPVC PIPE
	MANHOLE
	EXISTING RETAINING WALL

NOTES: -
 All dimensions are in meters unless otherwise mentioned
 Adjacent Road Level assumed ± 0.00

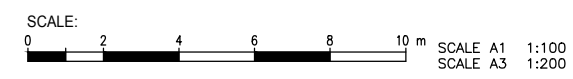
DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
 DEVELOPMENT AUTHORITY - WAPDA

Bid Drawing NCB No. DASU-02

DRAWING TITLE:
**REHABILITATION GBPS SHAH JAHANABAD
 WATER SUPPLY & SEWERAGE SYSTEM**

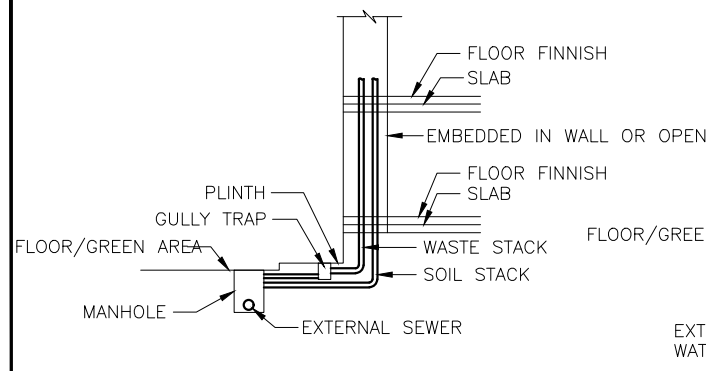


LAYOUT PLAN
 SCALE A = 1:250

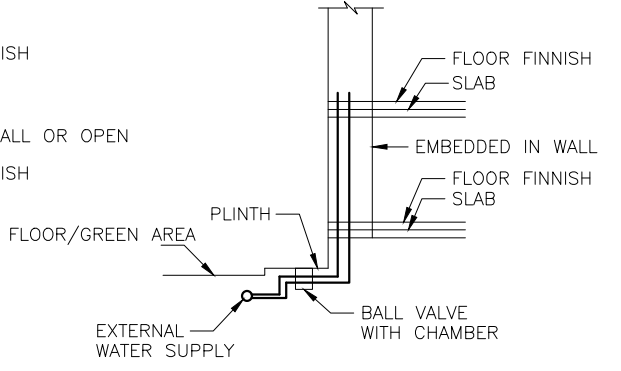
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Miss Sobia.Nazir		Name:Imtiaz Hussain	Name:H.Nishimia

<p>DASU HYDROPOWER CONSULTANTS JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAR ENGINEERING LIMITED in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.</p>	DATE: SEP/2024
	DRAWING No. 141-235

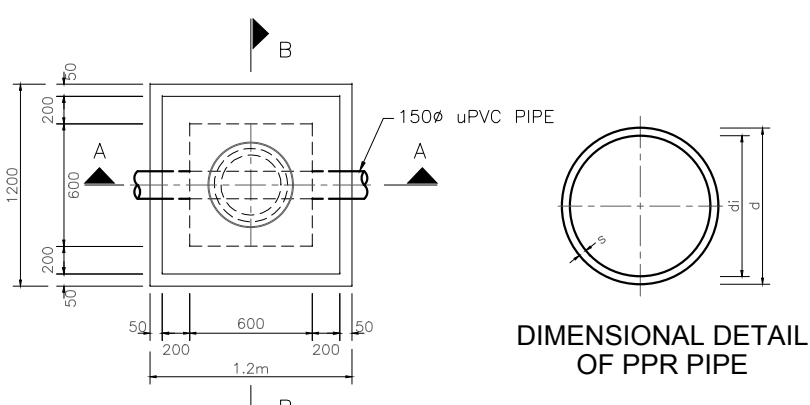
TYPICAL DRAWINGS



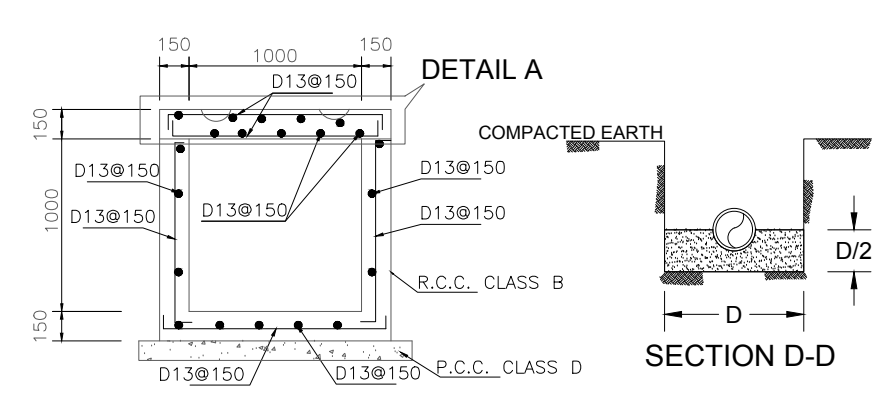
TYPICAL SECTION DRAINAGE PIPES FROM BUILDING TO SEWER



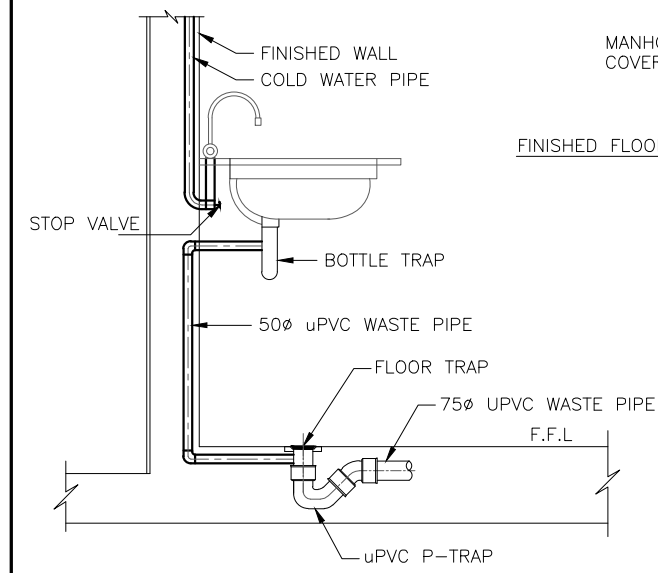
TYPICAL SECTION WATER PIPES FOR BUILDING



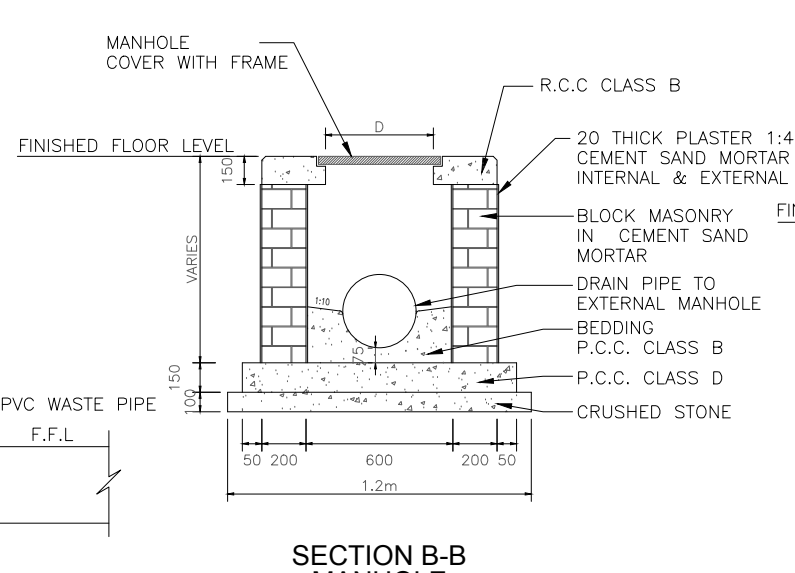
PLAN MANHOLE



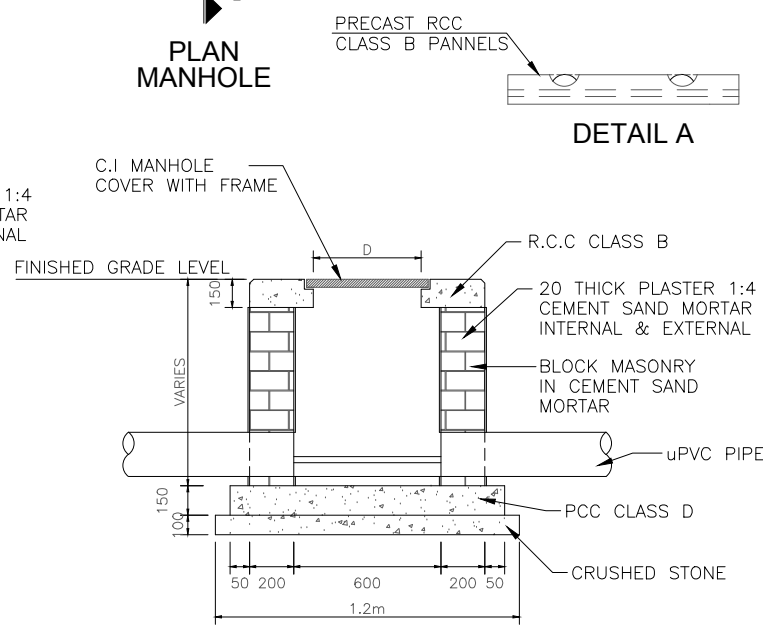
PIT SECTION PP



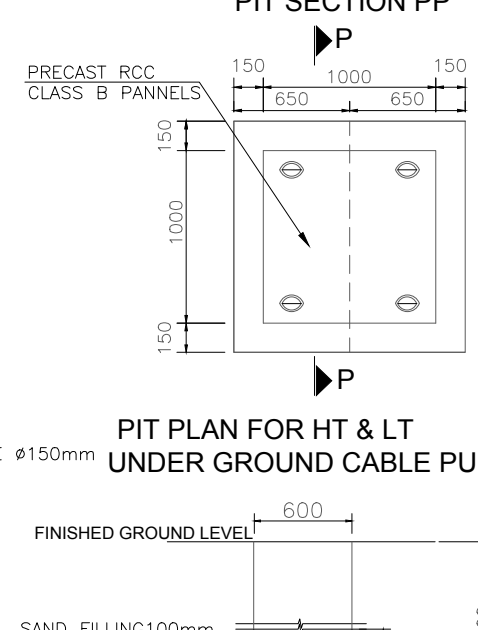
DETAIL OF BASIN CONNECTION WITH FLOOR TRAP



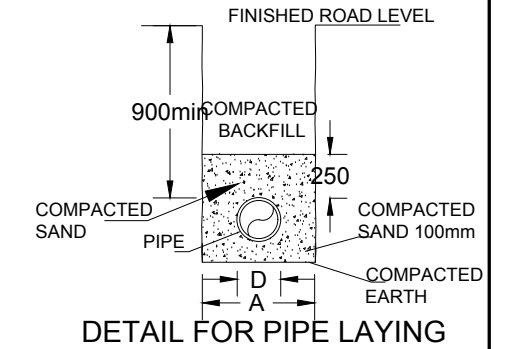
SECTION B-B MANHOLE



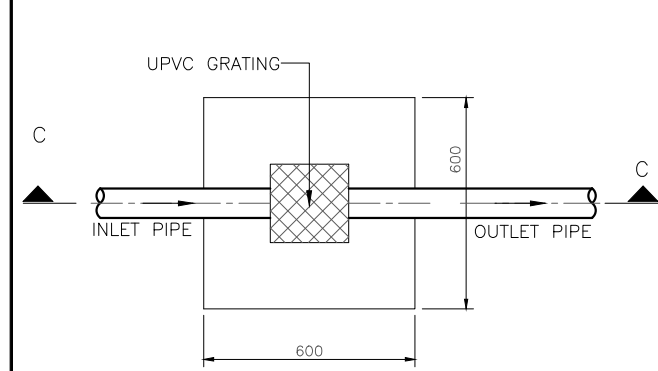
SECTION A-A MANHOLE



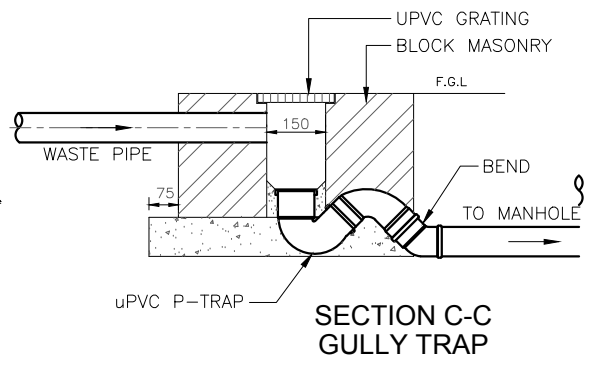
PIT PLAN FOR HT & LT UNDER GROUND CABLE PULLING



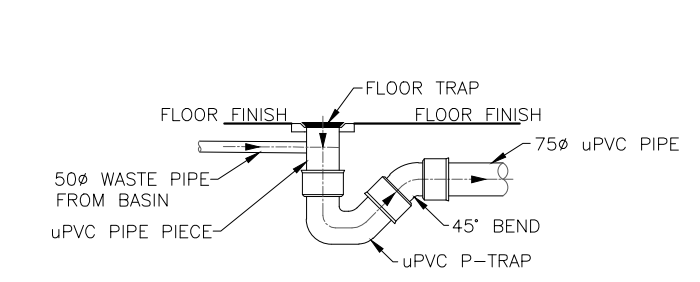
DETAIL FOR PIPE LAYING



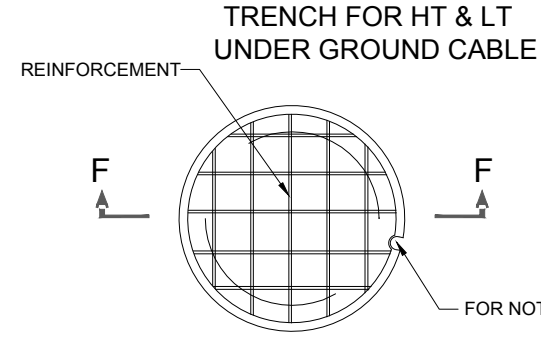
PLAN GULLY TRAP



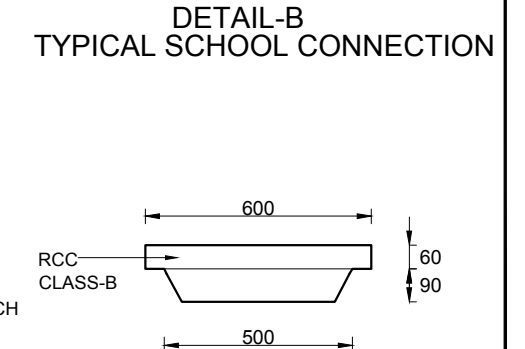
SECTION C-C GULLY TRAP



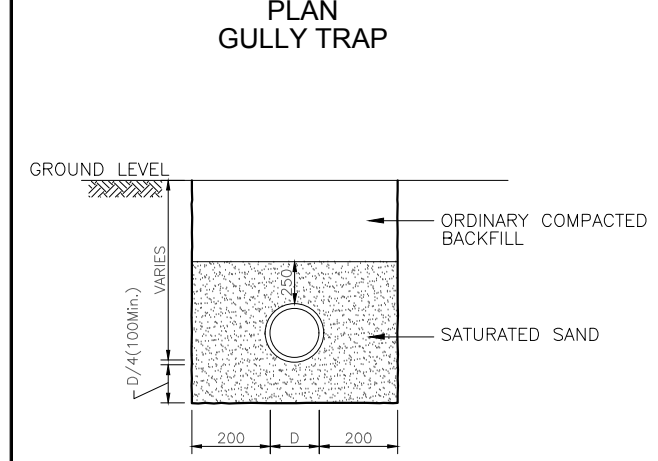
FLOOR DRAIN WITH P-TRAP



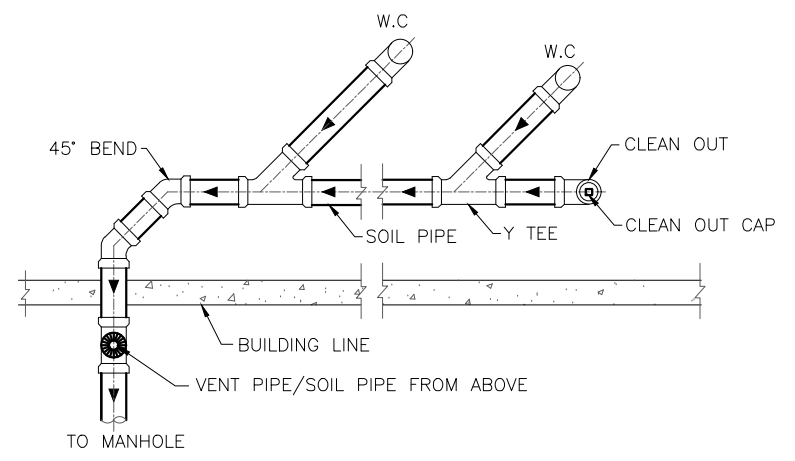
RCC COVER SCALE 1:20



DETAIL-B TYPICAL SCHOOL CONNECTION



BEDDING FOR LAYING UPVC PIPE



DETAIL OF W.C IN SERIES WITH CLEAN OUT

TABLE 1 FUSION DATA FOR PPR			
OUTER DIAMETER	AVERAGE HEATING TIME *	AVERAGE WORKING TIME (MAX.)	AVERAGE COOLING TIME (MIN.)
mm	sec	sec	sec
20	5	4	2
32	8	6	4
40	12	6	4
50	18	6	4
63	24	8	6
75	30	8	6
90	40	8	6
110	50	10	8

NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.

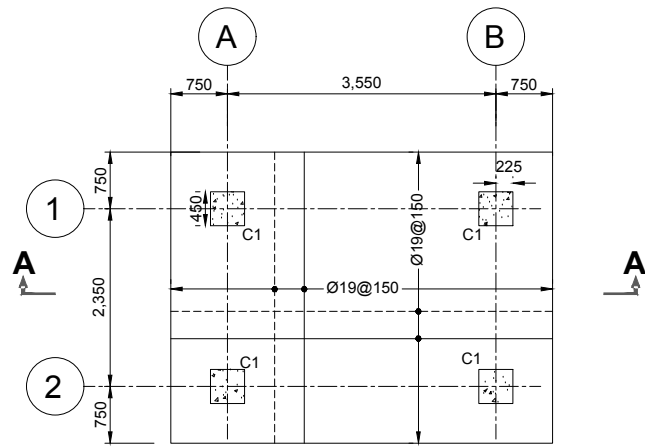
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **MISCELLANEOUS DETAILS**

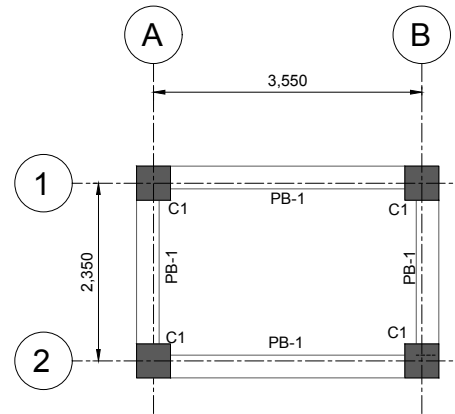
DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF NIPPON KOEI CO., LTD. and DOLAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.

DATE: SEP/2024
DRAWING No. 141-228

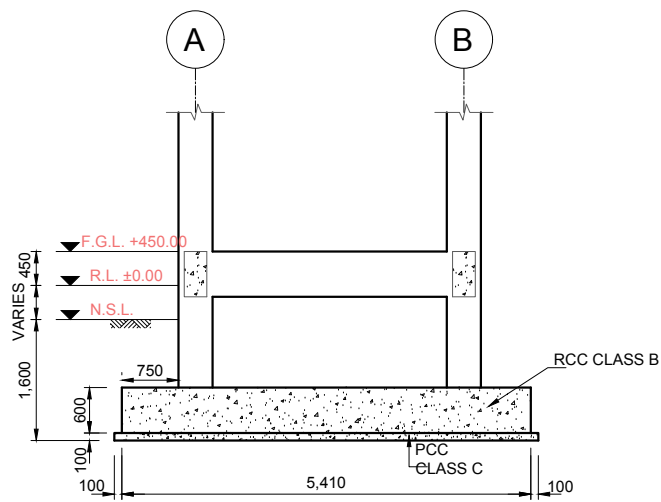
Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: M. Rasheed	Name: Imtiaz Hussain



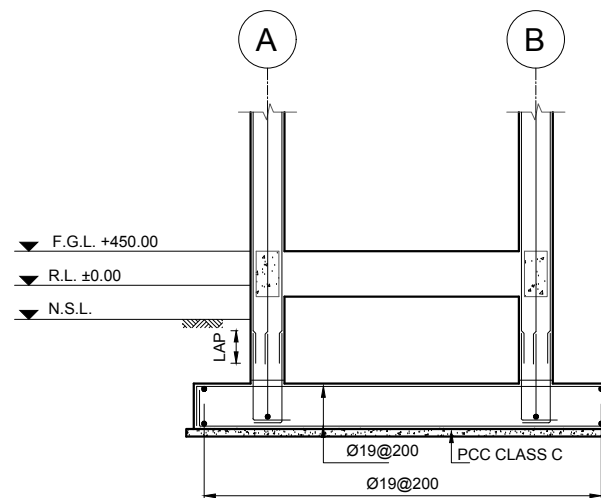
FOUNDATION LAYOUT PLAN



**PLINTH BEAMS LAYOUT PLAN
AT ELEVATIONS (+0.450 T.O.C)**



SECTION A-A



SECTION A-A

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. THE LOCATION OF TANK SHALL BE DECIDED BY THE SITE ENGINEER.
3. ALL EXPOSED CORNERS OF STRUCTURAL CONCRETE SHALL BE CHAMFER 20mmX20mm UNLESS OTHERWISE SHOWN.
4. ALL STRUCTURAL CONCRETE SHALL BE RCC CLASS-B AND THE USE OF SRC TO BE DECIDED BY THE SITE ENGINEER.
5. ALL CONSTRUCTION JOINT SURFACES SHALL BE ROUGHENED TO REMOVE LAITANCE. EXPOSE THE AGGREGATE SURFACE AND BE THOROUGHLY CLEANED AND WETTED BEFORE THE NEW CONCRETE IS PLACED.
6. ALL REINFORCED CONCRETE SURFACES IN CONTACT WITH EARTH SHALL B PROVIDED WITH HOT BITUMEN COATING AS DIRECTED BY SITE ENGINEER.
7. PROVIDE WELL COMPACTED BACKFILL MATERIAL IN EXCAVATED PORTION AROUND STRUCTURE AS PER SPECIFICATIONS.
8. NO FOUNDATION SHALL BE PLACED ON LOOSE SOIL.
9. EXCAVATION LINES SHALL BE AUTHORIZED ACCORDING TO SITE CONDITION: AS DIRECTED BY THE SITE ENGINEER.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY - WAPDA

**Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools**

DRAWING TITLE:
**OVERHEAD WATER TANK
FOUNDATION
PLAN, SECTIONS & DETAILS (SHEET 1 OF 3)**

DASU HYDROPOWER CONSULTANTS

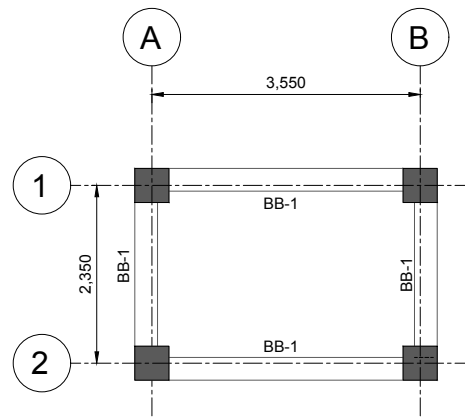
DATE:
SEP/2024



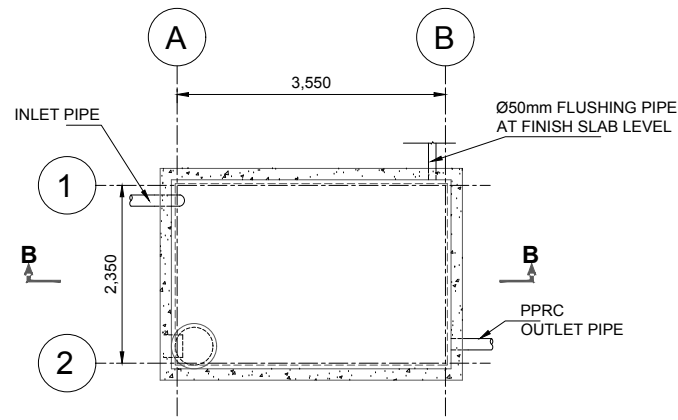
JOINT VENTURE OF
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in Association with
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PAKISTAN ENGINEERING SERVICES LTD.

DRAWING No.
141-229

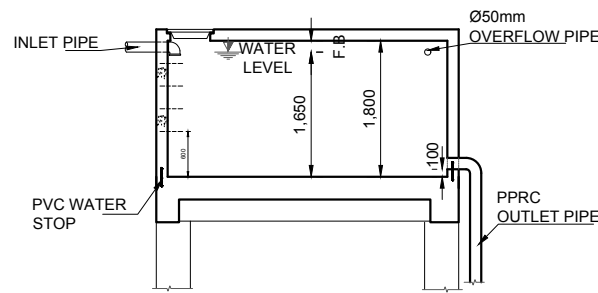
Prepared	Reviewed	Approved
Name: Anwar	Name: M.Rasheed	Name: Imtiaz Hussain



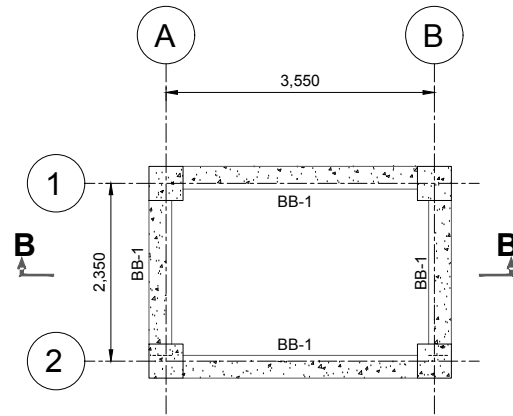
**TYP. BRACING BEAMS LAYOUT PLAN
AT ELEVATIONS (+3.950 T.O.C)**
SCALE A



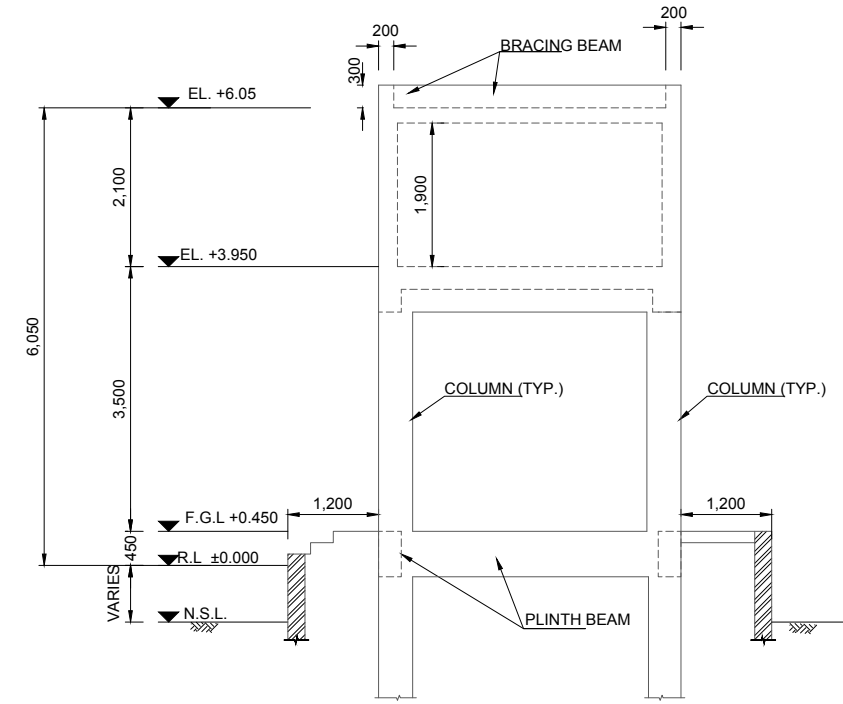
**TOP SLAB FRAMING PLAN
SLAB THICKNESS = 150**
SCALE A



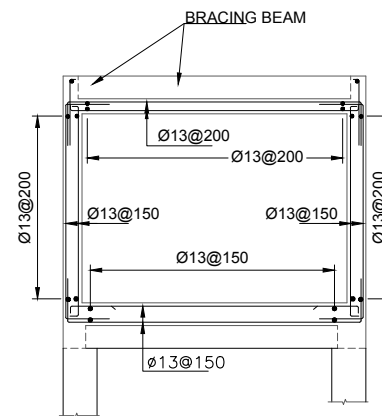
SECTION B-B
SCALE A



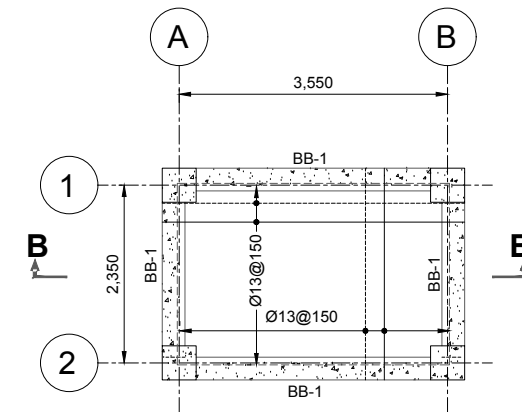
**BOTTOM SLAB FRAMING PLAN
SLAB THICKNESS = 300**
SCALE A



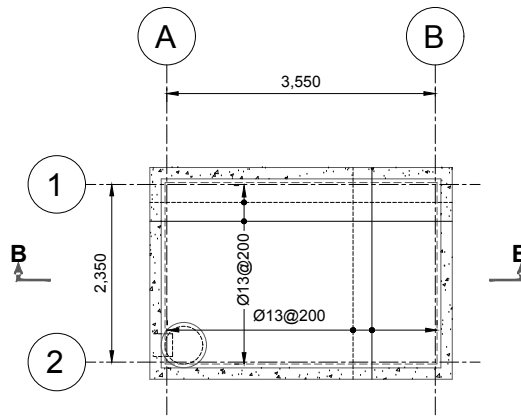
ELEVATION
SCALE A



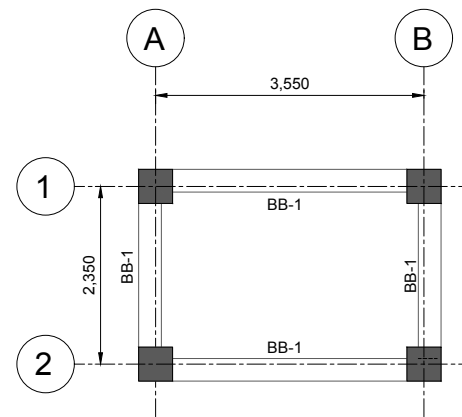
SECTION B-B



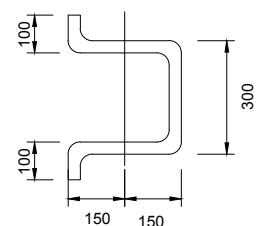
**BOTTOM SLAB FRAMING PLAN
SLAB THICKNESS = 300**
SCALE A



**TOP SLAB FRAMING PLAN
SLAB THICKNESS = 150**
SCALE A



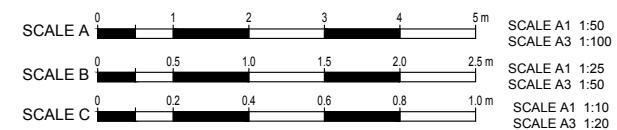
**TYP. BRACING BEAMS LAYOUT PLAN
AT ELEVATIONS (+3.950 T.O.C)**



DETAIL OF RUNGS (TYP.)
SCALE C

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.



Prepared	Reviewed	Approved
Name: Anwar	Name: M.Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY - WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

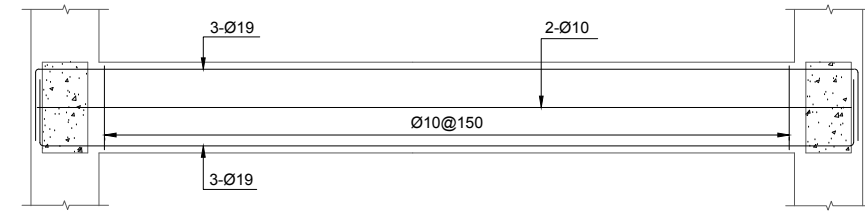
DRAWING TITLE:
**OVERHEAD WATER TANK
PLAN, SECTIONS & DETAILS
(SHEET 2 OF 3)**

DASU HYDROPOWER CONSULTANTS

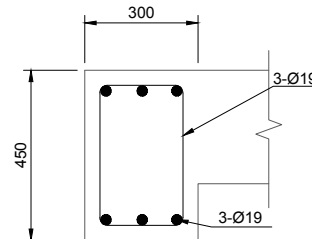
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NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024

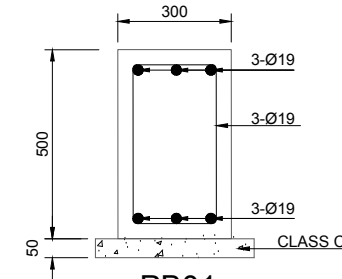
DRAWING No.
141-229



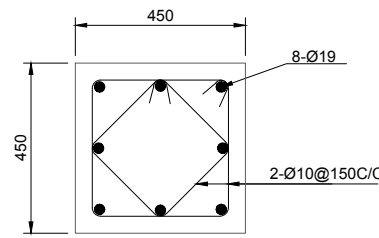
ELEVATION PB-1
SCALE A



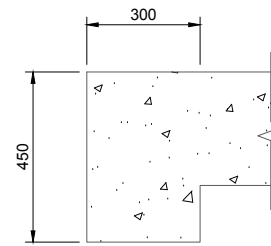
BEAM B-1
SCALE B



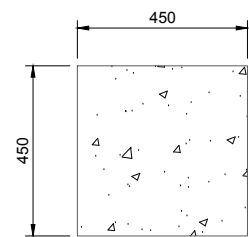
PB01
SCALE B



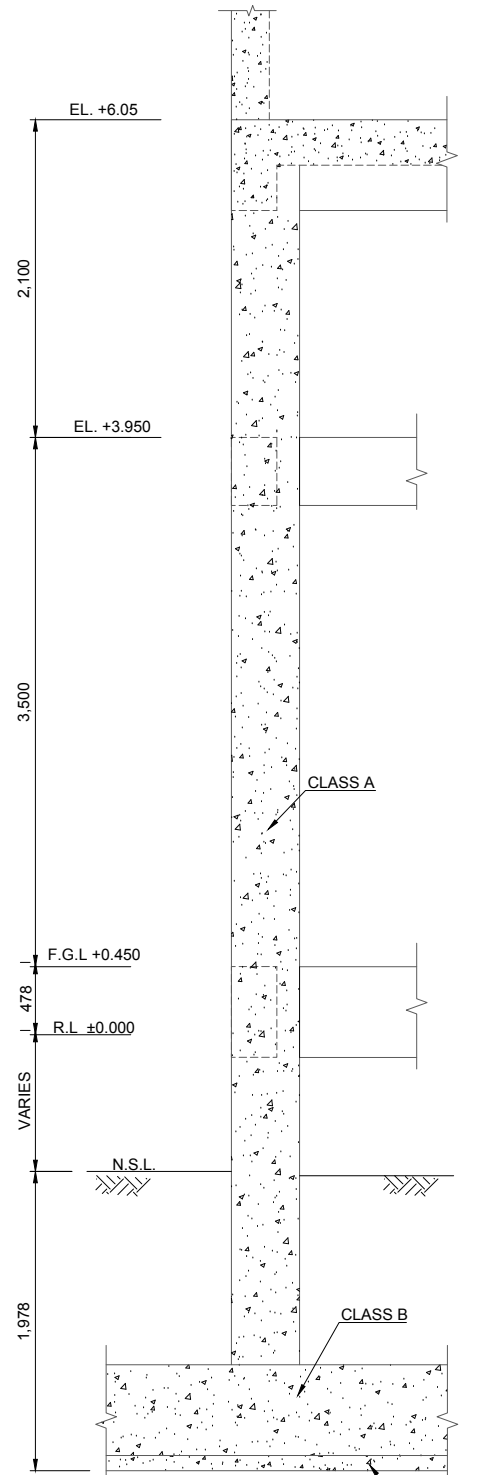
COLUMN C-1
SCALE B



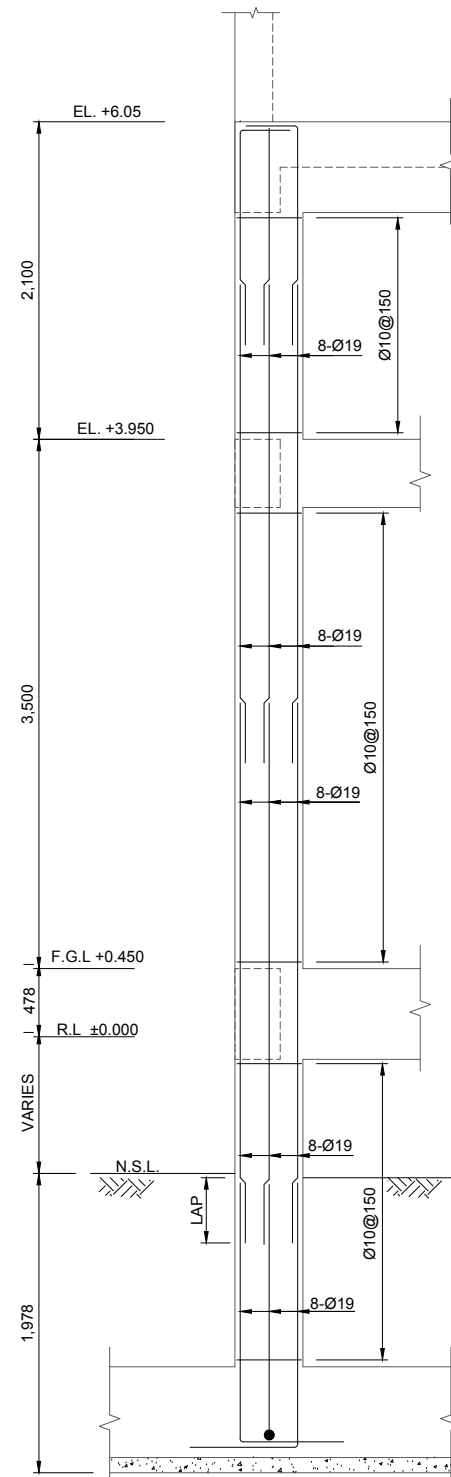
BEAM B-1
SCALE B



COLUMN C-1
SCALE B

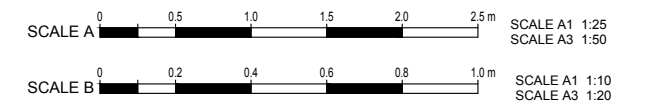


COLUMN C-1
ELEVATION
SCALE A



COLUMN C-1
ELEVATION
SCALE A

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.



DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY - WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
OVERHEAD WATER TANK
BEAMS & COLUMNS
(SHEET 3 OF 3)

DASU HYDROPOWER CONSULTANTS

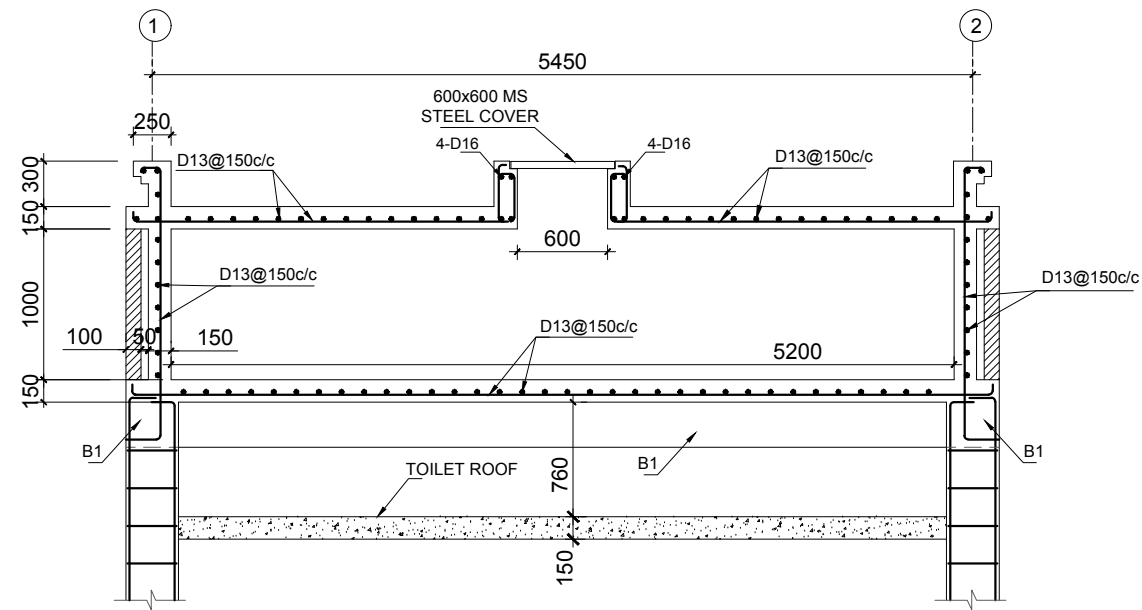


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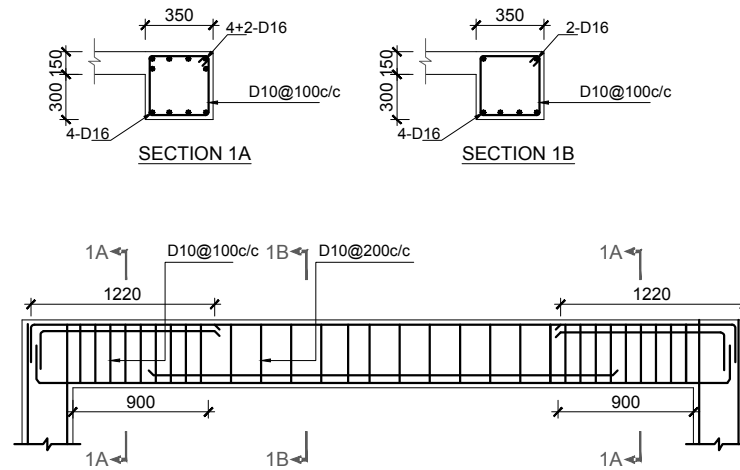
DATE:
SEP/2024

DRAWING No.
141-229

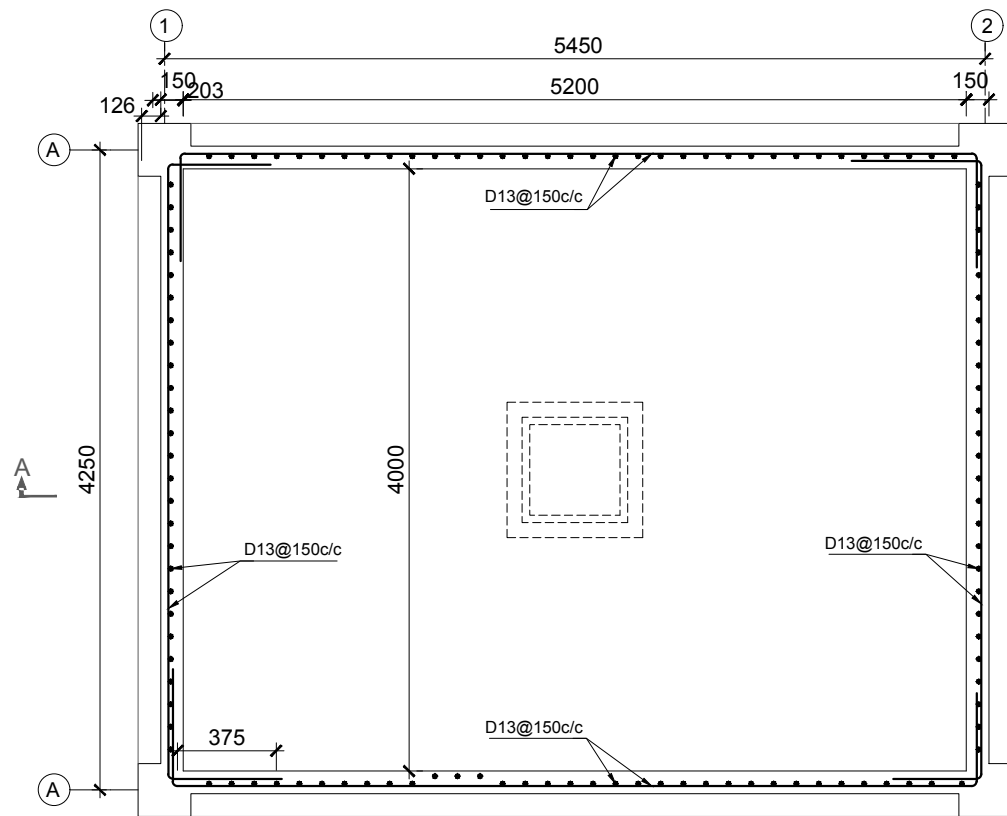
Prepared	Reviewed	Approved
Name: Anwar	Name: M. Rasheed	Name: Imtiaz Hussain



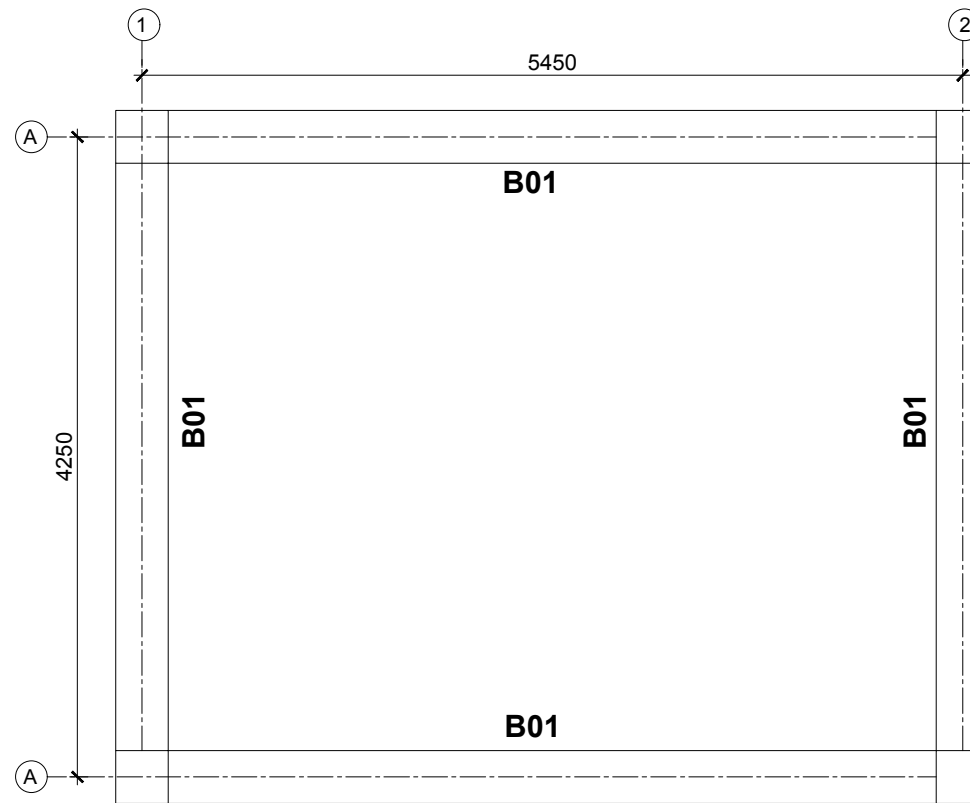
SECTION A-A
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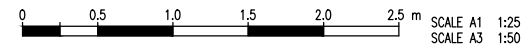
BEAM B01
SCALE A=1:50



OVERHEAD WATER TANK PLAN
SCALE A=1:50



OVERHEAD WATER TANK BEAM PLAN
SCALE A=1:50



Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Anwar		Name: Rasheed	Name: Imtiaz Hussain

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

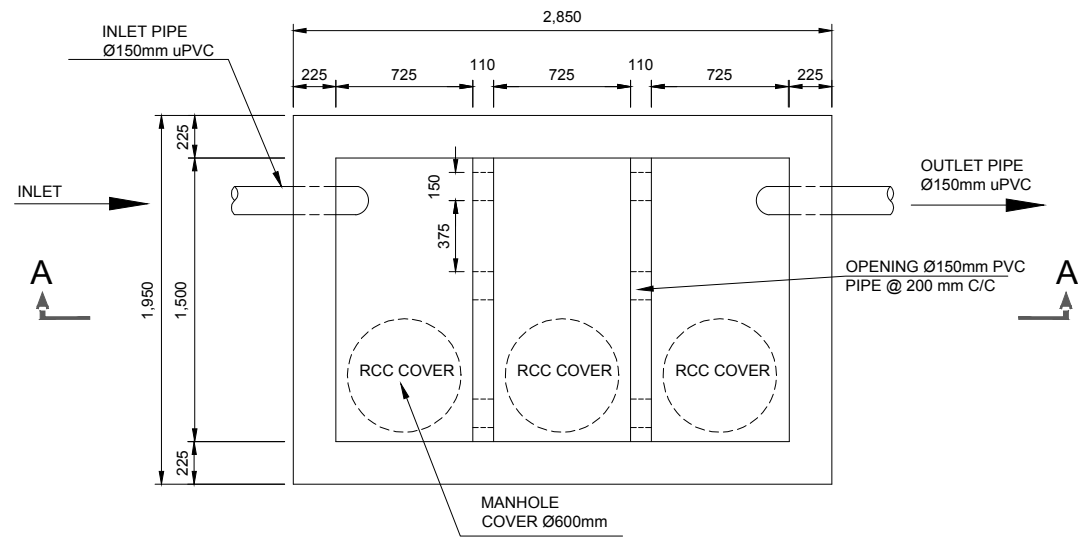
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
**RELOCATED PRIMARY SCHOOL
TOILET WITH OVER HEAD WATER TANK
DETAILS**

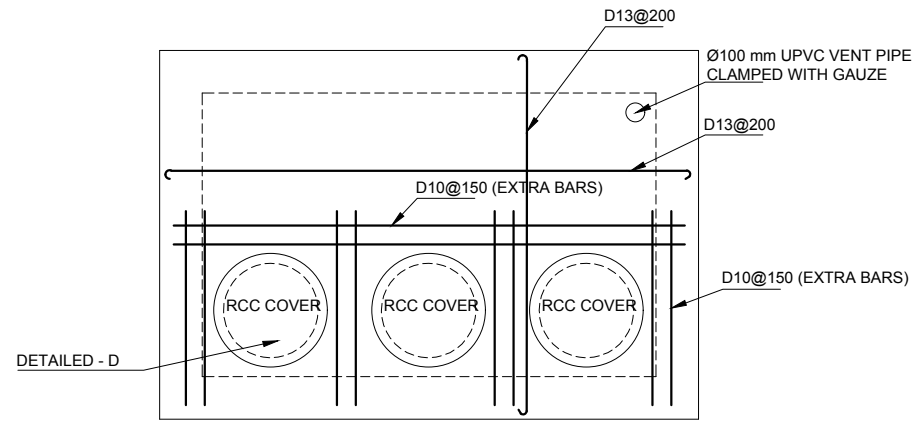
DASU HYDROPOWER CONSULTANTS
JOINT VENTURE OF
NIPPON KOEI CO., LTD. and
DOL-SAR ENGINEERING LIMITED
In Association with
DEVELOPMENT & MANAGEMENT CONSULTANTS,
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE:
SEP/2024

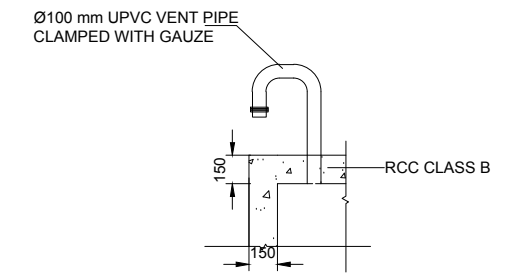
DRAWING No.
141-230



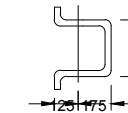
PLAN
SCALE: A



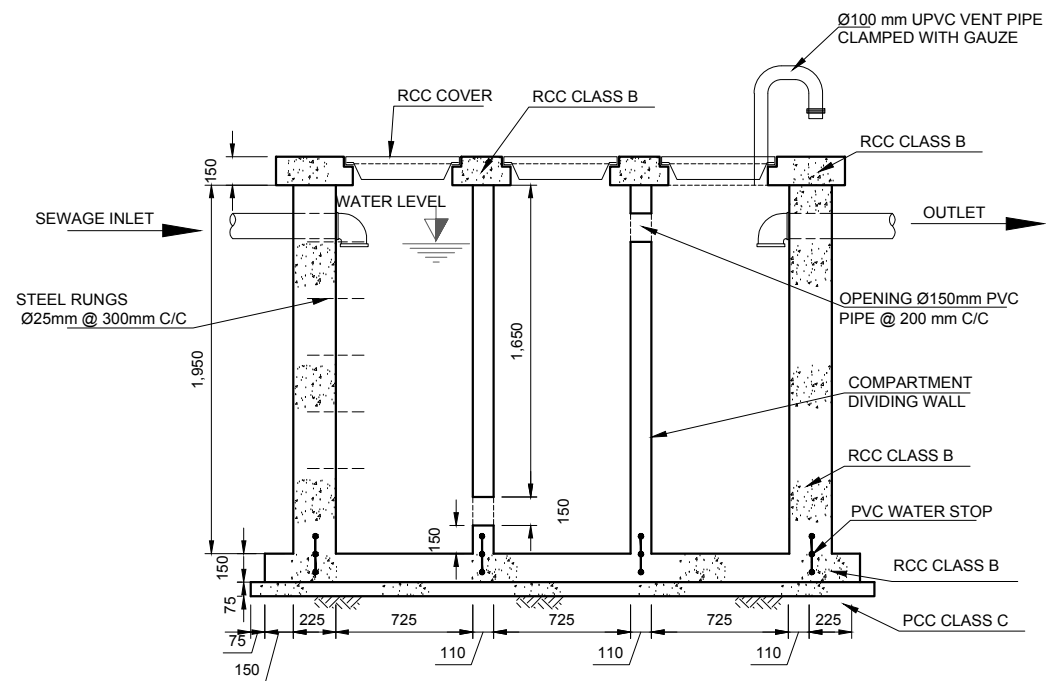
SLAB REINFORCEMENT PLAN
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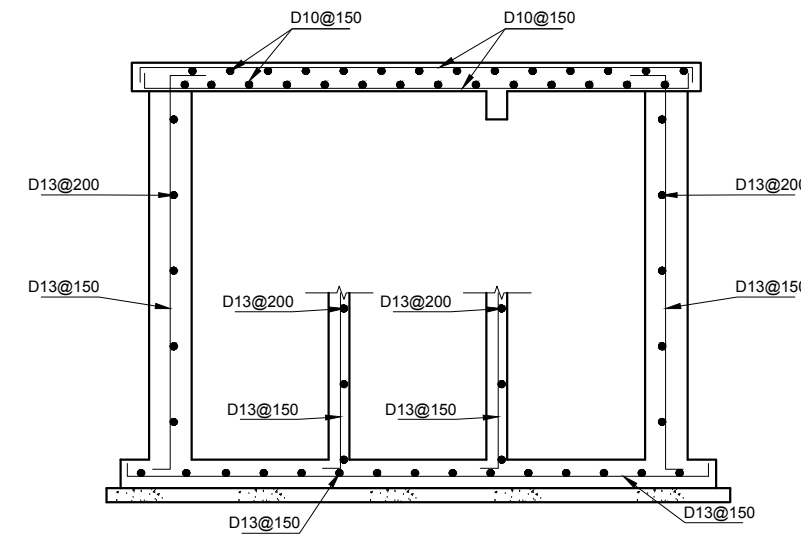
DETAIL-VENT PIPE



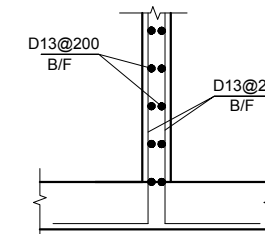
DETAIL OF RUNGS (TYP.)



SECTION A-A
SCALE: A



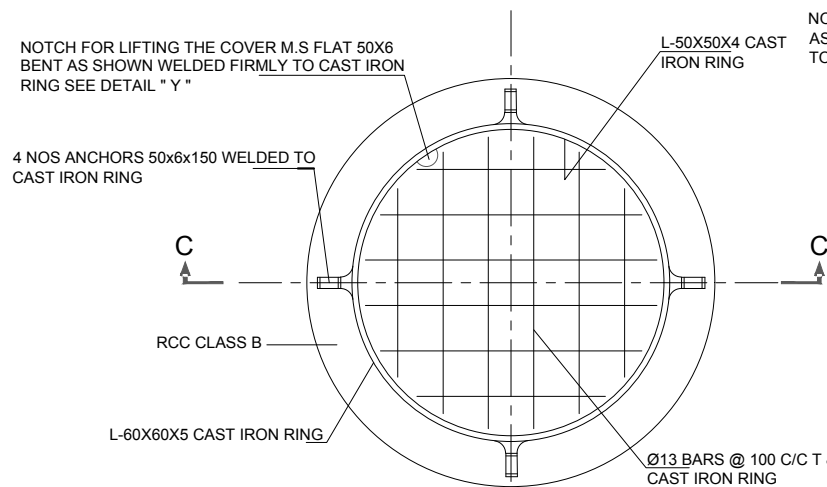
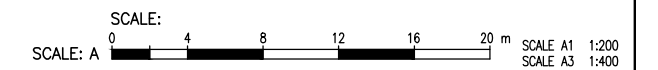
SLAB AND WALLS
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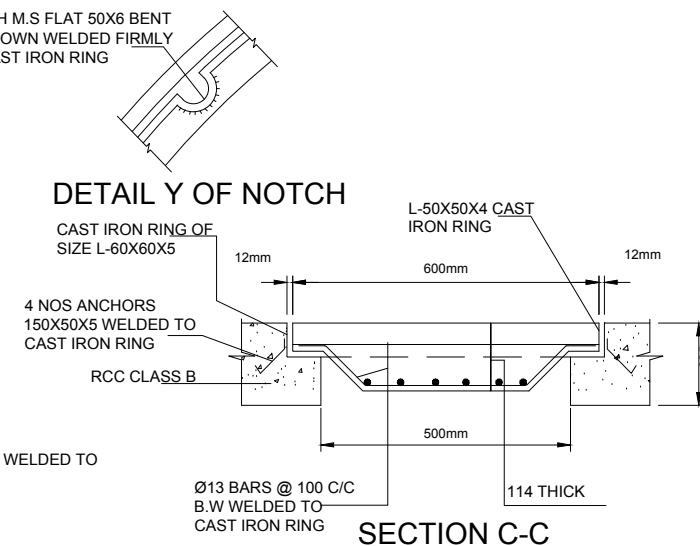
COPARTMENT DIVIDING WALL

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. THE LOCATION OF TANK SHALL BE DECIDED BY THE SITE ENGINEER.
3. ALL EXPOSED CORNERS OF STRUCTURAL CONCRETE SHALL BE CHAMFER 20mmX20mm UNLESS OTHERWISE SHOWN.
4. ALL STRUCTURAL CONCRETE SHALL BE RCC CLASS-B AND THE USE OF SRC TO BE DECIDED BY THE SITE ENGINEER.
5. ALL CONSTRUCTION JOINT SURFACES SHALL BE ROUGHENED TO REMOVE LAITANCE. EXPOSE THE AGGREGATE SURFACE AND BE THOROUGHLY CLEANED AND WETTED BEFORE THE NEW CONCRETE IS PLACED.
6. ALL REINFORCED CONCRETE SURFACES IN CONTACT WITH EARTH SHALL BE PROVIDED WITH HOT BITUMEN COATING AS DIRECTED BY SITE ENGINEER.
7. PROVIDE WELL COMPACTED BACKFILL MATERIAL IN EXCAVATED PORTION AROUND STRUCTURE. THE COMPACTION SHALL NOT BE LESS THAN 90% OF MAX. DRY DENSITY AS DETERMINED BY MODIFIED AASHTO. DESIGNATION: T180-193.
8. NO FOUNDATION SHALL BE PLACED ON LOOSE SOIL.
9. EXCAVATION LINES SHALL BE AUTHORIZED ACCORDING TO SITE CONDITION: AS DIRECTED BY THE SITE ENGINEER.



DETAIL 'D'



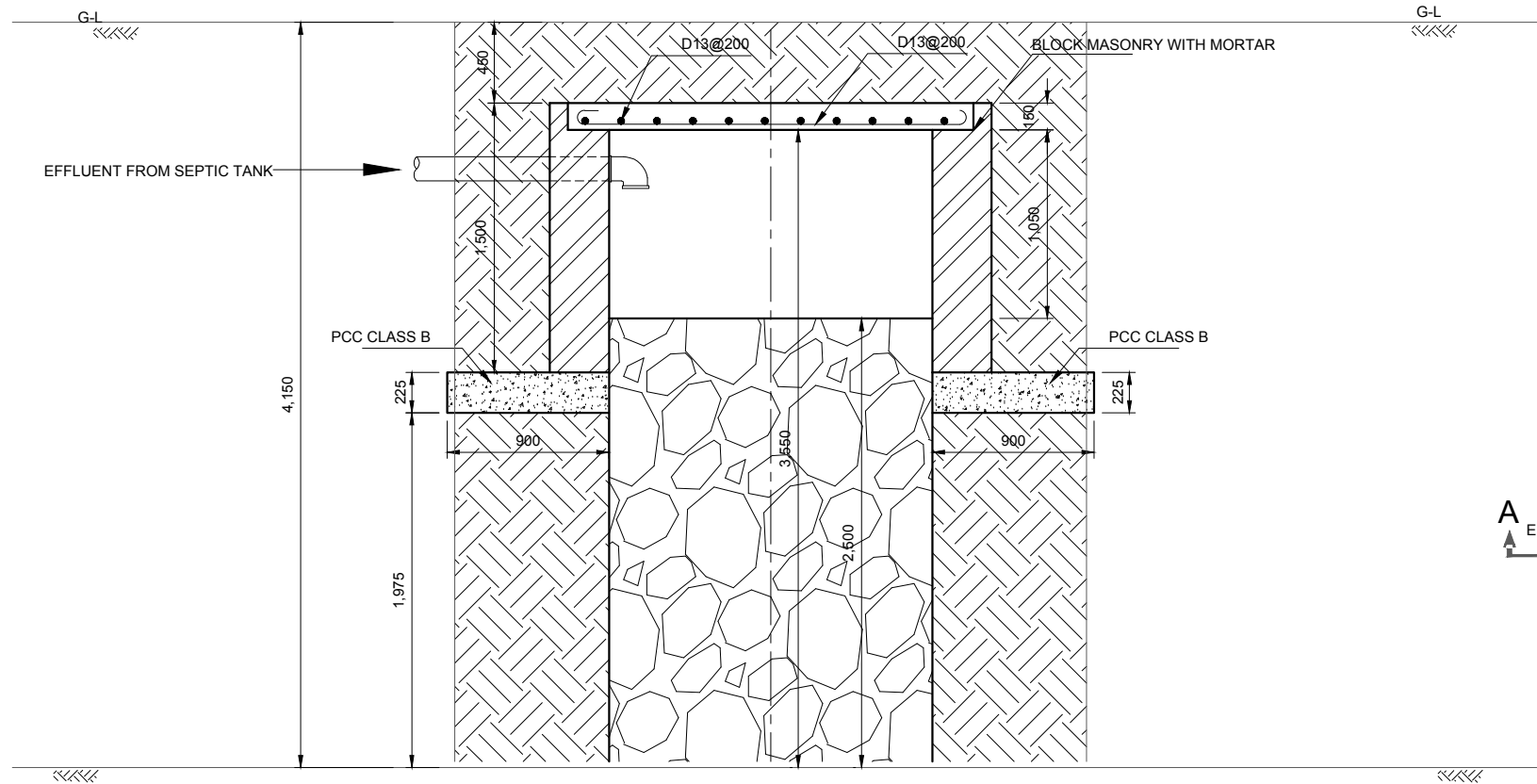
SECTION C-C

Prepared	Reviewed	Approved
Name: Anwar	Name: M.Rasheed	Name: Imtiaz Hussain

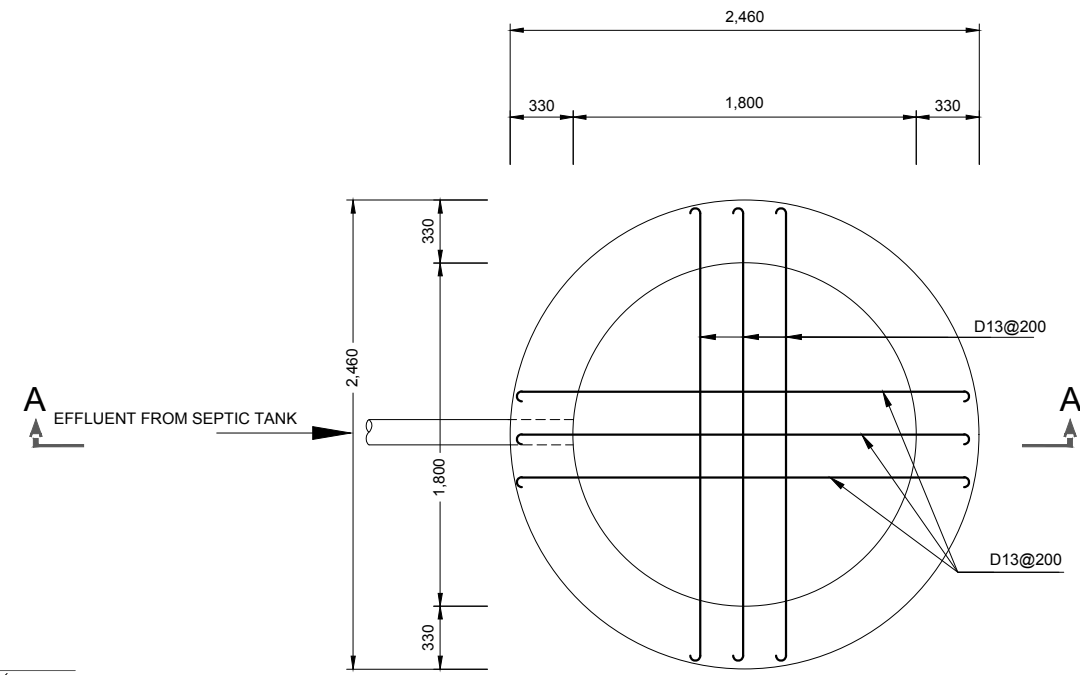
DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA
Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE: **SEWERAGE SYSTEM SEPTIC TANK PLAN, SECTIONS, DETAILS & REINFORCEMENT**

DASU HYDROPOWER CONSULTANTS
 JOINT VENTURE OF NIPPON KOGI CO. LTD. and DOLSAR ENGINEERING LIMITED
 In Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.
 DATE: SEP/2024
 DRAWING No. **141-231**

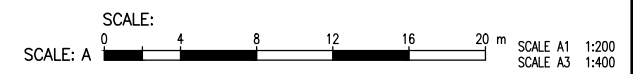


SECTION A-A
SCALE: A



PLAN OF SOAKAGE PIT
SCALE: A

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.



DASU HYDROPOWER PROJECT
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY - WAPDA

Bid Drawing NCB No. DASU-RS-02
Construction of Relocated Schools

DRAWING TITLE:
SEWERAGE SYSTEM
SOAKAGE PIT
PLAN, SECTIONS, DETAILS & REINFORCEMENT

DASU HYDROPOWER CONSULTANTS DATE: SEP/2024
JOINT VENTURE OF NIPPON KOEI CO.,LTD. and DOLSAR ENGINEERING LIMITED
in Association with DEVELOPMENT & MANAGEMENT CONSULTANTS, NATIONAL DEVELOPMENT CONSULTANTS LTD. and PAKISTAN ENGINEERING SERVICES LTD.
DRAWING No. **141-232**

Prepared	Reviewed	Approved
Name: Anwar	Name: M.Rasheed	Name: Imtiaz Hussain