



Government of the People's Republic of Bangladesh
Prime Minister's Office
Bangladesh Economic Zones Authority (BEZA)
Monem Business District (Level 12)
111, Bir Uttam C. R Dutta Road, Dhaka-1205
www.beza.gov.bd

International Competitive Bidding

Invitation for Bids

Foreign Direct Investment Promotion Project (FDIPP)

Date: 17 February 2019

Loan Agreement No: JICA L/A NO. BD-P 86

IFB No.: 03.772.14.00.00.107.2019-461 Date: 13/02/2019

1. The Government of the People's Republic of Bangladesh has received and will receive loan from Japan International Cooperation Agency (JICA) towards the cost of "Foreign Direct Investment Promotion Project (FDIPP)" and it intends to apply part of the proceeds of this loan to payments under the agreement(s) resulting from this IFB: Procurement of Land Development Works, Boundary Wall, Access Road, Retention Canal and Pumping Station for Bangladesh Special Economic Zone (Japanese Economic Zone) at Araihaaz, Narayanganj.
2. The Bangladesh Economic Zones Authority (BEZA) as the implementing agency for the project now invites sealed Bids from eligible Bidders for the construction and completion of the Land Development Works, Boundary Wall, Access Road, Retention Canal and Pumping Station for Bangladesh Special Economic Zone (Japanese Economic Zone) at Araihaaz, Narayanganj under Infrastructure Development for Japanese Economic Zone at Araihaaz, Narayanganj ("the Works").
3. Bidding will be conducted using Guidelines for Procurement under Japanese ODA Loans published in April 2012, and is open to all Bidders from eligible source countries, as defined in the Guidelines, that meet the following minimum qualification criteria (details in the bidding document):
 - (i) Financial Performance: 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 5 years (2014-2018) shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability. As the minimum requirement, a Bidder's net worth calculated as the difference between total assets and total liabilities should be positive.
 - (ii) Average Annual Construction Turnover: Minimum average annual construction turnover of USD 200 (two hundred) million calculated as total certified payments received for contracts in progress and/ or completed, within the last 5 (five) years from 2014 to 2018,

divided by 5 (five) years.

(iii) General Construction Experience: Experience under construction contracts in the role of prime contractor (single entity or JV member), subcontractor, or management contractor for at least the last 10 years, starting 1st January 2008.

(iv) (a) Specific Construction Experience: Minimum 1 (one) similar contracts that have been satisfactorily and substantially completed as a prime contractor (single entity or JV member) in G7 countries between 1st January 2008 and Bid submission deadline.

(iv) (b) Specific Construction Experience: Minimum 1 (one) reclamation or embankment construction experience having a contract amount of at least USD 50 million that have been satisfactorily and substantially completed as a prime contractor (single entity or JV member) for the work of Japanese ODA Loan project completed between 1st January 2008 and Bid submission deadline.

(iv) (c) Specific Construction Experience: For the above or other contracts completed and under implementation as prime contractor (single entity or JV member), management contractor or subcontractor between 1st January 2008 and Bid submission deadline, a minimum construction experience in the following key activities successfully completed: (1) At least 1 (one) land reclamation or embankment works using sand/earth or dredged materials of not less than 1 (one) million m³ (cubic meter)

(v) Financial Resources: (i) The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as USD 20 (Twenty) Million for the subject contract(s) net of the Bidders 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.

4. Interested eligible Bidders may obtain further information from and inspect the Bidding Documents at the address given below from 10:00 AM to 3:00 PM Bangladesh Standard Time:

Mr. Saleh Ahmed, Deputy Secretary & Manager (Planning & Development), Bangladesh Economic Zones Authority, Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205, Phone: 880-2-9632472, E-mail: saleh15th@gmail.com.

Potential Bidders may inspect the bidding document at the website of the project: www.beza.gov.bd. A pre-bid meeting which potential bidders may attend will be held on March 11, 2019 at 2:30 PM Bangladesh Standard Time.

5. A complete set of Bidding Documents in English may be purchased by interested Bidders on the submission of a written application to the address above and upon payment of a non-refundable fee of Eighty-Five Thousand Bangladesh Taka (BDT 85,000) or One Thousand US Dollar (USD 1,000) in favour of “Bangladesh Economic Zones Authority” from 17/02/2019. The method of payment will be Direct Deposit or Bank Draft or Pay Order from a Scheduled Bank located in Dhaka for Bangladesh Taka and Cashier’s Check or Bank Draft drawn on a local Scheduled Bank for United States Dollar.

6. The provisions in the Instructions to Bidders and in the General Conditions of Contract are the provisions of the Standard Bidding Documents under Japanese ODA Loans published in October 2012 for the Procurement of Works.

7. Bids must be delivered to the address below on or before 2:00 PM Bangladesh Standard Time on **18/04/2019** and must be accompanied by a security of Two Million Two Hundred and Thirty Thousand US Dollar (USD 2,230,000) or Two Hundred Forty Five Million Japanese Yen (JPY 245,000,000) or One Hundred Eighty Million Bangladesh Taka (BDT 180,000,000) and shall be valid for a period not less than 28 days beyond the Bid Validity Period.

8. Electronic bidding will not be permitted. Late bids will be rejected.

9. Bids will be publicly opened in the presence of Bidders' designated representatives who choose to attend at 2:30 PM Bangladesh Standard Time on 18/04/2019 at the Conference Room of Bangladesh Economic Zones Authority (BEZA), Monem Business District (Level-12), 111, Bir Uttam C.R. Dutta Road, Dhaka-1205

On behalf of the Employer,

Mr. Saleh Ahmed
Manager (Planning & Development)
Bangladesh Economic Zones Authority
Monem Business District, Level 12
111 Bir Uttam C R Dutta Road, Dhaka 1205
Phone: 880-2-9632472
E-mail: saleh15th@gmail.com

BIDDING DOCUMENTS

For

**PROCUREMENT OF LAND DEVELOPMENT
WORKS FOR BANGLADESH SPECIAL
ECONOMIC ZONE DEVELOPMENT UNDER
FOREIGN DIRECT INVESTMENT PROMOTION
PROJECT (FDIPP)
(Part 1 of 3)**

Employer: BEZA (Bangladesh Economic Zones Authority)

Country: Bangladesh

Project: Foreign Direct Investment Promotion Project
(FDIPP)

Loan No.: LA No. BD-P86 (December 13, 2015)

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INVITATION FOR BIDS:

Form of Invitation for Bids

Date: February 17, 2019

Loan Agreement N^o: *JICA L/A NO. BD-86*

IFB N^o: 03.772.14.00.00.107.2019-461 Date: 13/02/2019

1. The Government of the People's Republic of Bangladesh has received a loan from Japan International Cooperation Agency (JICA) towards the cost of "Foreign Direct Investment Promotion Project". It is intended that part of the proceeds of this loan will be applied to eligible payments under the contract for: **Procurement of Land Development Works for Bangladesh Special Economic Zone – Package No. 1.**

2. The Bangladesh Economic Zones Authority (BEZA) now invites sealed Bids from eligible Bidders for the construction and completion of the Land Development Works for Bangladesh Special Economic Zone ("the Works").

3. Bidding will be conducted through procedures in accordance with the applicable Guidelines for Procurement under Japanese ODA Loans, and is open to all Bidders from eligible source countries, as defined in the Loan Agreement.

4. Interested eligible Bidders may obtain further information from and inspect the Bidding Documents at the address given below:

Address: Bangladesh Economic Zones Authority (BEZA),
Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205
Phone: 880-2-9632472
E-mail: saleh15th@gmail.com

5. A complete set of Bidding Documents may be purchased by interested Bidders on the submission of a written application to the address above and upon payment of a non-refundable fee of Eighty Thousand Bangladesh Taka (BDT 85,000) or One Thousand US Dollar (USD 1,000) in favour of "Bangladesh Economic Zones Authority" from 17/2/2019. The method of payment will be Direct Deposit or Bank Draft or Pay Order from a Scheduled Bank located in Dhaka for Bangladesh Taka and Cashier's Check or Bank Draft drawn on a local Scheduled Bank for United States Dollar.

6. The provisions in the Instructions to Bidders and in the General Conditions of Contract are the provisions of the Standard Bidding Documents under Japanese ODA Loans for the Procurement of Works.

7. Bids must be delivered to the address above on or before 2:00 PM Bangladesh Standard Time on [18/04/2019] and must be accompanied by a security of Two million, Two hundred and Thirty Thousand US Dollar (USD 2,230,000) or Two hundred Forty Five million Japanese Yen (JPY 245,000,000) or One hundred Eighty million Bangladesh Taka (BDT 180,000,000).

8. Bids will be opened in the presence of Bidders' representatives who choose to attend at 2:30 PM Bangladesh Standard Time on 18/04/2019 at the offices of BEZA.

Yours sincerely,

Saleh Ahmed
Manager (Planning & Development)
Bangladesh Economic Zones Authority
Monem Business District, Level 12
111 Bir Uttam C R Dutta Road Dhaka-1205
Phone: 880-2-9632472
Email: saleh 15th @gmail.com

PART 1 – Bidding Procedures

Section I. Instructions to Bidders

The Instructions to Bidders governing this bidding process are the “Instructions to Bidders” included in **Option B: Two-Envelope Bidding**, Section I, of the Standard Bidding Documents for Procurement of Works (version 1.1), published by JICA in October, 2012. Those Instructions to Bidders are available on the JICA’s web site shown below:

http://www.jica.go.jp/english/our_work/types_of_assistance/oda_loans/oda_op_info/guide/tender/index.html

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A. General

1. Scope of Bid

1.1 In connection with the Invitation for Bids **specified in Section II, Bid Data Sheet (BDS)**, the Employer, as **specified in the BDS**, issues these Bidding Documents (hereinafter referred to as “Bidding Documents”) for the procurement of Works as specified in Section VI, Works Requirements. The name, identification, and number of the lot(s) (contract(s)) comprising this International Competitive Bidding (ICB) process are **specified in the BDS**.

1.2 Throughout these Bidding Documents:

- (a) the term “in writing” means communicated in written form and delivered against receipt;
- (b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and
- (c) “day” means calendar day.

2. Source of Funds

2.1 The Borrower **specified in the BDS** has received or has applied for a Japanese ODA Loan from Japan International Cooperation Agency (hereinafter referred to as “JICA”), with the number, in the amount and on the signed date of the Loan Agreement **specified in the BDS**, towards the cost of the project **specified in the BDS**. The Borrower intends to apply a portion of the proceeds of the loan to payments under the contract(s) for which these Bidding Documents are issued.

22 Disbursement of a Japanese ODA Loan by JICA will be subject, in all respects, to the terms and conditions of the Loan Agreement, including the disbursement procedures and the applicable Guidelines for Procurement under Japanese ODA Loans **specified in the BDS**. No party other than the Borrower shall derive any rights from the Loan Agreement or have any claim to the loan proceeds.

23 The above Loan Agreement will cover only a part of the project cost. As for the remaining portion, the Borrower will take appropriate measures for finance.

3. Corrupt and Fraudulent Practices

3.1 It is JICA’s policy to require that Bidders and Contractors, as well as Borrowers, under contracts funded with Japanese ODA Loans and other Japanese ODA, observe the highest standard of ethics during the procurement and execution of

such contracts. In pursuance of this policy, JICA:

- (a) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;
- (b) will recognize a Bidder or Contractor as ineligible, for a period determined by JICA, to be awarded a contract funded with Japanese ODA Loans if it at any time determines that the Bidder or the Contractor has engaged in corrupt or fraudulent practices in competing for, or in executing, another contract funded with Japanese ODA Loans or other Japanese ODA; and
- (c) will recognize a Contractor as ineligible to be awarded a contract funded with Japanese ODA Loans if the Contractor or subcontractor, who has a direct contract with the Contractor, is debarred under the cross debarment decisions by the Multilateral Development Banks. Such period of ineligibility shall not exceed three (3) years from (and including) the date on which the cross debarment is imposed.

“Cross debarment decisions by the Multilateral Development Banks” is a corporate sanction in accordance with the agreement among the African Development Bank Group, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank Group and the World Bank Group signed on 9 April, 2010 (as amended from time to time). JICA will recognize the World Bank Group’s debarment of which period exceeds one year, imposed after 19 July, 2010, the date on which the World Bank Group started cross debarment, as “cross debarment decisions by the Multilateral Development Banks.” The list of debarred firms and individuals is available at the electronic address **specified in the BDS**.

JICA will recognize a Bidder or Contractor as ineligible to be awarded a contract funded with Japanese ODA Loans if the Bidder or Contractor is debarred by the World Bank Group for the period starting from the date of the Invitation for Bid, if prequalification has not been conducted, or the date of the Advertisement for Prequalification, if prequalification has been conducted,

up to the signing of the contract, unless (i) such debarment period does not exceed one year, or (ii) three (3) years have passed since such debarment decision. If it is revealed that the Contractor was ineligible to be awarded a contract according to above, JICA will, in principle, impose sanctions against the Contractor.

If it is revealed that the subcontractor, who has a direct contract with the Contractor, was debarred by the World Bank Group on the subcontract date, JICA will, in principle, require the Borrower to have the Contractor cancel the subcontract immediately, unless (i) such debarment period does not exceed one year, or (ii) three (3) years have passed since such debarment decision. If the Contractor refuses, JICA will require the Borrower to declare invalidity or cancellation of the contract and demand the refund of the relevant proceeds of the loan or any other remedies on the grounds of contractual violation.

- 3.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 15.6 of the General Conditions.

4. Eligible Bidders

- 4.1 A Bidder may be a firm that is a single entity or any combination of such entities 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 JV, all members shall be jointly and severally liable for the execution of the 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.
- 4.2 A Bidder shall not have a conflict of interest. A Bidder shall not be employed under any of the circumstances set forth below, where it is determined to have a conflict of interest throughout the bidding/selection process and/or the execution of the contract unless the conflict has been resolved in a manner acceptable to JICA.
- (a) A firm shall be disqualified from providing goods or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of a project 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. This provision does not apply to the various firms (consultants, contractors, or suppliers)

only due to the reason that those firms together are performing the Contractor's obligations under a turnkey or design and build contract.

- (b) A firm that has a close business relationship with the Borrower's professional personnel, who are directly or indirectly involved in any part of: (i) the preparation of the Bidding Documents for the contract, (ii) the Bid evaluation, or (iii) the supervision of such contract, shall be disqualified.
- (c) Based on the "One Bid Per Bidder" principle, which is to ensure fair competition, a firm and any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm shall not be allowed to submit more than one Bid, either individually as a Bidder or as a member of a JV. A firm (including its affiliate), if acting in the capacity of a subcontractor in one Bid, may participate in other Bids, only in that capacity.
- (d) A firm having any other form of conflict of interest other than (a) through (c) above shall be disqualified.

4.3 A Bidder, and all members constituting the Bidder, shall be from any of the eligible source countries as indicated in Section V, Eligible Source Countries of Japanese ODA Loans.

4.4 A Bidder that has been determined to be ineligible by JICA in accordance with ITB 3.1 shall not be eligible to be awarded a contract.

4.5 This bidding is open only to prequalified Bidders unless **specified in the BDS.**

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

5. Eligible Materials, Equipment, and Services

5.1 The materials, equipment and services to be supplied under the Contract and financed by JICA shall have their origin in any of the eligible source countries indicated in Section V, Eligible Source Countries of Japanese ODA Loans. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.

- 5.2 For purposes of ITB 5.1 above, “origin” means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Documents

6. Sections of Bidding Documents

- 6.1 The Bidding Documents consist of Parts 1, 2, and 3, which include all the Sections specified below, and which should be read in conjunction with any addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures

Section I. Instructions to Bidders (ITB)
Section II. Bid Data Sheet (BDS)
Section III. Evaluation and Qualification Criteria
Section IV. Bidding Forms
Section V. Eligible Source Countries of Japanese ODA Loans

PART 2 Works Requirements

Section VI. Works Requirements

PART 3 Conditions of Contract and Contract Forms

Section VII. General Conditions (GC)
Section VIII. Particular Conditions (PC)
Section IX. Annex to the Particular Conditions - Contract Forms

- 6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Documents.
- 6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the Bidding Documents, responses to requests for clarification, the minutes of the pre-bid meeting (if any), or addenda to the Bidding Documents 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 Documents and to furnish with its Bid all information and documentation as is required by the Bidding Documents.

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

7.1 A Bidder requiring any clarification of the Bidding Documents shall contact the Employer in writing at the Employer's address **specified in the BDS** or raise its enquiries 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 no later than fourteen (14) days prior to the deadline for submission of Bids. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Documents 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 Documents, the Employer shall amend the Bidding Documents 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. 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 (1) 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 Documents in accordance with ITB 6.3. Any modification to the Bidding Documents 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 Documents

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

8.2 Any addendum issued shall be part of the Bidding Documents and shall be communicated in writing to all who have obtained the Bidding Documents from the Employer in accordance with ITB 6.3. If so **specified in the BDS**, the Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.

8.3 To give Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may 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 not 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 of Bid, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

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

11.2 The Technical Bid shall comprise the following:

- (a) Letter of Technical Bid;
- (b) Bid Security, in accordance with ITB 19;
- (c) alternative bids, if permissible, in accordance with ITB 13;
- (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;
- (e) documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the contract if its Bid is accepted;
- (f) Technical Proposal in accordance with ITB 16;
- (g) Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans (Form ACK), which shall be signed and dated by the Bidder's authorized representative.

(h) Any other document required in the BDS.

11.3 The Price Bid shall comprise the following:

- (a) Letter of Price Bid;
- (b) completed Price Schedules, in accordance with ITB 12 and 14;
- (c) alternative price bids, at Bidder's option and if permissible, in accordance with ITB 13;
- (d) Any other document required in the BDS.**

11.4 In addition to the requirements under ITB 11.2, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all 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.

12. Letters of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid and the Schedules, including the Bill of Quantities, 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 20.2. 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**, as will the method of evaluating different times for completion.
- 13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Documents must first price the Employer's design as described in the Bidding Documents and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.
- 13.4 **When specified in the BDS**, Bidders are permitted to submit alternative technical solutions for specified parts of the Works, and such parts **will be identified in the BDS**, as will the method for their evaluating, and described in Section VI, Works Requirements.

14. Bid Prices and Discounts

- 14.1 The prices and discounts (including any price reduction) quoted by the Bidder in the Letter of Price Bid and in the Bill of Quantities shall conform to the requirements specified below.
- 14.2 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 shall be deemed covered by the rates for other items in the Bill of Quantities and will not be paid for separately by the Employer. An item not listed in the priced Bill of Quantities shall be assumed to be not included in the Bid, and provided that the Bid is determined substantially responsive notwithstanding this omission, the average price of the item quoted by substantially responsive Bidders will be added to the Bid Price and the equivalent total cost of the Bid so determined will be used for price comparison.
- 14.3 The price to be quoted in the Letter of Price Bid, in

accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered.

14.4 The Bidder shall quote any discounts and the methodology for their application in the Letter of Price Bid, in accordance with ITB 12.1.

14.5 **Unless otherwise specified in the BDS** and the Contract, the rates and 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. In such a case, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Employer may require the Bidder to justify its proposed indices and weightings.

14.6 If so specified in BDS 1.1, Bids are being 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 Letter of Price 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 **Unless otherwise provided in the BDS**, all duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date twenty-eight (28) days prior to the deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.

15. Currencies of Bid and Payment

15.1 The currency(ies) of the Bid shall be **as specified in the BDS**. Payment of the contract price shall be made in the currency or currencies in which the Bid Price is expressed in the Bid of the successful Bidder.

15.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data are reasonable, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.

15.3 The foreign currency requirements generally include the

following:

- (a) expatriate staff and labour employed directly on the Works;
- (b) social, insurance, medical and other charges relating to such expatriate staff and labour, and foreign travel - expenses;
- (c) imported materials, both temporary and permanent, including fuels, oil and lubricants required for the Works;
- (d) depreciation and usage of imported Plant and Contractor's Equipment, including spare parts, required for the Works;
- (e) foreign insurance and freight charges for imported materials, Plant and Contractor's Equipment, including spare parts; and
- (f) overhead expenses, fees, profit, and financial charges arising outside the Employer's country in connection with the Works.

**16. Documents
Comprising the
Technical Proposal**

16.1 The Bidder shall furnish as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule, safety plan and any other information as stipulated in Section IV, Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidder's proposal to meet the work requirements and the completion time.

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

17.1 In accordance with Section III, Evaluation and Qualification Criteria, if the prequalification process was conducted prior to the bidding process, the Bidder shall provide in the corresponding information sheets included in Section IV, Bidding Forms, (i) updated information on any assessed aspect that changed from that time to establish that the Bidder continues to meet the criteria used at the time of prequalification and (ii) the requested information on the additional qualification criteria stated in Section III, Evaluation and Qualification Criteria, or if the assessment of qualification criteria was not conducted prior to the bidding process, the Bidder shall provide the information requested in the corresponding information sheets included in Section IV, Bidding Forms.

17.2 Any change in the structure or formation of a Bidder after

being prequalified and invited to bid (including, in the case of a JV, any change in the structure or formation of any member thereto) shall be subject to the written approval of the Employer prior to the deadline for submission of Bids. Such approval shall be denied if (i) such change has not taken place by the free choice of the firms involved; (ii) as a consequence of the change, the Bidder no longer substantially meets the qualification criteria set forth in the Prequalification Documents; or (iii) in the opinion of the Employer, the change may result in a substantial reduction in competition. Any such change should be submitted to the Employer not later than fourteen (14) days after the date of the Invitation for Bids.

18. Period of Validity of Bids

18.1 Bids shall remain valid for the period **specified in the BDS** after the Bid submission deadline date prescribed by the Employer in accordance with ITB 22.1. A Bid valid for a shorter period shall be rejected by the Employer as non-responsive.

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. The Bid Security 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, the Contract price shall be determined as follows:

- (a) In the case of fixed price contracts, the Contract price shall be the Bid Price adjusted by the factor **specified in the BDS**.
- (b) In the case of adjustable price contracts, to determine the Contract price, the fixed portion of the Bid Price shall be adjusted by the factor **specified in the BDS**.
- (c) In any case, Bid evaluation shall be based on the Bid Price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

19.1 The Bidder shall furnish as part of its Technical Bid, a Bid Security in the amount and currency **specified in the BDS**.

- 192 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 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 source country. If the unconditional guarantee is issued by a financial institution located outside the Employer's Country, the issuing financial institution shall have a correspondent financial institution located in the Employer's Country to make it enforceable. 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. In either case, the form must include the complete name of the Bidder. 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.
- 19.3 Any Bid not accompanied by a substantially responsive Bid Security shall be rejected by the Employer as non-responsive.
- 19.4 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 pursuant to ITB 42.
- 19.5 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.
- 196 The Bid Security may be forfeited:
- (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, or any extension thereto provided by the Bidder; or

(b) if the successful Bidder fails to:

- (i) sign the Contract in accordance with ITB 41; or
- (ii) furnish a Performance Security in accordance with ITB 42.

19.7 The Bid Security of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of bidding, the Bid Security shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.4.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the Bid as described in ITB 11 and clearly mark them “ORIGINAL – TECHNICAL BID” and “ORIGINAL – PRICE BID”. Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked “ALTERNATIVE.” In addition, the Bidder shall submit copies of the Technical and Price Bids, in the number **specified in the BDS** and clearly mark each of them “COPY.” In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation **as specified in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.

20.3 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.

20.4 Any inter-lineation, 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 enclose the original of the Technical Bid, the original of the Price Bid, each copy of the Technical Bid and each copy of the Price Bid, including alternative Bids, if

permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as “ORIGINAL - TECHNICAL BID”, “ORIGINAL – PRICE BID”, “COPY– TECHNICAL BID”, “COPY – PRICE BID”, and “ALTERNATIVE”,

as appropriate. These envelopes containing the original and the copies shall then be enclosed in one single envelope.

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; and
- (c) bear the specific identification of this bidding process specified in BDS 1.1.

21.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB 25.1.

21.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer, in accordance with ITB 25.7.

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

**22. Deadline for
Submission of Bids**

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

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

23. Late Bids

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

**24. Withdrawal,
Substitution, and
Modification of
Bids**

24.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with

ITB 20.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

- (a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” “MODIFICATION;” and
- (b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 22.

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

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

25. Bid Opening

25.1 Except in the cases specified in ITB 23 and ITB 24, the Employer shall publicly open and read out in accordance with ITB 25.5 all Technical 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 choose to attend. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening in accordance with ITB 25.7.

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 the opening of Technical Bids.

25.3 Second, outer envelopes marked “SUBSTITUTION” shall be opened. The inner envelopes containing Substitution Technical Bid and/or Substitution Price Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened

and read out. Substitution Price Bid will remain unopened in accordance with ITB 25.1. No envelope substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at the opening of Technical Bids.

25.4 Next, outer envelopes marked “MODIFICATION” shall be opened. No Technical Bid and/or Price Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened and read out at the opening of Technical Bids. Price Bids, both Original as well as Modification, will remain unopened in accordance with ITB 25.1.

25.5 All other envelopes holding the Technical Bids shall be opened one at a time, reading out:

- (a) the name of the Bidder;
- (b) whether there is a modification;
- (c) the presence or absence of a Bid Security; and
- (d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical Bids read out at Bid opening shall be considered for evaluation. The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).

25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; alternative proposals and the presence or absence of a Bid Security. The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder’s signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

25.7 At the end of the evaluation of the Technical Bids, the Employer will invite Bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the

Employer. The opening date should allow Bidders sufficient time to make arrangements for attending the opening of Price Bids.

25.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and return their Price Bids unopened.

25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, date and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

25.10 All envelopes containing Price Bids shall be opened one at a time, reading out:

- (a) the name of the Bidder;
- (b) whether there is a modification;
- (c) the Bid Prices, including any discounts and alternative Bids; and
- (d) any other details as the Employer may consider appropriate.

Only Price Bids discounts, and alternative Bids read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.

25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative Bids. 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 Contract award is

communicated to all Bidders in accordance with ITB 40.

26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.

26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract award, if 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 Technical and Price Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid, giving 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 in the substance of the Technical Bid or prices in the Price Bid, including any voluntary increase or decrease in the prices, shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33.

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

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of Bids, the following definitions apply:

- (a) "Deviation" is a departure from the requirements specified in the Bidding Documents;
- (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Documents; and
- (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Documents.

29. Preliminary Examination of Technical Bids

29.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted.

29.2 The Employer shall confirm that the following documents

and information have been provided in the Technical Bid. If any of these documents or information is missing, the Bid shall be rejected.

- (a) Letter of Technical Bid;
- (b) written confirmation of authorization to commit the Bidder;
- (c) Bid Security; and
- (d) Technical Proposal in accordance with ITB 16;

30. Qualification of the Bidder

- 30.1 The Employer shall determine to its satisfaction whether Bidders meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria, during the evaluation of Technical Bids. However, if prequalification was carried out prior to the bidding process, the Employer may carry out the assessment of the qualification criteria specified in Section III, Evaluation and Qualification Criteria, for the Bidder who submitted the lowest evaluated and substantially responsive Bid only.
- 30.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant ITB 17.
- 30.3 An affirmative determination 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 if the assessment of the Bidder's qualification was conducted for the lowest evaluated Bidder only, in accordance with ITB 30.1, the Employer shall proceed to the next lowest evaluated Bid to make a similar determination.

31. Determination of Responsiveness of Technical Bid

- 31.1 The Employer's determination of a Technical Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB 11.2.
- 31.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Documents 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 Documents, the Employer's rights or the Bidder's obligations under the proposed Contract; or
- (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

31.3 The Employer shall examine the Technical Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section VI, Works Requirements have been met without any material deviation, reservation or omission.

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

32. Nonmaterial Nonconformities

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

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

32.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method specified in Section III, Evaluation and Qualification Criteria.

33. Correction of Arithmetical Errors

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

- (a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price

and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;

- (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

33.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 33.1, shall result in the rejection of the Bid.

34. Conversion to Single Currency

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

35. Subcontractors

35.1 **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 (nominated subcontractors).

35.2 In case Prequalification was not conducted prior to the bidding process, Bidders planning to subcontract any of the key activities indicated in Section III, Evaluation and Qualification Criteria, shall clearly identify the proposed specialist subcontractor(s) in Forms ELI-2 and EXP-2(b) in Section IV, Bidding Forms. Such proposed specialist subcontractors(s) shall meet the corresponding qualification requirements specified in Section III, Evaluation and Qualification Criteria.

35.3 In case Prequalification was conducted prior to the bidding process, the Bidder's Bid shall name the same specialist subcontractor(s) whose experience in the key activities was evaluated in the Prequalification, unless such change is explicitly approved by the Employer in accordance with ITB 17.2.

36. Evaluation of Price Bids

36.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

36.2 To evaluate a Price Bid, the Employer shall consider the following:

- (a) the Bid Price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including Daywork items, where priced competitively;
- (b) price adjustment for correction of arithmetic errors in accordance with ITB 33.1;
- (c) price adjustment due to discounts offered in accordance with ITB 14.4;
- (d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 34;
- (e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 32.3;
- (f) the additional evaluation factors specified in Section III, Evaluation and Qualification Criteria;

36.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

36.4 If these Bidding Documents allow Bidders to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated price of the lot (contract) combinations, including any discounts offered in the Letter of Price Bid, is specified in Section III, Evaluation and Qualification Criteria.

36.5 If the Bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments,

the Employer may require that the amount of the Performance Security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

- 37. Comparison of Bids** 37.1 The Employer shall compare the evaluated prices of all substantially responsive Bids established in accordance with ITB 36.2 to determine the lowest evaluated Bid.
- 38. Employer's Right to Accept Any Bid, and to Reject Any or All Bids** 38.1 The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, Bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

- 39. Award Criteria** 39.1 Subject to ITB 38.1, the Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated Bid and is substantially responsive to the Bidding Documents, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.
- 40. Notification of Award** 40.1 Prior to the expiration of the period of Bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification letter (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called "the Accepted Contract Amount"). At the same time, the Employer shall also notify all other Bidders of the results of the bidding.
- 40.2 After a contract has been determined to be eligible for financing under Japanese ODA Loans, the following information may be made public by JICA:
- (a) name of each Bidder who submitted a Bid;
 - (b) Bid Prices as read out at Bid Opening;
 - (c) name and address of the successful Bidder;

(d) name and address of supplier; and

(e) award date and amount of the contract.

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

40.4 After notification of award, unsuccessful Bidders may request in writing to the Employer a debriefing seeking explanations on the grounds on which their Bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after notification of award in accordance with ITB 40.1, requests a debriefing.

41. Signing of Contract

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

41.2 Within twenty-eight (28) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

42. Performance Security

42.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the General Conditions of Contract, subject to ITB 36.5, using for that purpose the Performance Security Form included in Section IX, Annex to the Particular Conditions - 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.

42.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose Bid is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

Section II. Bid Data Sheet

Bid Data Sheet

A. General	
ITB 1.1	The number of the Invitation for Bids is: FDIPP/BEZA/Pkg1
ITB 1.1	The Employer is: Executive Chairman , BEZA (Bangladesh Economic Zones Authority)
ITB 1.1	The name, identification and number of the lot(s) (contract(s)) comprising this ICB are: Package 1: Land Development Works for Bangladesh Special Economic Zone under Foreign Direct Investment Promotion Project (FDIPP)
ITB 2.1	The Borrower is: The Government of the People's Republic of Bangladesh
ITB 2.1	The number of the Loan Agreement is: JICA Loan Agreement No. BD-P86 The amount of a Japanese ODA Loan is: JPY 15,825,000,000 The signed date of the Loan Agreement is: December 13, 2015
ITB 2.1	The name of the Project is: Foreign Direct Investment Promotion Project (FDIPP)
ITB 2.2	The applicable Guidelines for Procurement under Japanese ODA Loans are those published in April 2012.
ITB 3.1(c)	A list of debarred firms and individuals is available at the World Bank's website: www.worldbank.org/debarr .
ITB 4.5	This bidding is not subject to Prequalification.
B. Bidding Documents	
ITB 7.1	For clarification purposes only, the Employer's address is: Attention: Saleh Ahmed Manager (Planning & Development) Bangladesh Economic Zones Authority Address: Bangladesh Economic Zones Authority (BEZA), Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205 Phone: 880-2-9632472 E-mail: saleh15th@gmail.com
ITB 7.1	Responses to any request for clarification, if any, will not be published on the Employer's web page.

ITB 7.4	<p>A Pre-bid meeting will take place at the following date, time and place: Date: March 11, 2019 Time: 14:30 PM Bangladesh Standard Time Place: Bangladesh Economic Zones Authority (BEZA), Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205</p> <p>A site visit conducted by the Employer will not be organized.</p>
ITB 8.2	Addenda, if any, will not be published on the Employer's web page.
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: English
ITB 11.2 (h)	<p>The Bidder shall submit with its Technical Bid the following additional documents:</p> <ol style="list-style-type: none"> 1) Photocopy of money receipt given during purchase of Bidding Documents. 2) National (Bangladeshi) Bidders (or partners in case of a JV) shall provide the following information: <ol style="list-style-type: none"> (i) Value Added Tax Registration (VAT) Number; and (ii) Tax Identification Number (TIN).
ITB 11.3 (d)	The Bidder shall submit with its Price Bid the following additional documents: None
ITB 13.1	Alternatives shall not be permitted
ITB 13.2	Alternative times for completion will not be permitted.
ITB 13.4	Alternative technical solutions shall not be permitted.
ITB 14.7	For duties, taxes and other levies shall be referred to Sub-Clause 4.25 of the Specific Provisions of PCC.
ITB 15.1	<p>The currency(ies) of the Bid shall be as described below: The unit rates and prices shall be quoted by the Bidder in the Bill of Quantities separately in the following currencies:</p> <ol style="list-style-type: none"> (i) for those inputs to the Works that the Bidder expects to supply from within the Employer's country, in BDT, the name of the currency of the Employer's country, and further referred to as "the local currency"; and (ii) for those inputs to the Works that the Bidder expects to supply from outside the Employer's country (referred to as "the foreign currency requirements"), in Japanese Yen (JPY) and/or US Dollar (USD).
ITB 18.1	The Bid validity period shall be 180 days.
ITB 18.3 (a)	The Bid Price shall be adjusted by the following factor: Not applicable

ITB 18.3 (b)	The fixed portion of the Bid Price shall be adjusted by the following factor: Not applicable
ITB 19.1	The amount and currency of the Bid Security shall be : Two million, Two hundred and Thirty Thousand US Dollar (USD 2,230,000) or Two hundred Forty Five million Japanese Yen (JPY 245,000,000) or One hundred Eighty million Bangladesh Taka (BDT 180,000,000) in the form of bank guarantee issued by a reputable international bank through its branch or associated with a correspondent bank located in Bangladesh, and have a validity period of twenty eight (28) days after bid validity period, using the Bid Security Form in Section IV of the Bidding Documents.
ITB 19.2 (d)	Other types of acceptable securities: None
ITB 20.1	In addition to the original of the Bid, the number of copies is: 2 (two) hard copies and 1 (one) CD soft copy.
ITB 20.2	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: An authorization letter submitted with the Bid demonstrating the authority of the signatory to sign the Bid.
D. Submission and Opening of Bids	
ITB 22.1	For <u>Bid submission purposes</u> only, the Employer's address is: Attention: Saleh Ahmed Manager (Planning & Development) Bangladesh Economic Zones Authority Address: Bangladesh Economic Zones Authority (BEZA), Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205 Phone: 880-2-9632472 E-mail: saleh15th@gmail.com The deadline for Bid submission is: Date: 18/04/2019 Time: 14:00 PM Bangladesh Standard Time
ITB 25.1	The opening of the Technical Bid shall take place at: Date: 18/04/2019 Time: 14:30 PM Bangladesh Standard Time Place: Bangladesh Economic Zones Authority (BEZA), Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

E. Evaluation, and Comparison of Bids	
ITB 34.1	<p>The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid Prices expressed in various currencies into a single currency is: BDT [Bangladesh Taka]</p> <p>The source of exchange rate shall be: Bangladesh Bank</p> <p>The date for the exchange rate shall be: twenty-eight (28) days prior to the date for Technical Bid opening specified in ITB 25.1.</p> <p>The Employer will convert the amounts in various currencies in which the Bid Price, corrected pursuant to ITB 33, is payable (excluding Provisional Sums but including Daywork where priced competitively) to the single currency identified above at the selling rates established for similar transactions by the authority specified and on the date stipulated above.</p>

Section III. Evaluation and Qualification Criteria

Evaluation and Qualification Criteria

1. Evaluation

1.1 Evaluation of Technical Bids

1.1.1 Assessment of adequacy of Technical Proposal with Requirements

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 VI, Works Requirements.

The assessment of adequacy of technical proposal with requirements shall be conducted with the following points:

- (1) The safety plan and risk management plan is adequately proposed in accordance with the specifications.
- (2) The construction plan with adequate equipment plan is properly proposed within designated period including the schedule of partial taking over of specific areas.
- (3) Geotechnical investigation and analysis plan, and its soil improvement plan are technically and properly proposed and reflected on the construction schedule.

1.1.2 Personnel

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

No.	Position	Qualification	No.	Total Work Experience (Years)	Experience in Similar Works (Years)
1	Project Manager	B Sc. Eng. (Civil)	1	15	10
2	Chief Engineer, Civil Works	B Sc. Eng. (Civil)	1	10	5
3	Materials/ Quality control Engineer	B Sc. Eng. (Civil)	1	10	5
4	Geotechnical Engineer	B Sc. Eng. (Civil)	1	10	5
5	Health & Safety (Accident Prevention) Officer	B Sc. Eng. (Civil) or B Sc. Eng. (Mech)	1	10	5

The Bidder shall provide details of the proposed personnel and their experience records in Form PER-1 and Form PER-2 in Section IV, Bidding Forms.

1.1.3 Equipment

The Bidder must demonstrate that it has the key equipment, but not limited to, listed hereafter:

No.	Equipment Type and Characteristics	Minimum Number required
1	Sand Pump unloader and Booster Pump Sets with 300mm dia. Pipelines	6 sets or (equivalent nos by capacity)
2	Marsh Excavator (1m ³ bucket)	2
3	Marsh Buldozer (21 ton)	3

The Bidder may also propose alternative equipment or additional equipment he intends to employ, together with an explanation of the proposal for the contract construction completion requirements.

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

1.2 Evaluation of Price Bids

Part 1 - Evaluation of Compliance and Responsiveness

Under this Stage the following items will be checked:

- (i) The Bid Form (Letter of Price Bid) is compliant, i.e. it does not include any alteration to the basic terms and does not constitute an alternative offer;
- (ii) All Forms and Price Schedules have not been altered and are correctly completed and signed;
- (iii) All Forms and Price Schedules are complete and have been submitted for the whole of the Works; and

Part 2 – Detailed Financial Evaluation

After passing the above requirements the Bid will then proceed for final evaluation for which the following items will be checked for each Package, separately:

- (1) Arithmetic Checking and Correction;
- (2) Conversion to a Single Currency and Comparison; and
- (3) Check of an Unbalanced Bid.

The Bid evaluation will take into account the prices quoted in the Price Schedules and other financial features of the Bid.

The price of items against which the bidder 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 in accordance with ITB 14.2. Accordingly, there should be no adjustments for missing items in the Bill of Quantities in principle.

In principle the lowest priced Bidder resulting from above-mentioned process will be selected for award of Contract, subject to compliance.

2. Qualification

(i) Exchange Rate for Qualification Criteria

Wherever a Form in Section IV, Bidding Forms, requires a Bidder to state a monetary amount, Bidders should indicate the USD equivalent using the rate of exchange determined as follows:

- (a) For construction turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year.
 - (b) Value of single contract - Exchange rate prevailing on the date of the contract.
- Exchange rates shall be taken from the publicly available source **identified in BDS 34.1** or, in case such rates are not available in the source identified above, any other publicly available source acceptable to the Employer. Any error in determining the exchange rates may be corrected by the Employer.

Eligibility and Qualification Criteria			Compliance Requirements			Documentation
No.	Factor	Requirement	Single Entity	Joint Venture (existing or intended)		Submission Requirements
				All Parties Combined	One Member	
2.1. Eligibility						
2.1.1	Nationality	Nationality in accordance with ITB 4.3	Must meet requirement	N/A	Must meet requirement	Forms ELI – 1 and 2, with attachments
2.1.2	Conflict of Interest	No conflicts of interest in ITB 4.2	Must meet requirement	N/A	Must meet requirement	Letter of Bid
2.1.3	JICA Ineligibility	Not having been declared ineligible by JICA, as described in ITB 4.4	Must meet requirement	N/A	Must meet requirement	Letter of Bid Form ACK
2.1.4	ISO Certificate	Registration Certificate of 14001 in bidder's country in scope of construction works for civil and/or building engineering since 1 st January 2004.	Must meet requirement	N/A	Must meet requirement	Copy of original documents for the certificate of registration with appendix (if any)

Eligibility and Qualification Criteria			Compliance Requirements			Documentation	
No.	Factor	Requirement	Single Entity	Joint Venture (existing or intended)		Submission Requirements	
				All Parties Combined	Each Member		One Member
2.2. Historical Contract Non-Performance							
2.2.1	History of Non-Performing Contracts	Non-performance of a contract ⁽ⁱ⁾ did not occur as a result of contractor's default since 1 st January 2016.	Must meet requirement ⁽ⁱⁱ⁾	N/A	Must meet requirement ⁽ⁱⁱ⁾	N/A	Form CON
2.2.2	Pending Litigation	All pending litigation shall in total not represent more than 50 [fifty] % of the Bidder's net worth and shall be treated as resolved against the Bidder.	Must meet requirement ⁽ⁱⁱ⁾	N/A	Must meet requirement ⁽ⁱⁱ⁾	N/A	Form CON
2.2.3	Litigation History	No consistent history of court/arbitral award decisions against the Bidder ⁽ⁱⁱⁱ⁾ since 1 st January 2014.	Must meet requirement ⁽ⁱⁱ⁾	N/A	Must meet requirement ⁽ⁱⁱ⁾	N/A	Form CON
Notes for the Bidder							
(i)	Non-performance, as decided by the Employer, shall include all contracts						
	(a) where non-performance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) that were so challenged but fully settled against the contractor.						
Non-performance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism. Non-performance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.							
(ii)	This requirement also applies to contracts executed by the Bidder as a JV member.						
(iii)	The Bidder shall provide accurate information on the related Bidding Form about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the last five (5) years. A consistent history of awards against the Bidder or any member of a joint venture may result in failure of the Bid.						

Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Factor	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Parties Combined	Each Member	One Member	
2.3. Financial Situation							
2.3.1	Financial Performance	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 5 years (2013-2017) shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability. As the minimum requirement, a Bidder's net worth calculated as the difference between total assets and total liabilities should be positive.	Must meet requirement	N/A	Must meet requirement	N/A	Form FIN –I with attachments
2.3.2	Average Annual Construction Turnover	Minimum average annual construction turnover of USD 200 (two hundred) million calculated as total certified payments received for contracts in progress and/ or completed, within the last 5 (five) years from 2013 to 2017, divided by 5 (five) years.	Must meet requirement	Must meet requirement	Must meet 25% of the requirement	Must meet 40% of the requirement	Form FIN – 2

Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Factor	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Parties Combined	Each Member	One Member	
2.4. Experience							
2.4.1	General Construction Experience	Experience under construction contracts in the role of prime contractor (single entity or JV member), subcontractor, or management contractor ⁽ⁱ⁾ for at least the last 10 years, starting 1 st January 2008 .	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP – 1
2.4.2 (a)	Specific Construction Experience	Minimum 1 (one) similar ⁽ⁱⁱ⁾ contracts that have been satisfactorily and substantially ⁽ⁱⁱⁱ⁾ completed as a prime contractor (single entity or JV member) ^(iv) in G7 countries between 1st January 2008 and Bid submission deadline.	Must meet requirement	Must meet requirement ^(v)	N/A	N/A	Form EXP – 2 (a)

[illegible]

<p>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.</p> <p>(vi) For contracts under which the Bidder participated as a JV member or subcontractor, only the Bidder's share, by value, shall be considered to meet this requirement.</p> <p>(vii) Contract amount means entire contract amount including not only reclamation and/or embankment construction works but also other relevant works required under the contract. However, main part of the contract shall be reclamation and/or embankment construction works.</p>	
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Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Factor	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Parties Combined	Each Member	One Member	
2.5. Financial Resources							
2.5.1	Financial Resources	(i) The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as USD 20 (Twenty) Million for the subject contract(s) net of the Bidders other commitments.	Must meet requirement	Must meet requirement	Must meet 25% of the requirement	Must meet 40% of the requirement	Form FIR – 1
		(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	Form FIR – 1 and FIR – 2

Section IV. Bidding Forms

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Two-Envelope Bidding

Letter of Technical Bid

Date: *[insert date of Bid submission]*
Loan Agreement No.: JICA L/A NO. BD-86
IFB No.: FDIPP/BEZA/Pkg1

To:

Manager (Planning & Development)
Bangladesh Economic Zones Authority
Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including addenda issued in accordance with Instructions to Bidders (ITB 8). *[Insert the number and issuing date of each addendum]*;
- (b) We, including subcontractors meet the eligibility requirements in accordance with ITB 4 and ITB 5;
- (c) We, including subcontractors have no conflict of interest in accordance with ITB 4;
- (d) We offer to execute in conformity with the Bidding Documents the following Works: Land Development Works for Bangladesh Special Economic Zone;
- (e) Our Bid shall be valid for a period of 180 days from the date fixed for the Bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (f) We are not participating, as a Bidder or as a subcontractor, in more than one Bid in this bidding process in accordance with ITB 4.2(c), other than alternative Bids submitted in accordance with ITB 13; and
- (g) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud and corruption.

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

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

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

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

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

*: 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.

Two-Envelope Bidding

Letter of Price Bid

Date: *[insert date of Bid submission]*
 Loan Agreement No.: JICA L/A NO. BD-86
 IFB No.: FDIPP/BEZA/Pkg1

To:

Manager (Planning & Development) Bangladesh Economic Zones Authority
 Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including addenda issued in accordance with Instructions to Bidders (ITB 8). *[Insert the number and issuing date of each addendum]*;
- (b) We offer to execute in conformity with the Bidding Documents and Technical Bid the following Works: Land Development Works for Bangladesh Special Economic Zone;
- (c) The total price of our Bid, excluding any discounts offered in item (d) below is:
 In case of only one lot, total price of the Bid *[insert the total price of the Bid in words and figures, indicating the various amounts and the respective currencies]*
- (d) The discounts offered and the methodology for their application are:

 The discounts offered are: *[specify in detail each discount offered.]*

 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.]* ;
- (e) Our Bid shall be valid for a period of 180 days from the date fixed for the Bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (f) If our Bid is accepted, we commit to obtain a Performance Security in accordance with the Bidding Documents;
- (g) We 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; and

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

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

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

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

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

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

*: In the case of the Bid submitted by 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.

Schedule of Adjustment Data

Table A. Local Currency

The Bidder shall fill in column (e) and specify a value within the ranges given by the Employer in B, C, D and E of column (f), so that the total weighting equals 1.00.

From GC 13.8: Adjustments for Changes in Cost

The formulae shall be of the following general type:

$$P_n = a + b \frac{L_n}{L_o} + c \frac{E_n}{E_o} + d \frac{M_n}{M_o} + \dots$$

“ P_n ” is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period “ n ”, this period being a month unless otherwise stated in the Contract Data;

“ a ” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“ b ”, “ c ”, “ d ”, ... are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

“ L_n ”, “ E_n ”, “ M_n ”, ... are the current cost indices or reference prices for period “ n ”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“ L_o ”, “ E_o ”, “ M_o ”, ... are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

01. Site improvement by carted earth or dredged sand, sandy silt.

(a) Index code	(b) Index description	(c) Source of index	(d) Base value and date	(e) Bidder's related currency amount	(f) Bidder's proposed weighting
	A. Nonadjustable B. Royalty for sand C. Fuel D. Labour E. Misc	— DC office, NG Eastern Refinery BSS	— On Bid submission date On Bid submission date On Bid submission date On Bid submission date		A: 0.150 B: 0.05-0.25 C: 0.10-0.30 D: 0.10-0.30 E: 0.30-0.50
Total					1.00

02. Mechanical compaction of earth or sand

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. Fuel C. Labour D. Misc	— Eastern Refinery BSS	— On Bid submission date On Bid submission date On Bid submission date		A: 0.150 B: 0.40-0.60 C: 0.05-0.25 D: 0.10-0.30
Total					1.00

03. Geo-textile bagging

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. Geo-textile C. Labour D. Royalty E. Fuel	— BSS BSS DC office, NG Eastern Refinery	— On Bid submission date On Bid submission date On Bid submission date On Bid submission date	—	A: 0.150 B: 0.50-0.70 C: 0.20-0.40 D: 0.01-0.10 E: 0.01-0.10
Total					1.00

04. RCC Work

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. Bricks C. Sand D. Cement E. Labour F. Fuel	— BBS BBS BBS BBS Eastern Refinery	— On Bid submission date On Bid submission date On Bid submission date On Bid submission date On Bid submission date	—	A: 0.150 B: 0.20-0.40 C: 0.01-0.10 D: 0.30-0.50 E: 0.05-0.15 F: 0.01-0.10
Total					1.00

05. Shuttering

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. Wood C. Labour	— BBS BBS	— On Bid submission date On Bid submission date	—	A: 0.150 B: 0.20-0.40 C: 0.50-0.70
Total					1.00

06. Reinforcement, Steel

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. MS Rod C. Labour	— BBS BBS	— On Bid submission date On Bid submission date	—	A: 0.150 B: 0.70-0.90 C: 0.01-0.10
Total					1.00

07. MS Angle Post

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. MS Angle C. Labour	— BBS BBS	— On Bid submission date On Bid submission date	—	A: 0.150 B: 0.40-0.60 C: 0.20-0.40
Total					1.00

08. Barbed Wire fencing

(a)	(b)	(c)	(d)	(e)	(f)
Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	A. Nonadjustable B. Barbed wire C. GI Wire D. Labour	— BBS BBS BBS	— On Bid submission date On Bid submission date On Bid submission date	—	A: 0.150 B: 0.20-0.40 C: 0.05-0.15 D: 0.40-0.60
Total					1.00

(Note) BBS means Bangladesh Bureau of Statistics.

Table B. Foreign Currency (FC)

In this Table B, the Bidder shall indicate the type of currency and columns (c), (d), (e) and (f), and specify a value within the ranges given by the Employer in B, C and D of column (g), so that the total weighting equals 1.00.

Currency: _____ *[Insert name of currency; if the Bidder wishes to quote in more than one foreign currency then this table should be repeated for each foreign currency.]*

(a)	(b)	(c)	(d)	(e)	(f)	(g)
Index code	Index description	Source of index	Base value and date	Bidder's related source currency in type/amount	Equivalent in FC for payment	Bidder's proposed weighting
	Nonadjustable	—	—	—		A: <u>0.15</u>
Lo	Overseas Worker (Skilled)	(I)	(II)			B: _____
Mo	Imported Materials	(I)	(II)			C: _____
Eo	Imported Equipment and Spares	(I)	(II)			D: _____
Total						1.00

The Bidder's proposed weightings for Foreign Currency are subject to clarification / negotiation before formalizing the Contract.

Note:

(I) Inserted by the Bidder

(II) 28 days prior to the deadline for submission of the Bids

Bill of Quantities

The objectives of the Bill of Quantities are

- a) to provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and
- b) when a contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, the Works have been itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities have been kept as simple and brief as possible.

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
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, as measured by the Engineer (accepted by the Contractor) 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 Engineer may fix within the terms of the Contract. The quantities shall be computed net from the Drawings, unless directed otherwise in the Contract, and no allowance shall be made for bulking, shrinkage, or waste.
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 Materials, Plant, Contractor's Equipment, Temporary Works, constructional plant, labor, supervision, other materials, wastage, erection, maintenance, insurance, overheads, profit, VAT, IT, other 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. The cost of Items against which the Contractor has failed or omitted 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 and all necessary 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. The Employer shall indicate in the Summary of Provisional Sums an amount equivalent to one-half of the Employer's estimate of the cost of the Dispute Board (DB) for payments to the Contractor of the Employer's share of the payments to the DB member(s).
8. Contractor's overhead, profit, etc., shall not be included in or added to the Provisional Sums for the cost of the DB.
9. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part, or not at all, at the direction and discretion of the Engineer, except for the provisional sum for the cost of the DB, which requires no prior instruction of the Engineer, in accordance with Sub-Clause 13.5 and Clause 13.6 of the General Conditions.
10. Any arithmetical errors in computation or summation will be corrected by the Employer as follows:

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.

B. Work Items and the Bill of Quantities

1. The items in the Bill of Quantities have been grouped into sections and bills to distinguish between those parts of the Works that by nature, location, access, timing, or any other special characteristics may give rise to different methods of construction, phasing of the Works, or considerations of cost. General items common to all parts of the Works for a particular location have been grouped as a separate section in the Bill of Quantities. When a family of Price Adjustment Formulae is used, they shall relate to appropriate sections in the Bill of Quantities.
2. Bidders shall price the Bill of Quantities in the currency or currencies specified in the Instructions to Bidders.

Technical Proposal

- Site Organization
- Method Statement
- Mobilization Schedule
- Construction Schedule
- Quality Control Plan
- Geotechnical Investigation and Analysis Plan
- Safety Plan
- Personnel
- Equipment
- Others

Site Organization

[Insert Organization Information]

The Bidder shall submit a site organization statement to demonstrate sufficiency and fulfilment of the proposed site organization to effectively manage, control, execute and maintain the Works of the project implementation based on the characteristics and the scope of work and in accordance with the relevant requirements of the Bidding Documents.

The statement shall include the basic but comprehensive description on the proposed site organization to be deployed for construction activities and operation and relationship among joint-operation (if any) with the associated companies and sub-contractors.

1. Project Organization Structure
2. Functional Allocation of Each Substructure and/or Key Personnel and its Coordination for Joint Operation (if any) and Sub-Contractors and associated companies.
3. Roles, Responsibility and Powers of Each Substructure and Key Personnel.
4. Assignment Schedule of Each Key Personnel. The “Project Manager” and “Chief Engineer Civil Works” shall be continuously assigned at the construction site over an entire construction period of the Works
5. Functional Coordination and Cooperation among Partners and/or Sub-Contractors in Joint operation or subcontracting.
6. Other Specific Statement for Project Organization

The statement shall be prepared in the form of statement of A4 size sheets supported by organization chart, illustrations, figures, tables, etc. in maximum A3 size sheets.

Submit particulars of proposed Sub-Contractor for engagement identifying the part of the Works on which they will participate, either directly, specialty tasks and/or operation of a particular type of equipment. Complete information shall be provided in the Bid.

Name and Address	Work to Be Undertaken	Estimated Value of Works (US\$)

Method Statement

[Insert Method of Statement]

The Bidder shall submit a statement on work method and program supported by drawings, diagram, illustration and figures, etc. to demonstrate sufficiency and fulfilment of the proposed method and program of work in accordance with the relevant requirements of the Bidding Documents.

The statement shall include the basic but comprehensive description for methods and program of Works to cover major site and construction activities/operation in the following:

1. Mobilization and Demobilization
2. Program on Temporary Works and Preparatory Works
3. Procurement Scheme of Major Construction Materials. The Bidder shall clearly describe the procurement and/or production scheme of sandy materials for reclamation and ready-mixed concrete. The required production capacity of sand reclamation, sand transportation and sand extraction shall be not less than 18,000 m³ per day.
4. Method and workmanship for Each Sub-divided Construction operation including Environmental Protection Measures supported by description and schedule of Construction equipment and Manpower utilization for each sub-divided operation.
5. Scheme of Project Management and Control of Site Activities and Operation.
6. Method and Program on Environmental Management, Monitoring and Control.
7. Program on Safety Measure and Medical Care including HIV/AIDS prevention program.
8. Other Specific Statement for Construction Activities.

The statement shall be prepared in the form of A4 size sheets supported by maximum A3 size drawings, illustrations, figures, tables, etc.

Mobilization Schedule

[Insert Mobilization Schedule]

The Bidder shall submit a chart showing the monthly schedule of construction equipment to be used for the execution of works, together with the corresponding mobilization and demobilization dates, in accordance with the construction schedule.

The statement shall be prepared in the form of statement of A4 size sheets supported by illustrations, figures, tables, etc. in maximum A3 size sheets.

Construction Schedule

[Insert Construction Schedule]

The Bidder shall submit a comprehensive construction schedule in accordance with the requirements of the Bid Drawings, Volume IV, to indicate major work activities for the execution of the works in their sequence order and expected duration, sequence and inter relation of all major operation or construction activities. The overall construction period including mobilization and demobilization of construction equipment shall be not more than thirty (30) months from the date of commencement of the Work.

The construction schedule shall clearly show but not limited to the following views and work activities and shall be supported by a time schedule for equipment and manpower utilization and other relevant supporting data or statement, etc.

1. Mobilization and Demobilization Schedule
2. Procurement and Delivery of Major Construction Materials
3. Sequence Order and Duration of Major works
4. Indication of Works executed by Joint Venture Partner's and Sub contractor's.
5. Critical Operations or Activities of Construction
6. Environmental Survey and Monitoring Activities
7. Timing for Site Delivery of Materials.
8. Time for Sectional Completion, if any.
9. Testing and Commissioning Schedule
10. Time Completion of the Whole Works

The Bidder shall prepare his proposed equipment and manpower utilization schedule as supporting documents in separate form. The utilization schedule shall be prepared in the time frame schedule, fully describing the number of each equipment for each type and/or capacity to be utilized and the number of workforce for each category of manpower with identification of foreign/local and skilled/unskilled utilized to major work activities.

The Construction Schedule shall be prepared in the form of arrow diagram by adoption of Critical Path Method (CPM) or Program Evaluation and Review Technique (PERT) or other appropriate proposed by the bidder with necessary indications of milestones for construction activities as enumerated above.

Geotechnical Investigation with Analysis Plan and Expected soil improvement

[Insert Geotechnical Investigation with Analysis Plan and Expected Soil Improvement]

The Bidder shall submit a comprehensive geotechnical investigation with analysis plan and method of expected soil improvement with tentative proposal for the scale of the soil improvement in accordance with the technical specification “4.5 GEOTECHNICAL INVESTIGATION AND ANALYSIS REPORT” including assignment of Senior Geotechnical Engineer and capable consultant for investigation and analysis.

Safety Plan

[Insert Safety Plan]

The Bidder shall submit Safety Plan detailing all necessary rules, regulations, programmes and procedures to be implemented on the Site in respect of safety aspects and emergency procedures for the respective work components. The Safety Plan is fully and shall be effectively implemented throughout all areas of the Site. As part of the campaign to ensure an accident-free working environment on the Site, and to better the understanding of the issues involved.

The safety plan and statement of safety shall be prepared in the form of statement of A4 size sheets supported by illustrations, figures, tables, etc. in maximum A3 size sheets.

Safety Plan and Statement of Safety shall follow “the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects”.

Refer to: https://www.jica.go.jp/english/our_work/types_of_assistance/c8h0vm00008zx0m8-att/guidance_en.pdf

Form PER -1: Proposed Personnel*[insert day, month, year]*Bidder's Legal Name: *[insert full name]*IFB No. *[insert number]*Page *[insert page number]* of *[insert total number]* page

[The Bidder shall provide the names of suitably qualified personnel to meet the specified requirements stated in Section III, Evaluation and Qualification Criteria, Clause 1.1.2.]

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

**As listed in Section III.*

Form PER -2: Resume of Proposed Personnel

[insert day, month, year]

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

Joint Venture Party Legal Name: *[insert full name]*

IFB No. *[insert number]*

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

[The Bidder shall provide the data on the experience of the personnel indicated in Form PER-1, in the form below:]

Name of Bidder

Position							
Personnel information	<table border="1"> <tr> <td>Name</td> <td>Date of birth</td> </tr> <tr> <td colspan="2">Professional qualifications</td> </tr> </table>	Name	Date of birth	Professional qualifications			
	Name	Date of birth					
Professional qualifications							
Present employment	Name of employer						
	Address of employer						
	<table border="1"> <tr> <td>Telephone</td> <td>Contact (manager / personnel officer)</td> </tr> <tr> <td>Fax</td> <td>E-mail</td> </tr> <tr> <td>Job title</td> <td>Years with present employer</td> </tr> </table>	Telephone	Contact (manager / personnel officer)	Fax	E-mail	Job title	Years with present employer
	Telephone	Contact (manager / personnel officer)					
	Fax	E-mail					
Job title	Years with present employer						

[Summarize professional experience over the last 20 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.]

From	To	Company / Project / Position / Relevant technical and management experience

Form EQU: Equipment

[insert day, month, year]

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

Joint Venture Party Legal Name: *[insert full name]*

IFB No. *[insert number]*

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

[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, Clause 1.1.3. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.]

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

Omit the following information for equipment owned by the Bidder.

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

Bidders 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 Forms included hereunder:

Form ELI -1, Bidder Information Form
Form ELI -2, Bidder's Party Information Form
Form CON, Historical Contract Non-Performance
Form FIN -1, Financial Situation
Form FIN -2, Average Annual Construction Turnover
Form EXP -1, General Construction Experience
Form EXP -2(a), Specific Construction Experience
Form EXP -2(b), Construction Experience in Key Activities
Form FIR -1, Financial Resources
Form FIR -2, Current Contract Commitments

Form ELI -1: Bidder Information Form

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

IFB No.: *[insert number]*

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

[Bidders shall provide the following information:]

Bidder's legal name

[insert full name]

In case of a JV, legal name of the representative member and of each member:

[insert full name of each member in the JV and specify the representative member.]

Bidder's actual or intended country of registration:

[insert country of registration]

Bidder's actual or intended year of incorporation:

[insert year of incorporation]

Bidder's legal address in country of registration:

[insert street/ number/ town or city/ country]

Bidder's authorized representative information

Name: *[insert full name]*

Address: *[inset street/ number/ town or city/ country]*

Telephone/Fax numbers: *[insert telephone/fax numbers, including country and city codes]*

E-mail address: *[insert E-mail address]*

1. Attached are copies of original documents of

☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.3.

☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1.

2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -2: Bidder's Party Information Form

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

IFB No.: *[insert number]*

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

[The following form is additional to Form ELI-1, and shall be completed to provide information relating to each JV member (in case the Bidder is a JV) as well as any specialist subcontractor proposed to be used by the Bidder for any part of the Contract resulting from this process.]

Bidder's legal name: <i>[insert full name]</i>
Bidder's Party legal name: <i>[insert full name of Bidder's party]</i>
Bidder's Party country of registration: <i>[insert country of registration]</i>
Bidder's Party year of incorporation: <i>[insert year of incorporation]</i>
Bidder's Party legal address in country of registration: <i>[insert street/ number/ town or city/ country]</i>
Bidder's Party authorized representative information Name: <i>[insert full name]</i> Address: <i>[insert street/ number/ town or city/ country]</i> Telephone/Fax numbers: <i>[insert telephone/fax numbers, including country and city codes]</i> E-mail address: <i>[insert E-mail address]</i>
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 4.3. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form CON: Historical Contract Non-Performance

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

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

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

IFB No. *[insert number]*

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

[The following table shall be filled in for the Bidder and for each member of a JV]

1. History of Non-Performing Contracts

Non-Performing Contracts			
<input type="checkbox"/> Contract non-performance did not occur since 1 st January <i>[insert year]</i> , in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.1, as appropriate.			
<input type="checkbox"/> Contract(s) not performed since 1 st January <i>[insert year]</i> , in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.1, as appropriate, is(are) indicated below:			
Year	Non- performed portion of contract	Contract Identification	Total Contract Amount (current value, currency, exchange rate and USD equivalent)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[insert complete contract name, number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for non performance: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>

1. Pending Litigation

Pending Litigation				
<input type="checkbox"/> No pending litigation in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.2, as appropriate.				
<input type="checkbox"/> Pending litigation in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.2, as appropriate, is indicated below:				
Year of dispute	Amount in dispute (currency)	Outcome as Percentage of Net Worth	Contract Identification	Total Contract Amount (current value, currency, exchange rate and USD equivalent)
<i>[insert year]</i>	<i>[insert amount]</i>	<i>[insert percentage]</i>	Contract Identification: <i>[indicate complete contract name, number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/ city/ country]</i> Matter in dispute: <i>[indicate main issues in dispute]</i> Status of dispute: <i>[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]</i>	<i>[insert amount]</i>

3. Litigation History

Litigation History		
<input type="checkbox"/> No court/arbitral award decisions against the Bidder since 1 st January <i>[insert year]</i> , in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.3, as appropriate.		
<input type="checkbox"/> Court/ arbitral award decisions against the Bidder since 1 st January <i>[insert year]</i> , in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.3, as appropriate, are indicated below:		
Year of award	Contract Identification	Total Contract Amount (current value, currency, exchange rate and USD equivalent)
<i>[insert year]</i>	Contract Identification: <i>[indicate complete contract name, number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Matter in dispute: <i>[indicate main issues in dispute]</i> Party who initiated the dispute: <i>[indicate "Employer" or "Contractor"]</i> Status of dispute: <i>[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]</i>	<i>[insert amount]</i>

Form FIN -1: Financial Situation

[The following table shall be filled in for the Bidder and for each member of a JV.]

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

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

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

IFB No. *[insert number]*

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

1. Financial data

Type of Financial information in (currency)	Historic information for previous <i>[insert number]</i> years (amount in currency, currency, exchange rate, USD equivalent)				
	Year 1	Year 2	Year 3	Year 4	Year 5
Statement of Financial Position (Information from Balance Sheet)					
Total Assets (TA)					
Total Liabilities (TL)					
Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Information from Income Statement					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Profits After Taxes (PAT)					

2. Financial documents

The Bidder and its parties shall provide copies of the financial statements for *[number of years]* years pursuant the Prequalification criteria or Section III, Evaluation and Qualification Criteria Sub-Factor 2.3.1, as appropriate. The financial statements shall:

- (a) reflect the financial situation of the Bidder or in case of JV, of each member, and not of an affiliated entity (such as parent company or group member).
 - (b) be independently audited or certified in accordance with local legislation.
 - (c) be complete, including all notes to the financial statements.
 - (d) correspond to accounting periods already completed and audited.
- ☐ Attached are copies of financial statements* for the *[number of years]* years required above; and complying with the requirements.

* 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 -2: Average Annual Construction Turnover

[The following table shall be filled in for the Bidder and for each member of a JV]

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

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

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

IFB No. *[insert number]*

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

Annual Turnover Data (Construction only)			
Year	Amount and Currency	Exchange rate	USD equivalent
<i>[indicate year]</i>	<i>[insert amount and indicate currency]</i>	<i>[insert applicable exchange rate]</i>	<i>[insert amount in USD equivalent]</i>
Average Annual Construction Turnover *			

* Total USD equivalent for all years divided by the total number of years, in accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3.2, as appropriate.

Form FIR -1: Financial Resources

[The following table shall be filled in for the Bidder and for each member of a JV]

Date: *[insert day, month, year]*
 Bidder's Legal Name: *[insert full name]*
 Bidder's Party Legal Name: *[insert full name]*
 IFB No. *[insert number]*
 Page *[insert page number]* of *[insert total number]* page

[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, Sub-Factor 2.2 (Following Prequalification), or Sub-Factor 2.5.1 (Without Prequalification), as appropriate.]

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

Form FIR -2: Current Contract Commitments

[The following table shall be filled in for the Bidder and for each member of a JV]

Date: *[insert day, month, year]*
 Bidder's Legal Name: *[insert full name]*
 Bidder's Party Legal Name: *[insert full name]*
 IFB No. *[insert number]*
 Page *[insert page number]* of *[insert total number]* page

[Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued, in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2 (Following Prequalification), or Sub-Factor 2.5.1 (Without Prequalification), as appropriate.]

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

Form EXP -1: General Construction Experience

[The following table shall be filled in for the Bidder and for each member of a JV]

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

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

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

IFB No. *[insert number]*

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

[Identify contracts that demonstrate continuous construction work over the past [number] years pursuant to Section III, Evaluation and Qualification Criteria (Without Prequalification), Sub-Factor 2.4.1. List contracts chronologically, according to their commencement (starting) dates.]

General Construction Experience			
Starting Year	Ending Year	Contract Identification	Role of Bidder
<i>[indicate year]</i>	<i>[indicate year]</i>	Contract name: <i>[insert full name]</i> Brief description of the Works performed by the Bidder: <i>[describe Works performed briefly]</i> Amount of contract: <i>[insert amount in currency, mention currency used, exchange rate and USD equivalent]</i> Name of Employer: <i>[indicate full name]</i> Address: <i>[indicate street/number/town or city/country]</i>	<i>[insert "Prime Contractor (single entity or JV member)" or "Subcontractor" or "Management Contractor"]</i>

Form EXP -2(a): Specific Construction Experience

[The following table shall be filled in for the Bidder and for each member of a JV]

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

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

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

IFB No. *[insert number]*

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

[Fill out one (1) form per contract, in accordance with Section III, Evaluation and Qualification Criteria (Without Prequalification), Sub-Factor 2.4.2(a).]

Contract of Similar Size and Nature			
Similar Contract No. <i>[insert number] of [insert number of similar contracts required]</i>	Information		
Contract Identification	<i>[insert contract name and reference identification number, if applicable]</i>		
Award Date	<i>[insert day, month, year, e.g., 15 June, 2015]</i>		
Completion Date	<i>[insert day, month, year, e.g., 03 October, 2017]</i>		
Role in Contract <i>[check the appropriate box]</i>	Prime Contractor		
	Single entity <input type="checkbox"/>	JV member <input type="checkbox"/>	
Total Contract Amount	<i>[insert total contract amount and currency(ies)]</i>		USD <i>[insert exchange rate and total contract amount in USD equivalent]</i>
If member in a JV, specify participation in total Contract amount	<i>[insert a percentage amount]</i>	<i>[insert total contract amount and currency(ies)]</i>	USD <i>[insert exchange rate and total contract amount in USD equivalent]</i>
Employer's Name:	<i>[insert full name]</i>		
Address:	<i>[indicate street / number / town or city / country]</i>		
Telephone/fax number	<i>[insert telephone/fax numbers, including country and city area codes]</i>		
E-mail:	<i>[insert E-mail address, if available]</i>		

Similar Contract No. <i>[insert number] of [insert number of similar contracts required]</i>	Information
Description of the similarity in accordance with Sub-Factor 2.4.2(a) of Section III:	
1. Physical size of required works items	<i>[insert physical size of items]</i>
2. Complexity	<i>[insert description of complexity]</i>
3. Methods/Technology	<i>[insert specific aspects of the methods/ technology involved in the contract]</i>
4. Other Characteristics	<i>[insert other characteristics as described in Section VI, Works Requirements]</i>

Form EXP -2(b): Construction Experience in Key Activities

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

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

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

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

IFB No.: *[insert number]*

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

[Fill out one (1) form per contract, in accordance with Section III, Evaluation and Qualification Criteria (Without Prequalification), Sub-Factor 2.4.2(b).]

1. Key Activity No (1): _____: *[insert brief description of the Activity, emphasizing its specificity]*

Total Quantity of Activity under the contract: _____

Contract with Similar Key Activities			
Item	Information		
Contract Identification	<i>[insert contract name and number, if applicable]</i>		
Award Date	<i>[insert day, month, year, e.g., 15 June, 2015]</i>		
Completion Date	<i>[insert day, month, year, e.g., 03 October, 2017]</i>		
Role in Contract <i>[check the appropriate box]</i>	Prime Contractor Single entity <input type="checkbox"/>	JV member <input type="checkbox"/>	Management Contractor <input type="checkbox"/>
			Subcontractor <input type="checkbox"/>
Total Contract Amount	<i>[insert total contract amount and currency(ies)]</i>		USD <i>[insert Exchange rate and total contract amount in USD equivalent]</i>
Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year <i>[Insert extent of participation indicating actual quantity of key activity successfully completed in the role performed]</i>	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:	<i>[insert full name]</i>
Address:	<i>[indicate street / number / town or city / country]</i>
Telephone/fax number	<i>[insert telephone/fax numbers, including country and city area codes]</i>
E-mail:	<i>[insert E-mail address, if available]</i>

2. Activity No. (2) _____

3. Activity No. (3) _____

Form ACK

Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans

A) I, *[insert name and position of authorized signatory]*, being duly authorized by *[insert name of Bidder/members of joint venture ("JV")]* (hereinafter referred to as the "Bidder") to execute this Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans, hereby certify on behalf of the Bidder and myself that all information provided in the Bid submitted by the Bidder for *[insert Loan No and name of the Project]* is true, correct and accurate to the best of the Bidder's and my knowledge and belief. I further certify, on behalf of the Bidder, that:

- (i) the Bid has been prepared and submitted in full compliance with the terms and conditions set forth in the Guidelines for Procurement under Japanese ODA Loans (hereinafter referred to as the "Guidelines"); and
- (ii) the Bidder has not, directly or indirectly, taken any action which is or constitutes a corrupt, fraudulent, collusive or coercive act or practice in violation of the Guidelines and is not subject to any conflict of interest as stipulated in the relevant section of the Guidelines.

<If debarment for more than one year by the World Bank Group is NOT imposed, use the following sentence B).>

B) I certify that the Bidder has NOT been debarred by the World Bank Group for more than one year since the date of issuance of Invitation for Bids.

<If debarment for more than one year by the World Bank Group has been imposed BUT three (3) years have passed since the date of such debarment decision, use the following sentence B').>

B') I certify that the Bidder has been debarred by the World Bank Group for a period more than one year BUT that on the date of issuance of Invitation for Bids at least three (3) years had passed since the date of such debarment decision. Details of the debarment are as follows:

name of the debarred firm	starting date of debarment	ending date of debarment	reason for debarment

C) I certify that the Bidder will not enter into a subcontract with a firm which has been debarred by the World Bank Group for a period more than one year, unless on the date of the subcontract at least three (3) years have passed since the date of such debarment decision.

D) I certify, on behalf of the Bidder, that if selected to undertake services in connection with the Contract, the Bidder shall carry out such services in continuing compliance with the terms and conditions of the Guidelines.

- E) I further certify, on behalf of the Bidder, that if the Bidder is requested, directly or indirectly, to engage in any corrupt or fraudulent action under any applicable law, such as the payment of a rebate, at any time during a process of public procurement, negotiations, execution or implementation of contract (including amendment thereof), the Bidder shall report all relevant facts regarding such request to the relevant section in JICA (details of which are specified below) in a timely manner.

JICA's information desk on fraud and corruption (A report can be made to either of the offices identified below.)

- (1) JICA Headquarters: Legal Affairs Division, General Affairs Department

URL: <https://www2.jica.go.jp/en/odainfo/index.php>

Tel: +81 (0)3 5226 8850

- (2) JICA Bangladesh office, General Affairs Section
Bay's Galleria (3rd Floor), 57 Gulshan Avenue.
Dhaka, Bangladesh

Tel: +(880-2) 989-1897

The Bidder acknowledges and agrees that the reporting obligation stated above shall NOT in any way affect the Bidder's responsibilities, obligations or rights, under relevant laws, regulations, contracts, guidelines or otherwise, to disclose or report such request or other information to any other person(s) or to take any other action, required to or allowed to, be taken by the Bidder. The Bidder further acknowledges and agrees that JICA is not involved in or responsible for the procurement process in any way.

- F) If any of the statements made herein is subsequently proven to be untrue or incorrect based on facts subsequently determined, or if any of the warranties or covenants made herein is not complied with, the Bidder will accept, comply with, and not object to any remedies taken by the Employer and any sanctions imposed by or actions taken by JICA.

Authorized Signatory

[Insert name of signatory; title]

For and on behalf of *[Insert name of the Bidder]*

Date:

Form of Bid Security

(Bank Guarantee)

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: The Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority (BEZA),

Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

IFB No.: FDIPP/BEZA/Pkg1

Date: *[Insert date of issue]*

BID 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 the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof]* (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of Land Development Works for Bangladesh Special Economic Zone under the Loan Agreement No. JICA L/A NO. BD-86.

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 *[insert amount in words]* (*[insert amount in figures]*) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

- (a) has withdrawn its Bid during the period of bid validity set forth in the Applicant's 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 Bid Validity Period or any extension thereto provided by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to Bidders of the Beneficiary's bidding documents.

This guarantee will expire and shall be returned: (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 issued to the Beneficiary in relation to such contract agreement; or (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)]

[Note: All italicized text is for use in preparing this form and shall be deleted from the final product.]

Section V. Eligible Source Countries of Japanese ODA Loans

Eligible Source Country(ies) for Procurement of all goods and services to be financed out of the Japanese ODA loans are all countries and areas of the World.

BIDDING DOCUMENTS

For

**PROCUREMENT OF LAND DEVELOPMENT
WORKS FOR BANGLADESH SPECIAL
ECONOMIC ZONE DEVELOPMENT UNDER
FOREIGN DIRECT INVESTMENT
PROMOTION PROJECT (FDIPP)
(Part 2 of 3)**

Employer: BEZA (Bangladesh Economic Zones Authority)

Country: Bangladesh

Project: Foreign Direct Investment Promotion Project
(FDIPP)

Loan No.: LA No. BD-P86 (December 13, 2015)

PART 2 –Works Requirements

Section VI. Works Requirements

Contents

- A) Scope of Works
- B) Specifications
- C) Supplementary Information
- D) Drawings

Section VI: Works Requirements

Scope of Works

1. Description of the Works

The scope of works is as follows:

A. LAND DEVELOPMENT WORKS

- A-1) Land reclamation works for about 200ha EZ, access road, retention canal and pond
- A-2) Slope protection works surrounding 200ha EZ
- A-3) Rainwater drainage, fencing & detour community road

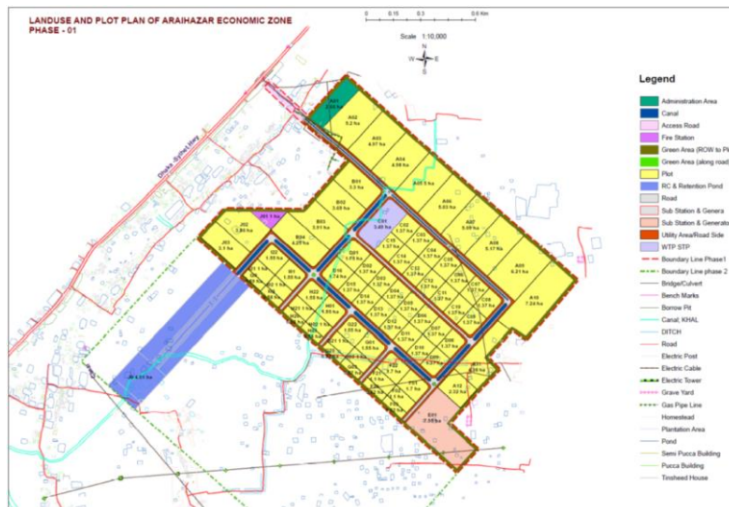
B. ACCESS ROAD WORKS

- B-1) Culvert for rainwater drainage and community movement
- B-2) Slope protection and retaining wall works
- B-3) Road pavement works
- B-4) Street lighting works

C. RETENTION CANAL, RETENTION POND & PUMPING STATION

- C-1) Retention canal works
- C-2) Retention pond works
- C-3) Pumping station and gate structure

2. Project Site Plan



Section VI:
Works Requirements

Specifications

Part-1: Land Development

Part-2: Access Road

Part-3: Retention Canal, Retention Pond & Pumping Station

Section VI:
Works Requirements

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SECTION 1: GENERAL CONDITIONS AND REQUIREMENTS

1.1 INTRODUCTION

These technical specifications are part of the bid documents for the Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP).

These Specifications shall apply to all such works to be executed involving the Land Development Works. In every case, the Work shall be carried out to the satisfaction of the Engineer and conform to the location, lines, dimensions, cross-sections, etc shown on the Drawings or in the Bill of Quantities (BOQ) or as indicated by the Engineer. The quality of materials, processing of materials as may be needed at the site, salient features of the Land Development work and quality of finished works shall comply with the requirements set forth in the succeeding Sections and Sub-sections. Where the Drawings and Specifications describe a portion of the work in only general terms and not in complete detail, it shall be understood that only the best general practices are to prevail, materials and workmanship of the best quality are to be employed and instructions of the Engineer are to be fully complied with.

1.2 GENERAL REQUIREMENT

The Technical Specifications (Part of Part-2) applicable to this contract shall be read in conjunction with other bid documents namely Part-1: Invitation for Tender, (IFT), Instructions to Bidder (ITB), Bid Data Sheet (BDS), Evaluation and Qualification Criteria (EQC), Bidding Forms (BF), Eligible Source Countries of Japanese ODA Loans, Part-3: Conditions of Contract and Contract Forms (CCC), Section VII: General Conditions (GC), Section VIII : Particular Conditions (PC), Section IX: Annex to the Particular Conditions - Contract Forms and BOQ & Drawings and other related documents together with any addendum issued in accordance with the Section I: Instructions to Bidder.

The specifications in accordance with which the entire work under the contract shall be completed by the Contractor have been described in the following:

General and Site Facilities, Specification for Civil Works

Notwithstanding anything contained in the Conditions of Contract, the Contractor shall be deemed to have visited the sites and by his own independent observation and enquiry, acquainted himself fully with local conditions, accuracy of the local records, accessibility of the sites (including working areas) and full extent and nature of all operations necessary for the full and proper execution of the contract, including, but not limited to the following:

- a) availability of potable water and electricity,
- b) space for construction of temporary works, labour accommodation, etc.
- c) the character of soil, water table, extremes of weather and other natural conditions,
- d) the supply and use of labour, transportation of materials, equipment and plant,
- e) all other things necessary for the proper construction, completion and maintenance of the work according to Conditions of Contract, Specification and Drawings,
- g) labour law and any other law that may affect the Contractor.

The specifications call for specific tests of materials, testing methods and standards: In addition to Bangladesh Standard (BDS), other equivalent international standards have been mentioned in the specification for the convenience of the Contractor. Materials shall be in accordance with BDS, ASTM, AASHTO or other International Standards.

The Contractor shall be responsible for ensuring that necessary tests of materials and measurement of works are carried out in order to ensure that quality of work is maintained

Section VI: Works Requirements
Specification Part-1: Land Development

as per requirement of this specification. Due allowance in the Contractor's program of work shall be kept for necessary testing of materials.

1.3 SCOPE OF WORKS UNDER THIS CONTRACT

The Contract comprises the works, completion and maintenance (defect liability period) of all works in accordance with the drawings, specifications, terms and conditions of the Contract, the Schedule of Items and Bill of Quantities (BOQ) including all labour, materials, construction plant, temporary works and everything whether of a temporary or permanent nature required for such construction, completion and maintenance.

The scope of work under this contract shall be Land Development works as followings:

- Item no. 1 - Erection and maintenance of site office
- Item no. 2 - Site improvement by dredged sand, sandy silt;
- Item no. 3 - Site improvement by carted earth (Clay);
- Item no. 4 - Mechanical compaction of earth or sand;
- Item no. 5 - Supply, making & laying Geo-textile bags filled with sand;
- Item no. 6 - RCC Works (for reference, if necessary)
- Item no. 7 - Supplying, fabrication and fixing Ribbed or deformed bar reinforcement, and (for reference, if necessary)
- Item no. 8 - Land rent for laying service pipe line

Preparatory Works: Including mobilization, demobilization, site survey, site preparation, temporary facilities, and other associated works as follows:

- a) The contractor shall arrange the sufficient number of pipelines for carrying the dredged sand from river belt to work site as demand of work and stated in Section III: Evaluation and Qualification Criteria (Equipment) and Section II: Works requirements (Supplementary Information).
- b) The contractor shall submit the works methodology with detailed drawing and it will be approved by the Engineer.
- c) The Contractor shall at all times maintain the pipelines over the existing roads, rivers and canals and take all necessary measures for the safety of traffic, pedestrians and workers. The Contractor shall provide, erect, operate and maintain signs, markings, lights, barricades and traffic control equipment in accordance with the Bangladesh Road Transport Authority's Traffic Signs Manual, unless otherwise directed by the Engineer. The Contractor shall provide and maintain all detours, temporary roads, temporary bridges, necessary barricades, boring, warning lights and signs as well as other equipment at all hours during the day or night

Where construction interferes with the existing roads, track and footpaths, other than as noted above, provision shall be made to a similar standard that existed prior to the works for the free movement of traffic and pedestrians. The Contractor shall take all necessary steps to avoid or minimize delays and inconvenience to road users during the course of the works

Payment for these item under Preparatory Works shall be deemed to be included by the contractor in his rates for the items of the works.

1.4 QUALITY CONTROL OF MATERIALS AND WORK

1.4.1 General

It shall be the responsibility of the Contractor to ensure that the materials incorporated

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and works carried out satisfy the quality requirements spelt out in the specifications. For this purpose, the Contractor shall carry out all the tests required by the specifications on materials at the laboratories approved by the Engineer. The Contractor should submit the same to the Engineer for his approval. Additional tests may also be conducted where, in the opinion of the Engineer, the need for such test exists. In the absence of clear indications about the frequency of tests for any item, procedures and tests as directed by the Engineer shall be followed. The cost for making any test shall be borne by the Contractor. It shall be clearly understood that no work shall be considered for payment unless it fully satisfies the quality requirements of the specifications in respect of both the materials and work.

1.4.2 Equivalency of Standards and Codes

Wherever reference is made in the contract to specific standards and codes to be met by the materials, plant and other supplies to be furnished, and work performed or tested, the provisions of the latest current edition or revision to the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the contract. Where such standards and codes are national, other authoritative standards that ensure substantial equivalences to the standards and codes specified will be accepted subject to the Engineers prior review and written approval.

1.4.3 Inspection and Approval of Material Sources

1.4.3.1 Natural Aggregate.

At least 14 days prior to procurement and haulage of the materials to site, the Contractor shall inform the Engineer in writing of the sources, he proposes to use and provide results of tests on representative samples thereof. The Engineer shall have inspected the materials sources, and if so required, the Contractor shall provide samples of the materials at his own cost for enabling the Engineer to have the tests carried out from the approved laboratories.

The materials will be permitted to be hauled to site of works only after approval of the material source by the Engineer. Despite the Engineer's approval, it shall be the responsibility of the Contractor to procure and haul to site materials of approved quality. The materials hauled to site shall be permitted to be incorporated in the works only after their passing the Quality Control Tests.

1.4.3.2 Manufactured Materials

For manufactured materials like Geo Textile, the source for procurement will be approved by the Engineer based on manufacturer's test certificate. The Contractor shall take all the necessary measures and precautions to store the materials at site so that these do not deteriorate in quality.

1.4.4 Quality Control of Materials at Site Prior to Incorporation in the Works

1.4.4.1 Natural Aggregate

The Contractor shall be responsible for properly stacking the filling materials brought to the site in such a manner that these do not get contaminated with mud and organic/deleterious matter. He shall carry out all the necessary quality control tests, to demonstrate that the materials he proposes to incorporate in the works conform to the quality requirements of the specification. All the results of the tests shall be documented on suitable proforma and the same shall require approval by the Engineer.

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1.4.4.2 Manufactured Materials

For manufactured materials like Geo Textile bag, the Contractor shall furnish the Engineer the manufacturer's test certificates with each lot of materials delivered to site and these shall be the basis for acceptance. However, in case of any doubt about the quality or where deterioration in quality because of poor storage condition is detected, the Engineer would order the relevant quality tests to be carried out from approved laboratories at the cost of the Contractor. The Engineer's decision in this regard shall be final and binding on the Contractor.

1.4.5 Checking and Approval of Materials and Work

For regular and systematic Control over the Quality of the Materials and Work, the Contractor shall send a request to the Engineer's representative for any inspection, checking and approval. The proforma for making the checking request shall be as approved by the Engineer. The request should be sent to the Engineer's representative at least 24 hours prior to proposed time for checking.

In case any material is not approved, the Contractor shall promptly remove the same from Site of Works. In case of work, the Contractor should carry out the corrective measures as instructed by the Engineer.

The Contractor shall be allowed to proceed with further stages of work only after the earlier stage has been checked and approved.

1.4.6 Rejected Materials

The Contractor at his own costs shall immediately remove all materials refused or rejected by the Engineer from site.

1.4.7 Removal of Defective and Non-Conforming Work

If any material incorporated or work performed by the Contractor is found to be defective and non-conforming to the specifications, the same shall be removed and replaced by the Contractor as per directions of the Engineer in accordance with the Conditions of Contract.

1.5 SITE SAFETY AND SECURITY REQUIREMENT

1.5.1 General Safety and Security at Site

The Security provision has been presented in two parts and the contractor shall consider the provisions as presented in Sl. 1.5.1 (General Safety and Security at Site) together with Sl. 1.5.2 (Special Safety and Security at Site) of this specification. The special Specification covers facilities and services that will be considered to mitigate, deter and defend against attacks of the nature of terrorism on all site facilities during the contract period.

The Contractor's responsibility for the security and safe working environment of the site commences from the time possession is given to him by the Engineer.

As soon as possible after possession has been given, the boundary of the site shall be marked out, and the Contractor shall submit to the Engineer for approval of his proposals for maintaining the boundary and the security within.

The Contractor's proposals shall include a security control system which shall consist of sufficient equipment and personnel to prevent unauthorized access and which can meet the prevailing circumstances to ensure the safety and security of persons and property on the site;

The Contractor shall erect and maintain at his own expense suitable and approved temporary fencing and gates to enclose certain areas of the works being carried out, the office and accommodation compounds, and other areas of land as may be necessary implement his obligations under the contract or as directed by the Engineer.

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All authorized persons shall be registered by the Engineer and this register shall be provided and maintained by the Contractor.

(a) Safety Organization, Safety Activities, Health and Safety Measures

- A. In establishing a “culture of safety” on site as required on all Japanese ODA Projects, the Contractor shall ensure human safety and respect for basic human rights in its operations throughout the contract period. The Contractor shall adhere to the guidance for the Management of Safety for Construction Works in Japanese ODA Project which can be downloaded from the following JICA website;

https://www.jica.go.jp/english/our_work/types_of_assistance/c8h0vm00008zx0m8-att/guidance_en.pdf

- B. The Contractor will be responsible for the safety of the public adjacent or passing through the Site. All excavations, and similar locations where the Contractor’s equipment or items may create potential danger to the public, must be barricaded and sign-posted to the satisfaction of the Engineer and the Contractor provide sufficient watchmen to ensure the safety of the public at all times. All existing pedestrian routes shall be maintained in a safe condition unless and until an alternative route is provided to the satisfaction of the Engineer.

Excavated materials shall be kept away from the edges of the trench to provide a clear berm of safe width. Where this is not possible, the design of protection for the trenches shall include for the additional load due to the surcharges of excavated materials. Flashing lights etc. shall be provided in the area. All such barricades, warning signs and lights shall comply with the relevant by-laws and regulations and shall be to the satisfaction of the Engineer and the local authority concerned.

The Contractor shall also provide, at his own cost, necessary watchmen and guards for the proper protection of public, works, temporary works, materials, plants, equipment until clearance of site.

All work must be carried out in such a way as to minimize danger to the public or the workmen on the Site.

- C. The Contractor shall provide safety management organization and mobilize the relevant personnel and resources prior to the commencement of any construction work, after then an emergency response flow chart shall be established.
- D. The Contractor shall in addition to complying with the specific requirements of the General Conditions and with the national standards of the Government of Bangladesh in respect of navigable waterways shall comply with all orders and directions given by the Engineer in respect of the safety of navigation and with requirements for marking, watching and lighting any structure, craft or equipment which may be used in the construction of the works.
- E. The Contractor shall take all necessary precautions and measures to avoid interruption of service of the existing ferry or navigation as a consequence of his temporary work or construction of the permanent work.
- F. The Contractor shall submit Project Health and Safety Plan, and Safety Audit Plan for the Engineer’s approval in accordance with relevant Health and Safety provisions of the Contract Documents.

The Contractor shall implement and maintain the safety activities (such as Daily Safety Inspection, Report and Statistic Records, Weekly Safety Walk with all parties, meetings, Monthly Safety Mass Meeting, etc.) following the Approved Project Health and Safety Plan, and Safety Audit Plan.

The Contractor shall provide Safety Hazard Identification and Safety Risk Analysis including safety counter measures for each work item and shall provide Material

Section VI: Works Requirements
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Safety Data for any hazardous material or chemicals prior to the usage of such at site and enclose it in the Methods Statement of the relevant construction work.

The Contractor shall provide Safety barricades for any Temporary Works (including roadways, footways, guards and fences) which may be necessary, during the execution of the works, for the use and protection of the public and of owners and occupiers of adjacent land.

- G. The Contractor shall observe and strictly comply with the applicable Laws and Regulations in relation with public health and safety in construction site and incorporate all such requirements into the Project Health and Safety Plan.
- H. The Contractor shall implement all measures to ensure health and social hygiene of all workers and personnel engaged in the project. The Contractor shall comply fully with all instruction given by the Engineer regarding promotion program and publication of measures to prevent and monitor HIV or AIDS and other epidemic diseases and to follow any recommendations of the relevant authorities or from the WHO guidelines. In the event that the Engineer issues instructions for the Contractor to install publication boards, distribute posters or notices to workers, implement any hygienic control within labour camps or in any part of the Site, etc., the Contractor shall follow such instructions strictly and execute the required works and measures promptly.
- I. The Contractor shall submit monthly Safety Report to the Employer and the Engineer in accordance with the approved Project Health and Safety Plan and include a statement in his monthly Interim Payment application. Otherwise, an amount equivalent to 10% of the interim payment for that month will be held until issuance of the monthly Safety Report to the satisfaction of the Engineer.

(b) Fire Precautions

Adequate precautions shall be taken against fire throughout all the Contractor's and Sub-Contractor's operations. Quantities of flammable materials on living accommodation, sheds, workshops and stores and site shall be kept to an absolute minimum, and shall be properly handled and stored. The Contractor shall arrange at site sufficient 3kg capacity multipurpose ABC dry chemical powder stored pressure type fire extinguisher with manometer system. The extinguisher shall be of the type suitable for repeated use complete with wall brackets, discharge valve, hose pipe and easy refilling system. In addition to that, sufficient buckets for sand and water shall also be provided at site. Proper arrangements shall be made to hang the extinguishers as well as buckets. The Contractor shall arrange for periodic inspection by the local fire authority and shall co-operate with the said authority to promptly carry out their recommendations at his own expense.

(c) Diversion or Upholding of Existing Services

The Contractor shall divert, at his own cost and to the approval of the Employer/Engineer, any power, water, gas or other services encountered during the progress of the works. Where diversion of services are not required in connection with permanent works, the Contractor shall uphold, maintain and keep the same in working order in existing locations. Notwithstanding the above, necessity of diversion of (a) existing two gas transmission pipelines with diameters of 14 inches and 20 inches running through in the targeted Economic Zone (as described in Supplementary Information (2)) and (b) 230kV power transmission line running above the Economic Zone will be considered by Employer, and that cost shall not be included in the Bid price.

(d) Protection of Materials, Plants etc.

The Contractor shall arrange security guards for the protection of materials and plant, pipeline against theft, pilferage etc. The Contractor shall provide temporary fencing and/or watching and lighting deemed necessary for the purpose. Such security shall be in force for the entire period of construction.

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(e) Control of Noise, Vibration and Dust Nuisance

To minimize annoyance and provide a healthy environment at the working site as well as to its surroundings, the Contractor shall take appropriate and adequate measures to control noise, vibration and dust nuisance. All noise generating sources shall be identified and provisions to be made for attenuating airborne and structure borne (vibrations) effects.

(f) Precaution to Control Pollution

The Contractor shall take necessary precaution to control pollution of the environment. All effluent should be properly treated prior to disposal. Among others care should be taken to control unburnt fuel in the exhaust of engines, proper sanitation and sewage disposal etc.

(g) Cost Allocation and Measurement

The Contractor shall provide and satisfy all safety requirements specified in the table below as a minimum, and comply with all provisions as stipulated in the relevant Clauses of the Contract Documents. The Contractor shall be fully responsible for the health of workers and safety of all operations and activities of the Works throughout the entire Contract period and for complying with all laws and regulations in relation to health and safety of workplace and workers including implementation of all measures and payment of any fines and penalty imposed by the relevant authorities.

The Contractor shall allocate all the necessary costs for complying with the health and safety requirements in all respect as part of his overhead cost and include into the unit prices and rates of the relevant Pay Items in the BOQ. No payment other than for those items listed in the pay items shall be referred to and accordingly measured and made. And all provided equipment, facilities and goods shall be properties of the Contractor

Table: Minimum Safety Requirements to be satisfied

Sl	Description	Standard/Requirement	Quantity	Unit
1	Safety Manager	Over 15-year construction supervision & over 6 year safety officer	30	Man-Month (MM)
2	Safety supervisor	Over 5 years construction supervision	30	MM
3	Safety reports & meetings	Daily safety report, weekly safety report, monthly safety report, weekly safety meeting, monthly safety mass meeting and any other meetings required by the Engineer.	30	MM
4	Safety sign boards	Every 20m or as required by the Engineer, safety attention boards.	400	each
5	Safety banners	Every 200m or as required by the Engineer, safety slogan banners.	40	each
6	Personal protection equipment	Helmets, safety shoes, safety wear & gloves, safety goggles (if any), safety belt (if any) etc.	Every workers and personnel present on site.	
7	Safety access	Safety platform, scaffolding boards, walkways, shades/covers, hand rails (two layers), ladders, safety access stairs.	Relevant work places following the contractor's work Plan.	

Section VI: Works Requirements
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1.5.2 Special Safety and Security Requirements

In addition to the General Safety and Security at Site in S1. 1.5.1 of the general specifications, The Contractor shall provide for safety and security at site including advance technology security measures with Walkie-Talkie arrangements and remote monitoring facilities.

The following items shall be considered together with items listed in Table 1.5.2.01. The quantities provided in Table 1.5.2.01 are only for guidance in the Contractor's comprehensive proposal preparation on Special Safety and Security at Site. Actual quantities shall be established based on obtaining site conditions, Contractor's mobilization, and detailed security proposals which shall be submitted by the Contractor for approval by the Engineer and the Employer.

- Contractor's Base Camp (including office and laboratory)
 - Security lighting along the perimeter.
 - CCTV cameras along the perimeter with central monitoring facilities.
 - Manned watch towers.
 - ID Cards with photos to all personnel working in the base camp.
 - Visitor Passes to all visitors.

A professional armed security service from a Government-sanctioned organization with Walkie-Talkie arrangements to be operating from the Contractor's base camp providing dedicated 24-hours security services, also covering the Engineer's Site Office including armed security personnel for accompanying the Expatriates on inspection visits to sites and other offices.

- The total number of security personnel (armed Ansars) should be fixed to approx, 18 based on an assumption that 10 Ansars will be engaged for 24 hours security at base camp and boundary of the construction site, 4 Ansars will be ready to accompany with Expatriates during their site visit and the remaining 4 Ansars will be engaged at Employer/ Engineer's site offices. However, the utilization of Ansars may be rearranged by the Contractor in consultation with Engineer in advance. The Contractor will arrange the security for which the Employer/Engineer will provide all necessary assistance and coordination with security agencies to deploy them.
- Work Sites
 - Security lighting and personnel.
 - Facilities for web-based remote monitoring of work sites through Internet Protocol (IP) Cameras and associated equipment installed at each of the ongoing works sites and appropriate software applications for remote monitoring from project offices and smart-phones.
- Employer's Site Offices
 - Security lighting and CCTV cameras on the building exterior/ boundary wall as appropriate.
 - 2 Armed security personnel (Ansars) for accompanying the Employer on inspection visits to work sites and other offices.

All camera system shall be connected to the Employer's core office and Engineer's office at Dhaka and site offices as well, and to the Contractor's Base Camp. Prior to provision of safety and security at site as outlined above, the Contractor shall submit a comprehensive proposal detailing the proposed facilities, services, equipment and number of personnel for the Engineer's acceptance.

Table 1.5.2.01: List of special security and safety tools at Base Camp, construction site and Site Offices:

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Item No.	Equipment Items	Unit	Quantity
(a)	Security camera (CCTV camera or PTZ camera)	no	25
(b)	Security camera system	no	1
(c)	Alarm system (4 nos bidirectional sirens, 8 nos mini sirens)	no	1
(d)	Walk through metal detector system	no	1
(e)	Walkie-Talkie sets	no	10
(f)	Watchtower	no	8
(g)	Brick boundary wall with barbed wire spiral type around the base camp and site offices	m	400
(h)	Zinc steel boundary wall with barbed wire spiral type specified in the BOQ (Temporary fence)	m	Approx. 6500 m
(i)	Light posts for security	no	24
(j)	Temporary shed for armed security (Ansars),specified in the BOQ	No	1
(k)	Bus for security staffs' transposition	no	1
Item No.	Security Staffs	Unit	Quantity
(l)	1 Chief and 1 Sub-chief Security Inspectors	man	1
(m)	Security Inspectors (1 person x 3 shifts)	man	3
(n)	Security Officers (Ansars and other persons x 3 shifts) specified in the BOQ (Armed Security guardsman)	man	54 54x30= 1620 MM

Installation of Security Camera

(a) CCTV Cameras (including cabling)

The entire surveillance system is designed to control and monitor the project sites/Contractor's base camp, and ensure coverage of perimeter, utility areas, critical installations and internal access points. The construction sites and base camp shall have IP Fixed dome Close Circuit TV (CCTV) camera to monitor all activities in 24 hours. The CCTV camera shall be full HD IP CC camera which has 1080p real-time video streams, 120dB wide dynamic range with 3D digital noise reduction. The features of this product along with Technical Specifications are summarized as follows:

Table 1.5.2.02: Requirements of CCTV Cameras

Product Feature	Specification
CCTV Type	Bullet or Equivalent
Sensor	1/3" CMOS Sensor
Lens	Min. 4mm
Video Resolution	2MP
Day/Night	Auto
IR	50 meter
IP Camera	IP Camera

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CCTV Usage	Outdoor/Weather proof (IP66 requirement)
Vandal Resistant	IK 10
Other Features	POE (Power over Ethernet)

(b) Security Camera System

The required software to operate CCTV camera will be highly scalable having enterprise level solution and also provide Video Surveillance solution. The system shall be capable of working on latest Windows as and Windows Server platforms. The system software should function followings but not limited to:

- It should support free distribution to multiple machines (total five monitors;
- 1 in base camp, 1 in Employer's site office, 1 in Engineer's site office, 1 in Employer's core office in Dhaka and 1 in Engineer's office in Dhaka);
- Its package should be open on open platform/standard media player;
- It must support all upgrades and releases at free of cost during construction period;
- It must allow operation with a PC keyboard or mouse;
- It will have built in a web server, making it accessible for configuration using a standard Internet browser (data backup at least in two storages, 30 days storage at 15 fps);
- It must be compatible to support advanced analytics software which should be able to perform followings;
- Intelligent Motion Detection
- Left item detection
- Theft item detection
- Objecttracking
- It must ensure coverage of perimeter, utility areas, critical installations and internal access points in base camp.

(c) Warning Alarm System for Emergency Action

The Warning Alarm system is comprised of AC motor siren, alarm switches, and all of which shall be installed at different locations in base camp. Mini sirens should be installed so as to ensure that they are heard from all points within the facility. The salient features of Warning Alarm System shall include following minimum requirements.

Table 1.5.2.03: Requirements of Warning Alarm System at Base Camp

Alarm Features	Specification
Bi-directional AC motor	Flash mounting
siren	AC voltage 220v with big size at pole stand
Alarm switch	1 for each watchtower, 1 for control room, 1 for Main gate
Master switch	1 for control room
Mini AC motor siren	Flash mounting, AC voltage 220v
Pole stand for big siren	20 ft long

(c) Security Gates

The gates should have adequate strength to prevent a forced entry. There should be a separate pedestrian entry gate. The Contractor shall submit detailed drawing design of the

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vehicle gate facilitated with pedestrian entry separately and obtain Engineer's approval prior to its execution.

(d) Walk Through Metal Detector System

The metal detector shall be installed at front gate of base camp in order for access control, which shall be portable and water tight having vibration indication and operation system with bright LED light. Its item description includes following Technical Specifications or equivalent;

Table 1.5.2.04: Requirements of Metal Detector System at Main Gate

Item description	Specification
Alarm indication	Steady yellow
LED	Target detection by green LED, Power flushing by red LED, Low voltage directive
Alarm sound	Buzzer pattern, Red LED vibration mode,
Battery	9V alkaline or Lithium battery life 30-40 hrs or Alkaline battery life 28hrs
Temperature	-15°C to 45°C
Frequency	25Hz
Reset time	0.5 sec, and automatically
Under vehicle search mirror	1 for security guard at main gate
Hand held metal detector	1 for security guard at main gate

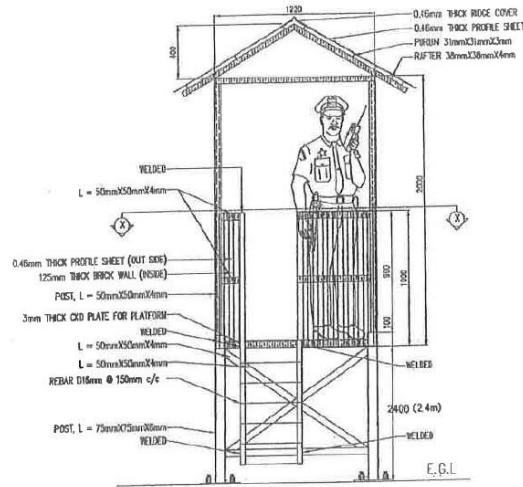
(e) Security Control Room

A 12 sqm space shall be earmarked in the office complex for the Security Control Room (SCR).

(f) Watchtower

The watchtower should be sited at an inter-se distance of 400 m as the distance which a guard can effectively observe with the help of binoculars is 200 m. The number of watchtowers will be determined by the length of the perimeter. The height of watchtower shall be determined in such a way that the platform shall be raised at 2.4m height from existing ground level from where the security guard can easily visualize base camp vicinity. Size and material specifications of each member of watchtower are shown below based on which the Contractor shall submit detailed drawing and obtain Engineer's approval prior to its execution.

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Schematic diagram of watchtower

(g) Boundary Wall with Barbed Wire

The Contractor's base camp shall be fully fenced with brick wall which will be supported by RC grade beam-column and lintel beam and topped with barbed wire provided that no unauthorized person can enter the camp by jumping from outside. The boundary wall along with size specifications are summarized as below, however the Contractor shall submit drawing of boundary layout including details of a 3m strip wall and seek Engineer's approval prior to construction.

Table 1.5.2.05: Specification of Wall Boundary Facilitated with Barbed Wire

Item description	Specification
Boundary wall	Masonry type
	3m strip
	Thickness 12.5 mm, Height 2.4m
	RC grade beam-column lintel beam supported
Barbed wire spiral type (Razor wire)	Length same as boundary wall
	0.5 meter dia. on boundary wall top 0.3meter pitch
	Galvanized wire or equivalent
	Weight 0.345 kg/m length
	Angle bar

(h) Security Lighting

The Contractor shall install 'Security Lightings' at the suitable locations inside base camp and boundary parameter so that the security guard from watchtower can easily visualize the entire vicinity of base camp at night time. A minimum lux level requirement of 30 lux is necessary based on Illuminating Engineering Society Standards. The locations where security lighting is to be installed will be based on the requirement of surveillance of critical areas (access points, perimeter and vital installations). It will be designed with adequate height (more than 2m) and also considering base camp size. A sample view of

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base camp lighting and perimeter lighting is shown below based on which the Contractor shall submit detail drawing including lighting specification and arrangement, and obtain Engineer's approval prior its installation.



Sample view of Security Lighting inside Base Camp



Sample view of Perimeter Lighting

(i) Temporary Shed for Armed Security

(a) Temporary shelter/Office (30 sqm)

The temporary shelter shall be 30 sqm semi-permanent type brick structure with CI roof and false ceiling underneath and the floor should be furnished with ceramic tiles with approved quality. This shelter is necessary for armed security forces where they will take rest beyond their duty hours. It shall be constructed at desirable location inside base camp and facilitated with sufficient ventilation, electrification, lighting, fan, toilet facilities etc. ensuring comfortable environment for living.

(b) Bulletproof shelter for armed security personnel

A Bulletproof Shelter shall be constructed at main gate of base camp where at least three security personnel shall be present stand by with armed forces for 24 hours a day. Their service should be arranged under shifting schedule (8 hours/day) provided that the base camp shall be protected and restricted from the entrance of unauthorized person.



Bullet proof shelter roof

(j) Maintenance of Security System

The Safety and Security System including necessary devices/software as described in this Clause shall be properly maintained deploying system operator (s) including one (1) for Dhaka office. The system should be kept functional ensuring adequate power supply or alternative power source from generator in case of load shedding. Prior to this system execution, the Contactor shall submit his comprehensive plan and proposal addressing all safety and security issues and obtain Engineer's approval accordingly.

1.5.3 Measurement and Payment

Payment for all of the items, materials required and actions taken relating to Site Safety and security as discussed above in Sub-Clause 1.5.1: General Safety and Security at Site will be deemed to be included by the Contractor in his rates in the items of works. The Sub-Clause 1.5.2: Special Safety and Security at Site under Clause 1.5: Site Safety and Security Requirement, will be deemed to be included by the Contractor in his lump sum rates for the items of BOQ.

1.6 USABLE WATER ON SITE

The Contractor himself shall make arrangement for procuring, transporting, storing, distributing and applying the water needed for all construction work purposes. No direct

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payment will be made for providing water, the cost of which shall be included in the rates tendered for the various items of work for which water is needed.

Only clean potable water, free from undesirable concentrations of deleterious materials, shall be used. All water sources used shall be approved by the Engineer. The Contractor shall by no means withdraw ground water to such an extent that tube wells in the neighbourhood fall dry and drinking water facilities are disturbed unless the Contractor guarantees supply to the effected persons.

1.7 SETTING OUT

The Contractor shall layout the Site positions based on the approved site plan and carry over PWD/SoB Bench-Mark (BM) at site, property lines, average ground level (AGL), formation ground level (FGL), plinth levels (PL), setting and marking all pillars, marker, pegs etc. in red paint, showing and maintaining reduced levels (RL) including locating, establishing, protecting all public utilities within the premise of work.

Payment for these Item shall be deemed to be included by the contractor in his rates for the items of the works

1.8 QUALITY MANAGEMENT SYSTEM

A strategic approach to the implementation mechanism of the project is of vital importance for its successful completion according to design, on time and within budget. The Contractor is responsible for achieving the quality standards specified in the contract and to identify a correct and effective strategy and work plan to analyse the type and extent of works.

The Contractor shall prepare and operate a Quality Management System Plan (QMS) complying with ISO 9001. The Contractor shall submit his QMS to the Engineer for approval within three weeks of the award of contract. The QMS shall be reviewed, updated and resubmitted for approval as necessary throughout the contract period.

Major components of QMS shall cover Mobilisation Plan, Manning Schedule, Engineering and Administrative Management of the Contract, Implementation Schedule, Procurement Schedule, Cash Flow and Financial Resources Management, Quality Control of Work, detailed Work Plan, Site Safety requirements, Environmental Protection etc. The QMS shall specifically address the procedures for maintaining the project quality requirements with respect to the use of subcontractors, vendors and suppliers. The QMS shall reflect the criticality of the items or materials concerned. The Engineer shall approve the criteria for assessment of criticality. The Contractor's QMS shall also include post-construction activities during the Defects Liability Period.

The Contractor must obtain the approval of the Engineer in writing before commencing each stage of the Works. Approval will be based on satisfactory quality control tests on the preceding stage and other requirements of the specification. On completion of a part of the works they shall be inspected and approved by the Engineer in accordance with the QMS. Only Works approved after inspection will be deemed to be measurable for payment.

The Contractor shall cooperate with the Engineer and provide all necessary access to the works, testing laboratories and records to enable the Engineer to assess the Contractor's Quality System and to audit the implementation of the QMS and the approved procedures.

Production of the document, distribution, training and any other costs associated with the Contractors Quality Management System will be deemed to be included by the Contractor in his rates for the Works.

1.9 SHOP DRAWINGS

The Contractor will prepare Shop Drawings for the items of works which have not been explicitly detailed in the construction drawings attached with these bid documents.

The Contractor will submit the shop drawings to the Engineer for approval. The fabrication work will only commence after approval by the Engineer.

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Payment for the shop drawing shall be deemed to be included by the contractor in his rates for the items of the works.

1.10 SIGN BOARDS

1.10.1 Description

The Contractor shall provide one project profile sign board for the site of the size not exceeding 1 m x 2 m, and maintain them in good condition. All information on the signboards will be written in English and Bengali. The signboards will be positioned on a steel frame as directed by the Engineer. The Contractor shall submit proposals for the materials of the signboards, the text layout (in English and Bengali) on an approved yellow background and installation of the signboards on Site to the Engineer for approval. The sign board shall show:

- the name of the Project
- the name of the Employer
- all other details as required by the Engineer

The Contractor shall maintain the sign boards and remove them on completion of the Works or when instructed by the Engineer. Prior to installation of sign board, approval for design, size, etc. shall be approved by the Engineer.

1.10.2 Basis of Payment

Payment for this item shall be deemed to be included by the contractor in his rates for the items of the works.

1.11 AS-BUILT DRAWINGS

The Contractor shall furnish one complete set of As-built drawings on electronic format (on a CD) and three complete sets (A-2 size) of prints of As-built drawings, showing the permanent works as actually constructed, within one month of completion of the Works. Included in the sets of As-built Drawings will be revisions of Tender Drawings and Drawings supplied to the Contractor during the Contract as well as revisions of drawings supplied by the Contractor during the Contract. The As-built drawings submitted by the Contractor will be subject to the approval of the Engineer. The Engineer will supply information required on title blocks.

Payment for this item shall be deemed to be included by the contractor in his rates for the items of the works.

1.12 CLEARANCE OF SITE ON COMPLETION

On completion of the works the contractor shall clear away and remove from the site all construction plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and works clean and in workman like conditions to the satisfaction of the Engineer/Consultant at his own cost.

SECTION 2: TEMPORARY WORKS AND FACILITIES

2.1 GENERAL

This section pertains to the mobilization and temporary works for the execution of the Works and the demobilization after the completion of the Works, which includes the removal of all construction equipment and materials from Site as well as the clean-up of the premises of the Site. It also refers to the supply and transportation of all construction equipment and other facilities for the completion of the Works together with incidentals necessary to maintain the said equipment. The maintenance of the Works from the Provisional Acceptance to the Final Acceptance.

2.2 TEMPORARY WORKS

2.2.1 Safety of Temporary Works

Before any Temporary Works are commenced, the Contractor shall submit, at least fourteen (14) days in advance to the Engineer for approval, his proposals for all Temporary Works including drawings and calculations.

Notwithstanding the approval by the Engineer of any submitted design for any of the Temporary Works, the Contractor shall remain entirely responsible for such works in all aspects. The Engineer shall be at liberty to require modifications to the Temporary Works in accordance with the Conditions of Contract. Unless otherwise specified, the Contractor shall carry out such modifications at his own expense.

In the event of the Contractor considering that such modifications required by the Engineer affect the security of the Temporary Works or increase the Contractor's liability under the Contract, he shall give notice in writing to the Engineer within seven (7) days. The Engineer will thereupon review and assess the matter.

The Contractor shall take full responsibility for the stability and safety of interim sections or partially finished Permanent Works.

All of the Temporary Works shall be adequate for their intended uses and for all loads imposed without excessive settlement, deflection or deformation, sliding. All parts and members shall be properly supported, wedged, braced and secured to prevent displacement or failure.

2.2.2 Temporary Accommodation and Messing

The authorization for the occupancy by the Contractor of the area for his camp, storage and office use on the construction area in the project site would be secured on his responsibility by approved with the Engineer.

Any temporary field camp and services provided by the Contractor shall be established and operated in accordance with local regulations governing operation of temporary field camps, and/or the consent of the Engineer.

The Contractor shall obtain the necessary permits from the relevant authorities, prior to establishing of any camp outside the construction area.

After the completion of the Project, the Contractor shall dismantle and remove such temporary camp and the area shall be cleaned and reinstated.

2.2.3 Temporary Utilities and Services

It shall be the Contractor's responsibility to make the necessary arrangement for temporary utility services and to apply all necessary permissions for connection of existing power supply, water supply, telephone line and permit of construction for the Works as specified in this Specifications. These responsibilities shall include but are not limited to obtaining all necessary permits, approvals,

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payment of supervision expenses and compliance with all regulations etc. required by the relating Authority or Agency.

1) Water

The Contractor shall make the necessary arrangements for adequate water supply for safe drinking and other water on the Site, including provision of any storage tanks so that sufficient fresh water shall always be available during the execution of the Works. The quality, number, capacity and location of the installations shall be to the satisfaction of the Engineer, and conform with the requirements of the appropriate authorities.

2) Electricity

The Contractor shall make his own arrangements for the supply of all electricity for the execution of the Works. The Contractor shall install and maintain at his own expense a system of lighting to provide a sufficient degree of illumination over the area of the Works, offices and camp. He shall submit details of his scheme for the approval of the Engineer before any work commences.

3) Communication Facilities

The Contractor shall arrange for, provide, install and construct adequate and sufficient means of telecommunication for the use of the Engineer and the Contractor on the Site. The office of the Engineer shall be connected with the international communication system by telephone and internet system acceptable to the Engineer.

The running costs of communication for telephone (except international calls) and internet for the Engineer shall be included in the unit rates for such pay items entered into the Bill of Quantities.

4) Drains, Watercourses and Sanitary Facilities

All drains, pipes, channels, watercourses or streams and drainage structures temporarily cut through or disturbed by execution of the Contractor's Temporary Works are to be restored so that the water flowing in them may continue to flow in as full and free a manner as it did before the disturbance.

All the necessary precautions and measures shall be taken by the Contractor at his own cost in order to prevent the Site from any flooding, forming ponds or the like by providing and maintaining appropriate temporary drainage, watercourses, channels, etc. for smooth discharge of water flowing in or caused within the Site throughout the execution of the Works or unit such time that the permanent drains or channel required in the Contract have been completed and approved by the Engineer to cut or demolish such temporary drainage, watercourses or channels.

The Contractor shall provide normal sanitary facilities for use by his personnel, and they shall be kept in good sanitary conditions by the Contractor.

5) Waste and Rubbish

The Contractor shall carry out a regular daily clean-up and removal of trash, solid waste, construction debris, etc. in the Site and Temporary Work Yard. Disposal of such waste and rubbish to disposal areas, with regard to waste oil from machinery, hazardous materials, and through a specialized company authorized by city government for ordinary waste, generated by the works) shall be arranged and carried out by the Contractor.

6) Parking

The Contractor shall provide parking space for his mobile equipment and vehicles.

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7) Storage

The Contractor shall provide and maintain roofed open and/or closed temporary storage areas as necessary.

8) Temporary Fencing

Immediately on gaining possession of the construction area, the Contractor shall erect a work compound surrounded by a 1.3 meters high unclimbable fence of barbed wires as specified in the Bill of Quantities. Temporary gates in the fence shall be provided, at contractor's own cost, adequate to maintain the security of the area and shall be subject to the approval of the Engineer.

2.2.4 Safety Requirements

The necessary safety requirements relative to these Works are additional and/or complementary to those set forth by the Government and non-government entities that regulate such matters. The Contractor however, shall ensure that all safety measures at the Site be strictly undertaken.

1) Announcement and Notice Board

The Contractor shall maintain the Site in a safe condition for his employees. The Contractor shall install an announcement and notice board, 2 meters by 3 meters in size at a location agreed by the Engineer. Such board shall show the project's information including the area for public transport area and the area being used by the Contractor.

2) Construction Safeguard

Trenches which intersect thoroughfares shall be provided with temporary bridges or other suitable crossing in order for human and vehicular traffic to pass safely, according to the type of traffic, and with railings if necessary.

Deep trench excavation shall be provided with temporary timbering to prevent the works from failure due to earth pressure or similar.

Open shafts, openings in floors, ramps, platforms and other such conditions shall be protected by sturdy barricades or railings.

Scaffolds, ladders, ramps, hoists, and other facilities shall be provided, maintained and operated as necessary. Scaffolds shall be provided with enough strength and stiffness to support the weight of loads and any dynamic forces by construction efforts.

Storage and site work shop areas shall be provided, arranged and maintained at approved locations as necessary to properly store, handle and fabricate the various materials and facilities required.

3) Temporary Storm Water Drainage

Temporary drainage shall be provided in order to drain surface water to the open sea and to prevent the earth at the Site from excess water content.

4) Heavy Duty Crane or Mobile Equipment

When the Contractor uses a mobile duty crane or mobile equipment, he shall ensure that the foundation will have sufficient strength to support heavy loads.

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5) First-Aid and Fire Protection

a) Emergency Call

The Contractor shall determine the locations of the nearest and most available police, firemen, hospital or medical services. He shall maintain lists of such information at the Contractor's Site Office.

The Contractor shall provide the Engineer with the information mentioned above.

b) Fire Protection

The Contractor shall establish appropriate emergency routes and "means of escape" procedures and shall submit such plans to the Engineer. The Contractor shall maintain fire extinguishers, connected hoses and other facilities necessary for reasonable fire protection at the Site and the Temporary Work Yard.

c) Minor Injuries

The Contractor shall provide and maintain at the Contractor's Site Office reasonable quantities of bandages and sterile materials for the first-aid treatment of minor injuries.

d) Prior Arrangements with Local Hospital

The Contractor shall make prior arrangements with any Hospital in the vicinity of the Site, in order to provide medical assistance to any of his workers in the case of serious injuries which could occur during construction operations.

2.3 MOBILIZATION/DEMOBILIZATION

2.3.1 Mobilization

The Contractor shall mobilize, and employ all personnel, plant and equipment required to undertake the Works in conformity with his own detailed Master Schedule and methods of construction and proposed minimum equipment required in the Bid Documents will be formed of basis for payment as approved by the Engineer.

Mobilization shall include the provision, organization and transportation to the Site of materials, vessels, construction plant, equipment, staff and all necessary items for the execution and completion of the Works. Mobilization shall also include the setting up and the installation of all equipment, and all other plant until it is rendered operational.

In the event that repairs are beyond the ability of personnel or tools at Site to effect repairs in a reasonable time, then such constructional plant must be removed from the Site. The Contractor shall provide replacement machine or equipment or plant of a similar capacity neither without additional mobilization cost to the Employer nor extension of completion period for the Works.

Mobilization shall also include installation/construction of communication facilities, electricity and water supply lines and fixtures, temporary roads, sanitary and security facilities, temporary buildings for the project office, space requirements necessary for the efficient execution of the Works. Such facilities and temporary utilities shall be consented by the Engineer prior to its installation and construction. Additional equipment / plants shall be mobilized as the need arises consistent with the Detailed Construction Master Schedule.

2.3.2 Demobilization

Demobilization shall include dismantling and the removal of all construction equipment from the Site and the cleaning up of the Site as provided by the Contract.

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Demobilization shall include dismantling and removal of all temporary buildings, structures and utilities. However, the Employer reserves the right to retain any or all of the said facilities if he so chooses.

Demobilization shall include the removal of all supplementary markers furnished and installed by the Contractor, provided that the Employer has not taken the option to retain all or part of such markers. Only those markers which the Employer has released shall be removed by the Contractor. Demobilization shall include the authorized removal and disposal of debris and materials which have not been incorporated into the Contract. It should occur prior to the Contractor's final departure from the Project.

2.3.3 Final Cleaning

In the preparation for the Substantial Completion, the Contractor shall conduct an inspection of sight-exposed interior surfaces.

The Contractor shall remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior and exterior finished surfaces including glass and other polished lighting surfaces. The Contractor shall replace ventilating and air conditioning filters, if units were operated during the construction period. The Contractor shall sweep clean by broom all paved surfaces and rake clean all other ground surfaces.

2.4 THE CONTRACTOR'S SITE OFFICE AND THE ENGINEER'S / EMPLOYER'S SITE OFFICE

2.4.1 Contractor's Office on Site

The Contractor shall provide necessary Contractor's office in the project site, fixtures, equipment, furniture, etc. to maintain in approved manner to the Engineer during construction period, if necessary /requested by the Employer, to maintain until the duration of Defects Liability Period or as directed by the Engineer. Such Site Office, the Contractor shall provide the HIV/AIDS prevention room with health counselling room and meeting rooms, pantries, etc in his office.

The Contractor shall design aesthetically, structurally sufficient, weatherproof type suited to the prevailing climatic conditions and fully burglar-proof with Air conditioners and toilet including supply utilities such as power, water and sewerage.

The Contractors Site Office, unless otherwise stipulated elsewhere in the Contract, shall include all cost associated with requirements as indicated above and other incidental works for the completion of works satisfactory to the Engineer. No additional payment will be made in this regard and no claim will be permitted in connection with any such cost or costs.

2.4.2 Engineer's and Employer's Site Office and Laboratory

The Contractor shall provide and maintain site office during the construction period for the use of Construction Management Unit of Employer and the Consultant. The particulars of the site office shall be as below:

- The floor area of the office shall be min. 100 (one hundred) sqm.
- The floor area of the Laboratory shall be min 30 (thirty) sq.m.
- The site office with toilet facilities is to have a concrete floor with ceramic tiles on it, adequate foundation, brick walls, false ceiling of hard/plastic board with seasoned Garjan wood frame and painted, C.I. sheet/Profile roofing and all windows are to be glazed and provided with steel grill. Outside and inside wall surfaces are to be painted on plaster acceptable to the Engineer.

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- This office shall be protected against weather, dust, insects, noise and other nuisance to the satisfaction of the Engineer.
- The office shall be located in a position with access roads approved by the Engineer.
- Before construction, the contractor shall prepare an architectural plan of the proposed Site Office incorporating requirements of the employer and get it approved by the Engineer.
- The Contractor shall provide necessary number of furniture i.e. tables, chairs, almirahs, whatnots, etc. of design, standard and finish approved by the Engineer. The crockeries, tea sets, glass sets, door & window curtain shall have to be provided. The Contractor shall provide arrangement for conducting meetings at site.
- Necessary cleaning, washing, dusting of rooms and toilets shall be done by the Contractor by engaging his own personnel.
- The Contractor shall provide electricity, water, gas, firefighting extinguishers, internet connection system capacity having more than 20 persons and lighting, ceiling fans, Air Conditioners of required number and capacity to the satisfaction of the Engineer and the toilets shall be with tiles, wash basin, shower, high commode, and pan including water supply and sewerage facilities. The required number of electric bulb, ceiling fans, calling bells and electric power points etc. including IPS or standby generator of required number and capacity for emergency power supply shall be provided.
- The Contractor shall provide Computer with colour LED monitor, computer table, laser kjet printer, UPS, required office equipment/consumables like staplers, punches, pens & pencils, files, papers etc.
- The Contractor shall provide one fridge and water purifier of approved capacity.
- The office, complete with furnishings, fittings, access roads and hard standings shall be ready for occupation by the Engineer within 1 (one) month of the date when the Contractor first occupies the site, or as required by the Engineer.
- The Contractor shall provide first aid box, safety helmet, etc. as per requirement by the Engineer.
- The Contractor will arrange necessary security of the office, engage office peon and cleaner, etc.

At the end of the works of this contract, the site office with all materials, equipment, furniture, fittings, etc. will be the property of the Contractor.

All laboratory equipment shall be provided at the laboratory within fifty six (56) days after commencement of the works. All equipment shall be maintained by the Contractor or the sub-contractor in a serviceable condition and all measuring and control equipment shall be checked and calibrated from time to time as required by the Engineer, and immediately corrected or replaced if it is found to be inaccurate or defective.

The Contractor shall be responsible for all tests and quality control works and shall provide sufficient Laboratory personnel with the necessary number of Laboratory Aides in order to carry out the whole of the tests as they are defined in the Contract or as directed by the Engineer.

The personnel appointed by the Contractor shall be well-experienced in the type of work to be undertaken, and shall be subject to the approval of the Engineer. The Contractor shall provide all electrical power and water supply to the laboratory, furnished all consumables, reagents and chemical required for the smooth and proper functioning of the laboratory.

The Engineer's and Employer's Site Office and Laboratory, unless otherwise stipulated elsewhere in the Contract, shall be paid in accordance with the Bill of quantities. All cost associated with requirements as indicated above and other incidental works for the completion of works

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satisfactory to the Engineer shall be included into the unit cost in BOQ. No additional payment will be made in this regard and no claim will be permitted in connection with any such cost or costs.

2.5 HEALTH AND MEDICAL FACILITIES

2.5.1 Health and Medical Cares and HIV/AIDS Prevention Program

The Contractor shall take due precautions, at his own cost, to ensure the health and safety of all his own staff and labour as well as employees of the Employer and the Engineer on the site, in collaboration with the local health authorities. The Contractor shall ensure that medical staff, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps, housing and on the Site at all times throughout the period of the Contract and that suitable arrangements are made for the prevention of epidemics including HIV/AIDS and for all necessary welfare and hygiene requirements. All medical facilities provided under the Contract shall become the property of the Employer on completion of the Contract.

The Contractor shall provide for his workforce the appropriate means of protection against such diseases. The Contractor shall also undertake, throughout the duration of the contract and to the approval of the Engineer, an information and education program relating to socially transmitted diseases, including HIV/AIDS, for his workforce. The program shall be formulated, implemented and reviewed in conjunction with local health authorities involved in campaigns directed at such diseases. Education facilities and all information necessary for the program shall be provided by the Contractor.

In order to reduce the risk of HIV/AIDS infection spread caused by the Contractor's personnel, the Contractor shall conduct a prevention program which consists (i) Information, Education and Communication (IEC) campaigns, (ii) condom distribution and (iii) screening, diagnosis, counseling and referral to a treatment provider. The program shall implement in collaboration with the Employer and appropriate service provider. The target personnel of the program shall cover all those who work at or commute to the construction site including truck drivers and material suppliers regardless the form of employment contract. The Contractor shall instruct the target personnel to participate in the program in the course of their employment and during their normal working hours or any period of overtime provided for in the relevant employment contracts.

The Contractor shall prepare an implementation plan of the program to be approved by the Engineer within 56 days from the Commencement Date. The implementation plan shall include names of the service providers to be assigned for the program, method and schedule of the IEC campaigns, method of condom distribution and the testing methodology.

During the entire construction period, the Contractor shall continue implementing the program and submit reports to the Engineer every other month in both a hard copy and an electric file. The items to be included in the reports are described in the following table together with the required activities.

Components	Required activities	Items to be reported
IEC campaigns	Group sessions for the workers to promote awareness on HIV/AIDS and Sexual Transmitted Infection (STI) at least every other month.	Date, time, venue, contents and number of participants of each session, Response/questions from the participants, Proportion of the workers who

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		have attended the sessions at least one time to entire number of the workers working for three months or more at the project site.
Condom distribution	Condom distribution to the workers at no charge.	Number of distributed condom. (monthly and accumulated), Place and method of distribution.
Screening, diagnosis, counseling and referral to a treatment provider	For those of the workers who are interested, screening (testing), diagnosis and counseling for HIV shall be conducted as well as diagnosis of other STI at no charge. The opportunities of testing, diagnosis and counseling shall be provided at least every other month.	Date, venue and number of workers who received the services of testing, diagnosis and counseling.

The Contractor shall provide first aid outfit/s as may be required by subsequent amendments thereto and adequate supply of bed sheets, pillows, blankets, and lines. The Contractor shall employ permanently on site a Nurse and fully trained Medical Aide who shall be engaged solely for medical duties. The Contractor shall also provide on site a doctor one day within three months period for medical and consultancy services relating to health impacts of construction activities. The location of the medical room and any other arrangement shall made known to all employees by posting notices on prominent locations suitable within the Site.

DESCRIPTION	QUANTITY
Washbasin (hand) and a hot and cold water tap	1
Hospital Bed	1
Chairs	3
Office Table	1
Electric Kettles or other equipment for boiling water	1

2.5.2 STI / HIV Clinic

The Contractor shall provide the daily HIV/AIDS clinic services room of at least 30 m2 located inside the Contractor's Site Office Building throughout the duration of the Contract. The clinic services shall be able to provide STD diagnosis and treatment services, IEC (information, education and communication) on HIV/AIDS prevention at regular intervals for the Contractor's personnel and workers. The clinic service shall include the distribution of condom to the Contractor's personnel and workers free of charge.

2.5.3 Operation and Maintenance

The Contractor shall provide at his own cost and responsibility all power and water supply including communication facilities and all other services which may be normally necessary for the efficient running and maintenance to the Contractor's site office, and maintain, repair, replace and renew all furniture, fixtures and equipment, until the duration of Provisional Acceptance Period or as directed by the Engineer. .

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Should the Contractor fail to maintain, repair or replace any item when such is required or to supply any material, article or thing necessary within the times to be specified by the Engineer, the Engineer may execute or cause to be executed by others such maintenance, repair or replacing works and procurement and the Contractor shall pay therefore as certified by the Engineer or the Engineer shall have the right to deduct the sum from any money which is due or which will become due to the Contractor.

2.6 SUPPORTS TO THE EMPLOYER AND ENGINEER

2.6.1 Assistance to the Engineer

The Contractor shall render such assistance with facilities, labour, constructional plant and materials as at any time may be required by the Engineer directly or indirectly in connection with the Works

One experienced janitor shall be attached to the Engineer's Office and shall be at his disposal at all times. The Contractor shall also provide, when required, tradesmen, labourers, tools and equipment to assist the Engineer.

The costs of such assistance shall be deemed to be included in the pay items in the Bill of Quantities regardless that such pay items are separately scheduled or not scheduled. The assistance to the Engineer includes but not by way of limiting the items specified in these Specification.

2.6.2 Vehicle for Engineer's Use

1) General Requirement

Within forty-eight (48) days after the commencement date of the works, the Contractor shall provide the Engineer and his staff the following vehicles:

Type	Two unit of 4-wheel drive motor car with minimum 5 persons
A:	seating capacity, air conditioned for Construction Period.(2units x 30 months = 60months)

The vehicles shall be in a good working condition acceptable to the Engineer. All vehicles shall carry or be fitted with the accessories as may be described by laws and shall comply in all respects with all relevant nation or local laws, statutes and regulations.

All registration, renewal registration cost and other fees shall be borne by the Contractor. The Contractor shall accept that the Engineer can interrupt or restart the service of the car with 30 days notice. The car shall be for the sole use of the Engineer's site staff when in service.

The Contractor shall provide competent drivers for each abovementioned car. The service of the driver (or substituted driver) shall be available at all times during service of the car.

The Contractor shall provide fuel, oil, proper maintenance and repairs, road tax, comprehensive insurance for the Engineer's car.

If any vehicle is under repair or service, a replacement complying with the above requirements shall be made available. In the event of a failure to provide a replacement within three days, the Engineer is entitled to rent a replacement from other sources at the cost of the Contractor.

2) Operation and Maintenance

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The Contractor shall maintain all vehicles in first class condition and shall be supplied with appropriate fuel, lubricants, types, spare parts, etc. at all times during the construction period until the turned-over dates as specified here above. The Contractor shall provide well experienced drivers for all the above mentioned vehicles. He shall also provide all operation and maintenance including registration and comprehensive insurance needed for the proper operation of the vehicles.

In the event of a vehicle's breakdown or being taken out of service for maintenance, repair or any other reason, the Contractor shall furnish/rent another vehicle of equivalent standard and number to replace the one under repair, taken out of service for maintenance, or any other reason until such vehicle is operational.

Should the Contractor fail to maintain, repair or provide temporary replacement during breakdown within the times to be specified by the Engineer, the Engineer may execute or cause to be executed by others such maintenance, repair or replacing works and procurement and the Contractor shall pay therefore as certified by the Engineer or the Engineer shall have the right to deduct the sum from any money which is due or which will become due to the Contractor.

2.6.5 Protective Items

The Contractor shall provide for the use of the Engineer and the Employer, adequate protective items such as safety shoes and boots, waterproof top-coats, first-aid equipment, safety-jackets, hard hats and other safety equipment as required by the Engineer in connection with the Contract at his own cost.

2.6.6 Survey Equipment

The Contractor shall arrange the necessary survey instruments with transducer frequency of 200 KHz or equivalent, GPS accuracy of $\pm 30\text{cm}$ and a first class condition to execute the Works until the completion of the projects for Topographic. All survey instruments shall be made available when or where for the use of the Engineer as requested by the Engineer.

The Contractor shall submit to the Engineer a full survey instruments list for his approval and satisfaction within 14 days after the Commencement Date of the Works.

The Contractor shall make available manpower and every other assistance to the Engineer and his staff in carrying out their duties and shall provide pegs, poles, paint, lines and spirit levels and other materials and small tools as needed by the Engineer and his staff for checking and setting out and for the measurement of the work. The cost of shall be deemed included in the Inspection and tests.

Unless otherwise stipulated elsewhere in the Contract, all the Contractor's unit prices shall include any and all cost associated with requirements indicated herein. No additional payment will be made in this regard and no claim will be permitted in connection with any such cost or costs.

2.7 SURVEY WORKS

2.7.1 General

The Contractor shall be responsible for the execution of the surveys and investigation at pre-construction stage, Interim/During construction stage and "Post Construction Survey" Records including provisions and maintenance of all equipment, labours and any other things and matters necessary to execute the works.

All surveys shall be carried out with reference to the Benchmarks as designated by the Engineer. The Contractor shall install and maintain supplemental benchmarks adjacent to the project boundary at his own expense.

All items specified herein shall be carried out by the Contractor's licensed Geodetic Engineers (Surveyors). The Contractor shall submit in advance, for the consent of the Engineer, true copies of

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the licenses and qualification of the Geodetic Engineers (Surveyors) to be employed for the Works.

2.7.2 Submittals

The Contractor shall submit, for the Engineer's approval out before the commencement of the works, the list of equipment and machinery, working method and schedule, staffing and name of the laboratory where the test will be carried.

Field notes, calculation sheets and all other documents shall be prepared in the way approved by the Engineer and shall be submitted upon request of the Engineer. Upon completion of the works, the Contractor shall submit the survey and investigation report as required under the Contract for the Engineer's inspection and examination.

2.7.3 Items to be Surveyed

The Survey Works shall be undertaken in complementary with other related sections of Specifications. Survey works anticipated in the Contract are outlined as follows:

1) Topographic Survey (Pre-Construction)

The Contractor shall verify the topographic maps provided in the Drawings. Survey will be carried out by means of traversing and leveling and shall be drawn in the scale directed and/or approved by the Engineer and the survey area shall be covered the construction area in accordance with the quantities mentioned in BOQ .

The Contractor shall prepare, install and maintain temporary survey base points for significant base lines of Permanent Works, including the following:

- Project Boundary and Construction Limits
- Face line of the marine structures such as berth/quay to be directed by the Engineer.
- Edges of the reclamation/filling areas.
- Edges of the drainage channel areas
- Access Road Area
- Other areas as directed by the Engineer.

a) Interim Topographic Survey

Survey for filled area and subsequent works by means of step by step basis during the duration of the works as specified in the Contract Documents, Specifications or directed by the Engineer at contractor's cost. The data shall be the basis for confirming the works performed under the Contract and Interim Payment Certificates.

b) Post Topographic Survey

Post construction survey for the verification of completion of filling /reclamation and other works and the data will be used as the basic figures for Final Measurement and Payment Certificates.

2) Environmental Monitoring

As per the approved environmental impact assessment (EIA) by the department of environment (DOE) and the appraised EIA by JICA and disclosed on the JICA web site (ref. Article 2.8.1, Environmental survey by monitoring and protection measures of the site condition during the execution of works. The contractor shall carry out the monitoring on environmental condition during the construction period in accordance with Article 2.8 specified hereunder.

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3) Settlement Monitoring Survey

The Contractor shall monitor the progress of the settlement in the reclamation/ filling and other affected areas as directed by the Engineer during the construction period in accordance with the requirements as specified in Article 2.9.” Settlement Monitoring”.

4) Geographic Investigation and Analysis (Specified Provisional Sum)

The Contractor shall conduct the soil boring investigation for (five) 5 positions dolling 35m length of each point at designated area in the construction site directed by the Engineer the construction period in accordance with the requirements as specified in Sub-Clause “ Geographic Investigation and Report of Analysis”.

2.8 ENVIRONMENTAL MANAGEMENT

2.8.1 General

During the design and execution of the Works, the Contractor shall strictly conform to all requirements relating to the environmental protection as per the Sub-Clause 4.18 of the General Conditions of the Contract and detailed in this Works Requirements. The Contractor shall also strictly conform to all applicable Bangla environmental protection/management-related Laws and all current national/state codes and standards established by the concerned authorities, and other government agencies for environmental protection-management.

The Contractor shall avoid, minimize and mitigate, as per concerned laws and regulations and practicable good practices, the adverse effects of all its and the Subcontractors’ activities on the natural and social environment throughout the execution of the Works. Due to the JICA loan project, the Works must comply with not only Bangla regulatory requirements but also the JICA guidelines for environmental and social considerations, 2010 (following link #0) as well as “Additional” environmental monitoring requirements by JICA specified in Appendix 1 of this Work’s Requirements.

Link #0 JICA Guidelines for Environmental and Social Considerations 2010	https://www.jica.go.jp/english/our_work/social_environmental/guideline/pdf/guideline100326.pdf
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In order to adapt the project phases and unforeseen incidences throughout the construction period, the Contractor shall commit the environmental protection and social safeguards with the two step schemes, namely the first “Outline environmental management plan (EMP)” and the second “Method specific EMP.” It is the Contractor’s responsibility to monitor the compliances of the EMPs through its monitoring programmes and periodical reports. Once the Contractor, the Employer, or the Engineer recognize the non-compliances/violations of the EMPs including regulatory requirements, the Contractor must commit the compliance in time as per the instructions by relevant authorities, the Employer or/and the Engineer.

2.8.2 Frameworks for Environmental Protection and Management

Law and Regulations

The activities of the proposed economic zone project fall under the ‘red’ category according to the Bangladesh Environment Conservation Rules (ECR) 1997. In accordance with ECR, the Employer conducted an EIA study and obtained an environmental clearance from the DoE. The provisions of the EIA approval and the approved EIA are the most project specific and mandatory requirements for the Work. It is the Contractor’s responsibility to continuously comply with any updates or restrictions by applicable laws and regulations. The Contractor shall regularly communicate with

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relevant authorities to update the applicable laws and regulation and ensure the compliances of any updated and applicable changes. The following is a list of the primary laws and regulations. More detailed list including but not limited to environmental protection and social safeguards are given in the Table 2-1: Applicability of Key Environmental Legislation at a Glance, EIA.

- Bangladesh Environmental Conservation Act, 1995 (subsequent amendments in 2000 and 2002)
- Environment Conservation Rules (ECR), 1997 (subsequent amendments in 2002 and 2003)
 - Memo No: DoE/22.02.6700.140.72.101.18/H.O.-334, dated 27/5/2018, Approval of Environmental Impact Assessment (EIA) Report for Proposed Bangladesh Special Economic Zone Project at Araihaaz Upazila under Narayanganj district
- Environment Court Act, 2000 and subsequent amendments in 2002
- JICA Guidelines for Environmental and Social Considerations, April 2010

Rights and Licenses

The Contractor shall obtain, as required under the applicable Laws, all applicable permits and licenses including, but not limited to, the following permits and licenses on or before the starting relevant activity, save and except to the extent of a waiver granted by the relevant authorities of jurisdiction.

- a) Permission for extraction of sand from river bed
- b) Environmental clearance by DoE
- c) Permission for drawing water from river/reservoir
- d) Permission for borrowing earth
- e) Permission from relevant Authorities for cutting trees, and
- f) Any other permits or clearances required under the applicable Laws.

All permits and permissions obtained by the Employer have been included in this bid document. Any permit and permissions to be obtained during construction and beyond those that have been obtained by the Employer are the principally responsibility of the Contractor.

2.8.3 Environmental Management Plan and Enforcement

Based on the Contract, the Contractor shall appoint an environmental control manager for the appropriate implementation of the Works, who shall be responsible for preparing the outline EMP and the method specific EMPs, supervising the compliances of EMPs within the Contractor including all sub-contractors.

Firstly, the Contractor shall prepare its Work specific “Outline” EMP based on the approved environmental impact assessment (EIA) report approved by Department of Environment (DoE) (following link #1) and resettlement action plan (RAP) approved by the Employer (following link #2) with the given instructions (Appendix 1) within 49 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works] of the General Conditions. Secondly, upon the approval of the “Outline EMP”, the Contractor shall prepare and obtain the approval for its construction methodologies/plans attached with each “Method specific EMP” that shall demonstrate assurance of environmental protection and enforcement of necessary counter measures as per the outline EMP as well as requirements under the Contract. All potentially affected areas within and in the vicinity of the project site, as instructed by relevant authorities, the Employer and the Engineer, shall be covered by both outline and each method specific EMPs.

Link #1	https://www.jica.go.jp/english/our_work/social_environmental/id/asia/south/bangladesh/c8h0vm000090rzis-att/c8h0vm0000cyvu7u.pdf
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Link	#2	https://www.jica.go.jp/english/our_work/social_environmental/id/asia/south/bangladesh/c8h0vm000090rzis-att/c8h0vm0000czwlj7.pdf
RAP 2018		

2.8.4 Monitoring and Reporting

The Contractor shall take full responsibility to continuously commit the compliances of the given requirements. In order to confirm the commitments, the Contractor shall prepare overall monitoring programmes in the outline EMP first and obtain the approval from the Employer and the Engineer before any physical work. Once the Contractor finalizes its design and construction methodologies and plans, the Contractor shall update the outline EMP by the method specific EMP.

Due to the technical requirements for the sampling and testing, the Contractor shall appoint a qualified environmental monitoring agency to conduct the periodical sampling surveys and ecological surveys as well as prepare qualified standard reports. The detailed instructions to prepare the outline EMP should be referred to the Appendix 1.4 of this Works Requirements.

It is mandatory requirement of the Contractor to prepare periodical monitoring reports to the Employer as well as DoE as per the approved EIA and this Works Requirements. The detailed instructions to prepare the monitoring report should be referred to the Appendix 1.4 of this Works Requirements.

2.8.5 Measurement and Payment

All the costs for the provision of Sub-section 2.8 of Environmental Management shall be deemed to be included with all other payment items in the Bill of Quantities and shall not be measured and paid except the items specified herein after.

2.9 SETTLEMENT MONITORING

1) General Provisions

The Contractor shall monitor progress of the settlement in the reclamation/ filling and other affected areas shown on the Drawings due to consolidation of the existing cohesive sub-soils and/or other reclamation fills.

The Contractor shall make due allowances for settlement and consolidation of both the reclamation fill material and the existing ground during the construction period. The profiles and reclamation levels shown on the Drawings are those of the completed reclamation at the date of certified completion for the reclamation works. The certification of the completion of the reclamation works is acceptable values of the initial settlement to be recorded in the settlement monitoring, which is assumed to take about two months after filling up to designated level. After certification of the initial settlement by the Engineer, subsequent works could be started at area by area approved by the Engineer. Before handover works, additional filling at the settlement area shall be required to be the designated final ground level (FGL). These filling costs for the allowance and additional filling such as loose material rate to filled material, transportation loss of material, compaction loss of material and initial consolidation settlement loss of material shall be included in the unit rates of filling work. Any loss and reducing ratio and consolidation of filled material would not be added for BOQ and contract cost.

2) Preparation, Placement and Maintenance of Monitoring Device

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Prior to the reclamation and filling works, the Contractor shall prepare, install and maintain settlement monitoring plate and rod at locations directed by the Engineer.

The Contractor shall supply and install settlement gauges of the type and number shown in the following Table for the settlement monitoring of the existing seabed in the course of reclamation and take measurements of settlement once a week or as directed by the Engineer, during the whole period of the filling works and submit a monthly report to the Engineer for each set of measurements.

Settlement Monitoring Requirement

Type of Settlement gauge	No. of gauge	Depth of installation below the final ground level
Settlement plate and rod gauge for the upper layer	1 per 30,000 sq.m of filling area (200 Ha)	Approximately 4m +2.8m (Av.Existing grand level) +6.8m (Av. Final Grand Level)

The settlement gauges shall, in principle, be of the double tube steel post structure with a steel bed plate welded to the bottom and supporting steel rods. The Contractor shall submit a drawing showing the construction of settlement gauges to the Engineer for prior approval. The location of settlement gauges and time of installation shall be approved by the Engineer.

Settlement gauges shall be fixed on a foundation with clear filling as soon as the toe of the filling reaches the proposed position of any gauge.

The levels of the original ground bed surface and of the base plate shall be recorded. All gauges shall be securely fixed or guided into position until such time as the fill is sufficiently deep to hold them in position.

The Contractor shall allow for the supply, installation, maintenance, lengthening and re-leveling as directed, protection by approved heavy stakes, taking levels as directed, finally removing or cutting off the pipe or rod upright as directed, and all other expenses of whatsoever nature in connection with the devices.

3) Monitoring Program

The Contractor shall regularly monitor the settlement on a time schedule and at an appropriate frequency as directed by the Engineer.

The Contractor shall be responsible for the monitoring works throughout the period. The markings on the rod shall be surveyed in order to measure the settlement as changes in the elevation of the markings.

The reading of the monitoring rods shall be submitted to the Engineer for the consent after recording. The following readings on all gauges shall be taken by the Contractor at weekly or as directed by the Engineer and a signed copy of the log shall be lodged with the Engineer within two (2) days of the taking of the readings of;

- a) reduced levels of the base plate and indication of the amount of settlement up to the time of reading;
- b) level of reclamation, with the actual date of change of applied level, if any ;
- c) level of the grand water, if directed;
- d) any other information as directed by the Engineer.

SECTION 3: CIVIL WORKS REQUIREMENTS

3.1 SAND FILLING

3.1.1 Description:

Site Development/Improvement by carted/dredged sand (free from any organic, foreign, environmental hazard substances) carried by head or truck or any other means in/c cost of cutting/dredging of sand, carrying, placing the sand in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.

3.1.2 Method of Sand filling:

Sand for filling is to be collected from Meghna River bed as described in Part 2: Works Requirement (Supplementary Information). Before starting the work the contractor shall submit the methodology of work which shall need approval of the Engineer.

3.1.3 Method of Measurement:

The worksite or filling area will be divided into small regular sections such as square or rectangular section of 10m x 10m or 3m x 5m or any other suitable dimension. Each sectional area is then multiplied by the average of corner ordinates or reduced levels (RL) of that section taken from pre-work contour levels and add the whole volume. This volume is termed as volume reference to zero (o) level. The square or rectangular sections at slope will be adjusted mutually to take into account the shape of the slope. Then the total sectional area is multiplied by the post-work level (average level after filling) of the filled area. The difference between post work and pre work volume is the actual filled volume of site or filling area as per BOQ item.

Measurement for which payment will be made for filling shall be the quantities of completed work in place determined by the method described above. The ground level elevations shown on the plan will be used as original level.

3.1.5 Basis of Payment:

Payment for filling will be made at the contract unit price per Cum measured as provided above which price shall be for full compensation for materials, dredging and carrying by ship, carrying from ship to project site by pipeline in mechanical process, placing, levelling and shaping of fill materials in layers and furnishing of all equipment, tools, incidentals such as overhead, profit, taxes, etc. necessary to complete the work.

Before handover works, additional filling at the settlement area shall be required to be the designated final ground level (FGL). These filling costs for the allowance and additional filling such as loose sand material rate to filled material, transportation loss of material, compaction loss of material and initial consolidation settlement loss of material shall be included in the unit rates of filling work. Any loss and reducing ratio and consolidation of filled material would not be added for BOQ and contract cost.

Notwithstanding the above, in case that the average consolidation value of the total reclaimed area surveyed during construction (except the area to be improved the soil and the soil improvement area proposed by the Contractor) would be over 10cm larger than the estimated average settlement value of the area described in the supplementary information, the additional filling volume to be necessary for handover would be taken into account for the payment upon discussion of the appropriate volume with the Engineer

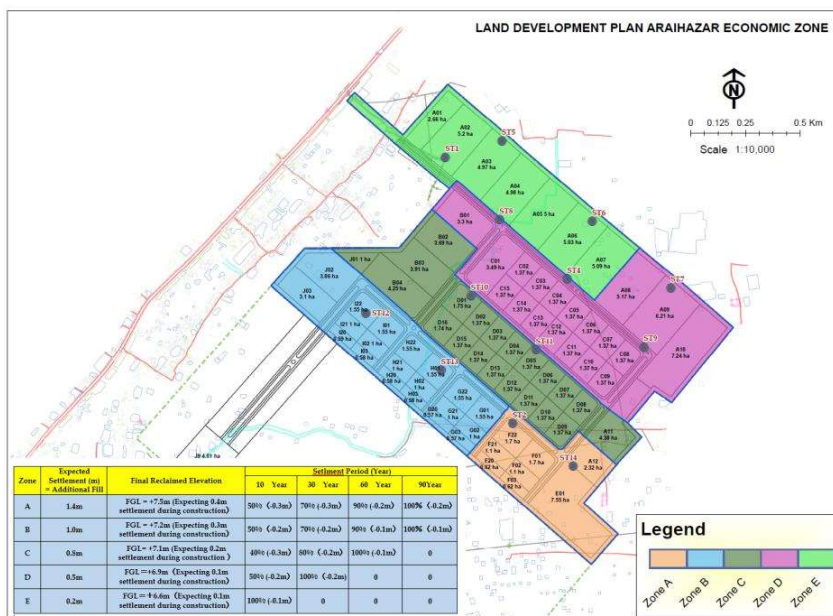
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approved by the Employer.

For reference, ratio of the loose sand material to convert filled sand material is generally 1 in 1.1, the compaction loss rate is 0.9, and initial settlement by the time of handover will be 20cm in average (see attached technical report of Analysis of Soil Investigation)

Estimated average settlement value during and after construction

Zone	Expected Settlement (m) = Additional Fill	Final Reclaimed Elevation	Settlement Period (Year)			
			10 Year	30 Year	60 Year	90Year
A	1.4m	FGL = +7.5m (Expecting 0.4m settlement during construction)	50% (-0.3m)	70% (-0.3m)	90% (-0.2m)	100% (-0.2m)
B	1.0m	FGL = +7.2m (Expecting 0.3m settlement during construction)	50% (-0.2m)	70% (-0.2m)	90% (-0.1m)	100% (-0.1m)
C	0.8m	FGL = +7.1m (Expecting 0.2m settlement during construction)	40% (-0.3m)	80% (-0.2m)	100% (-0.1m)	0
D	0.5m	FGL = +6.9m (Expecting 0.1m settlement during construction)	50% (-0.2m)	100% (-0.2m)	0	0
E	0.2m	FGL = +6.6m (Expecting 0.1m settlement during construction)	100% (-0.1m)	0	0	0



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3.2 MECHANICAL COMPACTION OF FILLING SAND

3.2.1 Description

Mechanical compaction of earth or sand of top layer in 150mm thick including levelling, watering and consolidating each layer with Chain dozer, Grader, Roller etc. to achieve minimum dry density of 90% with optimum moisture content (standard dry density test) up to finished level all complete and accepted by the engineer subject to submission of the method statement.

For the under 150mm thick of top layer, the fill materials would be deposited and spread by using sand water pumping method for filling with hydraulic compaction, the Contractor shall demonstrate the hydraulic compaction of sand in 2m layer for the designated area (30m x 30m) proposed by the Contractor. The hydraulic compaction of sand in 2m layer shall be conducted the proposed cone penetration test and the results of the test shall meet with the same value of requirement to achieve minimum dry density of 85% with optimum moisture content (standard dry density test) for 150mm layer each in 2m demonstrated fill. The cone penetration test (Method for Swedish weight sounding test JIS A 1221:2002) will be recommended. However, the contractor shall propose the suitable cone penetration test and its method to confirm the required compaction value.

3.2.2 Method of Compaction

The fill materials shall be deposited and spread in successive uniform horizontal top layer of about 150 mm thick and compacted by use of mechanical approved devices 90% standard dry density for site development & other area. For under 150mm thick of top layer, the fill materials shall be deposited and spread in successive uniform horizontal of about 150 mm thick and compacted by using of mechanical approved devices 85% standard dry density for site development & other area.

In filling /back filling against a newly constructed structure, precaution must be taken so that the structure is well matured to take the thrust of filling and while filling that against a wall, the filling is done from both sides simultaneously.

Tests will have to be carried out at Engineers' laboratory to ascertain the nature of the fill material and the degree of compaction obtained for the filled material for which samples have to be taken and transported to the Engineer's laboratory by the contractor at his expense and as directed by the Engineer

In case hydraulic compaction by using sand water pumping method for filling, the fill material shall be deposited and spread by water sand pumping through the pipelines to the filling area with Chain dozers compaction tread on the filling sand constantly during filling works.

The Contractor shall propose the detailed hydraulic compaction method to the Engineer for approval. The cone penetration test value to meet the minimum dry density of 85 % with optimum moisture content (the AASHTO T99-74 maximum dry density at moulded moisture contents of optimum +1% to optimum -2%.) for 150mm layer each under 150mm of top layer shall be calculated and proposed maximum thickness of the layer to be filled by the Contractor for approval by the Engineer. Maximum filling thickness for hydraulic compaction method shall be less than 2m layer. Final compaction for 15cm thickness under final ground level (FGL) shall be used the mechanical compaction of earth or sand in 150mm layers including levelling, watering and consolidating each layer with Chain dozer, Grader, Roller etc. to achieve minimum dry density of 90% with

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optimum moisture content (field dry density for AASHTO test method T99-74) up to finished level.

The Contractor shall perform the field trial filling to demonstrate about 30m x 30m x 4m in thick by using hydraulic filling method with hydraulic compaction of Chain dozers in order to confirm the correlation between the minimum dry density of 85 % with optimum moisture content for each 30cm layer and meeting with the cone penetration test value for the approval of the Engineer.

3.2.3 Method of Measurement

Measurement for which payment will be made for filling shall be the quantities of completed work as discussed in Serial no. 3.1.3 above.

3.2.4 Basis of Payment:

Payment for compaction of earth or sand will be made at the contract unit price per Cum measured as provided above which price shall be for carrying, placing, compacting, levelling and shaping of fill materials in layers and furnishing of all equipment, tools, incidentals such as overhead, profit, taxes, etc. necessary to complete the work.

These compaction costs for the allowance and additional filling such as loose sand material rate to filled material, transportation loss of material, compaction loss of material loss of material shall be included in the unit rates of compaction work.

3.3 Geo-Textile Sand bagging

3.3.1 Description

Supply, making & laying 2 mm thick Geo-textile sand bag, size of each bag: perimeter 3.143m x Length 20m as per drawing and filled with 12.5 cum of sand per bag, of approved quality and origin/manufacturer as per manufacturer's instructions approved and accepted by the Engineer.

Before commencing dumping of Geo-textile bags, the Contractor must submit the method statement for carrying out this work including sample with evidence of origin and compliance certificate from independent testing laboratory for approval.

3.3.2 Methodology of Work

The contractor shall supply the Geo-textile bags (capacity 12.5cum per bag) as per drawing and instruction of the Engineer & fill the bags with pre-selected approved sand and sew the bag by swing machine at site and these will be dumped on side slopes as per drawing and direction by the Engineer.

The Contractor shall take adequate precautionary measures in the form of barriers, warning signals marked with red lights at night and notices to avoid accidents.

The Contractor shall be responsible for the preservation of properties along and adjacent to works being done and shall avoid any damage or injury there to as a consequence of his negligence. He will also take adequate protection measures to see that dumping works do not affect or damage adjoining structures. The Contractor shall be liable for or in respect of any damage or compensation payable at law in respect or in

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consequence of any accident or injury to any workman, other persons, public or anybody else at the time of execution of the work.

3.3.3 Method of Measurement

Measurement for which payment will be made is for each bag filled with sand.

2.3.4 Basis of Payment

Payment for Supply, making & laying of the Geo-Textile sand bags will be made at the contract unit price for each bag measured as provided above which price shall be for carrying, placing in layers, levelling and furnishing of all equipment, tools, incidentals such as overhead, profit, taxes, etc. necessary to complete the work.

3.4 EARTH FILLING

3.4.1 Description

The work covered by this item shall consist of earth filling at the periphery of developed economic zone area to make up levels, according to these Specifications and Plans with specified earth materials.

3.4.2 Methodology of Work

Ordinary fill material for site development may be carted earth/clay materials or other approved materials. All shall be free from large lumps, organic or other extraneous materials. Materials from excavation on the sites may be used as ordinary fill if it is approved.

The fill materials shall be deposited and spread in successive uniform horizontal layers of about 150 mm thick and compacted by use of mechanical or other approved devices to a 90% standard maximum dry density.

3.4.3 Method of Measurement

Measurement for which payment will be made for filling shall be the quantities of completed work in place determined by the method of average sectional area. The ground level elevations shown on the plan will be used as original level.

3.4.4 Basis of Payment

Payment for filling will be made at the contract unit price per cubic meter (Cum) measured as provided above which price shall be for carrying, placing, levelling and shaping of fill materials in layers and furnishing of all equipment, tools, and incidentals necessary to complete the work. In the case of refilling by the site excavated earth, only labour and other related charge shall be paid except material charge.

3.5 REINFORCED CEMENT CONCRETE WORK (RCC)

3.5.1 Description:

This item shall consist of manufacturing concrete as provided in these Specifications and construction where required, and of the form, dimensions and design shown on the plans.

3.5.2 Construction Requirements:

Concrete shall consist of a mixture of Portland cement, fine and course aggregate and water. The proportions in which the various ingredients shall be used in the concrete mix

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for various work, shall be designed in accordance with the specified strength and suitable workability.

Material shall conform to the requirements specified below and in the relevant sections of Material Specifications.

Construction shall be according to these specifications. Contractor shall follow the following standards of American Society of Testing Materials along with the Building Code Requirements for Reinforced Concrete ACI 318-89 for Specification not covered in these Specifications. In case of differences between specifications contained in this book and those of ASTM or ACI, the specifications specified in this book shall stand.

"Specification for Ordinary Portland Cement" (Type-1)	- ASTM C150 or BS12
"Specification for Concrete Aggregates" -	ASTM C 33
"Standard Method of Making and curing concrete Test Specimen in the field"	- ASTM C31-89
"Standard Method of Test for compressive strength of cylindrical concrete Specimens"	- ASTM C39-86
"Standard Method of Sampling Fresh Concrete"	- ASTM C 172-90
"Standard method of Making & Curing concrete Test Specimens in the laboratory"	- ASTM C192-90
"Standard method of obtaining and Testing Drilled Cores and Sawed beams of Concrete"	- ASTM C42-90
"Standard Specifications of Chemical admixtures in concrete"	- ASTM C494
Cement shall be Portland Cement Type-I, ASTM	- ASTM C150

Cement:

Portland cement to be normally used shall conform to ASTM specification C-150 type-1 or BS-12. It shall be free from any hardened lumps and any foreign material other than the manufacturing ingredients. Cement shall have a minimum 90% of particles by weight passing the 75 micron sieve. Cement shall have an initial setting time in excess of 30 minutes and final setting time not longer than 7 hours. The Engineer's Representative reserves the right to reject any cement that fails to achieve specified concrete strength as per proportion of materials laid down in the schedule of items.

Only approved brand, grade or kind of cement shall be used in a given structure above the ground level especially for fare face finished concrete, tiles works etc. except upon the written permission of the Engineer of other used.

The Contractor shall be responsible for the proper storage of the cement at the job site. Cement shall be stored in a air tight waterproof shaded area having damp roof floor, waterproof walls and leak proof roof. The cement stacks shall be placed at a minimum distance of 300 mm from the walls. The damp roof floor shall be constructed by raising it minimum 300 mm above the ground. If the cement is damaged and becomes lumpy due to

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defective storage, it shall be removed from the job site within 24 hours of receipt of instructions from the Engineer's Representative.

Cement may be measured by weight or in a standard bag to weigh 1 cwt or 112 pounds/50kg having a volume of 0.0354 cum/1.25 cft. The Contractor shall maintain the record of deliveries of cement to the site and its use in the work.

Fine Aggregate (Sand):

Fine Aggregate shall consist of well-graded clean natural sand, free from injurious amount of organic impurities and deleterious substances and shall have a fineness modulus of not less than 2.50. Fine aggregate shall be well graded from coarse to fine and when tested by means of laboratory sieves shall conform to the following requirements:

Sieve	Mass Percent passing
9.5 mm (3/8 in)	100
4.75 mm (No. 4)	95 - 100
1.18 mm (No. 16)	45 - 80
0.300 mm (No. 50)	10 - 30
0.150 mm (No. 100)	2 - 10

Coarse Aggregate:

Coarse Aggregate shall consist of well-graded broken or crushed first class jhama bricks or boulder chips as specified on the structural drawings and/or BOQ and shall be free from any adherent coatings.

Grading of Coarse Aggregates:

Coarse aggregate shall be well graded, between the limits specified and the size or sizes designated shall conform to the requirements given in the following tables or otherwise specified or directed by the Engineer.

Designated sizes	Percentage by weight passing US Standard sieves having square openings						
	38 mm	25 mm	20 mm	12 mm	10 mm	No. 4	No. 8
25 mm down graded	100	95-100	--	25-60	--	0-10	0-5
20 mm down graded	--	100	90-100	--	20-55	0-10	0-5
12 mm down graded	--	--	100	90-100	40-70	0-15	0-5

Delivery and Storage of Materials :

a. **Cement** in transit and storage or stock-piled at site shall be protected from dampness or any damage by climatic conditions that would change its characteristics or usability. Cement godown shall be constructed to be fully air-tight. Batches of cement shall be used for the work in the order in which they are delivered to the site. A register shall be maintained by the Contractor listing date of delivery and quantity of each consignment for easy identification.

b. **Aggregates** shall be stock-piled at least 7 days prior to their anticipated use to permit the Engineer to sample each stockpile to determine the acceptability of the material for the intended use.

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Aggregates of different sizes or grades and from different sources of supply shall not be mixed . All aggregate shall be stored free from contact with earth and other deleterious matter.

Every precaution shall be taken during transport and stockpiling of coarse aggregate to prevent segregation.

Segregated aggregates shall not be used until they have been thoroughly remixed and the resultant pile is of uniform and acceptable grading at any point from which a representative sample is taken.

Composition of Mix: The strength requirement and workability shall govern the mix proportion for each class of concrete:

Proportion of concrete	28 day cylinder crushing strength (min.)	Place of Use	<u>Aggregates</u>		Min. Cements per m ³ (50 kg bag)
			<u>Fine</u>	<u>Coarse</u>	
1:2:4	22 MPa	In column, slab, beam, stair and all other RCC works as specified	Sand FM 2.5	20 mm down graded stone chips	7.0 bags

* Slump: Slab, Beam, Columns etc. -50mm.

Trial mixes for every class of concrete with representative materials from site shall be prepared by the Contractor and carried to the laboratory in accordance with approved procedure. The nominal strength in these tests shall exceed the specified minimum strength by at least 20%. No concrete shall be placed in the permanent works until the relevant mix has been approved by the Engineer.

** Trial mixes shall confirm the strength of the concrete with the mixing of water reducing admixture.

Batching: The Contractor shall provide and maintain in good order suitable measuring equipment and devices required to determine and control accurately the relative amounts of various materials entering the mix. All measurements shall be by weight/volume and shall be accurate within a tolerance of 1 % for each batch. If the measurements are by volume then standard wooden boxes shall be used.

- Cement:** Unless an integral number of bags, as packed by the manufacturer is used, the Cement shall be weighed. A bag of cement weighing 50 kg net will be considered as 0.035 m³
- Aggregates:** Different types and sizes of aggregates shall be batched separately by weight/volume.
- Water:** The amount of mixing water shall be weighed/measured, allowance being made for the quantity of the free water contained in the aggregates. Water cement ratio shall be decided for every class of concrete and according to the place of use. The water/Cement ratio shall not exceed 45% by weight for all type of concrete.

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Sufficient acceptable materials shall be available at the batching site to ensure continuous placement necessary for structures. The moisture content of the accepted aggregate shall remain consistent to the extent that the resultant successive batches of concrete do not vary in consistency by more than 6 mm of slump. If the moisture content in the aggregate varies by more than the above tolerance, corrective measures shall be taken to bring the moisture to a constant and uniform quantity before any more concrete is placed.

Coarse aggregate shall be saturated with water at least 12 hours before use to prevent absorption of the mixing water.

Mixing: Concrete shall be mixed in concrete mixer of approved type and appropriate capacity.

Each batch shall be thoroughly mixed for a period of not less than 2 minute after all materials including the water are in the drum and during this period the drum shall be in the mixing position and revolve at uniform rate of not less than 14 or more than 20 revolutions per minute. The cement and sand shall be thoroughly mixed in dry condition.

The batch shall be so charged into the mixer drum that some water shall enter in advance of the cement and aggregate. The entire content shall be removed from the drum before the succeeding batch is placed.

Concrete shall be mixed in quantities required for immediate use. Concrete shall not be used which has developed initial set or which is not in place within **thirty** (30) minutes after the water has been added. Retempering of partially hardened concrete by remixing with or without additional materials or water, or by other means will not be permitted. The inside of the mixing drum shall be kept free of hardened concrete at all times. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Unless otherwise agreed by the Engineer, the first batch of concrete through the mixer shall contain only two thirds of the normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

Consistency of Concrete: The consistency of concrete shall be determined following evaluation of the placement conditions for each individual section of the work but in no case the slump shall exceed 62mm unless otherwise decided. Mix proportions and consistency shall produce a dense, well compacted concrete with a minimum tendency to segregate under placing conditions, free from sand streaks, honeycomb, air-pockets, exposed reinforcing steel and other forms of structural weakness or unsatisfactory appearance.

Transport and Placing: Concrete shall be so transported from the mixer and placed in the form that contamination, segregation or loss of the constituent materials does not occur. Before placing the concrete, all form work, space and the reinforcement contained in it shall be thoroughly cleaned of all extraneous matter. Care shall be taken to fill every part of the forms, to work the coarse aggregate back from the face so that sufficient mortar will be flushed from the mass to form a smooth surface, and to force the concrete under and around reinforcing bars without displacing them.

The concrete shall be deposited in the forms in horizontal layers to a depth not exceeding 300 mm and each layer shall be properly vibrated before laying the next one.

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The concrete shall not be dropped freely from a height exceeding 1.8 meter nor shall it be deposited in large quantities at any point. In columns of structures special tremie pipe may be used for drop more than 1.8 meters. Dragging of concrete inside the forms or distribution by vibrators or allowing it to flow by gravity to the ends of the forms will not be permitted.

In sections where it is extremely difficult, to place concrete containing the larger sizes of the coarse aggregate, a modified mix, as approved by the Engineer, may be used to ensure against honeycomb and separation of the coarse aggregate from the mortar. Concrete shall be deposited and compacted in its final position within 30 minutes of its discharge from the mixer and shall not be subjected to vibration between 2 and 24 hours after compaction. When in situ concrete has been in place for 4 hours no further concrete shall be placed against it for a further 20 hours.

Compaction: Concrete, during and immediately after placing, shall be thoroughly compacted by mechanical vibration. The vibration shall be internal unless otherwise authorized by the Engineer.

Vibration shall be of a type and design approved by the Engineer. It shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

The intensity of vibration shall be such as to visibly affect a mass of concrete of one inch slump over a radius of at least 450 mm.

The contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms. He also provides sufficient number of nozzles of different diameter to execute the work smoothly.

Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to lie plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation. Vibrators shall not be used to transport concrete in the forms.

Concrete pouring schedules and construction joint sequences of different stages shall have to be approved well in advance by the Engineer.

Construction and Expansion Joints: Expansion joints shall be constructed at the locations and to the dimensions shown on the plans. Position and detail of construction joints, not shown on the plans, shall be planned in advance and approved by the Engineer. Placement of concrete shall be in a continuous operation between consecutive joints.

Where sections of the work are carried out in lifts, the line of the proposed joint on all exposed surfaces shall be made truly straight by tacking a temporary horizontal straight edge on the inside of the form with its lower edge on the line of the joint and then placing concrete 12 mm higher than this edge to allow for settlement. In case of water reservoir PVC water stopper shall be used in all construction joints with 250mm overlapping at the water stopper joints.

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In resuming the work, the old concrete surface shall be thoroughly cleaned of laitance and all loose material by stiff wire brush, roughened, if deemed necessary, and washed with clean water.

The surface then shall be coated with very thick cement slurry before fresh concrete is placed.

Control Tests for Concrete :

- a. **Sampling:** The number, frequency and location of batches to be sampled shall be decided by the Engineer. The method of sampling shall be according to ASTM C-172.
- b. **Slump :** This determination shall be made at the commencement of concreting, on the occasion of each change in mix proportions, and thereafter as desired by the Engineer. The testing shall be in accordance with ASTM C- 143, current issue.
- c. **Compressive Strength:** Test cylinders 150 mm in diameter and 300 mm high shall be made at the site of the work in sets of three (3) from each thirty (30) cubic meter of each class of concrete or fraction thereof or as directed by the Engineer.

Casting and curing the concrete cylinders shall be in accordance with ASTM C-31, current issue. Testing of cylinders shall be done in accordance with ASTM C- 39, current issue; one cylinder at 7 days and 2 at 28-days. Cylinder at 7 days test shall not be less than 70% of the specified (design) strength.

If the Engineer allows cubes to be tested instead of cylinders, the cube strength shall be at least 25.0 percent higher than the cylinder strength specified.

Formwork: Formwork may consist of steel sheets of minimum thickness of 14 BG or wooden planks of hard wood of approved variety having a minimum thickness of 45 mm with necessary battens, struts, stringers, beams, ties, etc. In case of wooden planks the same shall be new and shall not be used more than three times in contact with concrete.

All formworks, specially for fair face concreting, must be 12 BG steel sheet and should be dented, rust free by using of sanding disk etc. before every lift of casting.

All formwork shall be of sound materials constructed water-tight, true to line as per drawing and of such rigidity to prevent bulging or movement during the placement and curing of the concrete. Form work for bases and walls of water reservoir shall have chamfer of appropriate dimension as per drawing and direction. After hardening the concrete shall conform to the shape, dimensions and surface finish described in the Contract. The forms shall be simple in construction, easy for erection, maintenance and removal.

Form lining shall be in largest practicable panel to minimise joints. Under usual conditions the following minimum periods between concreting and the removal of formwork shall be observed:

Vertical sides	72 hours
Soffits from under span of 6 meter or less	18 days
Soffits from under span of over 6 meters	min. 21 days
and as directed by Engineer.	

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Concrete exposed by the removal of formwork shall be left untouched pending inspection by the Engineer. Cement mortar separators or block of appropriate sizes is to be used in all covering as per drawing or directed by Engineer-in-charge.

The drip course shall be constructed at the edge of roof slab etc. by means of an approved batten included in the form work before casting or after casting as desired by the Engineer-in-charge.

Surface Finish and Remedial Treatment of Surfaces: Unless otherwise provided on the plans, all reasonably true and even surfaces, which are of uniform colour and texture, and free from stone pockets, honeycomb, depressions or projections, shall be considered as acceptable surfaces.

Immediately after the removal of forms, all cavities produced by form ties and all other holes, broken corners or edges and other defects except air bubble holes, shall be cleaned and after having been kept saturated with water for a period of not less than two hours shall be completely filled, rammed and made good with a mortar of the same proportions as used in the concrete being finished.

The holes shall be completely filled by use of a pressure gun or hand rammed method as directed by Engineer's representative.

Any remedial treatment to surfaces shall be agreed with the Engineer following inspection immediately after removing the formwork and shall be carried out without delay. Any concrete, the surface of which has been treated before being inspected by the Engineer, shall be liable to rejection.

Curing and Protection: Concrete shall be protected against harmful effects of weather for a period of not less than seven (7) days immediately following the placing of concrete.

All concrete surface shall be covered with two thicknesses of wet burlap which have been spot stitched, or wet jute felt or gunny bags as soon after placing of concrete as it can be done without marking the surface and kept thoroughly wet by continuous sprinkling of water for a period of not less than 21 days after the concrete has taken its final set.

In lieu of continuous sprinkling, plastic sheeting or plastic-coated burlap may be used to prevent moisture loss. The concrete RCC shall be pre-moistened and the plastic sheeting shall be held securely in place so that positive moisture seal is provided to retain the curing moisture during the 21 days curing period. Form of perforated sheeting shall be without delay repaired or replaced with acceptable material.

3.5.3 Method of Measurement:

- i) **Concrete:** This item shall be measured by the cubic meter complete in place for the several classes of concrete that may be involved. However measurements of particular items are indicated in Bid schedule Measurement shall be to the neat lines of the structure shown on the plans or as ordered in writing by the Engineer. The volume of reinforcement embedded in the concrete shall not be deducted from volume of the concrete.
- ii) **Formwork:** The formwork shall be measured in square metres.

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3.5.4 Basis of Payment:

- i) **Concrete**-The amount of completed and accepted work, measured as provided above, shall be paid for at the contract unit price per cubic meter or as indicated in Bid Schedule for the several classes of concrete, which prices shall be full compensation for furnishing, preparing, transporting, delivering, breaking chips, screening chips as required, mixing and placing all materials, including any admixtures, curing compound and curing and finishing of concrete, construction including chamfering and for all labour, equipment, tools and incidentals such as overhead, profit, taxes, etc. necessary to complete the item, except reinforcing steel unless otherwise noted in the Bid Schedule as per BOQ item.
- ii) **Form Work**-Payment for formwork will be made at the contract unit price per sqm measured as provided above which price shall be full compensation for materials, props, scaffolding, carrying, levelling, shaping, cutting, welding, electrode, electricity and storing, lift, fill materials in layers and and removal of formwork and scaffolding where required furnishing of all labours, equipment, tools, incidentals such as overhead, profit, taxes, VAT etc. necessary to complete the item as per BOQ item.

3.6 REINFORCING STEEL IN CONCRETE

3.6.1 Description:

This item shall consist of furnishing and placing in concrete reinforcing steel (Tor Steel and Deformed bar) of quality type size and quantity designated, all as required by these Specifications and as shown on the applicable structural drawings.

3.6.2 Construction Requirements:

Reinforcing steel may be plain & deformed bars as specified on the structural drawings and shall meet the following requirements :

- 1. Quality of reinforcement steel, its properties including strength, elongation, bending, splicing, hooking, covering and all related events shall be in accordance with the requirements of ACI 318-89.
- 2. De-formed bars, when used shall meet the requirements of BDS ISO 6935-2: 2009 ASTM A615M-88 & ASTM A706 or the latest such equivalent standard of specification.

It should be noted that steel made from scrap iron shall not be accepted for any type of work. All reinforcement bars shall be clean and free from loose scale, dirt, paint oil, grease or other foreign substance. Bars should be placed in position as drawing/design requirement and be cleaned with a stiff wire brash if required.

Bending of Reinforcement:

All reinforcement bars shall be bent cold to pertinent dimensions using bending appliances and method approved by the Engineer. All bars of slab and beam shall invariably have standard hooks at the end. All standard hook shall meet the following requirements:

- a. A semicircular turn plus an extension of at least four bar diameters but not less than 62 mm at the free end of the bar.

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- b. A 90 degree turn plus an extension of at least 12 bar diameters at the free end of the bar.
- c. For stirrup and tie anchorage only either a 90 degree or a 135 degree turn plus an extension of at least six bar diameters but not less than 62 mm at the free end of the bar.

The radii of bend measured on the inside of the bar for standard hooks shall not be less than the values given below:

<u>Bar size</u>	<u>Minimum radii</u>
10 mm, 12 mm, 16 mm	2.5 bar dia
19 mm, 22 mm, 25 mm	3 bar dia
28 mm, 32 mm, 35 mm	4 bar dia

Bends for stirrups and ties shall have radii on the inside of the bar not less than one bar diameter.

Placing of Reinforcement:

Reinforcement shall be placed, supported and maintained in the position shown in the Drawing and shall be checked and approved by the Engineer before placement of concrete begins. Unless otherwise permitted by the Engineer, all intersecting bars shall be tied together with double layer of 22G black iron wire and the ends of wire shall be turned into the main body of the concrete. Clear cover must be maintained to the side of reinforcement as shown on the drawing by using concrete blocks or separators.

Splicing of Reinforcement:

No splices shall be made in the reinforcement where not shown in the drawing. Wherever it is necessary to splice reinforcement at points other than those shown on the plans, Drawings showing the location of each splice shall be submitted to and approved by the Engineer before the reinforcing steel is placed.

- a. **Splices in reinforcement in which critical design stress is tensile** : Splices at points of maximum tensile stress shall be avoided where possible, such splices where used shall be lapped or otherwise fully developed. In any case the splice shall transfer the entire computed stress from bar to bar without exceeding three fourths of the permissible bond values for the concrete. The length of lap shall be 40 bar diameter excluding hook. However length of splices to be used for different bars shall be according to drawing or according to the direction of Engineer.
- b. **Splices in reinforcement in which critical design stress is compressive** : Where lapped splices are used it shall be minimum of 30 bar diameters excluding hook. Where longitudinal bars are offset at a splice the slope of the inclined portion of the bar with the axis of the column shall not exceed 1 in 6 and the portions of the bar above and below the offset shall be parallel to the axis of the column. Adequate horizontal support at the offset shall be secured by additional stirrups, ties, etc. Offset bars shall be bent before they are placed in the forms.

Supports: Precast concrete blocks or metal supports of adequate strength, of proper dimension and in sufficient number shall be used for supporting the bars in position. Blocks shall be of a shape acceptable to the Engineer and designed so that they will not

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overturn when concrete is stored. They shall be made of concrete with 10 mm maximum aggregate size from same materials and of the same mix proportions as that of the concrete in which they are to be used. They shall be cast and properly cured for at least seven days before use and shall have wire or other device cast in the block for the purpose of attaching them securely to the reinforcement. Where directed chairs made with 12mm bars shall be provided for keeping the negative reinforcement in place during concreting. These chairs when used shall provide proper cover as required and the numbers shall be as decided by the Engineer.

Welding of Reinforcement: Reinforcement in structures shall not be welded except where permitted. All welding procedures shall be subject to the prior approval of the Engineers in writing. In pile reinforcement welding may be necessary and shall be done in accordance to the drawing and with the approval of the Engineer. Welding for connecting the damaged portion of the reinforcement shall be allowed on both sides of the Re-bar and shall be 50 mm of welding length on both sides and on ends.

If welded connections are made on intermediate grade reinforcing steel, to hold bars in position, low hydrogen electrodes shall be used.

Concrete protection for Reinforcement: Unless otherwise shown on the plans, the covering of reinforcement for different types of members shall be as follows:

Column & Pile Cap

All sides, below FGL	75 mm
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Column:

All sides, above FGL	40 mm
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Grade Beam:

All faces	75 mm
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Other beams in Structures:

Side, Top and Bottom	50 mm
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Other beams in other structures:

Side, Bottom and Top	50 mm
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Slab:

Bottom	25 mm
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Top	20 mm
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Protective Coating: All exposed reinforcing steel at construction joints shall be protected with a brush coat of neat cement, mixed to a consistency of thick paint, within one week after the placing of the initial concrete, unless it is definitely known that the steel will be embedded within 60 days. This coating shall be entirely removed, by lightly tapping with a hammer or other tool, more than one week previous to the placing of the final pour. The contractor shall notify the Engineer-in-charge or his authorised representative when the steel has been placed in position for pouring concrete and no concrete shall be placed until the Engineer-in-charge has inspected the steel and given his approval in writing.

3.6.3 Method of Measurement:

Reinforcement actually in place as shown on the plans or as ordered in writing by the Engineer shall be considered for measuring the amount of reinforcing steel. The weight

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paid for shall include splice laps of reinforcement if allowed in the contract but no allowance will be made for the clips, wires chairs, over weights etc. or other fastening devices for holding the reinforcement in place in other words no measurements shall be given for overweight, chairs, clips or other fastening devices.

3.6.4 Basis of Payment:

The amount of completed and accepted material, measured as provided above, shall be paid for at the contract unit price per BOQ for "Reinforcing Steel", which prices shall be full compensation for furnishing, fabricating, transporting, delivering, erecting, and placing all materials, and for all labour, equipment, tools, including all chairs, overweight, overhead, profit, taxes, etc. and incidentals necessary to complete the work. The weight shall be considered as per ACI 318 as per BOQ item.

3.7 BARBED WIRE FENCING

3.7.1 Description

The work covered under this item shall consist of supplying of barbed wire fencing on the top of the Geo-Textile Sand bag with mortar base. Security wall and fitting & fixing the same to the 'Y' shaped MS angle posts of which lower 300mm are embedded into the Geo-Textile Sand bag with mortar base including all accessories and finished in accordance with the approved plans, drawing.

3.7.2 Construction Requirement

Providing 8 lines of 12 BWG barbed wire (2 ply, 4 points) in fencing work horizontally and 2 lines diagonally (from post to post) in each part of the 40x40x5 mm 'Y' shaped MS angle posts (inclined 353mm+353mm+vertical 250mm clear) @ 3m c/c as per drawing and straightening, binding the joints with 18 BWG GI wire, making holes in the angle posts etc. in/c supplying of all necessary materials complete in all respect and accepted by the Engineer. (Rate excludes the cost of RCC and MS angle posts which are to be paid as per corresponding items in the schedule).

3.7.3 Method of Measurement

Measurement for payment shall be in Sqm.

3.7.4 Basis of Payment

Payment shall be according to the contract unit price which will cover cost of all material, labour, transport and all other incidentals.

3.8 STRUCTURAL STEEL

3.8.1 Description:

This item shall consist of furnishing and making the steel structural works with different quality, size and quantity designated, all as required by these Specifications and as shown on the applicable drawings.

(In this BOQ this refers to making MS angle post on security wall.)

3.8.2 Construction Requirements:

Steel in structural works shall meet the following requirements:

- a. Angle, Tee, FI bar, Channel & 'I' section when used, It should meet the requirements of BDS and ASTM standards of specification. In this case Mild steel Grade - 250 with minimum $f_y = 250$ MPa to be used in MS angle posts.

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- b. It should be noted that steel made from scrap iron shall not be accepted for any type of work. All steel section shall be clean and free from loose scale, dirt, paint oil, grease or other foreign substances. Section should be placed in position as per drawing/design requirement and be cleaned with a stiff wire brash if required.

STEEL SECTION

Mild steel work should be done with mild steel sections of different sizes as per design and drawings.

The dimensions and unit weight of M.S angles are given below:

Unit Weight of M.S Angle	
Size in mm	kg/meter
40 x 40 x 3	1.813
40 x 40 x 5	2.944
40 x 40 x 6	3.485

3.9 PERMANENT FENCE ON TOP OF SLOPE

3.9.1 General

This section shall apply to the construction related to civil works which the Contractor shall execute in full compliance with the Specifications.

The works shall be performed in accordance with the lines, grades, dimensions and details, as per proposal by the Contractor, or as may be modified by written orders of the Engineer, including the furnishing all appliances, equipment, machinery, materials, labours, tools, supplies, tests and incidentals necessary to the satisfactory prosecution.

The works shall consist of Permanent concrete hollow block fence having 2.3 m in height with RCC base and columns in 3m intervals and installing the barbed wires on the top of the fence, shall be proposed by the Contractor .

The works shall include earth works, laying compacted crashed-rock base, lean concrete, reinforced concrete works, steel and metal works, masonry works, and other necessary works as directed by the Engineer.

The Contractor shall be deemed to have satisfied himself as to the site conditions and other particulars whatsoever in connection with the works as specified herein.

Before proceeding works, the final ground elevation shall be surveyed by the Contractor, and approved by the Engineer. The checked cross section sheets including lay out plans shall be mutually signed by the Contractor and the Engineer.

The Contractor shall submit complete shop drawings for the whole of the construction of fences to the Engineer for approval. All such drawings shall show all details and methods of construction. All materials shall not be ordered until the Engineer in writing approves such shop drawings.

3.9.2 Earth Work

1) Description

This work shall consist of excavation for the foundations of all structures, not otherwise provided for by the specifications; backfilling and filling of completed structures; disposal of excavated material.

The area for the base concrete of fences shall be excavated and backfilled in accordance

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with this section and measurement and payment shall be in accordance with the related sections.

2) Materials

Foundation filled Material

Material for foundation fill shall consist of suitably graded sand, gravel or stone as required by the Engineer.

Concrete for Foundation Fill

Concrete to be mixed and placed under water shall be used as foundation fill in dry excavation shall be made with an aggregate and cement conforming to the requirements of 3.5 RCC Works for Civil and Facility Works.

3) Backfill Material

Backfill shall be of approved compatible material. It shall be obtained from the structure excavation if such material is approved by the Engineer as suitable. Any additional material needed shall be obtained from borrow excavation unless otherwise directed by the Engineer.

4) Construction Methods

Clearing

Prior to starting excavation operations in any area, all necessary clearing and grubbing shall have been performed.

Excavation

The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation so that cross section, elevations and measurement may be taken of the undisturbed ground. The natural ground adjacent to the structure shall not be disturbed without permission of the Engineer.

Wall and Base foundations and structure footings shall be excavated to the lines, grades and elevations as approved shop drawings. The elevations of the bottoms of footings are approximate only and the Engineer may order in writing such changes in the dimensions or elevations of footings as may be deemed necessary to secure a satisfactory foundation.

If foundation filled material is required, it shall be placed and compacted in layers not more than 15 cm thick or as directed by the Engineer. The degree of compaction shall be equivalent to that of the surrounding foundations.

All excavation surfaces and surfaces of backfill material against which concrete is to be placed shall be smooth and firm and true to line and level.

Laying Course Sand and Crushed Rock Base

Material and construction method for laying course sand under foundation and structures shall conform to the requirements as directed by the Engineer

3.9.3 Concrete Works

The works shall consist of the construction of all or portions of structures for Fence

The grades of concrete shall conform to the requirements of section 3.5 RCC Concrete unless otherwise directed by the Engineer.

All requirements of concrete works for this section shall be as specified in Section 3.5: RCC for Civil Works.

3.9.4 Steel and Metal Works

The structural steel and metal works shall involve the fabrication of steel beams, columns, and other structural steel works required for the various fences, gate and miscellaneous works under the Contract.

The work includes but is not limited to furnishing of all labor, materials, equipment and other

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incidentals necessary for the fabrication and installation of structural steel and miscellaneous metal works as specified in relevant items of this Specifications in section 3.7 for reinforcing steel and 3.8 for structural steel.

The Contractor shall submit shop drawings for the whole of the steelwork to the Engineer for approval. All such drawings shall show the dimensions of all parts, method of construction, spacing of bolts, welding sectional areas and all other details. Where welds are used, either at shops or on site, they shall as possible, be continued and returned around any meeting face to ensure that the joints are completely sealed against corrosion.

The details of connections on shop drawings shall be such as to minimise formation of pockets to hold condensation, water or dirt and the like and a minimum gap between joined angles shall be tried wherever possible to eliminate any traps and facilitate maintenance painting.

The materials shall not be ordered nor fabrication commenced until the Engineer in writing approves such shop drawings.

The Contractor shall be responsible for all errors of detailing, fabrications and for correct assemblies of the structural members.

3.9.5 Unit Masonry

1) Description

The contractor shall provide all materials, labor, equipment and other incidentals necessary for the supply of materials and the complete construction of all masonry work including mortar as indicated as specified herein. All masonry walls shall be installed after the structural concrete frame has been constructed unless specifically approved by the Engineer.

The works shall include but not limited to:

- All concrete blocks.
- Masonry reinforcing for concrete masonry blocks.
- Masonry control joints and expansion joints.
- Connecting wall anchors and related embedment items.

Before commencing any masonry works, the Contractor shall ensure all piping, conduits, drains, sleeves, bolts, hangers, fixing lugs or timber fillets, or any other materials necessary to be installed in block work have been properly fixed.

The extent and general assembly of the construction, but members, connections, fixing details etc. shall be designed by the Contractor. Modification of details may be permitted but subject to the approval by the Engineer. Such approved modification shall not relieve the Contractor from responsibility for coordination with other works or from any other responsibility required in the Contract.

2) Material

Cement, and other cementitious materials shall be delivered to the site and stored in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturer's names and brands. Mortar materials shall be stored and handled in such manner that will prevent the inclusion of foreign materials and damage by water or dampness. Masonry unit shall be handled and stored with care to avoid chipping and breakage. Masonry materials shall be protected from contact with the earth and exposure to the weather, and shall be kept dry until used.

3) Masonry Units

The sizes of masonry units shall be as herein specified. Masonry units that are to be exposed in finished work shall be manufactured to an acceptable tolerance.

Concrete blocks shall be as manufactured by local manufacturers or by any other manufacturers engaged in the mass production of concrete blocks of equal quality and design and the above referenced manufacturer, and shall be subject to approval by the Engineer. The Engineer shall

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reserve the right to subject the concrete block to whatever tests he deems necessary in order to assure the soundness of the product at the Contractor's expense.

Block shall be furnished in stretcher, regular shapes, half sizes, corner lintel and any other regularly manufactured type and shape required to insure a satisfactory arrangement of the block installation.

Block shall be of modular type as required for normal wall thickness of 20 cm. Blocks shall be uniform in size BL 819 (39x19x19 cm.), texture and colour.

Block shall be saw cut where fitted to non modular spaces. The units shall have a regular rectangular shape and perpendicular aligned holes.

- a) Bonding Materials
Cement, fine aggregate and water of bonding materials shall comply with the requirement of Sub-section 3.5.2: Materials.
- b) Reinforcements
Bars for vertical reinforcing of concrete block walls shall be plain and round steel bars conforming to the requirement of Sub-Section 3.6 Reinforcing Steel and shall be of the size proposed on the shop drawings.
- c) Samples and Sample Walls
Sample of the following shall be submitted to the Engineer for approval.
Concrete block 3 pieces
Sand 1 cubic foot
Masonry units submitted for approval shall be of such size, structural quality, texture, and manufacture as to meet all requirements for vertical and horizontal measurements.
Before commencing the laying of any exposed masonry, the Contractor shall construct a sample wall of each type of masonry unit and joint spacing proposed for the finished wall. Each sample wall shall be 2 meters long and one meter high and show type and tolling. The sample wall shall be reworked, if required, until approved by the Engineer. Sample walls shall be left in place until completion of the masonry work for which they were constructed and then shall be disposed off.
- d) Mortar for Masonry
Masonry mortar for setting block shall be in proportion as follows:
Cement 1 part (by volume)
Sand 4 part (by volume)
Water Sufficient to make a plastic mix that can be trowelled and will develop a complete bond.

4) Installation

Concrete block shall not be wetted before laying. Blocks shall be laid either in stacking bond or running bond, and in alignment from the bottom to the top of the wall. Walls shall be started on the structural beam or slab and shall be wedged tight against the construction above. Walls shall be laid out with starting course to define spaces, openings, etc., and to serve as a guide for other trades. Joints shall be finished flush where exposed to view, and shall be raked to an even depth of 10 to 12 mm. Concrete block shall be laid on a full unfurrowed bed of mortar and with end joints solidly filled with mortar. Units shall be shoved into place, squeezing out all air pockets and insuring a full bed of mortar. The faces of walls shall be laid plumb and true with cells in vertical alignment. Chases, pockets, and other breaks in masonry construction shall be formed where shown or directed. Frames and other built-in items shall be maintained in proper position and bracing for same shall not be removed until they have been securely anchored in the masonry, and of other construction and finishes shall be kept clean at all times and protected against damage.

Unless otherwise specified on the Drawings, anchors and ties shall be plain and round steel bars (RB6), two bars for walls which have thickness more than 90 mm and one bar for 90 mm thick wall. Wire mesh shall be expanded metal No. 23.

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Metal anchors and wire mesh ties shall be used where concrete blocks butt concrete surfaces. Wire mesh ties for partitions placed every second layer shall be securely anchored to the concrete and shall extend into the block wall not less than 20 cm. Wire mesh shall be placed at the bottom of concrete block holes where metal anchors are to be placed to prevent the mortar from falling into lower cell holes.

Vertical Reinforcing Bars shall be as specified on the Drawings. Reinforcing bars shall be installed in the open cells of block and shall extend over the full height of the walls. Reinforcements shall be accurately placed and secured in a manner to prevent displacement during grout filling operations. Cells containing reinforcement shall be solidly filled with mortar in lifts not to exceed 1.20 meters, and pours shall be stopped 4 cm below the top of the course to form a key at pour joints.

5) Caulking

All joints adjacent to concrete surfaces of exposed masonry work shall be raked to an even depth of not less than 13 mm and then caulked with an approved caulking compound.

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SECTION 4: PROVISIONAL SUM

4.1 INSPECTION ASSISTANCE FOR THE ENGINEER

4.1.1 General

This provision is applicable to supply assistance for the engineer which is applied in “Provisional Sum of the Bill of Quantities”. The Contractor shall produce the quotation of the services and satisfactory evidence of having paid 100% of such quotation as part of the substantiation of those Statements which contain requests for the services under the Provisional Sum toward the cost of the services. The Engineer’s certification of such Statements shall be based upon such quotation and such evidence of payment by the Contractor. Contractor’s overhead, profit as 5 % of the quotation could be included in the provisional sums for the cost of the services

4.1.2 Laboratory Assistance Staffs

The Contractor shall provide one (1) laboratory assistance staff for the Engineer during the construction period. The laboratory staff shall be well experienced with concrete works and civil works, etc. The Contractor shall submit bio-data of laboratory staff for Engineer’s approval.

4.2 PREVENTION OF HIV/AIDS PROGRAMS

4.2.1 General

In amplification with the Article 2.6 of the Specifications, the Contractor shall conduct prevention measures for HIV/AIDS infection through awareness program and other educational information in order to reduce the risk of infection among the construction related staff and labor to Site and the local community, to promote early diagnosis and to assist affected individuals.

This provision is applicable to execute the prevention measures of HIV/AIDS Programs which is applied in “Provisional Sum of the Bill of Quantities”. The Contractor shall submit the prevention of HIV/AIDS Programs and satisfactory evidence of having paid 100% of execution of the program as part of the substantiation of those Statements which contain requests for the executed events under the Provisional Sum toward the cost of the execution. The Engineer’s certification of such Statements shall be based upon such costs and such evidence of payment by the Contractor. Contractor’s overhead, profit as 5 % of the quotation could be included in the provisional sums for the cost of the execution of the programs.

The Contractor HIV/AIDS Prevention Program shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the program shall detail the resources to be provided or utilized and any related sub-contracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor shall not exceed the Provisional Sum indicated in the Bill of Quantities dedicated for this purpose

The Contractor is responsible for implementing an HIV/AIDS Prevention Program among the Contractor’s Employees for the duration of the Contract or time duration as instructed by the Engineer and commencing as soon as practicable after the Contractor’s Employees arrive at Site in conjunction with the Service Provider and local health authorities involved in HIV/AIDS prevention.

4.2.2 Definitions

- 1) “The Contractor’s Employees “ means without prejudice to any other definition contain in the Contract, any workers who are under the Contractor’s control including any workers who are under the control of any person or entity to whom the Contractor has sub-contracted any obligations under the Contract other than responsibilities set out in this Sub-Clause.

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- 2) "The HIV/AIDS Prevention Program" means an HIV-AIDS prevention program to be conducted by the Contractor's via approved service provider as follows:
- a) Conduct Information, Education and Consultation Communication Campaign (IEC) for the construction related site personnel and labor (including all the Contractor's employees, Sub-Contractors and Engineer employees, all truck drivers and crew for deliveries to Site and the immediate local communities) with respect with Sexually Transmitted Diseases (STD), or Sexually Transmitted Infection (STI) and HIV/AIDS.
 - b) Provide condom.
 - c) Provide STI and HIV/AIDS screening, diagnosis, counseling and testing (unless otherwise agreed of all Site staff and labor) and to submit an alleviation program for STI, STD, HIV/AIDS in the program for Site staff and their families in the implementation of the work.
- 3) "The doctor and nurse" means a person or entity approved by the employer and the Engineer.

4.2.3 Scope of Work

- 1) Conduct Information, Education and Consultation Communication Campaign (IEC)

The Contractor shall conduct the information, education and consultation (IEC)

The IEC will be conducted monthly basis at the HIV/AIDS prevention office in the site by a doctor and nurse employed in time basis.

For the information and campaign,, the Contractor shall advertise the prevention of HIV/AIDS at site and office by using poster,(large size and small size), leaflet and etc. subject to approval of the Employer.

- 2) Provide Condom.

Where a clinic is provided on Site, a nurse shall be employed for duties in the clinic for all the construction period by the Contractor. The Contractor shall ensure that such clinic provides to the Contractor's Employee without charge, information and counselling on STI/HIV/AIDS and condoms supply that comply with the quality standard made by Ministry of Health or relevant authorities in Bangladesh and with the WHO/AIDS Specification Guideline for Condoms 1998 to a maximum 180 per number of the Contractor's Employees per year.

4.3 DISPUTE BOARD

4.3.1 General

In accordance with the Appendix General Conditions of Dispute Board Agreement, Provisional Sums in Specific Provisions for General Conditions of the Contract, the Provisional Sum for the cost of the Dispute Board shall be used for payments to the Contractor of the Employer's share (one-half) of the invoices of the Dispute Board for its fees and expenses, in accordance with General Conditions Clause 50., No prior instruction of the Engineer shall be required with respect to the work of the Dispute Board. The Contractor shall produce the Dispute Board invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted, which contain requests for payment under the Provisional Sum toward the cost of the Dispute Board. The Engineer'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 Dispute Board.

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4.4 ENTRANCE GATES PROPOSED AND DESIGNED BY CONTRACTOR

The Contractor shall provide one (1) entrance motor sliding gate with a gate booth at the entrance for the EZ connected with rural road. The entrance gate consists of steel sliding gates having 7m width and 2m height each for incoming and outgoing lane. A reinforced concrete structure booth having 2m in width, 4m in length and 2.5m in height with four windows at the centre of the both lanes of the entrance. Contractor shall propose the design and shop drawings of the gate and booth for the Engineer's approval.

The Contractor shall be responsible for execution of works, and shall provide and maintain all equipment, materials, labours, and all other necessities for execution of such works.

The Contractor shall supply, install and test motor sliding gate with caution lights and remote control on rail mounted type and complete with all trim and fittings necessary for proper installation and operation. It shall be installed in the all the gate as approved by the Engineer.

The Contractor shall test the gate its full stroke of operation.

Any alternatives due to standards normally applied by the manufacturers or resulting from special schemes developed by the manufacturers may be proposed by the Contractor provided shall meet the requirements as subject to the approval by the Engineer.

The Contractor shall submit for approval shop drawings and work schedule, catalogue cuts, diagrams, and such other description as may be required by the Engineer for the works for the approval of the Engineer, prior to the construction. No works in shop drawings shall be executed prior to the approval of the Engineer. The approval of shop drawings shall not relieve the Contractor from responsibility of proper fitting and construction of works, nor furnishing of materials or works required by the Contract.

4.4.1 Specifications of the Motor

Type: Rail mounted sliding gate, and electric motor driven ,

Maximum gate weight :1.2 metric tons

Power Requirement :OIC-EB-750 (Three-phase), AC 380V, 50 HZ

Motor Power : 750W, torque : 35 Nm

Motor rotation speed: 1400r/min

Gate speed : 12m/ minute

Control:

Thermal magnetic breaker and test tripper with "on lamp"

Thermal relay for over load protection with reset push buttons for electric motors

Push buttons box for open and close gate

Limit switches for stop end.

4.5 GEOTECHNICAL INVESTIGATION AND ANALYSIS REPORT

4.5.1 GENERAL

The Contractor shall be responsible for execution of the soil investigation, soil sampling and laboratory tests of the samples, and shall provide and maintain all equipment, materials, labours, and all other necessities for execution of such works.

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The Contractor shall submit the following documents for the Engineer's approval before commencement of the works.

- 1) Name of Sub-contractor for and address with their company's information and experience for geotechnical investigation and sampling of un-disturbed material with consolidation tests for minimum 3 projects as Japan's ODA (Minimum qualification of such experience), the international company will be preferable.
 - Type and name of the drilling machines and these catalogues
 - Type and name of the sampler, field vane and portable dynamic cone penetration test equipment,
- 2) Working method of staging, drilling and collection of undisturbed sampling
- 3) Name and address of the laboratory where the laboratory test will be carried out
- 4) CV of responsible geotechnical engineer qualified PhD of geotechnical engineering to be in-charged at the site and laboratory.
- 5) Working schedule
- 6) Staffing schedule

The Contractor shall not withdraw any equipment from the works and change/replace any personnel without the prior approval of the Engineer.

The Contractor retains the right to stop any work if it is not being performed in accordance with SCHEDULE 2 herein contained and/or standards of workmanship, which are normally recognized sound and reasonable.

Work quantities of the Geotechnical Investigation are shown in below.

The field Investigation and laboratory tests shall be carried out under the supervision of the contractor's geotechnical engineer(s). The Contractor shall submit to the Engineer for approval of the engineer(s) prior to commencement of the works.

4.5.2 SCOPE OF THE WORKS

- 1) Borings, Standard Penetration Test

The Contractor shall use drilling machines approved by the Engineer in the boring and sampling works.

Five (5) on-land borings shall be conducted by the Contractor within 60 days after commencement of the works. The boring points would be instructed by the Engineer. The points shall be jointly confirmed between the Contractor and the Engineer. The Contractor shall be responsible for provision of five borings to complete the field works within 30 days after starting the boring subject to approval by the Engineer.

The Second Party shall duly secure the fixation of the working platforms and casing guide piles stable against waves, currents and whatever affected as external forces during soil boring activities, in order to assure quality of SPT, and disturbed and undisturbed samplings.

The location of the boring would be designed at south east area having 70 ha in the Construction site. The existing elevation of such area is about DL +2.8m .

If the original boring point(s) are shifted to the other point(s) due to changes in the design requirement or any other reason(s), the Contractor shall check the existing buried utility facilities or other foreign objects at each boring point before the drilling works.

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In each borehole, Standard Penetration Test (SPT) shall be conducted at one (1) meter intervals according to internationally acceptable testing procedures, principally specified in relevant ASTM standards. All the borings shall be drilled until apparent bearing stratum where SPT values exceed 50 blows/ft over five consecutive intervals or the depth specifically designated by the representative of the Engineer.

The SPT-N values shall be properly recorded in the field note and submitted to the representative of the Engineer daily when the SPT is carried out.

The Contractor shall survey the position (coordinates and elevation) of each borehole by an approved method to suffice with the requirement of the Engineer. The respective latitude/longitude and northing/easting shall be reported based on the closest benchmarks or the other fixed marks temporary or previously established in relation to the latest coordinate system as designated by the Engineer.

The elevation of the ground, i.e., top of the boreholes, shall be also measured and recorded based on the Benchmarks confirmed by the Engineer.

4.5.3 Sampling

Disturbed samples shall be taken by Split-barrel sampler where each STP is carried out.

For layers, where cohesive soil, which has equal or less than 10 blows of SPT, is encountered or specifically designated by the representative of the Engineer, undisturbed samples shall be taken by the thin-wall samplers approved by the Engineer.

All disturbed and undisturbed samples shall be stored in airtight transparent containers, on which the location and depth of the samplers taken shall be labeled. The soil samples thus prepared shall be handed over to the Engineer after all the tests are completed.

In total, fifty five (55) undisturbed samples shall be taken, whereas number of the undisturbed sampling for each borehole depends on the sub-soil condition as indicated in Table below, Basically, undisturbed samples shall be taken from DL- 10 m to -30m of cohesive layer at approximately 2 m interval. Should it be technically unreasonable in undisturbed sampling, for sandy soil or very soft clay layers, the undisturbed soil sampling may not be carried out.

Immediately after the undisturbed sampling, the samplers shall be sealed and transported from the site to the laboratory. The samples shall be prevented from shocks, vibrations and changes in moisture content during the transportation.

In case drilling encounters hard stratum when its completion satisfactory, at least coring for sample of the hard stratum shall be conducted up to at least five (5) meters below.

4.5.4 Laboratory Tests

All laboratory tests shall be carried out in conformity with internationally acceptable testing procedures, principally specified in relevant ASTM Standards.

Representative specimens (geotechnical engineer) from all the samples taken shall be subject to physical property tests as listed below:

- Gradation (Sieve and Hydrometer Tests)
- Water content
- Specific gravity

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- Atterberg's Limit Tests (Liquidity Limit and Plastic Limit)

Mechanical property tests shall be conducted for all undisturbed samples. The tests shall include Oedometer Consolidation Tests and Unconfined Compression Tests. For all the specimens, wet density shall be measured, together with the physical properties above specified.

4.5.5 Geotechnical Investigation Report

All results of the sounding and laboratory tests shall be reported in the forms internationally recognized or acceptable to the Engineer. They shall be complied together with cross-sections/profiles of soil stratification and the location maps in Geotechnical Investigation Report.

The sounding results at each boring shall be summarized in bore-hole logs, wherein principal information of soil result, sample recovery, STP and corresponding results from the laboratory tests are included, specially consolidation test results shall be covered the value of Compression Index (C_c), consolidation coefficient (C_v) and Initial void ratio (e_0); with those calculation/ figure sheets into the report..

The laboratory test results shall be prepared in an appropriate data sheet format for each test item. As much as being the results specific, original reading during measurement should be reported, so that the Engineer is able to check the data, if required.

Upon completion of the works, the Contractor shall submit to the Engineer all the field notes, photographs and other relevant document(s), all soil samples in water/air tight sample containers in holder box(s) and four (4) copies of the final report in English.

4.5.6 Consolidation Analysis and Recommendation of Alternative Soil Improvement

Upon completion of the investigation works, the Contractor shall make analysis of the consolidation of the cohesive layer (expected from GL -10m to GL-30m), settlement value and settlement period shall be analysed in the conditions of sand filling up to designated elevation (FGL) of each boring points.

The Contractor shall make and submit the analysis report above four (4) copies in English to the Engineer and approved by the Engineer. In case that the settlement value has analysed more than 1.0m (100cm) or /and 60cm settlement down would be analysed within the 20 years period, the Contractor shall consider and recommend the soil improvement with those method including its cost, construction period and construction area to the Engineer for discussion between the employer and the Engineer. The Engineer may request an alternative soil improvement method and its scale or/and area, the Contractor shall be considered the alternative method including its cost and construction period to submit the Engineer for approval.

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Table : Planned Boring numbers and Tests Requirement

Description	Borehole/ Test Pit/Coring Pit No.	Drilling Depth	Field Test S.P.T	Un-disturbed Soil Sampling (GL-10m~ GL-30m)	Laboratory Test					
					Physical Property Tests				Mechanical Property Test	
					Specific Gravity Test	Natural Water Content	Grain Size Analysis	Liquid & Plastic Limit Test	Unconfined Compression Test	Oedometer Consolidation Test
Position	unit	m	nr	nr	nr	nr	nr	nr	nr	nr
On land	BH-01	38	38	10	38	38	38	38	10	10
(East half Area)	BH-02	38	38	10	38	38	38	38	10	10
Existing ST-10 ~ST-14)	BH-03	38	38	10	38	38	38	38	10	10
	BH-04	38	38	10	38	38	38	38	10	10
	BH-05	38	38	10	38	38	38	38	10	10
Total	5	190	190	50	190	190	190	190	50	50

4.6 SOIL IMPROVEMENT

4.6.1 GENERAL

The Contractor shall be responsible for execution of the soil improvement. Upon completion of the geotechnical investigation and analysis which will be targeted area Zone A, B and C in Figure 4 of Supplementary Information, described in Chapter 4.5 above, the Contractor shall consider and propose the soil improvement with those method including its cost, construction period and construction area to the Engineer for discussion between the employer and the Engineer. The soil improving works will be paid as the Provisional Sum for Soil Improvement in which might be limited the cost described in BOQ.

In case that the settlement value has analysed more than 1.0m (100 cm) or /and 60cm settlement down would be analysed within the 20 years period, the area would be improved by the Contractor's proposed method.

Based on the Figure 4 of Supplementary Information, Zone A and a part of B (expected about 40 ha) will be necessary to improve by PBD method.

The Contractor shall submit the following documents for the Engineer's approval before commencement of the works.

- 1) Technical calculation report for soil improvement by using proposed method, area and scale of the improvement including necessary additional filling for settlement.
- 2) Method statement of catalogues and construction equipment
- 3) Construction schedule and monitoring schedule.
- 4) Cost proposal for the improvement works including additional filling cost.
- 5) CV of responsible geotechnical engineer qualified PhD of geotechnical engineering to be in-charged at the site and settlement monitoring
- 6) Staffing schedule

The Contractor shall not withdraw any equipment from the works and change/replace any personnel without the prior approval of the Engineer.

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4.6.2 SCOPE OF THE WORKS

1) Soil Improvement :

Plastic Board Drain (PBD) method or equivalent will be expected about 40 ha area and 20m~ 30m in depth. (Average about 25m).

2) Additional Filling of the improved area

Additional Filling will be proposed average settlement value of 70 % until handover of the area. However, the value shall be deducted initial settlement value (average settlement) considered to the unit cost in the case without soil improvement for the area by the contractor (reference to the specification of 3.1.5)

3) Design of Soil Improvement

Contractor shall calculate and design the drain board length, its driven pitch (interval) and surcharge of sand filling (additional filling thick) for settlement value of 70% for three to five months based of one board brain per 2 m² and 25 m~ 30m in length. The design and the method statement shall be submitted by the Contractor within 30 days after completion of the geotechnical investigation and analysis.

The contractor shall submit the technical specifications for the proposed works for approval by the Engineer.

4.6.3 Settlement Monitoring

Prior to the reclamation and filling works after soil improvement works, the Contractor shall prepare, install and maintain settlement monitoring plate and rod at locations directed by the Engineer.

The Contractor shall supply and install settlement gauges of the type and number shown in the following Table for the settlement monitoring of the existing ground in the course of reclamation and take measurements of settlement once a week or as directed by the Engineer, during the whole period of the filling works and submit a weekly report to the Engineer for each set of measurements for approval.

Settlement Monitoring Requirement

Type of Settlement gauge	No. of gauge	Depth of installation below the final ground level
Settlement plate and rod gauge for the upper layer	1 per 15,000 sq.m of filling area (expected 40 ha for improvement area)	Approximately 4m +3.8m (Av. Existing grand level +1m, on the drain sand mat), +6.8 m (expected Final Grand Level to handover)

The settlement gauges shall, in principle, be of the double tube steel post structure with a steel bed plate welded to the bottom and supporting steel rods. The Contractor shall submit a drawing showing the construction of settlement gauges to the Engineer for prior approval. The location of settlement gauges and time of installation shall be approved by the Engineer.

Settlement gauges shall be fixed on a foundation with clear filling as soon as the toe of the

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filling reaches the proposed position of any gauge.

The levels of the original ground bed surface and of the base plate shall be recorded. All gauges shall be securely fixed or guided into position until such time as the fill is sufficiently deep to hold them in position.

The Contractor shall allow for the supply, installation, maintenance, lengthening and re-leveling as directed, protection by approved heavy stakes, taking levels as directed, finally removing or cutting off the pipe or rod upright as directed, and all other expenses of whatsoever nature in connection with the devices.

APPENDIX

APPENDIX 1 Environmental Protection Requirements

1.1 REGULATIONS AND CLEARANCES

The following is a list of the primary laws and regulations. More detailed list including but not limited to environmental protection and social safeguards are given in the Table 2-1: Applicability of Key Environmental Legislation at a Glance, EIA. It is the Contractor's responsibility to regularly check any updates of the regulatory requirements and revise the outline EMP if it is necessary.

- Bangladesh Environmental Conservation Act, 1995 (subsequent amendments in 2000 and 2002)
- Environment Conservation Rules (ECR), 1997 (subsequent amendments in 2002 and 2003)
 - Memo No: DoE/22.02.6700.140.72.101.18/H.O.-334, dated 27/5/2018, Approval of Environmental Impact Assessment (EIA) Report for Proposed Bangladesh Special Economic Zone Project at Araihaazar Upazila under Narayanganj district
- Environment Court Act, 2000 and subsequent amendments in 2002
- JICA Guidelines for Environmental and Social Considerations, April 2010

Conditions of the approved EIA are as follows (4 pages);

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Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No : DoE/22.02.6700.140.72.101.18/H.O.- 334

Date: 27/05/2018

Subject: Approval of Environmental Impact Assessment (EIA) Report for Proposed Araihaazar (Japanese) Economic Zone Project at Araihaazar Upazila under Narayanganj district.

Ref: Your Application dated 08/05/2018 and 16/05/2018.

With reference to the above, the Department of Environment (DOE) is pleased to approve Environmental Impact Assessment (EIA) Report for Araihaazar (Japanese) Economic Zone Project at Araihaazar Upazila under Narayanganj district. This approval authorizes and regulates the following activities:

1. This Environmental Impact Assessment (EIA) report is approved only for construction of Araihaazar (Japanese) Economic Zone Project. Any expansion or extension of this project will require obtaining further EIA approval with additional EIA Study.
2. The detail design and layout plan should be maintained as per EIA report. In case of any changes in design the proponent must obtain consent from DoE.
3. Project Proponent may undertake activities for land development and infrastructural development of the project.
4. Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to waste treatment plant and other pollution control devices.
5. The activity under construction of Araihaazar (Japanese) Economic Zone Project shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources or ecosystem.
6. Proper and adequate mitigation measures shall be ensured throughout preparation and construction period of the proposed Araihaazar (Japanese) Economic Zone Project activities.
7. Any heritage sight, ecologically critical area, wetlands and other environmentally, religious and archeologically sensitive places shall be kept protected.
8. Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.
9. Construction works shall be restricted to day time hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.
10. Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.
11. In order to control noise pollution, vehicles & equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.



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12. No solid waste can be burnt in the project area. An environment friendly solid waste management system should be in place during the whole period of the project in the field.
13. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.
14. All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative/functioning on a continuous basis.
15. To control dust, spraying of water over the earthen materials should be carried out from time to time.
16. Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.
17. Adequate considerations should be given to facilitate drainage system for run off water from rain/tidal surge.
18. Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies.
19. There should be adequate and properly designed Central Effluent Treatment Plant (CETP) and Sewage Treatment Plant (STP).
20. Resettlement plan should be properly implemented and people should be adequately compensated.
21. Construction material should be properly disposed off after the construction work is over.
22. As described in the EIA report, environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.
23. All activities (pre-construction, construction and post-construction stage) should be implemented according to EMP clearly listed in the EIA report.
24. A third party/independent monitoring bodies excluding project authority should be engaged immediately for monitoring of all the activities during pre construction, construction and post construction phases as per monitoring plan of EIA report and monitoring report must be submitted to Narayanganj District Office, Narayanganj and Headquarter of the Department of Environment simultaneously.
25. Regular monitoring of the susceptible places of surroundings for protecting ecosystem, biodiversity and forest coverage should be made using latest high resolution image for keeping ambient environment protected.
26. Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the surroundings and other fragile ecosystem and report of monitoring results should be submitted to Narayanganj District Office, Narayanganj and Headquarter of the Department of Environment simultaneously.
27. There should be regular disclosure of the report through workshops and websites and responses should be taken care accordingly.
28. Online air and water quality monitoring system should be made functional throughout the life of the project.
29. Management Information System (MIS) are to be developed for this project. The scope of MIS services will obviously include representing the real time monitored data especially environmental parameters displaying at Narayanganj District Office, Narayanganj and Headquarter of the Department of Environment, project office and other agencies/Ministries concerned. The MIS should be web based for accessing every individual to show the real time monitored records.

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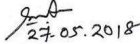
30. The project authority should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events
31. Conduct stakeholder meetings on regular basis for better performance the project as a whole
32. Additional environmental baseline data to be collected as suggested in the EIA report and conveyed to DOE and other authorities concerned.
33. The Environmental Management Plan under the EIA study shall strictly be implemented and kept functioning on a continuous basis.
34. The project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work commences in the field to the Narayanganj District Office, Narayanganj and Headquarter of the Department of Environment simultaneously.
35. Environmental Monitoring Reports according to specific format specified in the EIA Report shall be made available simultaneously to DOE Narayanganj District Office, Narayanganj and Headquarter on a quarterly basis during the construction period of the project.
36. The following records must be kept in respect of any samples required to be collected for the purposes of environmental monitoring activities :
 - (a) the date(s) on which the sample was taken;
 - (b) the time(s) at which the sample was collected;
 - (c) the point at which the sample was taken; and
 - (d) the name of the person who collected the sample.
37. The results of any monitoring required to be conducted under this EIA report must be recorded.
38. In case of any emergency, the following information shall immediately be reported to Narayanganj District Office, Narayanganj and Headquarter of the Department of Environment (DOE) simultaneously
 - a) Nature of incident (fire, accident, collision, land slide etc.)
 - b) Personnel affected (injured, missing, fatalities, etc.)
 - c) Emergency support available and its location (standby transport, medical facilities, etc.)
 - d) Weather conditions
 - e) Current operations (abandoning the site, fire fighting, etc.)
39. The project authority or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.
40. All pollution incidents shall be reported immediately and simultaneously to the Narayanganj District Office, Narayanganj Office and Headquarter of the Department of Environment (DOE) in Dhaka.
41. Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling of any plant/tree/sapling forested by any individual or government before doing such type of activity.
42. No activity of cutting/razing/ dressing of hill or hilly land is endorsed under this approval without due permission/clearance of the concerned authority of the Government of Bangladesh.
43. Re-vegetation and replantation under green belt activities shall be undertaken in consultation with the Forest Department according to those mentioned in the EIA report.
44. Climate Change impacts and maximum storm surge height (if necessary) shall have to be considered at the design and construction phase.
45. A separate hydrological study shall have to be conducted for ground water extraction to develop sound environmental management plan.



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46. A full-fledged institutional setup for Environment, Health & Safety (EHS) and Corporate Social Responsibility (CSR) must be put in place before operation of the project.
47. The project authority shall extend active cooperation to DOE officials to facilitate their visit to the site as and when necessary.
48. Violation of any of the above conditions shall render this approval void.
49. Any injunction on this project from the Honourable High Court Division or Appellate Division of the Supreme Court shall render this approval void.
50. Without installation of Central Effluent Treatment Plant (CETP), Sewage Treatment Plant (STP), online air and water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate the proponent shall not start operation of the project.
51. This EIA approval is valid for one year from the date of issuance and the project authority shall apply for renewal to the Narayanganj District office, Narayanganj with a copy to Head Office of DOE, Dhaka at least 30 days ahead of expiry.

This EIA approval has been issued with the approval of the appropriate authority.


27.05.2018

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 02-8181673

Project Director
Araihazar (Japanese) Economic Zone
Support to Capacity Building of Bangladesh
Economic Zones Authority Project
Bangladesh Economic Zones Authority (BEZA)
Monem Business District (Level-12)
111, Bir Uttam C.R. Dutta Road,
Kawran Bazar, Dhaka-1205.

Copy Forwarded to :

- 1) PS to Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Dhaka Regional Office, Dhaka.
- 3) Deputy Director, Department of Environment, Narayanganj District Office, Narayanganj.
- 4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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1.2 Contractor's Environmental Performance

After signing of contract, the Contractor shall be required to submit the "Outline" EMP describing their understanding of environmental management for construction works and details of implementation of environmental management during construction phase.

The outline EMP shall cover all aspects of the approved EMP by DoE and monitoring reequipments in the following subsections and consist but not limited to the following sections.

- a) Contractor's Organization: An organization chart indicating persons with environmental responsibilities, their level of authority, lines of reporting and contact details. Identify other responsibilities held and the proportion of their time allocated to environmental management. Information shall be provided for the Contractor and any subcontractors appointed by him.
- b) Staff Awareness: Method of developing environmental awareness within site staff such that the significance of the impact mitigation measures is understood.
- c) Environmental Compliance: Description of specific procedures to meet environmental performance requirements specified in appropriate legislations.
- d) Preventative Action and Mitigation Measures: Description of the procedures to be put in place to prevent environmental impacts from occurring or measures that will minimize the extent of impact to levels within Environmental Standards.
- e) Corrective Action Procedures: Description of procedures to be carried out in the event that the Contractor himself identifies the need for corrective action is informed by the Engineer of the need for corrective action or that the results of the environmental monitoring programme indicate that Environmental Standards are being breached.
- f) Communication Pathways: Description of the procedures for third parties to be able to notify the Contractor of environmental concerns and for the Contractor to communicate with third parties with regard to environmental performance.
- g) Environmental Monitoring: The Contractor shall be responsible for carrying out the Environmental Monitoring Programme associated with the construction phase of the project as described in the EMP. The Contractor shall propose a suitable organization to carry out the monitoring activities, subject to the approval of that organization by the Engineer. Prior to the start of construction, the Contractor shall carry out programme of environmental monitoring to establish the baseline conditions for air quality, water quality, seabed quality, traffic conditions etc.
- h) Details of how they will implement the environmental management obligations for this project. They shall address specific issues defined in the tender documents which will include:
 - Materials delivery plan and management on local road traffics
 - Mitigation plan of land reclamation
 - Site pollution management
 - Clarification of both dry-season-specific and rainy-season-specific measures or precautions to be taken in regards to dredging work and land filling work.
 - Management of site run off during the rainy season
 - Solid and liquid waste management plan
 - Environmental management and monitoring plan

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- Environmental monitoring checklist

1.3 ENVIRONMENTAL MANAGEMENT PLAN

1.3.1 General Requirements

- a) All debris from demolition and site preparation works shall be removed and disposed to suitable locations outside of the premises in a manner that will not be an environmental hazard, or cause it to be an open dump that may attract animals and birds to the vicinity of the site.
- b) A wheel wash shall be installed at the exit to the site to ensure that loose material associated with excavation, removal of soil, debris and delivery of construction materials is not carried by vehicle types and deposited on public roads. The road carriageway adjacent to the site shall be hosed down at the end of each working day.
- c) Construction materials (soil, crushed material etc.) shall be covered with tarpaulin during transportation and precautions (spraying of water or other appropriate adhesive material) shall be taken to avoid dust emissions during loading, transportation and unloading.
- d) All vehicles shall conform to Air Pollution Control and Noise stipulated Sub-decree issued as National Environmental standards.
- e) All activities at the construction site shall be managed by the Contractor in such a manner that the National Environmental Laws, Regulations Code and Standards.
- f) Environmental impact on ecosystem, both inland and aquatic species is expected due to the nature of the activities. River dolphin, which are enlisted as an endangered species by IUCN, has been confirmed to inhabit in the dredging site in Meghna river. Necessary measures must be taken to minimize impact on River Dolphins (see Environment Management Plan in Appendices for details).
- g) All construction equipment and processes shall be managed in order to satisfy the Standards for vibration of the operation of machinery, construction activities and vehicle movement. The Contractor shall be responsible for compensating for any damages caused to property due to their works during the construction period.
- h) Provide adequate sanitary facilities at site and in the labor camps and quarters for the work force and provide septic tank/cesspool systems, and make sure that these are used and maintained properly.
- i) Provide separate covered bins for litter (stationery, glass, food, PET bottles and other plastics) with collection and recycling and disposal arrangements in the labor camp, and strictly control the labor force by proper education.
- j) Educate the workforce on good health and safety practices and ensure that no dumping grounds are created within the premises by throwing food or other organic substances that would attract animals.
- k) Provide proper drainage at the site and ensure that drains are not blocked by debris or other foreign materials at all times to prevent stagnation of water either at the site or within the port premises due to the construction activities during the entire construction period.
- l) Provide and maintain adequate temporary provisions such as settling ponds in order to avoid pollution of the waterways due to washed off sand, earth etc. during the construction period.
- m) Take necessary steps to minimize soil erosion during land preparation by scheduling these activities during the dry season where possible, and avoiding exposure of bare land to rains by covering with suitable material if needed.
- n) Make arrangements with the BEZA authorities to have a separate lane opened as a haul road for construction vehicles to avoid congestion on the road. The Contractor shall

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also try as much as possible to minimize movements of construction vehicles during peak hours.

- o) Prepare a traffic management plan in order to minimize the impact of construction vehicles on the normal traffic on the National Road particularly during peak hours. Traffic management will be reflected comments received from Traffic Police.
- p) Take adequate insurance cover in order to compensate for any fatalities, medical bills or damages to property arising out of accidents at site.

1.3.2 Water Pollution Control

- a) The Contractor shall design methods of working to minimize water pollution and to meet the appropriate environmental standards and shall provide experienced personnel with suitable training to ensure that these methods are implemented.
- b) The Contractor shall provide portable toilets with sufficient capacity for the number of workers on the site. The Contractor shall be responsible for arranging for the wastewater from the toilets to be collected at regular intervals by an authorized contractor. No overflows from the storage tanks to the surface water drains will be permitted.
- c) The Contractor shall describe all proposed methods of working in the OUTLINE EMP.

After commencement of the Works, if the Construction Equipment or work methods are believed by the Engineer to be causing unacceptable levels of pollution the Construction Equipment or work methods shall be inspected and remedial proposals drawn up, approved and implemented. Where such remedial measures include the use of additional or alternative Construction Equipment, this shall not be used on the Works until agreed by the Engineer. Where remedial measures include maintenance or modification of previously approved Construction Equipment, this shall not be used on the Works until such maintenance or modification is completed and the adequacy of the maintenance or modification is demonstrated to the satisfaction of the Engineer.

- d) Where visual monitoring of the water quality by the Engineer or the formal environmental monitoring indicates an impact on the surface waters the Contractor shall review the mitigation measures. The review of the mitigation measures shall include but not be limited to the following:
 - Checking of all Plant and Equipment;
 - Maintenance or replacement of any Construction Equipment contributing to the impact;
 - Checking and maintenance of silt traps where used; and
 - Review of all working methods.
- e) The Contractor shall, as a result of the review, implement further mitigation measures such that the water quality is restored.
- f) In the case that the Contractor fails to implement the necessary mitigation measures or the water quality deterioration persists despite the mitigation measures then the Engineer can instruct the Contractor to temporarily suspend the causative works until the Engineer is assured that proper mitigation measures have been implemented and the water quality has returned to acceptable levels.

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1.3.3 Air Pollution Control

- a) The Contractor shall maintain an inventory of the number, type and location of all stationary emission sources within the boundary of the construction site during the period of construction.
- b) The Contractor shall undertake at all times to prevent dust nuisance and excessive exhaust emissions as a result of his activities.
- c) Before the commencement of any work, the Engineer may require the methods of working and equipment intended to be used on the site to be made available for inspection and approval to ensure that they are suitable for the project.
- d) The Contractor shall ensure that all Plant and Equipment to be used on site are properly maintained in good operating condition and that the Plant and Equipment does not give rise to excessive exhaust smoke emissions.
- e) In the process of material handling, any material which has the potential to create dust shall be treated with water or wetting agent sprays, especially when dusty materials are being loaded or unloaded.
- f) Any vehicle with an open load-carrying area used for moving materials, and having the potential to create dust, shall have properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300 mm over the edges of the side and tail boards.
- g) The Contractor shall frequently clean and water the any public road used by vehicles accessing the site to minimize the fugitive dust emissions.
- h) The Contractor shall restrict all vehicles on the Site to a maximum speed of 8 km per hour and confine haulage and delivery vehicles to designated roadways inside the site.
- i) The Contractor shall provide and maintain wheel and sub-frame cleaning facilities at location(s) approved the Engineer. The design of the wheel and sub-frame cleaning facility shall be approved by the Engineer before installation in order to ensure that it is suitable for the project. All vehicles leaving the site shall be cleaned to the satisfaction of the Engineer. No earth, mud, debris, dust and the like shall be deposited on access and public roads.
- j) Where inspection of the site by the Engineer or the formal environmental monitoring indicates significant increase in dust level the Contractor shall review the mitigation measures. The review of the mitigation measures shall include but not be limited to the following:
 - k) Checking of water spraying/dust suppression equipment;
 - l) Maintenance or replacement of any Plant or Equipment contributing to the impact;
 - m) Checking and maintenance of tarpaulin or enclosures where used; and

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- n) Review of all working methods.
 - o) The Contractor shall, as a result of the review, implement any further mitigation measures that may be required such that the dust levels are reduced.
 - p) In the case that the Contractor fails to implement the necessary mitigation measures or the increased dust level persists despite the mitigation measures then the Engineer can instruct the Contractor to temporarily suspend the causative works until the Engineer is assured that proper mitigation measures have been implemented.
- 1.3.4 Hazardous Substances and Chemical Management
- a) The Contractor shall provide secure storage facilities for all Hazardous Substances and Chemicals to be used on the site. Such facilities should be banded areas with sufficient capacity to contain the capacity of the store and be designed in such a way as to prevent spillage or leakage washing into surface water drains or draining into the soil. The banded areas should be constructed with a rainwater drain and accumulated uncontaminated rain water drained at regular intervals.
 - b) Maintain an inventory of all Hazardous Substances and Chemicals stored on the site and will hold Material Safety Data Sheets for each substance or chemical.
 - c) Sufficient spill management materials shall be available at the store and the use areas to control any accidental spillages.
- 1.3.5 Waste Management
- a) The Contractor shall include in the OUTLINE EMP a Waste Management Plan which will include procedures for waste minimization and waste segregation.
 - b) The Contractor shall provide sufficient containers on the site for the temporary storage of solid waste generated from his activities. In particular the Contractor shall take such precautions as are necessary to prevent waste being blown to the operation area.
 - c) Separate containers shall be provided for hazardous and non-hazardous wastes which will be clearly labelled. Separate containers will be provided for waste oils and hydraulic fluids.
 - d) The Contractor shall be responsible for arranging the collection of the waste from the site at suitable intervals by an authorized waste disposal contractor.
 - e) The Contractor shall refrain from carrying out burning of rubbish.
 - f) Where inspection of the site by the Engineer indicates that the containment and disposal of waste is not being carried out satisfactorily the Contractor shall review the mitigation measures. The review of the mitigation measures shall include but not be limited to the following:
 - Suitability, sufficiency, location, labelling and access to waste containers;
 - Maintenance or replacement of any faulty containers;
 - Checking and maintenance of nets where used; and
 - Review of all working methods.

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- g) The Contractor shall, as a result of the review, implement further mitigation measures that may be required such that waste management is adequate.
- h) In the case that the Contractor fails to implement the necessary mitigation measures or the waste management problem persists despite the mitigation measures then the Engineer can instruct the Contractor to temporarily suspend the causative works until the Engineer is assured that proper mitigation measures have been implemented.

1.3.6 Community Relationship Management

a) Distribution of Information Regarding Construction Work

There are farmers who utilize the access route of the farmland for farmer's activities.

After the contract with BEZA and pre-construction phase, the Contractor shall distribute the following information of the project through installation of signboards (total 4 sites) informing the local residents who live in the port area and farmers who utilize vehicles or boats in the proposed project area.

- Location of construction work
- Notices of the construction work etc.

b) Installation of boundary fence

For the smooth and safety operation of traffics, the contractor shall install boundary fence around the working area. Contractor shall be responsible for arranging of the barricades or fence and type of materials. The Contractor shall undertake at all times to maintain safety operation of traffics for farmer's vehicles and boats during construction works.

c) Reporting Requirement

If there is any public complaint reported, immediate action should be taken for water sampling at the locations identified and will inform to the Engineer including the written report stating the cause and source thereof. The Contractor shall provide details of how they will implement the environmental monitoring obligations for this project, as set out in the EMPs.

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1.3.7 Environmental Management Plan as per the approved EIA (mandatory requirements by law)

Table Appendix 1-1

Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
Environmental Pollution	Air Pollution	<ul style="list-style-type: none"> To minimize the dust generation, water should be sprinkled regularly at the site and low sulphur diesel should be used in land levelling equipment's to control the SO₂ emissions Construction vehicles and machinery should be regularly serviced and check for pollution control 	Appointed Contactor
	Water Pollution	<ul style="list-style-type: none"> Avoid excavation activities during rain; Minimize run-off by using sprays for curings; Construct the project boundary by the earth material prior to the land filling for avoiding tailwater runoff in the surrounding agricultural land and water bodies; Ensure the proper drainage network to discharge the tailwater; Leaching from the sediments as well as other site runoff shall be contained, either to seep into the subsoil, or to be discharged in a controlled manner so as to minimize release of sediment laden water in excess of 200mg/l of suspended materials into adjacent lands or waterways; The contractor shall regularly monitor water quality of site runoff; If necessary, additional siltation ponds shall be constructed and utilized by the contractor to settle out excess suspended materials prior to discharge into the environment 	Appointed Contactor
	Waste	<ul style="list-style-type: none"> Avoid excavation activities during rain; Construct the project boundary by the earth material prior to the land filling for avoiding tailwater runoff in the surrounding agricultural land; Ensure the proper drainage network to discharge the tailwater; 	Appointed Contactor
	Soil Pollution	<ul style="list-style-type: none"> Debris/Raw material will be stored under covered sheds and paved surface; Fuel storage area should be proper containment; 	Appointed Contactor

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
	agricultural productivity will be reduced	<ul style="list-style-type: none"> • Surplus water should not be disposed into surrounding land; • Properly disposed the surplus water as stated in the mitigation measures of water pollution • Waste from labour camps can be segregated at site. Food waste/wet waste should be composted in pits within the camp site; • Recyclable waste should be sold to the authorized dealers ensuring environmental friendly and the remaining should be disposed off at designated sites through local agencies responsible for waste management in the area; 	
Noise and Vibration	<ul style="list-style-type: none"> • Noise and vibration levels will increase in the surrounding community due to operation of compactor. • Vibration from the machineries may damage the surrounding structure. 	<ul style="list-style-type: none"> • Construct the earthen embankment near the settlement prior to the compaction activities of the EZ area to reduce the structure damage; • Land development activities will be implemented with a focus on vibration control at source and consultation with potentially affected receptors; • Contractor shall give prior notice/warning to every household or owners of structure whose property could be potentially affected due to noise and/or vibration. • If any structure will be damaged due to the compaction activities then contractor should properly compensate to the property owner; • Use low vibration generating machineries near the settlement area; • Where machines are fitted with engine covers, these will be kept closed whenever the machine is in use. • All machineries will be well maintained and fitted with adequately maintained silencers which machineries design specifications. • Machinery to be used should comply with the noise standards prescribed by DoE. • No activities to be undertaken during night hours to prevent any disturbance to nearby residents <p>Monitor the noise and vibration monitoring in the nearby homestead area. Following codes may be adhered; 5228-1:2009 Code of practice for noise control on construction and open sites –</p>	Appointed Contractor

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
		<p>Part 1: Noise guidance and BS 5228-2:2009 Code of practice for vibration control on construction and open sites – Part 2: Vibration; Table B.1 and Table B.2.</p> <ul style="list-style-type: none"> • Earth filling material should be in proper containment; • Proper monitoring should be taken during land development; • Properly disposed the surplus water as stated in the mitigation measures of water pollution 	Appointed Contactor
Sediment Quality	<ul style="list-style-type: none"> • During the land development, earth-filling material may washout to the nearby canal and increases the sediment concentration. 		
Ecosystems	<ul style="list-style-type: none"> • Land filling • Increase sediment content in the water body may impact the aquatic animal; • Excavation of the top soil of the EZ site for land development will affect insect and amphibians present in the project site; • Noise and dust will be generated during the land development, which may affect surrounding inhabiting floral and faunal species; • A total 1055 trees will be affected by the project where 349 fruits trees, 127 timbers, 253 bananas and 326 Bamboos have been identified. • River dolphins and other aquatic species may be affected due to dredging work and transportation of dredged material. 	<ul style="list-style-type: none"> • Land development work should be confined within the project boundary. • Properly manage the tailwater as it may affect the surrounding land; • No solid or liquid waste shall be discharged in water bodies; • Septic tanks/soak pit should be provided to treat sewage to be generated from labour camps and prevent its disposal in water body; • Vehicle washing/equipment cleaning should not be allowed near canal/drains in EZ site; • Excavation and filling should be carried out in phased manner to minimize exposure of loose earth for longer duration; • Temporary storm water drainage system should be developed at site to channelize the storm water away from excavation/filling area, debris storage area and raw material storage area; • Animal killing/hunting by labour is strictly prohibited; • Avoid the night time work; • Tree plantation should be carried out along the project boundary after land development • If any kind of trees need to cut down for the project then project proponent/contractor should take NOC from Forest Department (FD). • During dredging work, illuminance at night should be minimized to not to disturb habitats of light-sensitive species such as river dolphins. • During dredging work, pingers can be used to keep away river dolphins from dredging sites and transportation routes under supervision of expert. Low noise 	Appointed Contactor

Natural Environment

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
Hydrology	<ul style="list-style-type: none"> Impact on drainage pattern & hydrology is temporarily expected caused by land modification Rainwater and floodwater drainage would be impacted due to the land development if proper drainage network system not present The adjacent land may inundate by high precipitation and over flow of canal/river water 	<p>machines should be used for dredging activity when possible. Further measures should be taken if experts of river dolphin find necessary.</p> <ul style="list-style-type: none"> It was confirmed that the path and the direction of Dhawrakhalī Canal & Brahmaputra River would be kept functional during all phases of the project Surface water flow would not change significantly and would keep its current water flow. Ensure the proper water drainage of the surrounding area 	Appointed Contactor
Topography and Geology	<ul style="list-style-type: none"> The average RL of Bangladesh Special Economic Zone site is 2.859 mMSL. The proposed land will be developed up to the 7.098 mMSL by dredged sand. The land should be raised 4.203 m from the average RL of the economic zone site. Therefore, present topographic condition will be changed due to the land development of the EZ site. Due to the significant sand reclamation from the surrounding river beds, erosion of the river bank could occur without proper sand dredging. 	<ul style="list-style-type: none"> Land development should be confined within the project site. Ensure the surrounding land would not be affected due to the land development; Save topsoil removed at the start of the project and use it to reclaim disturbed areas upon completion of construction activities. Apply protective covering on disturbed soils as quickly as possible. Clean and maintain catch basins and drainage ditches regularly. Re-establish the original grade and drainage pattern to the extent practicable. Obtain borrow material from authorized and permitted sites. The contractor should monitor condition of the riverbanks near dredging site on weekly basis by visual inspection and/or communicating with local residents. If dredging work is found to be the cause of erosion, the dredging work should be suspended and dredging location must be reconsidered in order to avoid further erosion. When the contractor obtain concession and conduct EIA for dredging site, the distances from river banks and impacts on river bank erosion should be taken in account. 	Appointed Contactor
Vulnerable Group	<ul style="list-style-type: none"> In Bangladesh Special Economic Zone project, out of 1,714 	<ul style="list-style-type: none"> Provide soft skill jobs (physically benign) and employment opportunities for vulnerable that may increase their participation and support them with income 	Appointed

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
	households, total 150 (8.75%) households were identified as vulnerable. Among them 25 are female headed having no male income earner, 58 are elderly headed and 67 were identified as extreme poor.	<ul style="list-style-type: none"> and livelihood. • Organising women in self-help group to operate canteens in the EZ; • Giving preference in physically less demanding jobs in the EZ such as cleaning, office assistant, computer operator etc; • Ensure non-exploitation of women in terms of equal wage, opportunity, participation indecision making etc. • Create awareness among the workers, staff and women about the exploitation and sexual harassment at work place; • Create awareness about sexually transmitted disease, HIV/AIDS, exploitation etc; and • Implementation of social welfare programs targeted at vulnerable groups including old aged, physically handicapped etc. under CSR programs and activities 	Contactor
Land use and utilization of local resources	<ul style="list-style-type: none"> • The temporary storage and stockyard are built up on the agricultural lands, and then the crop production will be obstructed in those areas. • Crops will also be damaged when the equipment and heavy vehicles will pass through agricultural fields around the project areas. 	<ul style="list-style-type: none"> • Inform the land owner prior to start the land development as they can harvest the standing crops; • Land development should be confined within the project site; • No activities should be carried out outside the project boundary since it may disturb the surrounding landscape • Plantation area which will be tentatively occupied during pre-construction, will be restored to original state and returned to the land owner after construction. 	Appointed Contactor
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> • Noise and vibration will be generated during the land compaction and leveling, which may affect the surrounding social infrastructure. 	<ul style="list-style-type: none"> • Construct the earthen embankment near the settlement prior to the compaction activities of the EZ area to reduce the structure damage; • Land development activities will be implemented with a focus on vibration control at source and consultation with potentially affected receptors; • If any structure will damage due to the compaction activities then contractor should properly compensate to the property owner; • Use low vibration generating machineries near the settlement area; • All machineries will be well maintained and fitted with adequately maintained 	Appointed Contactor

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
		<ul style="list-style-type: none"> silencers which machineries design specifications. Machinery to be used should comply with the noise standards prescribed by DoE. No activities to be undertaken during night hours to prevent any disturbance to nearby residents 	
Local conflicts of interest	<ul style="list-style-type: none"> Due to an increase in employment, opportunity will be increasing during land development; candidates of workers may have some conflicts between communities. 	<ul style="list-style-type: none"> Clear information about the needs of labor (number and qualification) should be provided with local people. The job skills and the priority for the affected people shall be taken into account and the workers can be chosen. 	Appointed Contactor
Landscape	<ul style="list-style-type: none"> The landscape will change due to the land development of Bangladesh Special Economic Zone. Moreover, 219 ha of agricultural land will be cleared and altered to industrial area as the part of Economic Zone development. 	<ul style="list-style-type: none"> Land development should be confined within the project site; No activities should be carried out outside the project boundary since it may disturb the surrounding landscape 	Appointed Contactor
Gender	<ul style="list-style-type: none"> Salary gap between gender 	<ul style="list-style-type: none"> Monitoring of payment to workers by the contractor shall be implemented not to allow payment gaps between male and female 	Appointed Contactor
Children's Right	<ul style="list-style-type: none"> Impact on educational opportunity on school children in PAHs of the Project; Impact on educational opportunity of school children in local community; Child labour may involve during land development 	<ul style="list-style-type: none"> Support of sending children to school; Helping the parents with hunting for a job, including at the project site; Introducing them to assistance organizations such as NGO and so forth; Regular monitoring of site to guide contactors and their related firms to discourage child labor; When the child labor will be detected, necessary and decisive actions to the violating firms are implemented; An HIV-AIDS awareness campaign via approved service provider shall be implemented 	Appointed Contactor
Infectious diseases	<ul style="list-style-type: none"> Transmission of disease by inflow of migrant workers 	<ul style="list-style-type: none"> An HIV-AIDS awareness campaign via approved service provider shall be implemented 	Appointed Contactor

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Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization
Working conditions, including occupational safety	<ul style="list-style-type: none"> There would be a possibility to occur accidents and incidents during land development work 	<ul style="list-style-type: none"> Provide adequate health care facilities and first aid within construction sites; Provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure; Provide adequate supplies and easy access of drinking water and sanitary; Provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed; Provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors; 	Appointed Contactor
Accidents	<ul style="list-style-type: none"> During land development accident would be happened which may impact on the workers 	<ul style="list-style-type: none"> Provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure; Provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors; 	Appointed Contactor
Others			

1.4 ENVIRONMENTAL MONITORING AND REPORTING

1.4.1 General instruction

- a) Implementation shall include for auditing, monitoring and reporting on the results of the above measures. Monitoring reports shall be in writing and submitted on a monthly basis as part of the Monthly Progress Report referred to above. The report shall include a listing and summary of daily testing and monitoring results on all aspects listed in the approved EIA and additional requirements of JICA.
- b) The Contractor shall provide all measuring equipment, necessary for monitoring, testing and accurately measuring the effects of the above all to the approval of the Engineer.
- c) All potentially affected areas of the Site, other areas used for or affected by the Works and all adjacent or affected waterways shall be monitored and tested.
- d) Within 49 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works] of the General Conditions, the Contractor shall submit OUTLINE EMP for the approval of the Engineer. This shall be a detailed plan, based on EMMP with the General Execution Scheme, updated and developed by the Contractor to form a comprehensive working management plan. The OUTLINE EMP will describe the potential impacts and the proposed mitigation measures.
- e) After approval, the OUTLINE EMP shall be implemented by the Contractor, properly and diligently throughout the execution of the Works.
- f) If the Contractor wishes to make changes to the approved OUTLINE EMP, he shall notify the Engineer not less than two (2) weeks prior to any proposed change. The implementation of any proposed changes is subject to the approval of the Engineer.
- g) If the Engineer makes any recommendations or issues instructions relating to the content of the OUTLINE EMP the Contractor shall revise and re-issue the OUTLINE EMP accordingly.

h) Conditions of Monitoring

Details of parameters to be monitored, locations (as guideline) and frequency of monitoring are shown in Table 1 of this document and EMP. The Monitoring program shall cover two phases of the project, namely: Pre-construction and Construction. Requirements of monitoring are shown in Table 1.

● Monitoring During Pre-construction Phase – Baseline Data

All existing data shall be gathered from available sources, and where data is not available, field studies and sample testing need to be carried out. Baseline data shall cover all likely conditions such as dry and wet weather, day time and night time, peak and off peak hours, wherever relevant.

● Monitoring During Construction Phase

Monitoring during the construction phase is important to take corrective action before causing serious impact to the environment, thus reducing the final cost of mitigation and also provide a satisfactory environment for the smooth functioning of the rest of the activities at the site while construction is being carried out.

i) Field Survey

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Prior to the commencement of the Work, the Contractor shall discuss the details of the Work with the Engineer, develop a work plan, and get approval from the Engineer. The work plan shall include 1) the names and positions of the persons to be responsible for the Work, 2) schedule, 3) sampling procedures and analytical methods, 4) necessary equipment for sampling, analysis, and mobilization, 5) QA/QC plan, 6) list of equipment to be used in the Work, and 7) other details. Based on the work plan, the Contractor shall make necessary preparations. The Contractor shall also ensure that all safety precautions are taken for water sampling staff, as well as any other persons which are associated with conducting of the Work. The Contractor shall be responsible for the final selection of sampling points, and the approval from the Engineer shall be obtained for the location of each sampling point two (2) weeks before commencement of monitoring works.

j) Analysis

The Contractor shall provide necessary laboratory equipment and facilities for water quality analysis and submit to the Engineer the official certificates of compliance that verify reliable and accurate quality of equipment to be used for each analysis. Analytical methods shall be approved method by MOE, If any other methodology is adopted, it should be clearly stated and acceptable to the Engineer.

k) Quality Control

The Contractor shall include a QA/QC plan in the work plan to be submitted to the Engineer, and adhere to the plan. All analytical equipment shall be properly calibrated and all external and internal standards shall be checked prior to use. The processes of analysis, such as the date of analysis, name of the chemist, equipment settings and conditions, calibration records, analysis of detection limits, dilution procedures, original charts, results of duplicate or multiplicate analysis, calculations of concentrations, etc., shall be properly recorded. If it becomes necessary, the Engineer will request submission of such records, and re-analyze dubious results.

l) Reporting

As per the monitoring requirements specified in Sub-section 1.4.2 Monitoring specifications, the Contractor is required to prepare following reports and submit them to Engineer for approval.

Submission	Contents
Weekly report	<ul style="list-style-type: none">● project activity summary● activity plan for next two weeks● PR activities if any
Monday of the next week	<ul style="list-style-type: none">● Complaints by public or authorities and the Contractor's responses or action plans● Daily site inspection records● All applicable items specified in the table in the subsection 1.4.2 Monitoring specifications

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Submission	Contents
Monthly report	<ul style="list-style-type: none"> ● Updates of relevant legal and policy framework ● project activity summary ● activity plan for next two months ● Summary of PR activities if any
10 th of the next month	<ul style="list-style-type: none"> ● Complaints by public or authorities and the Contractor's responses or action plans ● Summary of the daily site inspection records ● All applicable monitoring items specified in the subsection 1.4.2 Monitoring specifications ● Compliances of the monitoring items and counter measures if it is applicable within next month
Quarterly report	<ul style="list-style-type: none"> ● Updates of relevant legal framework ● activity summary ● activity plan for next four months ● Summary of PR activities if any
20 th of the next month after each three-month	<ul style="list-style-type: none"> ● Complaints by public or authorities and the Contractor's responses or action plans ● Quarterly summary of the weekly and monthly monitoring items ● All applicable monitoring items specified in the subsection 1.4.2 Monitoring specifications ● Compliances of the monitoring items and counter measures if it is applicable within next quarter

(1) Submission of Monitoring Report for Approval

Monitoring reports shall be submitted as per requirements after completion of the whole works summarizing the results of the environmental monitoring, highlighting problem areas, the cause thereof and the remedial measures action taken, if any. All the data obtained from the monitoring shall be compiled in appropriate forms approved by the Engineer.

- (2) All data shall be submitted on diskettes or acceptable to the Engineer in Microsoft Excel or Word format, and printed materials in the reports.
- (3) A photograph showing the sampling points and field measurement scene shall be taken and be attached in the monitoring reports.
- (4) The Contractor shall submit the reports based on the result of the monitoring and analysis according to the survey schedule and submission deadlines specified for each report above. Monitoring reports shall be prepared in English unless instructed by the Engineer.
- (5) All the data obtained from the monitoring survey shall be compiled in appropriate forms approved by Engineer. The forms shall be subjects for approval prior to the commencement of the monitoring works.

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- m) Daily site inspection and records
 - (1) The contractor shall prepare its DAILY site inspection sheets as per the potential impacts by its activities to confirm the compliance with the Contractor's outline EMP and method specific EMPs.
 - (2) All data shall be submitted weekly on diskettes or acceptable to the Engineer in Microsoft Excel or Word format, and printed materials in the reports as the attachment to the weekly monitoring reports.
 - (3) The Contractor shall submit the report based on the daily visual inspections and internal instructions and their result records with photos and/or other factual information sheets/documents. The daily inspection forms shall be subjects for approval prior to the commencement of the monitoring works.

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1.4.2 Monitoring specifications

Table Appendix 1-2: Environmental Monitoring Plan (EMoP) as per the approved EIA and additional requirements by JICA

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the EMP and as specified in Contractor Manual	Project site and construction workers camp	Visual inspection of all active work areas	Daily	EHS Team of Contractor
Ambient Air Quality	Dust generation	SPM, PM _{2.5} , PM ₁₀ , CO, SO ₂ , NOx	At 2 Locations - Land development site - Nearest settlement	24-hour	Quarterly	Contractor/ 3rd Party Environmental Consultant
Noise and Vibration	Increase in ambient noise levels	Noise levels in Leq, Leq _{day} , Leq _{night} and hourly Leq	At project site, nearest settlement and Important Sensitive Receptors	24-hour	Monthly	Contractor/ 3rd Party Environmental Consultant
Soil	Increase in vibration level	Vibration Level	At project site, nearest settlement and Important Sensitive Receptors	1 hour	Monthly	Contractor/ 3rd Party Environmental Consultant
	Quality of filling earth/sand	pH, salinity, NH ₄ ⁺ , total- P, heavy metals, oil & grease	Barge/ trawler	Standard analytical methods	The first delivery from any source and then random sampling of deliveries from that source	Contractor/ 3rd Party Environmental Consultant
Water	Tailwater	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	Prior to discharge location	Standard Analytical methods	Monthly	Contractor/ 3rd Party Environmental Consultant

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Affected Component	Environmental Issue	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
	Ground water quality	Drinking water quality parameters as per Schedule 3 of ECR 1997	Nearest Settlement area	Standard Analytical methods	Quarterly	Contractor/ 3rd Party Environmental Consultant
Hydrology	- Groundwater level - Ground elevation level - Consumption of groundwater amount	Compliance with mitigation measures presented in the EMP	Well near the construction site	Visual inspection of all active work areas	Once/ months	Contractor
Occupational Health and Safety	Accidents or incidents due to land development	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by contractor	Monthly	Contractor/ EHS Team of Contractor
Infectious Diseases	Risk of HIV/AIDS	Ensuring that contractor's personnel and local community understand HIV-AIDS awareness campaign	Project site	Consultation with workers and community	Quarterly	Contractor/ EHS Team of Contractor
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Approach Road	Incidents, accidents and community complaints	Based on occurrence	Contractor/ EHS and/or Community Liaison Officer of Contractor

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Table Appendix 1-3: Sampling Specification for Monitoring Parameters

Monitoring Element and Sampling Location	Parameter	Frequency		Notes
		Base Line data	During Construction	
Air Quality Location: To be determined unless stated in Table 2.8-2.	1. Particulate Matter- Aerodynamic diameter < 10µm in size (PM10)	Once during pre-construction	-	See EMP,
	2. Particulate Matter - Aerodynamic diameter < 2.5µm in size (PM2.5)			
	3. Nitrogen Dioxide (NO2)			
	4. Sulphur Dioxide (SO2)			
	5. Carbon monoxide (CO)			
Air Quality of construction site and land fill site	Visual inspection	-	Daily	See EMP Equipment and vehicle : visual inspection
Noise and vibration	Construction equipment/vehicles	-	Monthly	See Table Appendix 1-4
Soil erosion of land reclamation site	Monitoring of land reclamation/land cleaning work including scheduling and technical mitigation measures	-	Every working days of construction period	See EMP visual inspection
Soil Quality (landfilling material): Location: EACH dredging point at the time of environmental monitoring	pH value	The first delivery from any source	Quarterly sampling (Environmental parameters only) of deliveries from the same source as the baseline	See EMP (total three sites and 6 samples) Unit: mg/kg
	Total Sulphur, (T-S)			
	Total Nitrogen, (T-N)			
	Total Phosphorus, (T-P)			
	Total Mercury, (T-Hg)			
	Cadmium, (Cd)			
	Total Cyanides, (CN)			
	Chromium, (Cr)			
	Chromium, (Cr+6)			
	Lead, (Pb)			
	Arsenic, (As)			
	Polychloro biphenyl, PCB			

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Monitoring Element and Sampling Location	Parameter	Frequency		Notes
		Base Line data	During Construction	
Water Quality of Farming area around the filling site and water discharge site	Copper, (Cu)			
	Zinc, (Zn)			
	Turbidity (NTU)	Once in wet season and once in dry season	Once in every working days of construction period	See EMP, Continuously at one hour interval for 6 hours period.
Water quality of land reclamation site	Turbidity (NTU)	Once in wet season and once in dry season	Once in every working days of construction period	See EMP Continuously at one hour interval for 6 hours period.
Water Quality of water inside of reclamation area and outside of reclamation area and water discharge point Location: To be determined unless stated in Table 2.8-2.	1. Water temperature	Once in wet season and once in dry season Total: 3 locations x2 samples	Once in wet season and once in dry season Total: 3 locations x2 samples	See EMP Unit: mg/L
	2. Salinity			
	3. Turbidity			
	4. Total Suspended Solids (TSS), mg/L			
	5. pH value at ambient temperature			
	6. Dissolved oxygen (DO)			
	7. Biochemical Oxygen Demand (BOD5)			
	8. Chemical Oxygen Demand (COD)			
	9. Total nitrogen, (T-N)			
	10. Total phosphorus (T-P)			
	11. Oils and greases			
	12. Coliform bacteria, MPN/100 ml,			
Solid Waste accumulation at Construction site, Worker's camp and Disposal sites	1. -Conditions of excess materials such as excavation	-	Daily records And Weekly report	See EMP
	2. -Conditions of recycling			
	3. -Final treatment of waste			
	4. -Conditions of segregation			
	5. -Final disposal of waste			
	6. -Soil and liquid waste management etc.			

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Monitoring Element and Sampling Location	Parameter	Frequency		Notes
		Base Line data	During Construction	
	7. Conditions of collection/disposal site	-	Monthly records and Quarterly report	See EMP Visual inspection
Compliance with Contractor's Occupational Health and Safety	-Number of fatal, non fatal and minor accident -Date, time, location -Cause of accident and analysis -Counter measures etc.	-	Daily visual inspections Monthly monitoring	See EMP
Infectious disease and public safety	HIV/AIDS prevention programmes Other sensually transmitted diseases		Quarterly	
Traffic Congestion	-Traffic counts -Speed control of construction vehicles, -Timing/scheduling of construction vehicles, -Traffic control, -Site attention sign/traffic flag man etc.	Once in pre-construction phase	Daily visual inspections Monthly monitoring	See EMP

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Table Appendix 1-4: Monitoring parameters and result formats as per the approved EIA and additional requirements by JICA

- Air Quality (Emission Gas / Ambient Air Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards (Bangladesh, ECR,1997)	Referred International Standards (g/m ³)	Remarks (Measurement Point, Frequency, Method, etc.)
SO ₂	µg/m ³			365 (24 hr)	500(10 min) 125 (24 hr)	West- Geake
NO ₂	µg/m ³			65 (24 hr)	200 (1 hr) 40 (year)	Jacob and Hochheiser
CO	µg/m ³			9 (8 hr)	-	Indicator tube
SPM	µg/m ³			200 (8 hr)	-	Gravimetric
PM ₁₀	µg/m ³			150 (24 hr)	150 (24 hr) 70 (year)	Gravimetric
PM _{2.5}	µg/m ³			65 (24 hr)	75 (24 hr) 35 (year)	Gravimetric

- Noise / Vibration

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards (Bangladesh ECR,1997)		Referred International Standards		Remarks (Measurement Point, Frequency, Method, etc.)
				Day	Night	Day	Night	
Noise level	dB (A) Leq*			55	45	55	45	Residential Area
				50	40	55	45	Silent Area
				60	50	-	-	Mixed area
				70	60	70	70	Commercial
				75	70	70	70	Industrial
Vibration level	mm/s			N/A		BS 5228-2: 2009'Code of practice for vibration control on construction and open sites. Table B.1 and B.2(see the tables below)		Residential Area And areas with any structures/receptors that could be affected.

BS 5228-2: 2009'Code of practice for vibration control on construction and open sites. Table B.1

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

BS 5228-2: 2009'Code of practice for vibration control on construction and open sites. Table B.2

	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above

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2	Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
NOTE 1 Values referred to are at the base of the building. NOTE 2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.			

- Soil Quality (filling material)

「TABLE 5. ACTION LIST (MAXIMUM LEVELS), National Ocean Disposal Guidelines for Dredged Material, Australia 2002」

Soil Quality (landfilling material): Location: EACH dredging point at the time of environmental monitoring	pH value	10-50 mg/kg
	Total Sulphur, (T-S)	N/A
	Total Nitrogen, (T-N)	N/A
	Total Phosphorus, (T-P)	N/A
	Total Mercury, (T-Hg)	1 mg/kg
	Cadmium, (Cd)	10 mg/kg
	Total Cyanides, (CN)	N/A
	Chromium, (Cr)	370 mg/kg
	Chromium, (Cr+6)	N/A
	Lead, (Pb)	220 mg/kg
	Arsenic, (As)	70 mg/kg
	Polychloro biphenyl, PCB	N/A
	Copper, (Cu)	270 mg/kg
	Zinc, (Zn)	410 mg/kg

* Source: TABLE 5. ACTION LIST (MAXIMUM LEVELS), National Ocean Disposal Guidelines for Dredged Material, Australia 2002

- Water Quality (Effluent/Wastewater/Ambient Water Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards (Bangladesh, ECR,1997)	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
Temperature (°C)	°C			20-30 °C	-	Digital thermometer
EC	mS			0.05 mg/l	(2,000 by EPA)	Digital EC meter
pH	-			6.5-8.5	9.2	Digital pH meter
DO	mg/L			6	-	Digital DO meter
TDS	ppt			1000	1500	Digital TDS meter
Arsenic (As)	mg/L			0.05	0.05	AAS
Calcium (Ca)	mg/L			75	200.0	AAS
Chemical Oxygen Demand (COD)	mg/L			4.0	-	CRM
Chloride	mg/L			150-600	250.0	Titrimetic

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Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards (Bangladesh, ECR,1997)	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
Coliform (Faecal)	N/100ml			0	0	MFM
Coliform (Total)	N/100ml			0	0	MFM
Fluoride	mg/L			1.0	1.5	UVS
Iron (Fe)	mg/L			0.3-1	0.3	AAS
Lead (Pb)	mg/L			0.05	0.01	AAS
Manganese (Mn)	mg/L			0.1	0.1	AAS
Phosphate	mg/L			6.0	-	UVS
Sulphate	mg/L			400	400	UVS
Total Suspended Solid (TSS)	mg/L			10	-	Gravity Multimeter
Turbidity	NTU			10	5>	Turbidity Meter

Monitoring for the following elements; “**Solid Waste**”, “**Compliance with Contractor's Occupational Health and Safety**”, “**Infectious disease and public safety**”, and “**Traffic Congestion**”, is necessary as shown in “Table Appendix 1-3: Sampling Specification for Monitoring Parameters”. However formats are not specified. Contractor shall prepare format for each element in accordance with but not limited to the required parameters in Table Appendix 1-3

- Solid Waste

- Conditions of excess materials such as excavation
- Conditions of recycling
- Final treatment of waste
- Conditions of segregation
- Final disposal of waste
- Soil and liquid waste management etc.
- Conditions of collection/disposal site

- Compliance with Contractor's Occupational Health and Safety

- Number of fatal, non-fatal and minor accident
- Date, time, location
- Cause of accident and analysis
- Counter measures etc.

- Infectious disease and public safety

- HIV/AIDS prevention programmes
- Other sensually transmitted diseases

- Traffic Congestion

- Traffic counts
- Speed control of construction vehicles,
- Timing/scheduling of construction vehicles,
- Traffic control,

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-Site attention sign/traffic flag man etc.


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Supplementary Information

Construction Method for Land Reclamation Works

- 1) Finding of candidate borrow sites for filling material along Meghna river
Approximately 8,000,000m³ dredged material will be required to develop the project site. If fill material in candidate borrow sites is exhausted, find alternative sites in the upstream/downstream within +-10-20km along Meghna river, or in the next year.
Dredging depth is 1 – 3m
Need permission on dredging by the Government agency.



 Candidate borrow sites for fill material (approximately 1-2,000,000m³/site)
Figure 1: Candidate borrow sites at Meghna river

- 2) Dredging of fill material from the river bed at Meghna river by pumping up.



- 3) Transporting of dredged materials by boats to the unloading point. (about 45km)

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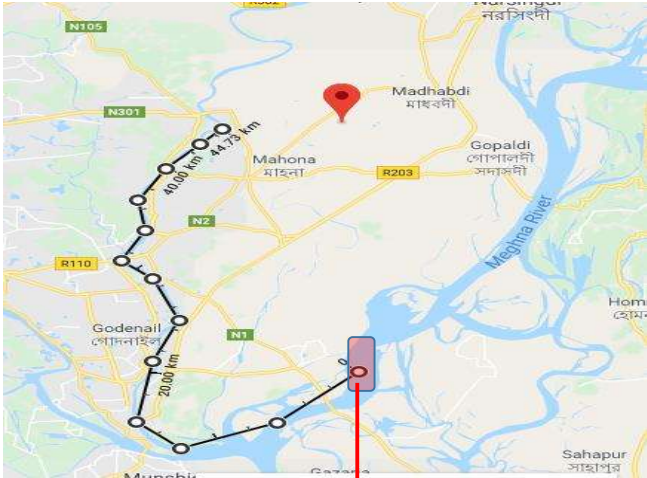
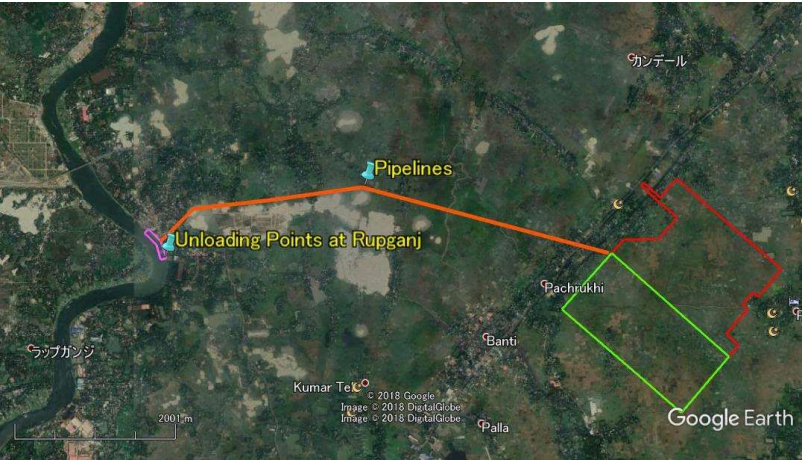


Figure 2: Transport route of dredged materials to the unloading point (Rupganj)

4) Unloading of dredged materials at Rupganj



5) Transporting of fill materials from unloading points to Araihaazar site (6 – 7km)

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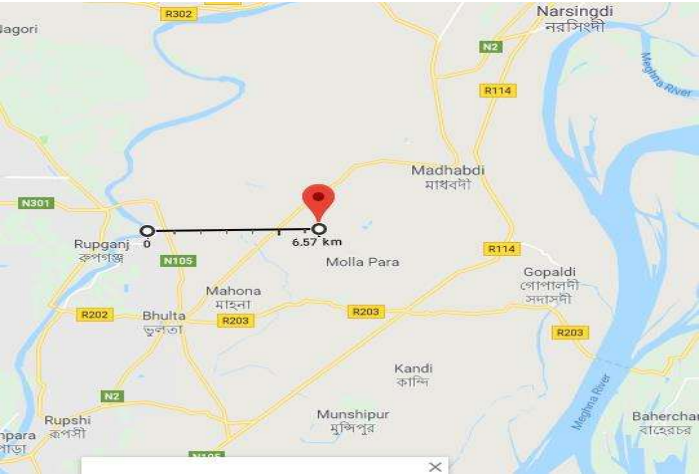


Figure 3: Transport of fill materials to Araihaazar site

Example of temporary pipelines for sand transportation are shown as follows:



Culvert Bridge on Dhaka-Sylhet Road near EZ. Calvert underneath will be used to make all the pipelines through.



6) Construction Schedule

Preparatory works for sand filling is estimated to be 2 months. Final compaction works, dewatering and demobilization is estimated to be 2 months in the end. The construction period for land development works as a whole is estimated to be 30 months.

Commented [OSAWA1]: As for partial taking over, we have to consult with Developer.

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Land development for Stage-1 (Zone E and Zone D) with 100 ha is scheduled for first 15 months, and land development for Stage-2 (Zone C, Zone B and Zone A) with 100 ha is for latter 15 months as shown in Figure 4. Final reclaimed elevations by zone are designed in Table 1. Taking-over of parts of the Works for Stage-1 to the Employer shall be done at 15 months after commencement of the Works.

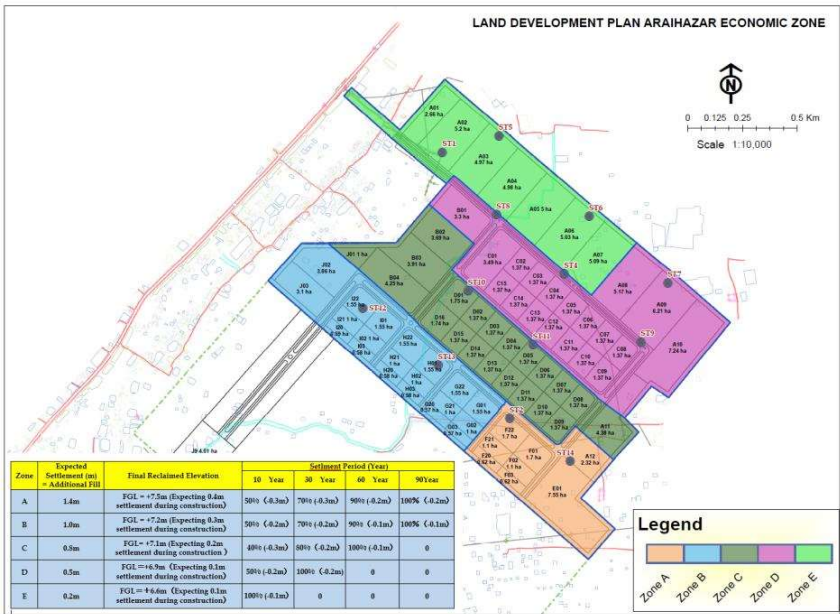


Figure 4: Land development plan

Table 1: Final reclaimed elevation by Zone

Zone	Expected Settlement (m) = Additional Fill	Final Reclaimed Elevation	Settlement Period (Year)			
			10 Year	30 Year	60 Year	90Year
A	1.4m	FGL = +7.5m (Expecting 0.4m settlement during construction)	50% (-0.3m)	70% (-0.3m)	90% (-0.2m)	100% (-0.2m)
B	1.0m	FGL = +7.2m (Expecting 0.3m settlement during construction)	50% (-0.2m)	70% (-0.2m)	90% (-0.1m)	100% (-0.1m)
C	0.8m	FGL = +7.1m (Expecting 0.2m settlement during construction)	40% (-0.3m)	80% (-0.2m)	100% (-0.1m)	0
D	0.5m	FGL =+6.9m (Expecting 0.1m settlement during construction)	50% (-0.2m)	100% (-0.2m)	0	0
E	0.2m	FGL = +6.6m (Expecting 0.1m settlement during construction)	100% (-0.1m)	0	0	0

7) Slope Protection Works for Land Development

Slope protection works in the surrounding of land development is designed. Typical section of slope protection works is shown as follows:

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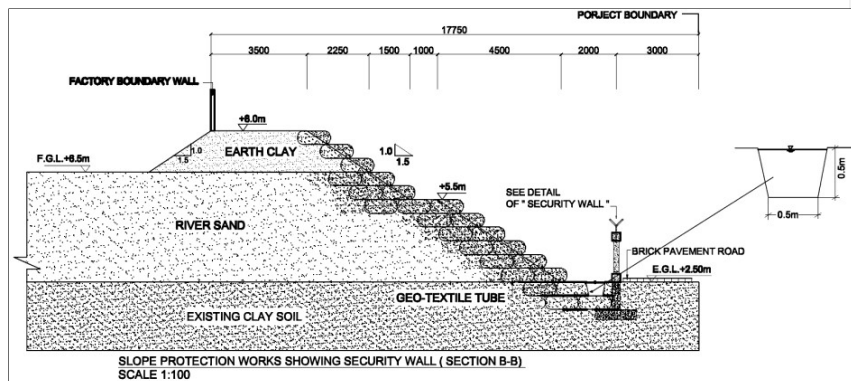


Figure 5: Typical Section of Slope Protection Works for Land Development

8) Consolidation settlement analysis for Araihaaz EZ development by JICA-SAPI Survey

(1) Locations of boring

14 of borings, ST-1 to ST-14, at the project site were carried out as shown by Figure 1.1 and laboratory test on undisturbed/disturbed soil specimens for ST-5 to ST-14 were carried out.

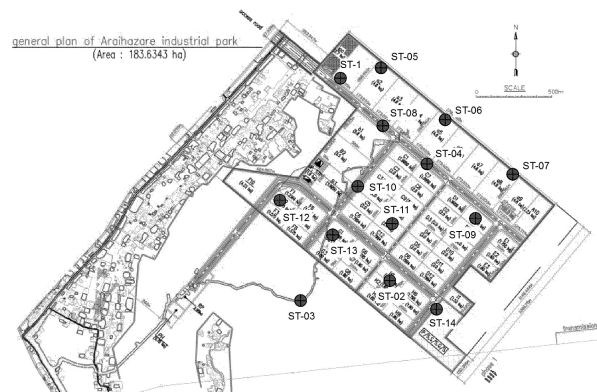


Figure 1.1 Location of borings

(2) Feature of stratifications at the Project site

According to the geological investigation report¹, elevation of the surface ground varies +2.5m to 3m and the stratification in the project site seems to be mainly composed of sandy/ silty/ clayey soil but their composition are rather complicated. In spite of such a difficulty to describe a simple feature on the stratifications, grouped bore logs based on the similar compositions of stratifications are shown in Fig. 2.1(a) ~ (d) .

Fig. 2.1(a) shows the bore log with distribution of N values at ST-1, where whole layer is composed of sit/clay layer with rather large N value despite of shallow depth. It is presumed that consolidation

¹ Geological investigation report for the pre-feasibility study on the economic zone in Araihaaz of Narayanganj district in Bangladesh.

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settlement seems to be very small or no settlement. Fig. 2.1(b) shows the bore logs at ST-6, ST-4 and ST-7. It is shown that surface layer up to GL-8-10 seems to be over-consolidated due to rather large N value and underneath it, silty layer with N of 2 to 14 is deposited. Fig. 2.1(c) shows at ST-5, ST-8, ST-9, ST-10 and ST-11. It is realized that the sandy layer with thickness of 2 ~ 4 m underneath surface stiff clay layer. Underneath sandy layer, soft silty layer with thickness of 6 ~ 18m are deposited. Fig. 2.1(d) shows at ST-2, ST-12, ST-13 and ST-14, where weak and thick silty soil layer is deposited. The composition of stratification at this zone seems similar to the other zones but bottom of silty layer at ST-14 has not been confirmed. Fig. 2.2 show the zone divisions based on the above described stratifications.

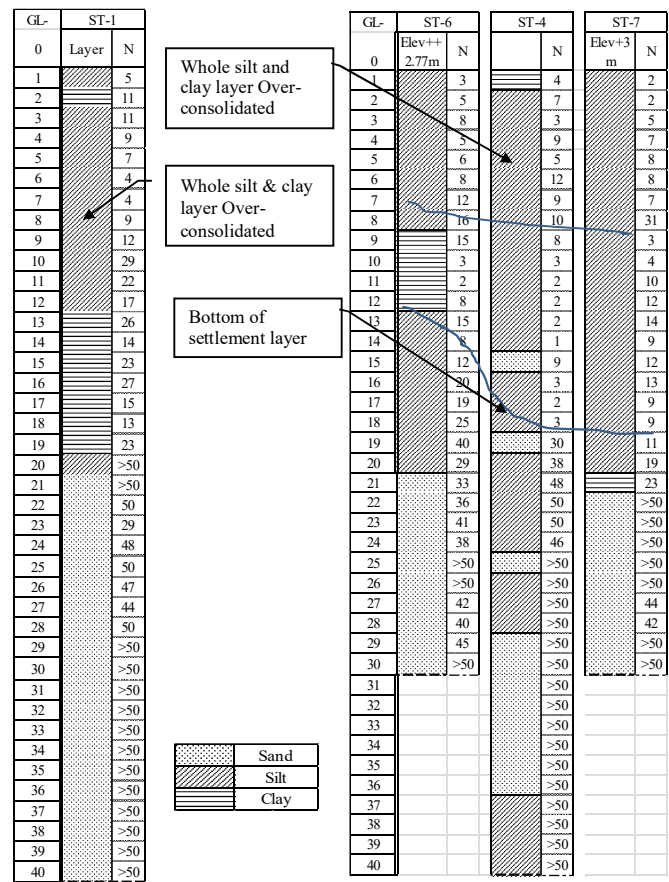
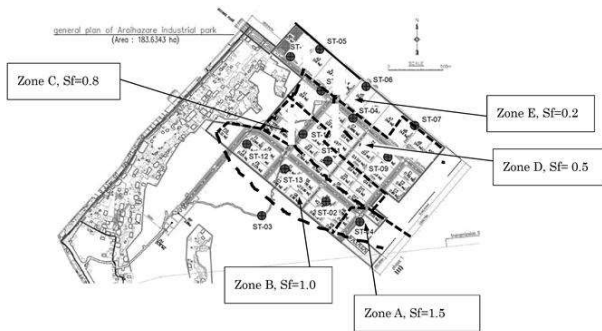
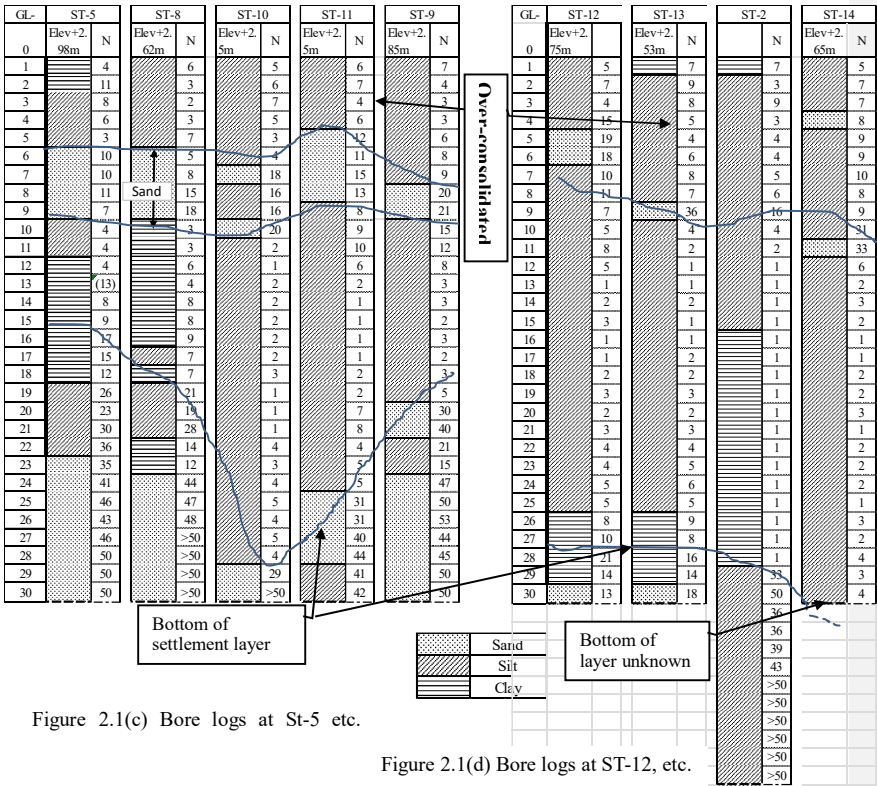


Figure 2.1(a) Bore log at ST-1

Figure 2.1(b) Bore log at ST-6, ST-4 and ST-7

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(3) Soil properties

Tab. 3.1 shows the soil properties obtained by the physical and mechanical laboratory test. According

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to the grain size distribution, although clay fraction of the soil is approximately 90% but the natural water content is 26 to 27%. It is presumed that clay/silty soil would be over-consolidated or desiccated in the past.

Table 3.1 Soil properties

			Depth		Wn (%)	γt (kN/m³)	Grain size distribution (%)			Consistency			Consolidation				Shear strength	
BH	UD No	GH	Depth	Elev			Sand (%)	Silt (%)	Clay (%)	W _L (%)	W _p (%)	IP	e ₀	P _c (kPa)	C _c	C _v (m²/day)	C (q _u /2) (kPa)	C _{uu} (kPa)
5	1	2.98	1.3	1.68	21	18.4	2	94	4	42	26	16						
	2		3.3	-0.32	17		(46)	(48)	(6)									
	3		5.3	-2.32	28	18.6											35	
8	1	2.62	0.55	2.07			1	96	3									
	2		2.55	0.07														
	3		4.55	-1.93														
	4		6.55	-3.93			(35)	(62)	(3)									
9	1	2.65	0.55	2.1												197.5	26.6	
	2		1.55	1.1		18.6										23	10.6	
	3		4.55	-1.9	31	17.9	8	84	8			1.02	110	0.18				
10	1	2.5	0.55	1.95	32		1	96	3	44	29	15				46	27.4	
	2		1.55	0.95												135	53.7	
	3		2.55	-0.05	31	18.9										47	28.5	
11	1	2.5	0.55	1.95	29		1	96	3							102	33.8	
	2		1.55	0.95		18.4				51	25	26				22.5	28.2	
	3		2.55	-0.05	29	20	1	94	5	38	28	10				88		
Ave					27	19	2	93	4	44	27	17	1.02	110	0.18		77	30
6	1	2.77	1.55	1.22	28	19.8							0.73	95	0.11		75.8	
	2		3.55	-0.78														
	3		6.55	-3.78														
7	1	3	0.55	2.45	29												30.3	
	2		2.55	0.45		19.3										41.5	35.5	
	3		4.55	-1.55	21													
Ave					26	20						0.73	95	0.11		42	47	
12	1	2.75	0.55	2.2	32		3	94	3	39	22	17				85		
	2		1.55	1.2												77	30	
	3		2.55	0.2	29	18.8	2	92	6	35	27	8	0.87	42	0.12			
13	1	2.53	0.55	1.98	27	18.1				50	28	22	0.87	72	0.16	194	68.4	
	2		1.55	0.98	32	17.9						0.94	102	0.12			35.1	
	3		2.55	-0.02	31	19.1	8	74	17	43	28	15				174	50.9	
14	1	2.65	0.55	2.1	31					42	28	14				49	38.3	
	2		1.55	1.1												101	40.9	
	3		2.55	0.1	24		18	80	2									
	4		4.55	-9.9														
Ave					29	18	18	85	7	42	27	13	0.89	72	0.13		113	44

Remarks: W_n: Natural water content, W_L: Liquid Limit, W_p: Plasticity limit, e₀: Initial void ratio, P_c: Consolidation yield stress, C_c: Consolidation Index, C_v: Consolidation coefficient, C: Cohesion, C_{uu}: Triaxial Undrained Test, FV: Field Vave Test,

(4) Calculation of consolidation settlement

4.1 Equation of settlement calculation

Consolidation settlement of clay layer is illustrated schematically with relationship between “e ~ log p” shown by Fig. 4.1. Vertical axis shows change of void ratio, which is equivalent to settlement of clay, induced by consolidation load. Horizontal axis shows the magnitude of consolidation stress that would induce settlement. In case existing clay layer is defined as normally-consolidated clay, overburden pressure (P_z), calculated by Equa.4.1, equal to the yield stress of clay (P_c), which is to be obtained by the consolidation test. On the contrary, in case of over-consolidated clay, P_c would turn to be larger than P_z due to long-time loading in the past.

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Incremental consolidation load (ΔP) such as reclamation fill on the existing ground can be estimated as 87 kPa (= fill load of 4m in thickness and building load of 15 kPa).

$$P_z = \sum \gamma_i \times H_i \quad \dots\dots\dots (\text{Equa. 4.1})$$

Here, P_z ; Overburden pressure, γ_i ; unit density of soil, H_i ; Thickness soil

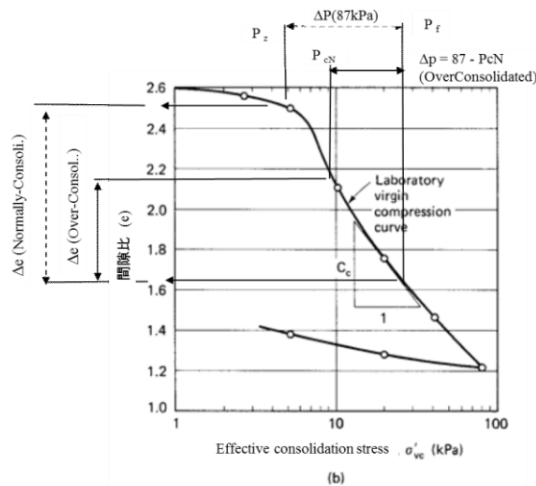


Figure 4.1 e ~ log P relationship

Consolidation settlement for normally consolidated clay can be calculated by Equa. 4.2. Relationship of time with settlement is calculated by Equa. 4.3. In case of over-consolidated clay, the equation of settlement calculation is turned to be Equa. 4.4. In the equation, P_{cn} is identified as P_c in the equation.

$$S_f = \frac{C_c \times H}{(1 + e_0)} \times \left(\frac{P_f}{P_z} \right) \quad \dots\dots\dots (\text{Equa. 4.2})$$

Here, S_f ; Total settlement of clay (m), C_c ; Consolidation coefficient, H ; Thickness of clay, e_0 ; Initial void ratio of clay, P_z ; Overburden pressure, $P_f = P_z + \Delta P$, ΔP ; Incremental load.

$$t = H^2 \times T_v / C_v \quad \dots\dots\dots (\text{Equa. 4.3})$$

Here, t ; Consolidation time (day), H ; thickness of clay layer (m), C_v ; Consolidation coefficient (m^2/day), T_v ; Consolidation factor

$$S_f = \frac{C_c \times H}{(1 + e_0)} \log \frac{P_f}{P_c} \quad \dots\dots\dots \text{Equa. 4.4}$$

4.2 Comparison with Overburden Pressure (P_z) and consolidation yield stress (P_c)

It is essential to determine the consolidation yield stress of the clay layer to calculate the settlement. Fig. 4.2 shows distribution of P_z , P_{cn} and P_{cn} of clay layers at ST-5, ST-6, ST-8, ST-9, ST-12 and ST-13, where P_{cn} is obtained by consolidation test and P_{cn} by N value of clay using Equa. 4.5.

As shown in Fig. 4.2, both P_{cn} s and P_{cn} s from ground surface ($\approx +3\text{m}$) up to -5m tend to be larger in general than P_z and clay/silt layers from -5m to -15m , seems to be normally consolidated other than ST-5, ST-6 and ST-8. Figure 4.4(a)~Fig. 4.4(f) show the distributions of P_z , P_{cn} , P_{cn} and $P_f (=P_z + \Delta P)$ line so as to investigate the possibility of settlement of clay layer. It is figured out that since P_{cn} and

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P_{cN} at most points are distributed between P_z -line and P_r -line, thus clay layer from -5m to -15m at most points would settle by incremental consolidation load.

$$P_{cN} = \frac{1}{0.34} \times \frac{N}{16} \times 98 \quad (\text{in kPa}) \quad \dots\dots\dots (\text{Equa. 4.5})$$

Here, assumed by $C_u / P_c = 1 / 0.34^2$ (Figure 4.3), and $C_u = N / 16^3$

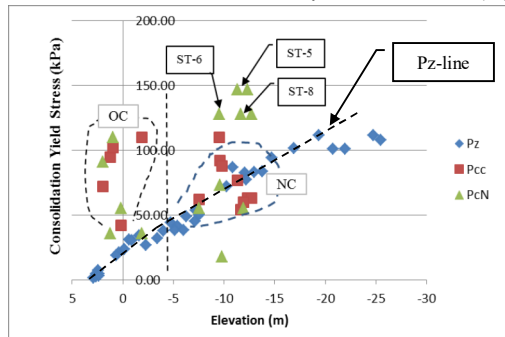


Figure 4.2 Comparison of P_z , P_{cc} and P_{cN}

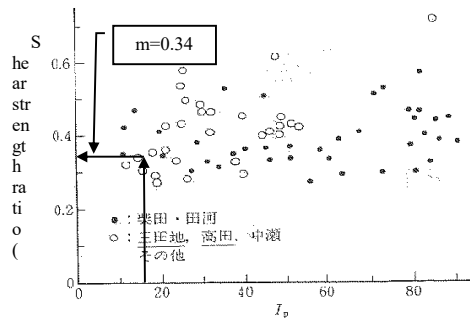


Figure 4.3 $m (=c_u/P_c) \sim I_p$ by means of triaxial shear test

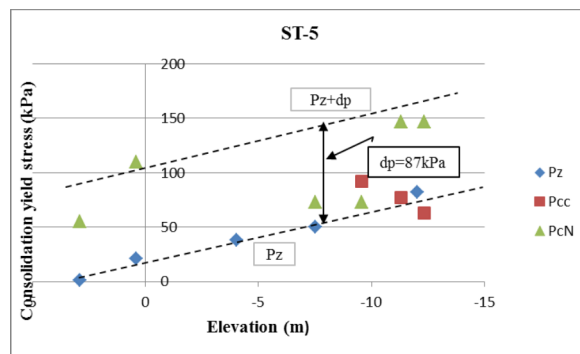


Figure 4.4(a) Comparison of P_z , P_{cc} and P_{cN}

² Shibata, T. (1967); Shear strength ratio of saturated clay, Proceeding of geotechnical symposium, JGS, pp.7-11, in Japanese.

³ Murayama et. al. (1956), Standard penetration test and bearing capacity of ground, "Tsuchi to Kiso", Vol.2 No.5, PP.12-18, in Japanese.

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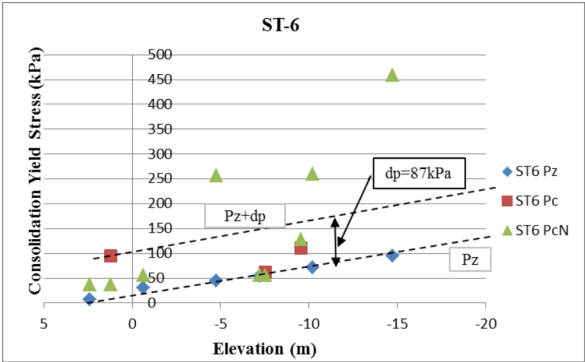


Figure 4.4(b) Comparison of P_z , P_{cc} and P_{cN}

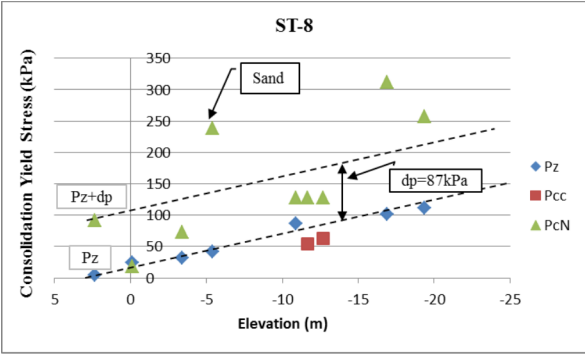


Figure 4.4(c) Comparison of P_z , P_{cc} and P_{cN}

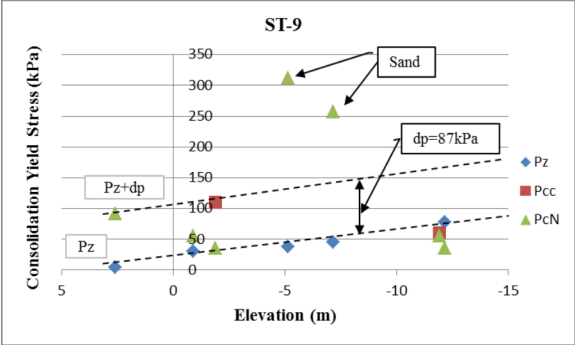


Figure 4.4(d) Comparison of P_z , P_{cc} and P_{cN}

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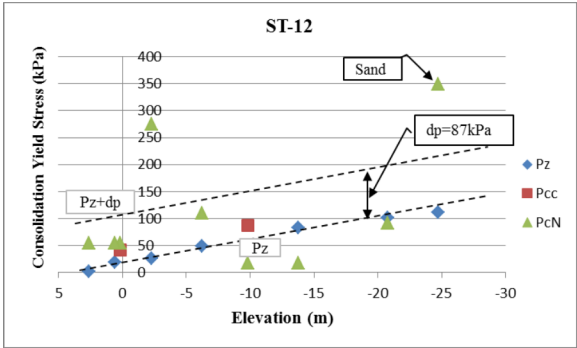


Figure 4.4(c) Comparison of P_z , P_{cc} and P_{cN}

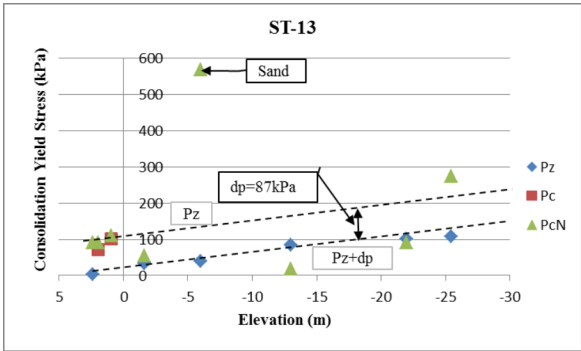


Figure 4.4(f) Comparison of P_z , P_{cc} and P_{cN}

4.3 Consolidation settlement

4.3.1 Consolidation settlement by total load of reclamation fill and building

Calculated consolidation final settlements (S_f) at ST-5, ST-6, ST-8, ST-9, ST-12 and ST-13 induced by the incremental load of 87 kPa, are shown in Tab.4.1. Total settlement at each point are obtained by summing up the final settlements of each layer devided with range of N value, layer of silt/clay/san and so on. Total settlement of layers at each point are summed up followingly.

Final settlement at investigated points						
	ST-5	ST-6	ST-8	ST-9	ST-12	ST-13
S_f (m)	0.14	0.19	0.46	0.53	0.73	0.83

It is realized that the calculated settlements at ST-5 and ST-6, are approximately 0.2m due to over-consolidated clay and at the area around ST-12 and ST-13 with large settlements of nearly 1m. On top of it, due to unknown bottom of clay layer at ST-14, where thickness of clay layer could be larger than ST-13, expected settlement would be getting larger toward ST-14. Taking such a distribution of settelemt within the project site into consideration, whole project area could be divided into 5 zones such as a) zone A (St-14); settlement with 1.4m, b) zone B; settlement with 1.0 m and c) zone C; settlement with 0.8m , d) zone D; settlement with 0.5m and e) zone E; settlement with 0.2m as shown in Fig. 4.5.

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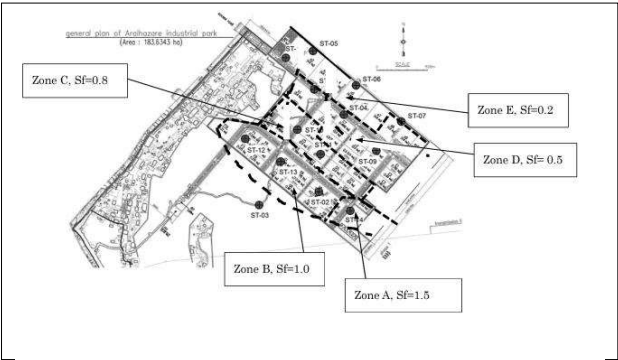


Figure 4.5 Existing, planned and settlement settlements

4.3.2 Extra fill to attain planned ground level

It is easily understood that when reclamation fill up to the planned ground height is executed on existing ground, final ground height can be lower than the planned ground height due to the settlement. Therefore, extra-fill should be added on the planned reclamation height. Fig.4.6 shows how to determine extra-fill height, as sample at ST-13, where targeted fill height could be +7.5m and 0.95m of settlement. Therefore final ground height would settle to be 6.5m ($+7.5-0.95 \approx 6.5\text{m}$). Table 4.2 shows the extra fill at Zone B and Zone C, while Zone A seems not to be necessary to consider the extra fill due to small settlement. It is figured out that extra fill would be 10% at Zone B and 15% at Zone C.

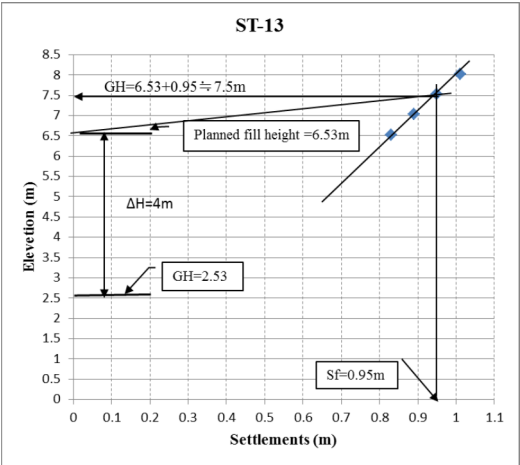


Figure 4.6 Determination of extra-fill height at ST-13

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Table 4.1 Calculated consolidation settlement

ST-5	Clay/ Sand	H (m)	Pz (kPa)	Pz+dP (kPa)	PcN (kPa)	NC/ OC	e0	Cc	Sf (m)				
1	Clay	0.15	14	101	> 55	OC	0.73	0.11	0.00				
2		4.85	20	107	≈ 110				0.00				
3	Sand	4				NS	-	-	0.08				
4	Clay	3	50	137	> 73	OC	0.82	0.18					
5		6	82	169	> 147		0.52	0.23	0.05				
Sum=									0.14				
ST-6													
1	Clay	0.72	7	94	> 36	OC	0.73	0.11	0.02				
2		5.34	31	118	> 55				0.11				
3		2.94	44	131	< 259	NS	-	-	0.00				
4		2	53	140	> 55	OC	0.71	0.12	0.06				
5		4	71	158	< 259	NS	-	-	0.00				
6		5	94	181	< 459				0.00				
Sum=									0.19				
ST-8													
1	Clay	0.5	4	91	≈ 91	NC	0.73	0.11	0.04				
2		4.5	23	110	> 18				0.19				
3	Sand	2					-	-	0.00				
4	Clay	2	41	128	< 238	NS	-	-					
5		9	86	173	> 128	NC	0.46	0.12	0.22				
6		3	101	188	< 312	NS	-	-	0.00				
7		2	111	198	< 257				0.00				
Sum=									0.46				
ST-9													
1	Clay	0.5	4	91	≈ 91	OC	1.02	0.18	0.00				
2		6.5	30	117	> 55				0.19				
3	Sand	2					-	-	0.00				
4	Clay	2	45	132	< 257	NS	-	-					
5		8	77	164	> 36	NC	1.19	0.28	0.34				
Sum=									0.53				
ST-12													
1	Clay	0.25	2	89	> 55	OC	0.87	0.12	0.00				
2		3.75	18	105	> 55				0.07				
3	Sand	2					-	-	0.08				
4	Clay	6	49	136	> 110	OC	1.13	0.30					
5		9	83	170	> 18	NC							
6		5	101	188	> 91	NS	-	-	0.19				
7		3	111	198	< 349				0.00				
Sum=									0.73				
ST-13													
1	Clay	0.3	2	89	≈ 91	OC	0.87	0.16	0.00				
2		3.24	34	121	> 55		0.94	0.12	0.07				
3	Sand	1					-	-	0.57				
4	Clay	13	83	170	> 18	NC	1.13	0.30					
5		5	100	187	> 91			0.19					
6		2	107	194	< 275	NS	-	-	0.00				
Sum=									0.83				

Note: H; Thickness of clay layer, Pz; Current over-burden pressure, dP; Incremental load inducing settlement, PcN; Consolidation yield stress by N value, NC; Normally consolidated clay, OC; Over-consolidated clay, NS; No-settlement due to extremely over-consolidated clay, e0; Initial void ratio, Cc; Compression Index.

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Table 4.2 Percent of Extra fill to final settlement

	Zone B		Zone C	
	ST-8	ST-9	ST-12	ST-13
Sf(m)	0.46	0.53	0.73	0.83
Sf with extra fill (m)	0.5	0.53	0.73	0.83
Increment	8%	10%	16%	14%
Average	10 %		15 %	

4.3.3 Possibility of underestimation of total settlement

It should be notified that calculated final settlements are subjected to include an error induced by the theoretically simplified assumption to calculate consolidation settlement of clay layer, inaccurate constants utilizing in the calculation such as C_c , C_v , e_0 etc. obtained through laboratory test and disturbance effect to the soil specimen. In particular, low quality of undisturbed sample would take place during sequence of pulling out clay specimen using thin-wall sampler and transportation from the site to the laboratory. Since it seems very difficult to get rid of them, underestimation of consolidation settlement would take place through ordinary soil investigation sequence.

Fig.4.6⁴ shows the comparison of $e \sim \log P$ relationship by Japanese sampler and locally popular sampler of Shelby sampler carried out at the same site. It can be understood that $e \sim \log P$ curve by Japan sampler show distinct consolidation yield stresses (P_c), where e would sharply decrease once consolidation stress exceed P_c and thus P_c would be easily determined. On the contrary, in case of Shelby sampler, change of e with increase of consolidation stress seems not clear thus definitely difficult to determine P_c . It is easily understood that C_c by Japanese sampler would give larger C_c than that of Shelby one.

Fig. 4.7 shows one of the typical $e \sim \log P$ relationship from UD4 at ST12 at the project site concerned. As can be seen, the shape of $e \sim \log P$ seems very similar to the one by Shelby sampler in Fig.4.6. Although it seems difficult to figure out the reason of its shape, it could be safer thought to judge that C_c shown in Tab.4.1 might be underestimated.

Therefore, it seems rationale to compare C_c obtained by another way. Fig.4.8³⁾ shows the relationship of W_L with C_c proposed by Terzaghi and Peck (1969) and Ogawa and Matsumoto (1978) shown by Equa. 4.6 and Equa. 4.7, respectively. As W_L at the project site is averaged by $W_L \approx 40$, C_c would be calculated by both equations as 0.27 and 0.31, respectively. Therefore, compared with averaged C_c (≈ 0.14 in Tab. 3.1) and 0.3 ($\approx (0.27+0.3)/2$) by Equa. 4.6 and Equa. 4.7, calculated settlement in Tab. 4.1 might be underestimated.

$C_c = 0.009 (w_L - 10)$	Equa. 4.6
$C_c = 0.015 (w_L - 19)$	Equa. 4.7

⁴ H.Tanaka (2000), Print of keynote address of Special lecture at int'l symposium on coastal geotechnical engineering in practice (IS-Yokohama 2000),

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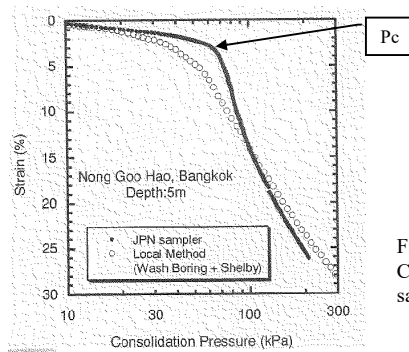


Figure 4.6
Comparison of $e \sim \log P$ curves for
samples with different quality

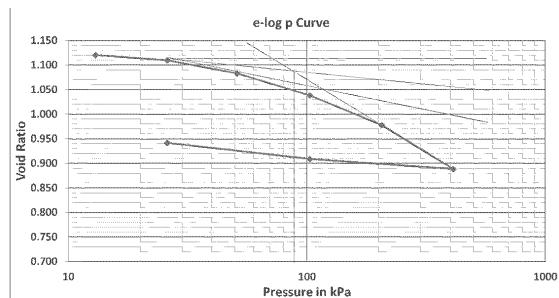


Figure 4.7 Typical $e \sim \log P$ relationship of UD4 at ST-12

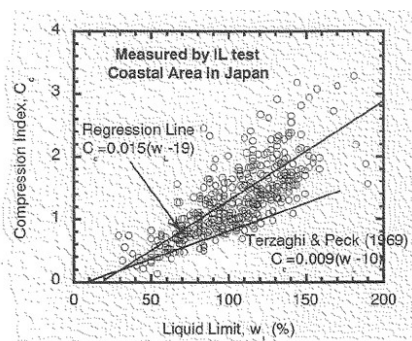


Figure 4.8 Relation of C_c and w_L for clays in coastal areas in
Japan (after Ogawa & Matsumoto 1978)

4.4 Settlement with time

Due to lack of consolidation coefficient (C_v), C_v would be converted from Plasticity index (I_p) as shown by Fig. 4.9⁵. According to Tab. 3.1, I_p is averaged as 16 and then C_v is converted to 1.1 cm^2/min ($=5.78 \text{ m}^2/\text{yr}$). Taking the stratifications shown in Fig. 2.1 (a)~(d) and three zones shown in

⁵ Intermediate Soil, Geo-tech note 2, JGS, p.15

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Fig.4.5 into consideration, presumed thickness clay layer to calculate the relationship with settlement and elapsed time are determined as the followings. As described in 4.3.1, although bottom of clay layer at ST-14 is unknown, clay layer at ST-14 seems to be deepest within the project site. Therefore it is important to investigate the time ~ settlement relationship at ST-14 with presumed thickness of 30m so as to avoid the risk of unexpected larger consolidation settlement. Drainage condition to calculated settlement with time is presumed as single drainage due to complicated distribution of clay and silt layers with low permeability.

	Zone E	Zone D & C	Zone B	Zone A (ST-14)
Thickness (m)	13m	19m	25m	30m

Fig.4.10(a) ~(d) show the settlement with time at Zone E, Zone D&C, Zone B and ST-14. Frequency of maintenance work such as re-pavement or restoration of damaged structure by post construction settlement are to be carried out after settlement occurrence of each 30cm. Followings are summaries on the results at each zone.

- Zone E; Total settlement (S_t) is expected to be approximately 0.2m. So, there will not necessary of maintenance work such as over-lay of pavement work.
- Zone D $S_t \approx 0.5$ m. After settlement occurrence of 0.3m at elapsed time of 20 years, maintenance work would be necessary.
- Zone C $S_t \approx 0.8$ m. After settlement occurrence of 0.3m at elapsed time of 20 years, maintenance work would be necessary.
- Zone B; $S_t \approx 1$ m. Maintenance work would be expected after elapsed time of 10 years, 20 years and 90 years at the settlement of 30 cm, 60 cm and 90 cm, respectively
- Proximity area to ST-14; $S_t \approx 1.5$ m. Maintenance works are expected to be necessary after elapsed time of 10 years, 20 years, 45 years and 90 years.

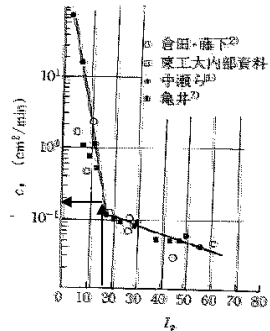


Figure 4.9
Relationship with C_v and I_p

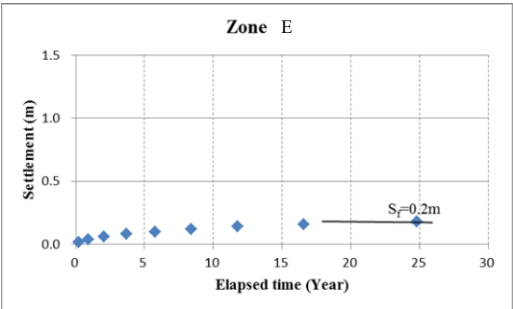


Figure 4.10(a)
Settlement with time at Zone-E

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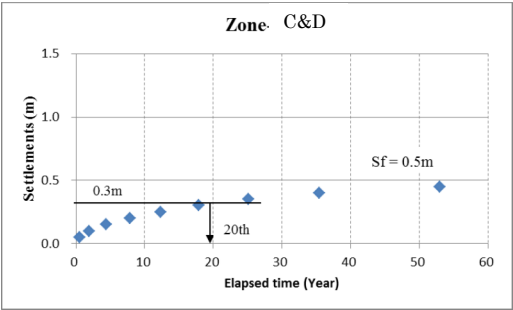


Figure 4.10(b)
Settlement with time
at Zone C&D

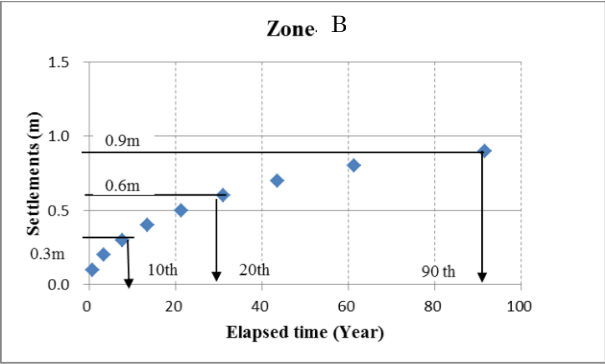


Figure 4.10(c)
Settlement with time
at Zone B

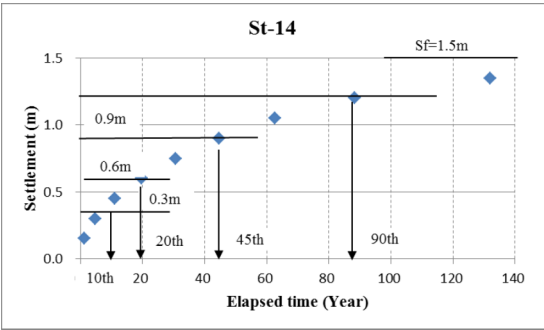


Figure 4.10(d)
Settlement with time
at St-14

4.5 Acceleration technique of consolidation settlement
Plastic board drain method (PBD) would be one of the most popular techniques to accelerate consolidation settlement. As discussed in 4.4, consolidation settlement in Zone B would last for 50years and Zone C to 100 years, even 150 years at ST-14, it might be one of countermeasures to minimize the maintenance cost for Zone B and ST-14 (Zone A) by utilizing PBD.

Equa. 4.8 gives relationship with consolidation degree and its time in case of consolidation by vertical drain.

$$t = d_v^2 \times T_h / C_h$$
 Equa.4.8

$$U = 1 - \exp\left(-\frac{8T_h}{F(n)}\right)$$
 Equq.4.9

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$$F(n) = \frac{n^2}{n^2-1} \ln(n) - \frac{3n^2-1}{4n^2} \quad \dots\dots\dots \text{Equa.4.10}$$

Here; $n = \frac{d_u}{d_w}$, de; equivalent effective diameter of drain, d_w ; diameter of drain well, U ; Consolidation degree, T_h ; Time factor, C_h ; Horizontal coefficient of consolidation.

Taking ordinary conditions of PBD such as:

- Spacing of PBD (d) ; 1.5m in square grid,
- d_w ; 0.05m
- $C_h = C_v = 1.58 \times 10^{-2}$ (m²/day)

into calculation of time, consolidation time would be:

Degree of consolidation (U)	80 %	90%
Acceleration time	3 months	5 months

Fig. 4.11 shows the improvement area and its division with depths of the PBD installations.

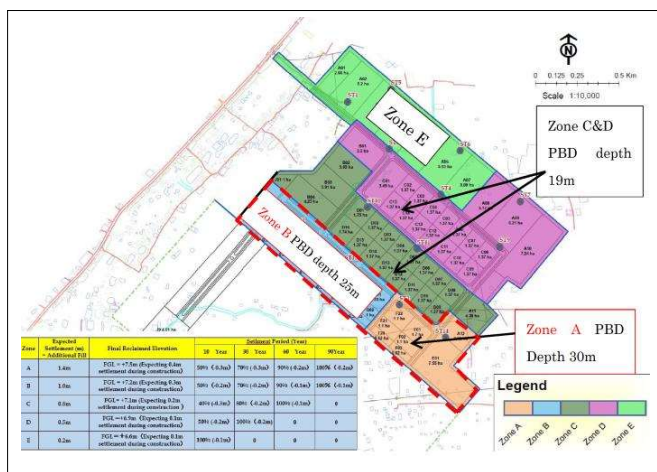


Figure 4.11 Area (A & B) to be improved by PBD

It must be emphasized to consider some difficulties when PBD is to be utilized. They are:

- When PBD is installed into the ground, mandrel would penetrate into the ground by hydraulic pressure system. Therefore, in case stiff layer larger than 10 of N value is deposited at surface layer, which is similar as this project site, additional preparatory boring work might be necessary for smooth penetration of the mandrel.
- In case of shortage of capable machines for deep installation, long execution time for PBD installation must be considered.

5. Shear strength of silty/Clayey layer

Figure 5.1 shows distribution of shear strength obtained by the Field Vane Test carried out at ST-05 to ST-14. It is realized that clay/silt layer from the ground surface to -6m have large strength due to over-consolidated state of silty/clayey soil.

Fig. 5.2(a) to Fig. 5.2(d) show distributions of N value with depth at ST-1, Zone E, Zone D & C and Zone B. It is figured out that N values increase with depth from the surface to 10m in common at Zone E to Zone D. Bearing stratum depth seem to vary from 20m at Zone C, 25m at Zone B and deeper than 30m at Zone E except for the vicinity of ST-14.

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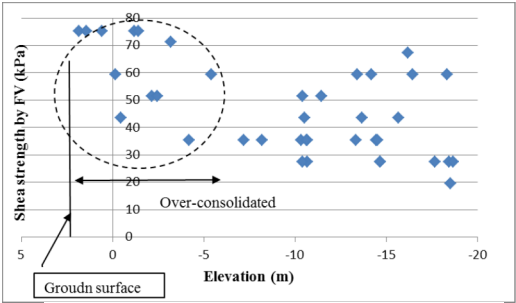


Figure 5.1 Shear strength by Field Vane Test

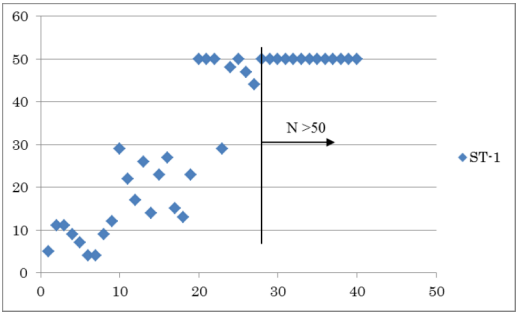


Figure 5.2(a) N vs Depth at ST-1

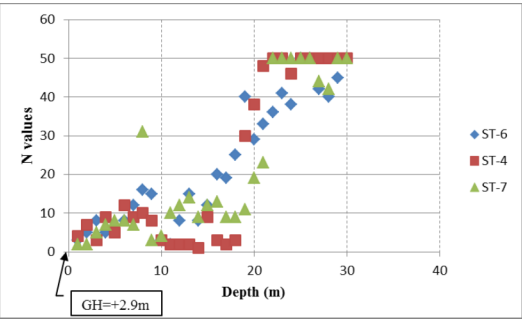


Figure 5.2(b) N vs. Depth at Zone E

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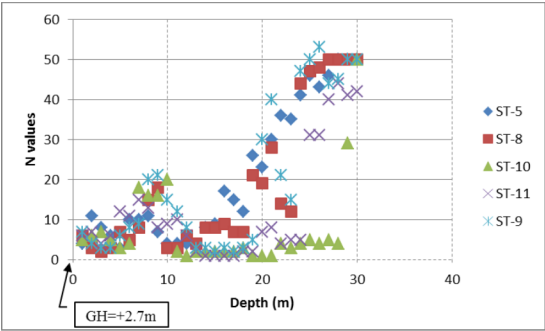


Figure 5.2(c) N vs. Depth at Zone D&C

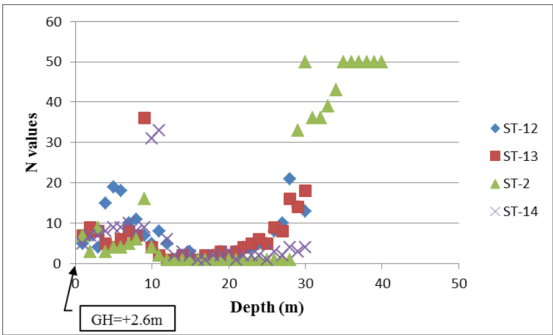


Figure 5.2(d) N vs. Depth at Zone B

6. Summary

Project site would be divided into 3 zones together with ST-14 based on their expected consolidation settlements. Summaries of each Zone are:

	Zone E	Zone D&C	Zone B	ST-14(?)
Approximate settlement	0.2 m	0.5m~0.8m	1m	1.5m
80 % /Consolidation	10yrs	40yrs	60yrs	90yrs
Maintenance (times)	≤ 1	≤ 2	≤ 3	≤ 4

There will be two ways of countermeasures against post construction settlement.

- i) PBD technique to accelerate consolidation settlement; Large initial cost and less maintenance free
It could be ordinary way to utilize the PBD technique, which is one of the most popular in the South-East Asia to minimize post construction settlement. Without a word, the followings must be considered:

- The installation cost, which would be calculated by

$$C = \frac{C_0}{d^2} (A_{ST-5} \times l_B + A_{ST-8} \times l_C + A_{ST-14} \times l_{ST-14})$$

Here, C; Total installation cost, C₀; unit cost of PBD installation per meter, d; spacing of PBD (1.5m for this case), l; installation depth +thickness of sand mat (1m),

- The execution time of PBD installation that depends on the efficiency of installation per a machine and number of installation machines
- Consolidation acceleration time, approximately 3 to 5 months, approximately 6 months.
- Additional possible cost and time would be necessary to make pre-boring for smooth

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installation of PBD

ii) Maintenance of structures; No initial cost but maintenance cost with damages by settlement

As described in 4.4, frequency of maintenance work would depend on the post construction settlement. Since damages to the structure would be easy to forecast, such as the utility, pavement of the road, drainage system and so on would be designed for easy maintenance.

Taking a consideration of the frequencies of maintenance such as 1st maintenance in 10 years and 20 to 30 years for 2nd maintenance, life cycle of building and so on, it seems advisable to take measure against post construction settlement by means of maintaining the structures as depending on their damages.

At the end of the report, it must be emphasized that as calculated settlement would be usually underestimated as described in 4.3, the importance is to carry out the further soil investigation before Detail Design and the importance during the execution time could be to monitor the settlement as one of supervision work and to reflect them to the management of the project.4-1) Equation of settlement calculation

It should be noted that based on these supplementary information and own survey by bidders, the bidders shall study and propose the construction method and schedule.

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Supplementary Information (2)

Existing Gas Transmission Pipelines

There exists two (2) gas transmission pipelines with diameters of 14 inches and 20 inches running through in the targeted Bangladesh Special Economic Zone in Araihaazar. Typical cross section of existing gas pipelines is shown in Figure 2-1. The locations showing the coordinates are shown in Figure 2-2, 2-3, 2-4, 2-5, 2-6 and 2-7.

Necessity of the diversion of the gas transmission pipelines will be considered by the Employer and the cost for the diversion shall not be included in the Bid price.

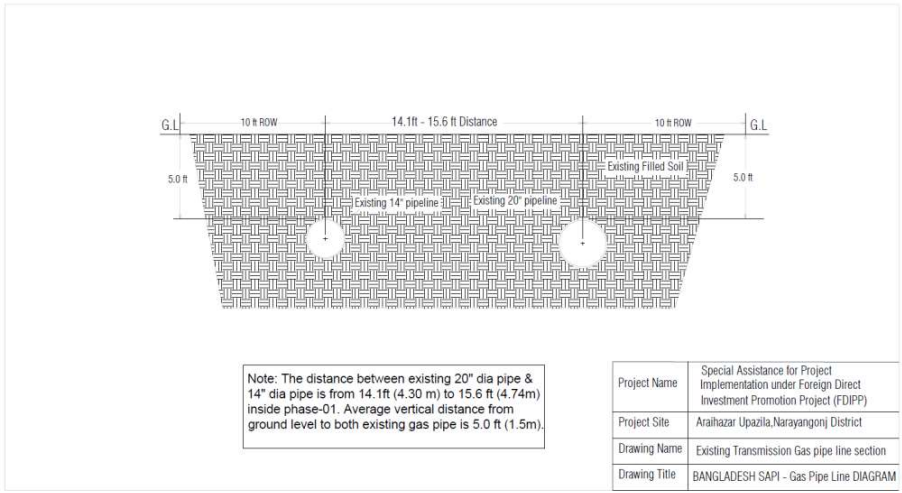


Figure 2-1: Typical Cross Section of Existing Gas Transmission Pipelines

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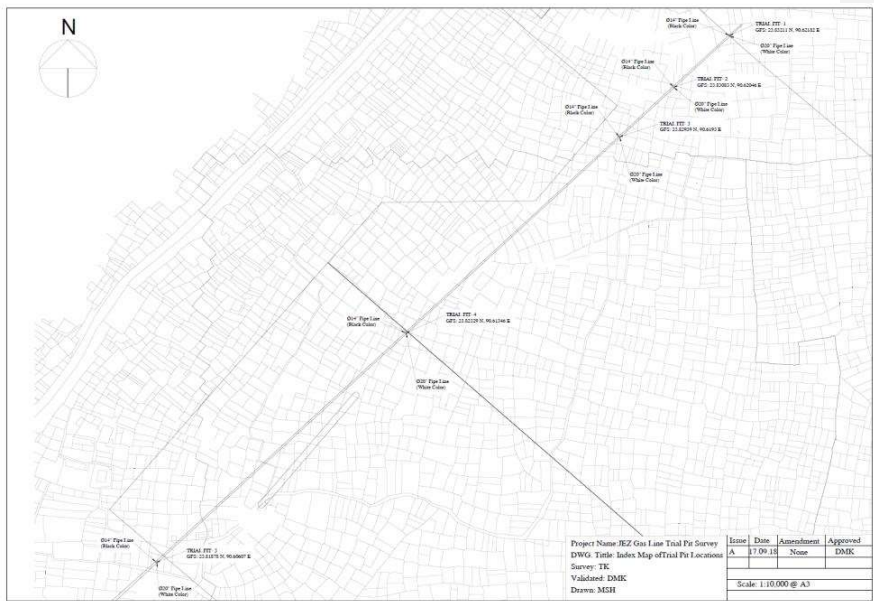


Figure 2-2: Plan of Existing Gas Transmission Pipelines

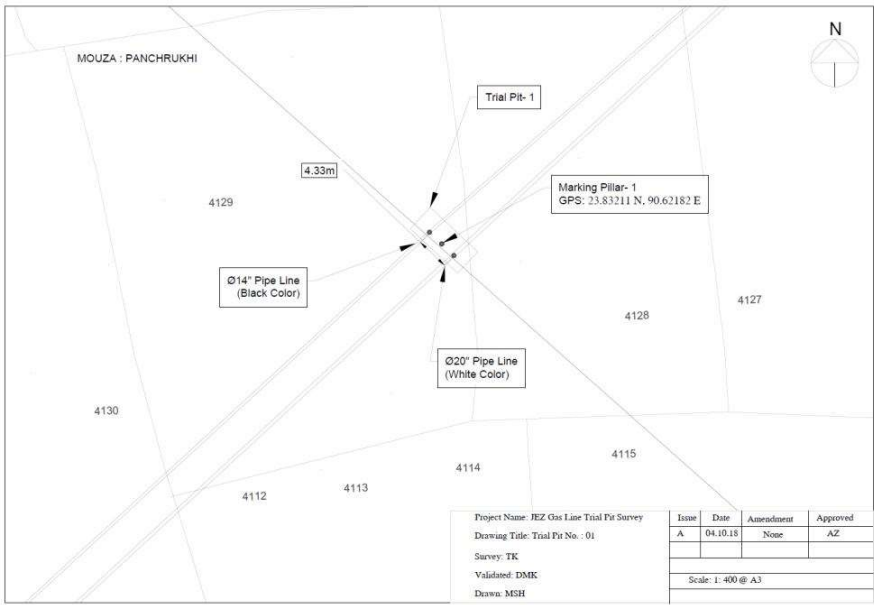


Figure 2-3: Information of Existing Gas Transmission Pipelines (1/5)

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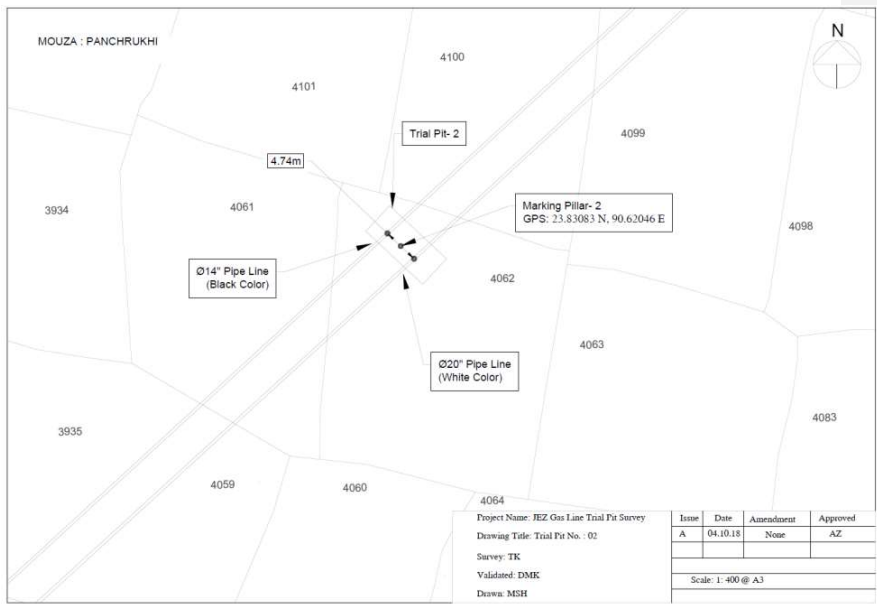


Figure 2-4: Information of Existing Gas Transmission Pipelines (2/5)

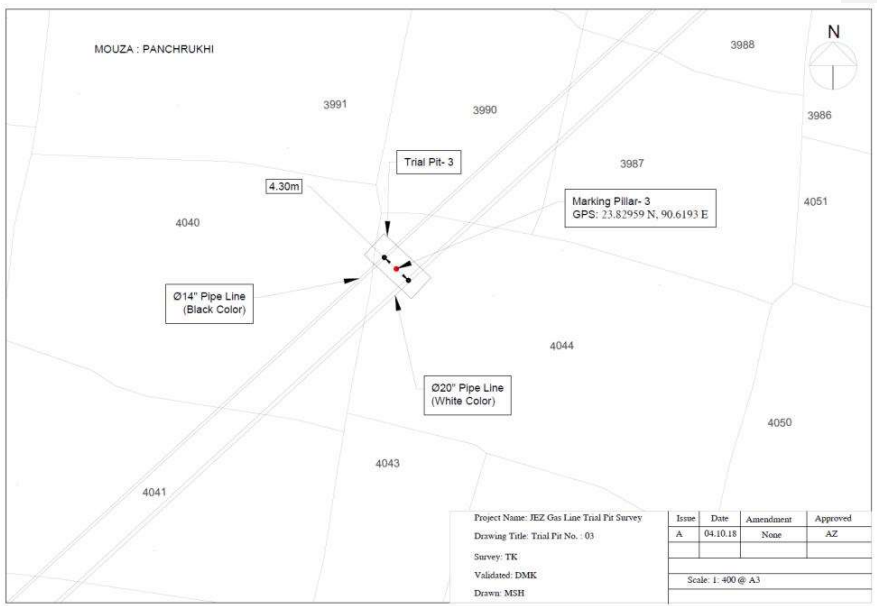


Figure 2-5: Information of Existing Gas Transmission Pipelines (3/5)

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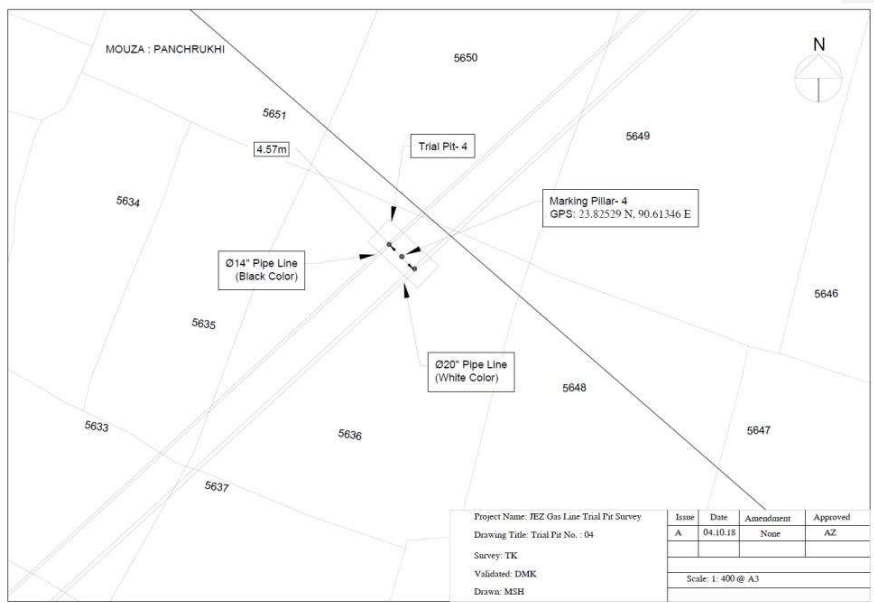


Figure 2-6: Information of Existing Gas Transmission Pipelines (4/5)

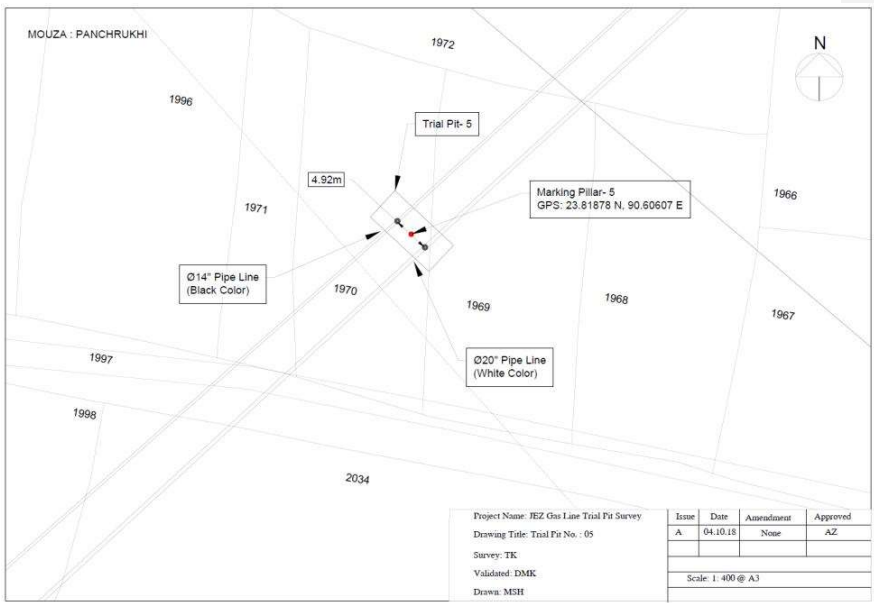


Figure 2-7: Information of Existing Gas Transmission Pipelines (5/5)

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For the reference, the extract of NATURAL GAS SAFETY RULES 1991 in Bangladesh in English translation is attached herewith:

Extract of NATURAL GAS SAFETY RULES 1991 (English Translation)

NATURAL GAS SAFETY RULES 1991 (REVISED 2003)	
Pigging system (Clause-8):	In a transmission line, scraper station with pig launcher and pig receiver should be installed for pigging and internal inspection system to remove the dust/ dirt/ condensate/ petroleum from the gas transmission line
Installment of Valve in gas pipeline (Clause -11):	In a transmission line, crossing through the locality, the distance between two shut-off valves is 10 km; in other cases, 30 km. The valve should be installed above the ground (above the highest point of the flood level) or under the ground.
Right of Way (Clause-24):	For transmission line, the pipe line should be laid along the right of way (The paddy land/ cross-country land/ path acquired for construction of pipeline as per the estate law) to ensure safety measures.
Safety Distance (Clause-31):	For transmission line, the safety distance between the outer surface of the pipe wall and the permanent civil structure/ building should be at least 2.5 meter.
Minimum Safety Depth (Clause-33):	To lay/ install the pipe to underground, the minimum safety depth from the road surface to the pipe wall surface should be at least 1.22 meter (4 feet).
Indication points/Marker Posts along pipeline route (Clause-35.1 & 35.2):	indication board/ RCC marker post (with red color) should be placed along the ROW of the pipeline. The distance between two marker post/ indication board is 500 meter (min.) and 200 meter (for public locality). Indication board/ RCC marker post should be placed at the both sides of the pipeline route crossing major road/ highway/ railway/ river/ canal/ khal.
Undergrounded pipeline	
Clause-36.1:	For undergrounded pipeline, the minimum distance between the pipeline and undergrounded civil structure/cable etc. is 20 cm (for transmission line). If it is not possible to keep the minimum distance between undergrounded the pipeline and civil structure/ cable, steel casing pipe/ RCC coating/ Non- conductive substance (PVC sleeve) should be placed between them.
Clause-36.2:	The minimum distance between two undergrounded high pressure pipelines, placed laterally, should be at least 0.5 meter.
Clause-36.3:	The minimum distance between two undergrounded high pressure pipeline s, placed in parallel, should be at least 1.5 meter.
Clause-36.4:	The minimum distance between undergrounded transmission pipeline and high voltage electric cable should be at least 1.0 meter.
Clause 36.5:	Cathodic protection should be arranged to protect the undergrounded pipelines from induction current of high voltage line/ corrosion.
Clause 36.6:	In adverse situation, steel casing pipe with proper ventilation/ safety measures to be used to cross the pipe along the sewerage line/ drain.
Claus -36.7:	The maximum depth from the road surface to undergrounded transmission/ distribution pipeline should be 2 meter.
Protection against Natural Hazards (Clause-37):	Special safety measures e.g., pipeline with higher wall thickness, steel casing pipe/ RCC coating are to be used over the pipe, or cathodic protection is to be used to protect the pipe from natural hazards (flood/ earthquake/ corrosion).

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Special safety measures/ arrangements for pipeline: For road crossing (Clause-39.2)/ railway crossing (Clause-39.3), steel casing pipe to be used over the carrier pipe to protect the pipe against traffic vibration. The minimum depth from the road/railway surface to the outer surface wall of the underground casing pipe to be 1.5 meter (Clause-39.5).
Design & Construction of Steel Casing pipe
For road/ highway/ railway crossing, steel casing pipe is to be used over the carrier pipe to protect the pipe from the external force and traffic vibration. End casing seal is used at both ends of the casing pipe and thinsulator/insulating spacer to be used inside the casing pipe over the carrier pipe (Clause-41).
The minimum gap between two thinsulators/ insulating spacers is to be 2 meter. The gap between the casing pipe and the carrier pipe is 2". Vent pipe (DN 2" = 3 meter) is to be used over the casing pipe to remove the internal air to the atmosphere. The top end of the vent pipe to be downward with two DN 2"x 90°elbows. A mesh is to be attached at the downward end of the vent pipe to resist explosion (Clause-41).
For railway crossing, shut-off valve is to be installed at the both side of the crossing for emergency shut-down. The distance between two vales will be determined by the project director and railway authority. Indication board (75 cmx75 cm, Black and White) is to be installed at the both sides of the railway crossing. The gap between the bottom end of the indication board and the railway surface is to be 25 cm (Clause 47.5).
Non Destructive Radiography Testing (NDT) (Clause-43)
Non Destructive Radiography Testing (NDT) should be performed over the butt welding joint of the pipeline to test/ examine the accuracy of the butt welding joint (As per American Petroleum Institute Standard Code No. 1104): (a) 10% - 30% of the butt welding joints of the high pressure carrier pipeline, (b) 100% of the butt welding joints of the carrier pipe for any water course (canal/river/khal)/ highway/ road/ railway crossing, and (c) 100% butt welding joints of the pipe installed in gas stations.
Defective butt welding joints of the pipe must be repaired and re-welded.
Hydrostatic Testing and Commissioning of Pipeline
Hydrostatic testing is to be performed during commissioning for high pressure (20.5 kg/cm ² = 290 psig) gas pipeline. Water is to be used in hydrostatic testing. The minimum time required for Hydrostatic/ Pneumatic testing & commissioning should be 24 hrs.
During hydrostatic testing & commissioning a. Test pressure= 1.25 x Maximum allowable pressure or Design pressure (outside the public locality) b. Test pressure = 1.50 x Maximum allowable pressure or Design pressure (within the public locality)
The test is to be performed to detect/ repair the faulty section in the pipe.
During hydrostatic testing, Brush pig (Cleaning pig), Cup pig (Batching pig) and foam pig (Drying pig) are used sequentially to remove the water/condensate from the pipe (Clause 59.1).
Dry nitrogen is used to remove the air/water from the pipe (Clause 59.3).
Protection of pipeline against Corrosion
Coating & Wrapping and Cathodic protection system are used to protect the pipe from external corrosion (Clause 60.1).
Electromechanical system/ machine is to be used for Coating & Wrapping work to

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ensure the longevity of the piping system (based on size of pipe, atmospheric condition and piping system) (Clause 61.1).
Cathodic protection system is to be installed to protect the pipe from corrosion (clause 62.1).
Sacrificial anode/impressed current system/ Transformer-Rectifier set should be used in cathodic protection system. (62.2).
Pressure Regulation (Clause 87)
An active regulating unit (primary pressure regulator) should be installed in the higher pressure source line to limit/regulate /control the pressure within the maximum allowable pressure of the line.
To protect the system against sudden excessive pressure and to limit the pressure within the maximum allowable pressure, relief valve/ monitoring regulator /series regulator/ automatic shut-off unit should be installed with the primary pressure regulator.
A monitoring regulator/automatic shut-off valve/similar active unit, installed with the active regulator, is used to protect the system from the excessive pressure if the active regulator becomes inoperative.
Position of meter and regulators (Clause 91): As per the actual site condition, gas flow meter and pressure regulator should be installed inside /outside of the customer premises.

BIDDING DOCUMENTS

For

**PROCUREMENT OF LAND DEVELOPMENT
WORKS FOR BANGLADESH SPECIAL
ECONOMIC ZONE DEVELOPMENT UNDER
FOREIGN DIRECT INVESTMENT
PROMOTION PROJECT (FDIPP)
(Part 3 of 3)**

Employer: BEZA (Bangladesh Economic Zones Authority)

Country: Bangladesh

Project: Foreign Direct Investment Promotion Project
(FDIPP)

Loan No.: LA No. BD-P86 (December 13, 2015)

PART 3 – Conditions of Contract and Contract Forms

Section VII. General Conditions (GC)

The General Conditions governing this Contract shall be Conditions of Contract for Construction MDB Harmonized Edition, prepared and copyrighted by the International Federation of Consulting Engineers (*Fédération Internationale des Ingénieurs-Conseils*, or FIDIC), FIDIC 2010, all rights reserved, (hereinafter referred to as “Standard GC”). This publication is exclusive for the use of JICA’s Borrowers and their project implementing agencies as provided under the License Agreement dated August 1st, 2008, between JICA and FIDIC, and, consequently, no part of this publication may be reproduced, translated, adapted, stored in a retrieval system or communicated, in any form or by any means, whether mechanical, electronic, magnetic, photocopying, recording or otherwise, without prior permission in writing from FIDIC, except by the parties above and only for the exclusive purpose of preparing this Contract.

The General Conditions of Contract are available on the JICA’s website shown below:

http://www.jica.go.jp/english/our_work/types_of_assistance/oda_loans/oda_op_info/guide/tender/index.html

A copy of these General Conditions is not attached to these Bidding Documents/Contract.

Section VIII. Particular Conditions (PC)

Particular Conditions (PC)

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

Part A - Contract Data

Conditions	Sub-Clause	Data
Employer's name and address	1.1.2.2 & 1.3	The Employer is: Executive Chairman, BEZA (Bangladesh Economic Zones Authority) The address is: Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205 Phone: 880-2-9632456 Facsimile: +880-2-9632402 E-mail: ayub6006@yahoo.com
Engineer's name and address	1.1.2.4 & 1.3	<i>[Engineer's name and address will be inserted once hired].</i> <i>[insert Contractor's name and address].</i>
Bank's name	1.1.2.11	Japan International Cooperation Agency (JICA)
Borrower's name	1.1.2.12	Government of the Peoples Republic of Bangladesh
Time for Completion	1.1.3.3	For whole of Works: 912 days For Sections: Refer to Table: Summary of Sections as follows.
Defects Notification Period	1.1.3.7	365 days.
Sections	1.1.5.6	Refer to Table: Summary of Sections
Electronic transmission systems	1.3	Email.
Governing Law	1.4	The contract shall be governed by the Laws of The Government of the People's Republic of Bangladesh.
Ruling language	1.4	English
Language for communications	1.4	English
Time for access to, and possession of all parts of, the Site	2.1	The time for access to and possession of the Site shall be twenty eight (28) days after the signing date at latest

Conditions	Sub-Clause	Data
Engineer's Duties and Authority	3.1(B)(ii)	Variations resulting in an increase of the Accepted Contract Amount in excess of 3% shall require approval of the Employer.
Performance Security	4.2	The Performance Security will be in the form of a "Demand Bank guarantee" in the amount(s) of 10% of the Accepted Contract Amount and in the same currency(ies) of the Accepted Contract Amount.
Normal working hours	6.5	8:00 am to 6:00 pm
Delay damages for the Works	8.7	0.01% of the Accepted Contract Price per day for "Stage-1" (Zone E and Zone D), described in the figure 4 of the "Supplementary Information" until Issue of sectional Taking-Over Certificate. Refer to " Table: Summary of Sections " below. 0.05 % of the Accepted Contract Price per day for Whole Area (Stage-1 and Stage-2), described in the figure 4 of the "Supplementary Information" until issue of Taking-Over Certificate for the Works. Refer to " Table: Summary of Sections " below.
Maximum amount of delay damages	8.7	Maximum 5 % of the Accepted Contract Price.
Provisional Sums	13.5.(b)(ii)	15 %
Total advance payment	14.2	15 (Fifteen) % of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable.
Repayment amortization rate of advance payment	14.2(b)	Amortization rate is 20 (twenty) % of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid
Percentage of Retention	14.3(c)	Percentage of Retention is 10% of each Interim Payment Certificate.

Conditions	Sub-Clause	Data
Limit of Retention Money	14.3(c)	The limit of Retention money is 5 % of the Accepted Contract Amount.
Plant and Materials	14.5(b)(i)	Plant and Materials for payment Free on Board <i>[list]</i> . Not applicable
	14.5(c)(i)	Plant and Materials for payment when delivered to the Site <i>[list]</i> . Not applicable
Minimum Amount of Interim Payment Certificates	14.6	0.3 (Zero point three) % of the Accepted Contract Amount.
Maximum total liability of the Contractor to the Employer	17.6	The product of 1.00 times the Accepted Contract Amount
Periods for submission of insurance: a. evidence of insurance. b. relevant policies	18.1	14 days 28 days
Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	US Dollar Ten Thousand (USD10,000) or equivalent
Minimum amount of third party insurance	18.3	US Dollar Ten Thousand (USD10,000) or equivalent per occurrence with the number of occurrences unlimited
Date by which the DB shall be appointed	20.2	28 days after the Commencement date
The DB shall be comprised of	20.2	3 (Three) Members
Appointment (if not agreed) to be made by	20.3	President of FIDIC

Table: Summary of Sections

Section Name/Description (Sub-Clause 1.1.5.6)	Time for Completion (Sub-Clause 1.1.3.3)	Damages for Delay (Sub-Clause 8.7)
Stage-1 (Zone E and Zone D), described in the figure 4 of the “Supplementary Information”	456 days	0.01%
Whole Area (Stage-1 and Stage-2), described in the figure 4 of the “Supplementary Information”	912days	0.05%

Part B - Specific Provisions

Sub-Clause 1.15 Inspections and Audit by the Bank

This Sub-Clause is deleted entirely.

Sub-Clause 4.1 Contractor's General Obligations

Replace in the third paragraph: "as defined by the Bank" *with* "as defined by the Loan Agreement between the Bank and the Borrower".

Sub-Clause 4.25 Taxation

The following additional Sub-Clauses 4.25 is inserted after Sub-clause 4.24:

4.25 Taxation

4.25.1 Foreign Taxation

The prices and rates quoted in the Bid by the Contractor shall include all taxes, duties, and other charges imposed outside the Employer's country on the production, manufacture, sale, and transport of the Goods, including Contractor's Equipment, Plant, Materials, Temporary Works and supplies, to be used on or furnished under the Contract, and on the services performed under the Contract.

4.25.2 Taxation on Locally Procured Goods and Services

The prices and rates quoted in the Bid by the Contractor shall include all local taxes and duties that may be levied or become payable in accordance with the laws and regulations of Bangladesh on all locally procured Goods, including Contractor's Equipment, Plant, Materials, Temporary Works and supplies, to be used on or furnished under the Contract, and on the local services performed under the Contract, including those from subcontractors of all tiers and suppliers.

4.25.3 Income Tax and VAT on Payments to Contractor

The individual prices and rates quoted in the Bid by the Contractor shall exclude local Income Tax and Value Added Tax (VAT) that may be levied or become payable on payments from the Employer to the Contractor. The Bidder shall add appropriate allowance for Income Tax and VAT in the Grand Summary page of the Bills of Quantities, which allowance shall

be deducted by the Employer from all payment certificates in accordance with the applicable laws and regulations of Bangladesh.

4.25.4 Income Tax for Local Staff and Workers

The Contractor's local staff and labour working on the Contract works shall be liable to pay personal income taxes in the Employer's country in respect of their salaries and wages as are chargeable under the laws and regulations for the time being in force.

4.25.5 Local Taxation and Duties on Imported Plant and Materials

The prices and rates quoted in the Bid by the Contractor shall exclude all custom duties, import duties, and taxes that may be levied or become payable in accordance with the laws and regulations of Bangladesh on all imported Materials, Plant and equipment that are to be incorporated in the Permanent Works.

Such local Taxation and Duties on imported Plant, Materials and equipment to be incorporated in the Permanent Works shall be directly paid to the concerned Authority by the Employer on submission of appropriate documents by the Contractor. However, all formalities and documentations associated with the importation and for the clearance of consignments shall have to be initiated and arranged by the Contractor.

The Contractor shall be required to pay all duties and taxes on any imported spare parts, consumables, breakables and expendable items that are not intended for incorporation in the Permanent Works, at the time of clearance of such goods as per existing custom rules. Such duties and taxes shall not be separately reimbursed to the Contractor and accordingly his bid prices and rates shall include for them where relevant.

4.25.6 Contractor's Equipment Imported on Re-export Basis

Permission for clearance of temporarily imported Contractor's Equipment, plant and Temporary Works items on re-exportable basis required for implementation of the Works will be granted free of Duties and Taxes according to the following:

- (a) The Contractor will be allowed to import only bona-fide

plant, Contractor's Equipment and Temporary Works items, which may include transport and delivery equipment such as cars, minibuses, jeeps, pick-ups and trucks, certified by the Engineer as being essential for project implementation on temporary importation-cum-re-exportable basis. However, the Contractor shall post with the customs authorities at the port of entry an approved export bond or bank guarantee, valid until the Time for Completion of the Works plus six months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment, plant and Temporary Works items and callable in the event that the Contractor's Equipment and plant are not exported from the Employer's country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer, and copied to the Engineer, upon the importation of individual items of the Contractor's Equipment, plant, Temporary Works items or goods.

To obtain exemption of Duties and Taxes on bona-fide plant, Contractor's Equipment and Temporary Works items, the Contractor shall submit a Master List, certified by the Engineer, to the National Board of Revenue for their information and final approval.

The Master List will be based on the list of equipment submitted by the Contractor in the Bid. The list of equipment submitted by the bidder will be reviewed and modified, if necessary, at the time of finalization of the Contract Agreement in consultation with the National Board of Revenue.

(b) The Contractor will be required to pay Duties and Taxes on imported spare parts, consumables, breakables and expendable items at the time of clearance of such goods as per existing customs rules. Such Duties and Taxes will not be reimbursed to the Contractor.

(c) At the time of exportation of any of the Contractor's Equipment, plant and Temporary Works items which have been imported on the basis of exemption, the Contractor shall pay to the customs authorities the evaluated amount of Duties and Taxes equivalent to the proportionate amount of the exempted Duties and Taxes by comparing the depreciated value of the items to be exported with the original value of the same equipment and plant at the time of importation. The Contractor will be responsible to pay for the applicable Duties and Taxes

for the deflated portion of the value of the relevant Contractor's Equipment, plant and Temporary Works items which has been consumed during the works implementation period. Any items of the Contractor's Equipment, plant and Temporary Works items which have been imported on the basis of exemption but are found or noticed as being not exported within the Contract execution period will be subject to imposition of the applicable Duties and Taxes in full with the payable amount becoming due at any time as determined by the customs authorities. The evaluation of the customs authorities or the National Board of Revenue for the payable amounts of Duties and Taxes for such exportable or demised items in any case will be final and conclusive.

(d) The Employer will give the required recommendation for import of necessary equipment, materials, etc. and re-export of the same upon completion of the relevant works so that the Contractor may obtain possible tax exemption. The Contractor is solely responsible for realization and processing of the same. If any guarantee or other kind of documentations is required in this respect, it shall be the responsibility of the Contractor to arrange and to pay for the cost. The Employer will not be held responsible for any import duties or taxes which will become payable by the Contractor on account of any part of the Contractor's Equipment, plant or Temporary Works items for which exemption is not allowed by the customs authorities due to whatever reason.

4.25.7 Contractor's Equipment and Plant Imported Previously for Other Project

If any Bidder proposes to use construction plant and equipment already imported to Bangladesh on re-export basis for another project, he must submit with his Bid a letter of approval from National Board of Revenue approving the use of such equipment in this Project if the Contract is awarded to the Bidder.

If the National Board of Revenue requires that any duties, taxes or fees are to be paid to allow the use of such equipment in this Project, then any duties, taxes and fees are to be included in the prices and rates quoted by the Bidder and shall not be reimbursed under the Contract.

4.25.8 Custom Clearance

The Contractor will bear all costs including port unloading, clearing and demurrage charges, related to or all other charges resulting from delays in obtaining custom clearance and inland transport charges in respect of any equipment, plant, materials and labour to be imported for the purpose of executing the Works under the Contract, or subsequent re-exportation if applicable, under the laws and regulations for the time being in force. The Employer will render its best endeavor in assisting the contractor by giving necessary recommendations where required for obtaining the necessary custom clearance through the relevant authorities for the Contractor's Equipment, plant, materials etc., but in no way will the Employer be held responsible for any delay to the Works and loss sustained as a result of obtaining the custom clearance.

**Sub-Clause 13.5
Provisional Sums**

The following text should be added at the end of Sub-Clause 13.5:

“As an exception to the above, the Provisional Sum for the cost of the DB shall be used for payments to the Contractor of the Employer’s share (one-half) of the invoices of the DB for its fees and expenses, in accordance with GC 20.2. No prior instruction of the Engineer shall be required with respect to the work of the DB. The Contractor shall produce the DB invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Sub-Clause 14.3, which contain requests for payment under the Provisional Sum toward the cost of the DB. The Engineer’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 DB.”

**Sub-Clause 14.1
The Contract Price**

As indicated in sub-paragraph (b), there will be no exemption from duties and taxes and the Contract Amount shall not be adjusted for any of these costs, unless otherwise described in “4.25 Taxation”.

**Sub-Clause 14.7
Payment**

Delete last paragraph and replace with the following provision:

“The payments to the Contractor under the Contract shall be made in the following procedures:

Advance Payment, Interim and Final Payments of Foreign Currency Portion and Local Currency Portion: To be paid through remittance of Advance Payment amounts respectively into the Contractor’s account at a bank in his home country for

the Foreign Currency Portion and at a bank in Bangladesh for the Local Currency Portion, those banks designated by Contractor. The payments will be financed with the Japanese ODA Loan disbursed accordance with the Transfer Procedure or Advance Procedure set forth in the Loan Agreement No. BD-P86 between JICA and the Government of the People's Republic of Bangladesh for the Project.

Payment responsibility of the bank charges will lie on the Employer.

Sub-Clause 14.15
Currencies of Payment

Replace the entire Sub-Clause 14.15 with the following:

The Contract Price shall be paid in the currency or currencies in which the bid price was expressed in the Letter of Bid. If more than one currency is so named, payments shall be made as follows:

- (a) payment of the damages specified in GC 8.7, shall be made in the currencies and proportions specified in the Letter of Bid;
- (b) other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;
- (c) if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and
- (d) the applicable rates of exchange shall be those prevailing on the Base Date and determined by the central bank of the Country.

Sub-Clause 15.6
Corrupt or Fraudulent Practices

Replace the entire Sub-Clause 15.6 with the following:

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2

[Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor's Personnel].

**Sub-Clause 20.6
Arbitration**

Replace the entire Sub-Clause 20.6 with the following:

Any dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.5 above and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Arbitration shall be conducted as follows:

- (a) if the contract is with foreign contractors (or if the lead partner is a foreign contractor, in case of JV), international arbitration with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.
- (b) if the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country.

The place of arbitration shall be a neutral location determined in accordance with the applicable rules of arbitration; and the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language].

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

**Section IX. Annex to the Particular Conditions
- Contract Forms**

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Letter of Acceptance

[Insert date]

To: *[Insert name and address of the Contractor]*

This is to notify you that your Bid dated *[insert date]* for execution of the *[insert name of the Contract and identification number, as given in the Contract Data]* for the Accepted Contract Amount of the equivalent of *[insert amount in words and figures]* *[insert name of currency]*, as corrected and modified in accordance with the Instructions to Bidders, is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section IX, Annex to the Particular Conditions - Contract Forms, of the Bidding Documents

Mohammed Ayub
Executive Member (Administration & Finance)
Bangladesh Economic Zones Authority

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made the *[insert day]* day of *[insert month]*, *[insert year]*, between Bangladesh Economic Zones Authority (hereinafter “the Employer”), of the one part, and *[insert name of the Contractor]* (hereinafter “the Contractor”), of the other part:

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

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

- (i) the Letter of Acceptance;
- (ii) the Letter of Technical Bid ;
- (iii) the Letter of Price Bid
- (iv) the addenda Nos *[insert addenda numbers, if any]* (if any);
- (v) the Particular Conditions ;
- (vi) the General Conditions;
- (vii) the Specification
- (viii) the Drawings;
- (ix) the completed Schedules; and
- (x) the Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans.

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

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of *[insert the laws of the borrowing country]* on the day, month and year specified above.

Signed by _____

Signed by _____

for and on behalf of the Employer
in the presence of

for and on behalf the Contractor
in the presence of

Witness, Name, Signature, Address, Date

Witness, Name, Signature, Address, Date

Performance Security

Demand Guarantee

Beneficiary: The Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority (BEZA),

Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

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 the contract and brief description of the 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 its demand or the sum specified therein.

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.

This guarantee shall expire, no later than the *[insert the day]* day of *[insert month]*, *[insert year]*², and any demand for payment under it must be received by us at this 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, 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 date twenty-eight days after the expected completion date as described in GC Clause 11.9. 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 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

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: The Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority (BEZA),

Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

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 of the contract]* 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

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.

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

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]*, *[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 expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Retention Money Security

Demand Guarantee

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: The Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority (BEZA),

Monem Business District, Level 12, 111 Bir Uttam C R Dutta Road, Dhaka 1205

Date: *[Insert date of issue]*

RETENTION MONEY 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, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, payment of *[insert the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security]* is to be made against a Retention Money 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

¹ The Guarantor shall insert an amount representing the amount of the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the

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 show grounds for its demand or the sum specified therein.

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 second half of the Retention Money as referred to above has been credited to the Applicant on its account number *[insert account's number]* at *[insert name and address of Applicant's bank]*.

This guarantee shall expire no later than the *[insert day]* day of *[insert month]*, *[insert year]*², and any demand for payment under it 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, 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.]

Retention Money and the amount guaranteed under the Performance Security and denominated either in the currency(ies) of the second half of the Retention Money as specified in the Contract, or in a freely convertible currency acceptable to the Beneficiary.

² *Insert the same expiry date as set forth in the Performance Security, representing the date twenty-eight days after the completion date described in GC Clause 11.9. 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 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."*

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1.0 EARTH WORK IN EXCAVATION FOR STRUCTURE

As per Section 19.0 of Specifications of Part-2

2.0 EARTH FILLING

As per Section 3.4 of Specifications of Part-1

3.0 SAND FILLING

As per Section 3.1 of Specifications of Part-1

Before handover works, additional filling by sand and earth shall be required to be the designated average final ground level (FGL+8.30mMSL). These filling costs for the allowance and additional filling such as loose sand material rate to filled material, transportation loss of material, compaction loss of material and initial consolidation settlement loss of material shall be included in the unit rates of filling work. Any loss and reducing ratio and consolidation of filled material would not be added for BOQ and contract cost.

4.0 BRICK FLAT SOLING

As per Section 14.0 of Specifications of Part-2

5.0 CEMENT CONCRETE

As per Section 17.0 of Specifications of Part-2

6.0 DAMP-PROOF COURSE

6.1 Description:

The work covered by this item shall consist of constructing, on top of foundation walls or elsewhere, 75mm/ 38 mm thick artificial stone with a 1:1.5:3 mix of cement, sand of FM 1.5 and 12 mm downgraded picked jhama/stone chips and finishing with a coat of bitumen as per instruction of the Engineer.

6.2 Construction Requirements:

Damp-proof course shall extend the full width of the plinth walls unless otherwise required by the plans and shall be laid only after the levels of the plinth have been checked.

6.3 Measurement:

Damp-proof course shall be measured by square meter in place.

6.4 Payment:

The amount of completed and accepted work, measured as provided above, shall be paid for at the contract unit price of Sqm which payment shall constitute full compensation for furnishing all materials, labour, tools and equipment in mixing, placing and curing concrete, application of bituminous coats and sand blinding and for all incidentals such as overhead, profit, taxes, VAT etc. necessary to complete the work according to the applicable plans.

7.0 REINFORCED CEMENT CONCRETE WORK (RCC)

As per Section 3.5 of Specifications of Part-1

8.0 REINFORCING STEEL IN CONCRETE

As per Section 3.6 of Specifications of Part-1

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9.0 CHEMICAL ADMIXTURE

As per Section 25.0 of Specifications of Part-2

10.0 250mm THICK AND ABOVE BRICK WORK

10.1 Description :

This item shall consist of constructing brick masonry work in 1:6/1:4 cement mortar in such thickness and at such heights as required by the plans.

10.2 Construction Requirement :

All materials shall meet the requirement of the relevant sections of Material Specifications.

- a. **Bricks** shall be 1st class well burnt bricks of uniform colour, shape, size with sharp corners bricks unless otherwise specified.
- b. **Cement** shall be Portland cement Type-I ASTM C- 150 or BS - 12
- c. **Sand** shall be clean well graded natural sand having a minimum FM of 1.5.
- d. **Water** shall be same as required for concrete.
- e. **Mortar** : Mortar of brickwork unless otherwise required shall consists of **1 part** of cement and **6 parts** of sand & **1 part** of cement and **4 parts** sand for (1:4).

Cement and sand shall be mixed dry in the specified proportions until the colour of the mixture is uniform. Water shall then be added sparingly, only the minimum necessary being used to produce a workable mixture of normal consistency, The water cement ratio in no case shall exceed 0.50 by weight, or as directed by the Engineer.

The mixing shall be done on a clean hard platform with watertight joints to avoid leakage. The mixture should be covered with polythene sheet or other means so that dust or other foreign materials cannot be deposited. At the close of each day's work, the mixing trough and the pans shall be thoroughly cleaned and washed.

Mortar shall be mixed in quantities required for immediate use within 30 minutes of mixing. Mortar, which has taken its initial set, shall, on no account be used on the work, nor shall it be remixed with or without additional materials or re tempered by other means.

Workmanship :

No bricks shall be used until they have been thoroughly soaked in clear water for at least eight hours. Soaking shall be discontinued one hour before use. Care shall be taken that the bricks are clean and free from lime or dirt of any kind. If necessary, bricks shall be scrubbed clean.

Brickwork shall be built in plumb and shall be carried up regularly throughout the entire length of the structure. Unless otherwise specified, bricks shall be laid in English Bond unless otherwise specified each brick being set with mortar in bed and vertical joints. All bricks shall be whole except where necessary for closers and where expressly authorised. All horizontal joints shall be parallel and level. Vertical joints in alternate courses shall come directly over one another. Joint thickness should be uniform and shall be 6 mm for pointing brick work and shall in no case exceed 10 mm for other brick works. Exposed joints shall be raked and flush-pointed unless otherwise specified and the face of the work shall be kept clean as work proceeds. The height of day's work shall be limited to 1.25 meter unless otherwise permitted. In exposed situations the day's work shall be protected against harmful effect of weather during and for a period immediately following construction until the mortar has sufficiently hardened. All brickwork shall be thoroughly cured for a period of at least 7 days. Fixture in masonry such as anchors,

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clamps, brackets, pipes, etc. shall be built-in during construction at no additional cost to the Contract.

10.3 Measurement:

This item shall be measured in net cubic meter of brickwork built in place to the neat lines of the structures shown on the plans.

10.4 Payment:

Payment shall be made at the Contract unit price per cubic metre of completed and accepted work measured as provided above which price shall constitute full compensation for furnishing, storing, transporting, preparing, laying, and curing all materials and for all labour, scaffolding, tools and equipment, overhead, profit, taxes, vat etc. and for all incidentals necessary to complete the item as per BOQ item.

11.0 125mm THICK BRICK WORK

The work covered by this item shall consists in constructing 125 mm thick wall with 1st class bricks in 1:4 cement mortar at any heights as required by the plans.

11.1 Construction Requirement and Materials :

Materials and method of construction shall be as stated in item 12 except that the mortar shall consist of 1 part of cement and 4 parts of sand.

11.2 Measurement :

125 mm thick brick walls shall be measured in square meter actually built wall deducting all openings and incorporated foreign structures, such as lintels, columns, beams, etc., provided that the area to be deducted exceeds 0.1 square meter.

11.3 Payment :

Payment shall be made at the contract unit price per square meter of completed and accepted work measured as provided above which price shall constitute full compensation for furnishing, storing, transporting, preparing, laying and curing all materials and for all labour, scaffoldings, tools and equipment, overhead, profit, taxes, VAT etc. and for all incidentals necessary to complete the item as per BOQ item.

12.0 PATENT STONE FLOORING

12.1 Description :

The item shall consist of constructing 38 mm /50mm thick concrete with 12 mm down graded picked jhama brick chips, sand and cement in specified panels of floor slab and else where in accordance with these Specifications. Use approximately 25 kg of cement per 10 m² for neat cement finish and finish with steel trowel upto the satisfaction of Engineer or as directed.

12.2 Construction Requirements :

Materials and construction shall be in accordance with the requirements of item 10 The flooring shall be laid preferably not later than 24 hours after the floor slab is poured. When flooring is to be laid on an older concrete slab, the base surface shall be thoroughly cleaned of all loose materials by stiff wire brush, roughened if seemed necessary and washed and soaked with clean water. Surplus water shall be removed and a dense cement grouting is applied to the surface before flooring is placed.

The floor shall be divided into panels of specified sizes, which shall not be more than 16 sq.m by means of wooden battens. The top of the battens shall be at the level of the finished floor surface.

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The mixture shall be spread evenly between the battens in alternate panels and shall be uniformly consolidated and levelled by a strike-off. When the moisture has disappeared from the surface, the surface shall be steel-trowelled under firm pressure to produce a dense uniform smooth surface free from trowel marks.

The dividing battens shall be removed carefully after 16 hrs and the remaining panels shall be completed in the aforesaid manner. Joints would be marked with thin ropes to allow cracks, if any, to form along straight line and providing neat appearance.

The work shall be cured and protected from weather for at least 10 days immediately following the laying.

12.3 Measurement :

Measurement for payment shall be made in square meter of visible finished floor surface, additions being made for thresholds and deduction for columns or other constructions and openings in the floor.

12.4 Payment :

The amount of complete and accepted work measured as provided above shall be paid for at the contract unit price per square meter which payment shall constitute full compensation for furnishing all materials, equipment and labour, including transport, storage and handling of all materials, batching, mixing, pouring, rolling and curing of concrete including overhead, profit, taxes, VAT etc. as well as all incidentals necessary to complete the work according to applicable plans as per BOQ item.

13.0 PLASTER ON BRICK MASONRY

13.1 Description :

This item shall consist of providing 12 mm to 20 mm thick **(1:4)/(1:6)** on walls, and where necessary in accordance with these Specifications & direction of Engineer.

13.2 Construction Requirements :

Materials shall meet requirements specified below and in the relevant section of Material Specifications.

- a. **Cement** shall be Ordinary Portland cement Type-I ASTM C- 150 or BS-12
- b. **Sand** shall be clean well-graded natural sand having a fineness modulus of 1.50. Sand shall be washed if necessary.
- c. **Water** shall be potable and clean and contain no salt or organic materials.
- d. **Admixture** shall be mixed with the cement mortar of approved quantity where item in BOQ is specifically mentioned.

Cement and sand shall be mixed dry in the specified proportion until the mixture is uniform in colour. Only enough water shall be added to provide plasticity. Mortar shall be mixed only in quantities for immediate use. Mortar which has taken initial set shall not be used on the work with or without addition of fresh material.

Before application of plaster, the joints in brick walls shall be adequately raked out where necessary and smooth concrete surfaces shall be roughened to provide key. The surfaces shall be scrubbed clean of loose materials and soaked with water and kept damped for 24 hours in case of brick masonry.

Plaster which consists of two coats, under and finish, when applied over brick masonry, the under and finish coats shall be applied with an interval to permit the undercoat to set.

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Water proofing admixture of specified quantity shall be mixed with cement mortar as per manufacturer's instruction.

Plaster shall be kept moist by watering and protected from weather for at least 10 days immediately following completion.

If any cracks appear in the plaster or any part sounds hollow when tapped or is found to be soft or otherwise defective after the plaster has dried, it will be considered as defect and the defect shall be made good by cutting out and re-plastering at the Contractor's own cost.

13.3 Measurement:

The work shall be measured in square meter of actually plastered surface.

13.4 Payment:

Payment shall be made for the amount of completed and accepted work measured as provided above at the contract unit price per sq. meter of plaster which price shall constitute full compensation for furnishing all materials, mixing of mortar, plastering surface to be plastered, watering and protecting the plaster after completion, provision, erection and removal of scaffoldings including overhead, profit, taxes, VAT etc. as well as incidentals necessary to complete the work according to the applicable plans as per BOQ item.

14.0 PLASTER ON RCC SURFACES

14.1 Description :

This item shall consist of providing 6 mm to 12 mm thick **1: 4** cement-sand plaster on all RCC members in accordance with these Specification.

14.2 Construction Requirements:

Plaster shall consist of 1 part cement and 4 parts sand and have thickness of 6 mm and shall be applied in a single coat, Where plaster on concrete surface is required 12 mm thick, it shall consist of two coats, under and finish. The under coat shall consist of a grout application and shall have minimum thickness of 6 mm and shall be levelled with straight edge and scratched for key. The finish coat shall be trowelled over with care and levelled with straight edge to obtain a flat smooth surface. The under and finish coats shall be applied with an interval to permit the under coat to set. All edges and corners unless otherwise shown on the plans, shall be rounded or chamfered as directed by the Engineer. All mouldings shall be neat, clean and true to template.

14.3 Measurement :

The work shall be measured in sq. meter of actually plastered surface.

14.4 Payment :

Payment shall be made for the amount of completed and accepted work measured as provided above at the contract unit price per sq. meter of plaster which price shall constitute full compensation for furnishing all materials, mixing of mortar, plastering surface to be plastered, watering and protecting the plaster after completion, provision, erection and removal of scaffoldings including overhead, profit, taxes, VAT etc. as well as incidentals necessary to complete the work according to the applicable plans as per BOQ item.

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15.0 NEAT-CEMENT (SKIRTING/DADO)

15.1 Description :

This item shall consist of providing 12mm thick neat cement with black/redoxide finished (1:2) cement- sand Skirting/Dado on a (1:4) cement-sand mortar plaster of 12 mm thick underbid on walls or where necessary in accordance with these specifications.

15.2 Construction Requirements:

Materials shall meet requirement as stated in item in plastering work.

Wall plaster, if any, shall be removed along the floor to the required height and the surface shall be thoroughly scrubbed and wetted before applying the underbid. The second undercoat shall have a nominal thickness of 6 mm and the total built-up thickness will be same as that of the plaster on the wall. A 3 mm deep and 3 mm wide groove shall be formed where skirting/Dado meets wall plaster.

The skirting/Dado shall be installed flush with the finished wall surface. The intersection with the floor shall be a right angle and the top of the skirting/Dado shall be straight and sharp.

The underbid shall be laid as uniformly as possible and allowed to become firm before scratching for key and subsequently allowed to become thoroughly dry before applying the second undercoat. A neat cement paste 3 mm thick shall be spread evenly over the second coat and shall be steel trowelled under firm pressure to produce a dense uniform smooth surface free from trowel marks.

The work shall be cured and protected from weather for at least 10 days immediately following the installation.

15.3 Measurement:

The work shall be measured in sq. meter of actually plastered surface.

15.4 Payment:

Payment shall be made for the amount of completed and accepted work measured as provided above at the contract unit price per sq. meter of plaster which price shall constitute full compensation for furnishing all materials, mixing of mortar, plastering surface to be plastered, watering and protecting the plaster after completion, provision, erection and removal of scaffoldings including overhead, profit, taxes, VAT etc. as well as incidentals necessary to complete the work according to the applicable plans.

16.0 ENAMEL PAINT

16.1 Description:

The work covered under this item shall consist of applying 2 (two) coat of synthetic enamel paint of approved colour over a coat of priming on plaster wall or ceiling surface where necessary in accordance with these specification.

16.2 Construction Requirements:

The plaster surface shall be painted with two coats or more of synthetic enamel ready mixed paint of best quality and approved colour. Before application the surface shall be given a through rub down to remove all loose materials and all cracks and surface irregularities shall be repaired with patching plaster and filler to obtain a smooth and even surface. The paint shall be applied on appropriate primer after the surface has been finished with filler/putty, etc.

Before applying the paint on plastered surface the surfaces must be thoroughly smooth and cleaned from grease dirt and other foreign materials by a use of stiff wire brush, sand papering or other approved means. Painting shall not be carried out in damp weather. No patchy overlap will be tolerated under any circumstances.

The enamel paint should Robialac (Berger)/or equivalent and must be approved by the Engineer.

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Manufacturers instructions for application for paint must be followed. The colour of the paint should be according to the direction of the Engineer.

A sample area must be prepared first and got inspected and approved by the Engineer before the full scale work commences.

16.3 Measurement :

Measurement for payment shall be made in sq. meter of actually completed acceptable snowcem surface.

16.4 Payment :

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price per sq. meter which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage, transport, preparing, mixing and applying putty, primer and paint and providing scaffoldings as well as all incidentals necessary to complete the work as per BoQ item.

17.0 FRENCH POLISHING TO WOODEN SURFACE

17.1 Description:

The work covered by this item shall consist of providing French polishing work to wooden surface as per direction of the Engineer-in-charge.

17.2 Construction Requirements:

French polishing to door frame and shutters three coats over a coat of priming including cleaning finishing and polishing with sand paper etc. all complete in all floor.

17.3 Measurement:

Measurement for payment shall be made in square meter of actually completed acceptable French polishing surface.

17.4 Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price per square metre which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage transport preparing mixing and applying putty, primer, polishing and providing scaffoldings as well as all incidentals necessary to complete the work as per BoQ item.

18.0 PLASTIC EMULSION PAINT

18.1 Description :

The work covered under this item shall consist of applying 2 (two) coat of plastic paint of approved color over a coat of priming on plastered wall or ceiling surface where necessary in accordance with these specifications. The painted surface shall be easily washable by soft soap and water.

18.2 Materials :

The plastic paint should be Robialac (Berger) or equivalent and must be approved by the Engineer. The priming consists of appropriate type as specified for the paint by the manufacturer, and shall be applied accordingly.

18.3 Application Method:

The surface to be plastic painted shall be dry, well cleaned and free from efflorescence dirt and stain of grease. The surface shall be given a through rub down to remove all loose materials and all cracks and surface irregularities shall be repaired with patching plaster and filler to obtain a smooth and even surface. The mixing of plastic paint shall be carried out in accordance with the instruction issued by the manufacturer of the particular brand of plastic paint that is to be used. Before starting work plastic paint shall be mixed in such way that one room can be finished with

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same mix. Plastic paint is to be applied with proper brushes as supplied or recommended by the manufacturer. A sample area must be prepared first and get inspected and approved by the Engineer before the full scale work commences. The paint work shall not be considered as complete till a surface of perfect uniformity in color, shade and texture is achieved.

18.4 Measurement:

Measurement for payment shall be made in square meter of the actually completed surface.

18.5 Payment :

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price per sqm which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage, transport, preparing, mixing and applying putty, primer and paint and providing scaffoldings as well as all incidentals necessary to complete the work as per BOQ item.

19.0 WEATHER COAT

19.1 Description :

On exterior surface applying as per manufacturer instructions three (3) coats of weather coat of approved quality and colour delivered from authorized local agent of the manufacturer in a sealed container including cleaning, sand papering, scaffolding, curing, drying, supply and carriage of all materials, labour, tools, plants, incidentals etc. complete in all respect in all floors and accepted by the Engineer.

19.2 Materials

The weather coat paint should be of standard brand and must be approved by the Engineer. The priming consists of appropriate brand as specified for the paint by the manufacturer, and shall be applied accordingly. The materials shall be delivered to site in unopened original container bearing approved manufactures label.

19.3 Application Method

The surface to be painted shall be thoroughly cleaned of all foreign matter by using stiff wire brush, sand papering or other approved means. The application of paint shall strictly comply with the manufacturer's instruction. The application shall preferably be carried out after a period of dry weather. Before application, the surface shall be thoroughly clean and dry. For mixing paint manufacturer's instruction details shall be followed. Prime coat shall be prepared according to the direction of the Engineer.

Weather coat paint shall be applied in 3 coats alternately laid on vertically and horizontally on prime coat. Each coat shall be perfectly dry before the succeeding one is laid over it. The wash shall be laid on with good hair brush / roller and not with brushes made of jute. A sample area must be prepared first and got inspected and approved by Engineer before full scale work commences.

19.4 Measurement

Measurement for payment shall be made in square meter (sqm) of actually completed acceptable weather coat surface.

19.5 Payment

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price per square meter (sqm) which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage, transport, preparing, mixing and applying putty, primer and paint and providing scaffoldings as well as all incidentals necessary to complete the work .

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20.0 DOOR SHUTTERS

20.1 Description:

Wooden Grooved Panel Door Shutter: Supplying, fitting and fixing 44mm (finished) thick well matured natural seasoned (min. 250mm wide plank) wooden grooved single panel door shutters with top, bottom and style 150mm x 44mm size, having horizontal panels 150mm x 44mm including keeping 8mm x 8mm even groove all around and 8mm x 8mm horizontal grooved lap to each panel, provided 4 nos. best quality 100mm brass hinges, 12 mm dia best quality 200 mm & 300 mm brass socket and tower bolts, best quality brass handle including supply of necessary nails and screws papering the surface by sand papering etc. for all floors as per drawing, specification and direction of the Engineer. ((All sizes of wood are finished).

Supplying, fitting and fixing 38 mm thick well matured, natural seasoned (min 10" wide plank) **wooden double leaf panel door shutters**. Top rail and styles of sections 100 mm x 38 mm, lock rail 125 mm x 38 mm and bottom rail 225mm x 38 mm, paneling 38 mm thick both sides raised, provided with best quality 6 Nos. 100 mm iron hinges, 2 (two) Nos. best quality 12 mm dia 300 mm and 225 mm long iron tower and socket bolts, 2 (two) Nos. heavy type nickel plated handle, 1 No. hatch-bolt hinged cleats, buffer blocks and finished by sand papering, necessary screws etc. all complete in all floors and accepted by the Engineer. (Double leaf. All sizes of wood are finished)

Supplying, fitting and fixing 38 mm finished well matured, natural seasoned (min 10" wide plank) wooden ornamental special design (equivalent hatil) both sides **Double panel flush door shutter** with top and middle rail 150 mm x 38mm bottom rail 225 mm x 38 mm and style 125 mm x 38 mm, having vertical panels 175 mm x 38 mm in/c minimum 12 mm lap to each panel providing 4 nos, best quality 100 mm brass hinges, 12 mm dia best quality 200 mm & 300 mm brass socket and tower bolts 2(two) now heavy type best quality brass handle hinges cleats, wooden buffer blocks in/c supply of necessary nails and screws finished by machine finished etc. all complete in floors and accepted by the Engineer.

Supplying, fitting and fixing of **steel door shutter** for single and double leaf made with 38 mm x 38 mm x 6 mm M.S angle for outer frame, inner member Tee made of 25 mm x 6 mm and 50 mm x 6mm flat iron (F. I) bar, cladding with 16 BWG M. S. sheet including hinged, fabricating, welding, riveting etc. all complete in all floors as per specification, drawing and direction of the Engineer.

Supplying, fitting, fixing of **uPVC solid plastic door shutter** having specific gravity 1.35 - 1.45, thickness 1.7 mm-2.2 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards of different sizes fitted fixed with uPVC plastic door frame weighing 5.82 kg/m² with at least 3 Nos. SS hinges by min 64 Nos. Ø 3.17 mm and 3.97 mm 12.7 mm long rivets, 12 Nos. 25.4 mm SS screws, Ø 9.38 mm, 150 mm long SS tower bolts 2 Nos., 146 mm SS handle by rivet 2 Nos., G.I inner joint 234.95 mm x 127 mm clamp, 76.2 mm x 57.15 mm, 25 mm dia 1 no SS haspbolt, special type round lock, carrying the same to the site and local carriage etc. complete in all respect accepted by the Engineer

20.2 Measurement

The method of measurement shall be as per BOQ.

20.3 Payment

Rates for door shutters shall be in square meter. All these rates shall also cover all, fitting, fixing, transportation, storage, labour taxes, VATs & all other necessary for any part of the works.

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21.0 DOOR ACCESSORIES

21.1 Description:

M.S. flat bar clamp 150mm x 38mm x 6mm bifurcated ends to door and window frames with necessary screws and encasing inside the wall with cement concrete (1:2:4) as per drawing, specification and direction of the Engineer.

Approved quality **door lock/MORTICE door lock/ Security lock** including cutting door shutter & frames etc. all complete as per drawing, specification and direction of the Engineer.

"King brand" (made in Korea /equivalent) **hydraulic door closer** (big size) etc. all complete as per drawing, specification and direction of the Engineer.

Best quality magnetic door **shock absorber** including all necessary tools and accessories etc. all complete as per direction of the Engineer.

Approved quality heavy type 19mm dia and 300mm long brass **hasp bolt & Tower bolt** including cutting grooves in door shutter and frames etc. all complete as per drawing, specification and direction of the Engineer.

21.2 Measurement

The method of measurement shall be as per BOQ.

21.3 Payment

Rates for all door accessories shall be in installed numbers. All these rates shall also cover all, fitting, fixing, transportation, storage, labour taxes, VATs & all other necessary for any part of the works.

22.0 FRAMES FOR SINGLE LEAF DOOR

22.1 Description:

This item shall consist of Supplying, fitting and fixing of frame for single leaf door in all floors with 50 x 50 x 6 mm M.S. angle, fixing 150 mm long 8 Nos. of iron clamps of same size (with one end bifurcated) with the vertical members of the frame, fixing the frame in wall/RCC member with cement concrete (1:2:4), mending good the damages, fixing 4 Nos. of 100 mm size iron hinges with the vertical members of the frame all complete including cutting, sizing, welding, fabricating, carriage from workshop to site including local carriage, curing etc. as per specification, drawing and direction of the Engineer. (Running meter of the door frame will be considered towards measurement).

22.2 Measurement:

Measurement shall be on running metre for completed and accepted works.

22.3 Payment:

Payment shall be given as per unit contract price per running metre as mentioned in the bid schedule. This payment will constitute full compensation for labour, materials, equipment, taxes, VATs etc. and all incidental charges necessary to complete the work.

23.0 M.S. GRILL

23.1 Description:

The steel frame shall be made of mild steel as per drawing and design. This is to be fitted at any places as per drawing and direction of the Engineer.

23.2 Construction Requirements:

The mild steel shall conform with the requirements of ASTM A-53. The structural steel shall conform with the requirement of ASTM A-36. These flat and angle M.S. sections are to be cut to sizes, fabricated, welded (continuous) and to the shape and sizes of the frame as per drawing. This

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frame shall have two coats of synthetic enamel paint over a coat of approved anticorrosive primer. The enamel paint should be of approved colour. Each frame must have min. 8 nos. of clamps on 3 sides of the frame.

A frame should be prepared and deposited with the Engineer for his approval. Only after approval the manufacturing should start.

23.3 Measurement:

The measurement shall be in square meter of the gap where the frame is to be fitted. No separate measurement for 3 coats of painting shall be given. No separate measurement will be considered for grill on boundary wall.

23.4 Payment:

Payment shall be in unit rate mentioned in the bid schedule inclusive of M.S. sections, electrode, labour, carrying, fitting, fixing, 3 coats of painting and all other insidentals etc. complete as per BoQ item.

24. AUTO SLUICE GATE

24.1 Description

This work shall consist of construction of manufacturing, supplying, fitting & fixing of auto system (sensor switch operating) M.S. Vertical Lift shutter for sluice gate in between two beam & wall/column in accordance with the details shown on the drawings and to the requirements of the work and direction of the Engineer.

Each gate shall be designed to withstand and operate against the seating head of water specified on the relevant Drawings with no water downstream and of being raised clear of the orifice soffit.

Each gate shall consist of framing incorporating guide grooves, sealing faces and a spindle guide bracket supporting members specified on the Drawings, movable gate leaf with sealing faces and operating gear.

A list of standards is given below as guidance for the materials to be used in manufacturing of Gates/Stop logs and hoists. A Contractor is permitted to use any standard equivalent to the specified one only after taking approval from the Engineer.

Hot Rolled Steel (Flats, Structural shapes, Plates)	ASTM, A 36 or BS 4848
Cold Rolled Steel (Shafting)	AISI, 1035 or BS 2994
Carbon Steel (Bots, Nuts, Fasteners)	AISI, 1015
Stainless Steel (Stem, Stem Coupling)	AISI, 303
Cast Iron (Housing, Gear, Shield)	ASTM, A48
Cast Steel (Wheel/Roller)	ASTM, A148
Phosphor Bronze (Bush, Bearing)	ASTM, B139C

- i. **Steel Plate:** Steel Plates, shapes and bars shall conform to ASTM Designation A 36 or approved equal.
- ii. **Water Level Gauges:** Water Level Gauges shall be made from mild steel and be coated with vitreous enamel. All cutting, drilling and punching of the plates shall be completed before the vitreous enamel is applied.

The steel shall be machined smooth and be thoroughly cleaned to remove all rust, scale dirt and grease before enamelling. The vitreous enamel shall have a minimum thickness of 0.5 mm on the numerical side and 0.25 mm on the reverse side and where the steel has been cut, punched or drilled.

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24.2. Works Requirement

i. Vertical Lift Gate /Shutter:

The gate shutter of size:1.95mx1.35m, made with 8mm thick M.S. skin plate and stiffener with minimum 75mmx75mmx10mm M.S. angle as frame, horizontal & vertical beam, 75mmx25mmx12mm P-type rubber seal, fixed with 10mm dia x 63.5 mm M.S. counter shank bolts with nuts and 40mmx10mm M.S. strip as clamp drilled spaces @ 150mm c/c stem attachment with proper thread, cotter pin and washer of proper grade & brand new with a prime coat of red oxide where necessary fabricating reworking, welding, fixing rubber seal, providing required nuts and bolts, making holes in concrete for lifting arrangements with supply of necessary materials, tools and other accessories required for fitting the same to regulator/sluiice and mending the damages with CC or As per shop design.

i. Pedestal

Manufacturing and supplying and installation of Pedestal as required number & suitable for auto lifting device of gate with 63mm dia thread as per shop drawing, steel shaft, 146 mm outer dia bronze nut, thrust bearing, steel bevel gear etc or as per shop design complete as required.

ii. Bushing

Wheel bearing of fixed wheel gates shall be provided with self lubricating bearings in accordance to the Drawings. All other bearings and bushes shall be provided with grease ways and proper grease fitting for preventive maintenance

iii. Electric motor: As per shop design/ direction of the Engineer.

iv. Sensor adjuster: As per shop design/ direction of the Engineer

v. Making groove

Outside wall/ column in shutter movement place the groove will be make upto 150 mm X 150 mm size or as required including scaffolding, curing etc. complete as per drawing and accepted by the Engineer-in-charge (Groove will be make at the time of column/wall casting)

vi. Welding

- a. Welding shall be metal-arc welding complying with the requirements of **BS 5135** as appropriate. All welds shall be continuous. The Contractor shall supply samples to the Engineer when required by him for examination or test.
- b. All weldable structural steel shall comply with the requirements of **BS 4360** and shall be the grade of steel as specified hereinafter, or on the Drawings.

The face of the gauge shall be white and numeral and graduations shall be dark blue. Graduations shall be sharp and accurate to the dimensions shown on the Drawings or as directed by the Engineer.

The Water Level gauges shall be extended from design bed level to about 2 meters above design full supply level and the zero level on each gauge shall be the design bed level. The reduced level for the zero gauge shall be shown on each gauge.

vii. Rubber Seals

Rubber scales shall be molded solid sections of the musical note type to the dimensions indicated in the Drawings. The material shall be a compound of natural rubber or a copolymer of reinforcing

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carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents and plasticizer. The physical Characteristics shall meet, the following specification:

Tensile strength	20 N/mm ²
Elongation at break	45%
300% modules	6 N/mm ²
Durameter hardness (shore type A)	60-70
Water absorption (max)	5% by weight
Compression set	30%
Tensile strength after oxygen bomb	
Against ASTM D572	80% of tensile strength
Tensile strength of vulcanized joints	10 N/mm ²

The seals shall be molded in one piece for each straight length, without the inclusion

viii. Embedded Metal work

- Metalwork component to be cast into the structures shall be fabricated as per the Drawing. Unless indicated on the Drawings, the components shall not be painted but prepared in accordance with direction of Engineer and then firmly secured in position prior to concreting.
- The contractor shall plan his concreting work so as to avoid risk of knocking or damaging the components. Second stage concreting shall be undertaken in accordance with design
- .Exposed surface second stage casting work shall be painted according to direction of Engineer
- Welding during positioning of parts shall be carefully, so that, vertical and horizontal levels of the exposed surfaces may not be disturbed due to heat, generated at the time of welding.

Rubbing surfaces shall be cleaned before installation gates or stop logs.

ix. Painting:

- a. All the paints shall be obtained from the same manufacturer and shall be compatible with the other paints in the same protective scheme. They shall be suitable for the climatic conditions in Bangladesh. The manufacturer and the formulation of the paints shall be subject to the approval of the Engineer. The Contractor shall supply to the Engineer samples of the paints at least a month before the paints are to used in the works.
- d. The primer used beneath the coal tar/epoxy paint shall be specially formulated for the purpose. In selecting or formulating the zinc rich priming paint the Contractor shall give due regard to the period of storage and to the requirement that it shall give protection outdoors in Bangladesh for periods of possible up to six months.
- e. Coal tar/epoxy paint shall be such that the coating will not run or craze when exposed to direct sunlight on the site for prolonged periods after immersion in water.
- f. The Contractor shall supply and deliver to the site a sufficient quantity of priming paint to make good any damage during supply and deliver to the site sufficient paint for the required under coats and finishing coat. The supply and delivery of the paint shall be in accordance with programmes which the Contractor shall have previously agreed with the Engineer having proper regard to the shelf life of the paints and all to the approval of the Engineer.
- g. The paint shall be delivered in the paint manufacturer's drums with seals unbroken. Each drum shall be clearly and indelible marked with a description of its contents, its date of manufacture, and the date before which it should be used. Each drum shall have a different serial number. The Contractor shall keep a record of the delivery dates of each drum and shall make copies of the record available for use on request by the Engineer or the Employer.

24.3 Method of Measurement:

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The completed and accepted work shall be measured in square meter .

24.4 Basis of Payment :

The amount of accepted work shall be paid for at the contract unit price per sqm which payment shall include cleaning and drying of surface including supply of all materials, labour, equipment, painting as well as all incidental necessary to complete the work according to applicable plan & all fitting, fixing, transportation, storage, labour, taxes, VATs & all other necessary for any part of the works.

NB: The Contractor is permitted to use any standard equivalent to the specified one only after taking approval from the Engineer

The contractor can arrange the shop design of Auto sluice gate. And it will be inspected in the manufacturing factory by the Engineer/ representatives of the Employer and Consultant before supplying Auto sluice gate . The inspection team will inspect the overall condition of Auto sluice gate and also will witness the performance tests of the Auto sluice gate. The contractor shall have to inform the Employer sufficient time prior to such inspection and shall have to arrange such inspection. All cost in this regard shall be borne by the supplier. The tenderer shall include above price in the price of the Auto sluice gate

25.0 G.I. PIPE RAILING

25.1 Description

Supplying, fitting and fixing 75 mm dia G.I. pipe railing of any standard height of any design and shape with 50 x 50 x 6 mm M.S. plate at the base of 75 mm dia G.I. Pipe and fitted and fixed by welding. Placing the pipes vertically @ 1000 mm c/c, 150 mm embedded into the R.C.C floor after cutting grooves and mending good the damages with C.C. and providing 75mm dia G.I pipe on the top of vertical G.I. pipe hand rail including polishing painting etc. all complete and accepted by the Engineer.

25.2 Measurement:

Exposed area of railing will be considered for measurement, rate is excluding the cost of paint The works under this item shall be measured on the basis of BOQ.

25.3 Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing all materials., VAT, IT and all charges.

26.0 LABOUR CHARGE FOR CC BLOCK

26.1 Description

Labour charge for laying single layer CC Block of different sizes for protective wall, including preparation trenches, true to level, maintaining alignment, watering and ramming the base, including carrying and placing CC blocks, filling minimum 65% interstices of CC Block work tightly with cement mortar (1:6), raking out joints, cleaning and soaking Block at least for 24 hours before use, washing of sand, curing for requisite period, etc. all complete in all respect as per approved drawing, specification and direction of the Engineer-in-charge.

26.2 Measurement:

This item shall be measured on the basis of BOQ

26.3 Basis of Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing

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all materials., VAT, IT and all charges. Excluding the cost of CC Blocks

27.0 PUMPING AND BAILING OUT WATER/DE-WATERING

As per Section 15.0 of Specifications of Part-2

28.0 SHORE PROTECTION WORK

28.1 Description

Shore protection work during excavation in foundation trenches up to 2.5 m depth, to protect loss due to damage of property by Palisading accepted by the Engineer. the rate is including cost of vertical post

28.2 Measurement:

This item shall be measured on the basis of BOQ

28.3 Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing all materials., VAT, IT and all charges

29.0 CC BLOCK

29.1 Construction Requirements

Supplying of CC Block, size 250mmx250mmx150mm/ as per drawing all complete accepted and approved by The Engineer. The work Construction Requirement stated in the item No 9

29.2 Measurement:

This item shall be measured on the basis of BOQ

29.3 Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing all materials., VAT, IT and all charges including the cost of shuttering.

30.0 BOULDER DUMPING

30.1 Description

Supply & laying of 100mm boulder into sloped area and gap will be filled with grout(1:2:4) between two boulder, Boulder shall consist of hard, dense, durable and free of sod, roots, organic materials, debris, all complete as per drawing, accepted and approved by The Engineer(Riprap).

30.2 Measurement:

This item shall be measured on the basis of BOQ

30.3 Payment:

The amount of completed and accepted work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing all materials., VAT, IT and all charges

31.0 CENTRIFUGAL WATER PUMP

31.1 Description

Providing following capacity **2800 - 2900 RPM single stage Centrifugal water pump manufactured according to DIN/NEMA/IEC/BS/VDE/JIS & ISO 9001 standard complete** with steel base plate frame, coupling flange with gaskets, bolts, nuts & standard, accessories etc. or closed coupled as required coupled with 3-phase, 400 volt $\pm 5\%$, 50 Hz 2900 RPM Horizontal motor having six terminals for star-delta or DOL starting & totally enclosed fan cooled & in built

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thermal protection, Insulation: Class F & Protection: IP44(Minimum) manufactured by CE certified/UL listed countries as per sample accepted/approved by the Engineer.

31.2 Measurement:

This item shall be measured on the basis of BOQ

31.3 Payment:

The amount of completed and accepted Work measured as provided above shall be paid for at the contract unit price stated in BOQ which payment shall constitute full compensation for furnishing all materials., VAT, IT and all charges.

32.0 GEO-TEXTILE SAND BAGGING

As per Section 3.3 of Specifications of Part-1

33. RULE POINTING

33.1 Description

Rule pointing to brick wall with cement sand (F.M. 1:2) mortar (1:2) with fresh cement and raking out the joints, scaffolding, curing at least for 7 days, cost of water, electricity and other charges etc. all complete in all respect as per drawing and accepted by the Engineer.

33.2 Construction Requirements :

Materials shall meet requirements specified below and in the relevant section of Material Specifications.

- a. **Cement** shall be Ordinary Portland cement Type-I ASTM C- 150 or BS-12
- b. **Sand** shall be clean well-graded natural sand having a fineness modulus of 1.50. Sand shall be washed if necessary.
- c. **Water** shall be potable and clean and contain no salt or organic materials.
- d. **Admixture** shall be mixed with the cement mortar of approved quantity where item in BOQ is specifically mentioned.

Cement and sand shall be mixed dry in the specified proportion until the mixture is uniform in colour. Only enough water shall be added to provide plasticity. Mortar shall be mixed only in quantities for immediate use. Mortar which has taken initial set shall not be used on the work with or without addition of fresh material.

Before application of rule pointing, the joints in brick walls shall be adequately raked out where necessary and smooth concrete surfaces shall be roughened to provide key. The surfaces shall be scrubbed clean of loose materials and soaked with water and kept damped for 24 hours in case of brick masonry.

Rule pointing shall be kept moist by watering and protected from weather for at least 10 days immediately following completion.

33.3 Measurement

Measurement shall be on square meter (sqm) for completed and acceptable works.

33.4 Payment

Payment shall be given as per unit contract price as mentioned in the bill of quantities. This payment will constitute full compensation for labour, materials, equipment, etc. and incidental charges necessary to complete the work

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34.0 CABLE WORKS

34.1 Description

a) Materials

i) Single core cable and conductors:

Single core low voltage cables and conductors shall be as per BS 6004/6346 or IEC 60502-1/60502-2 or VDE 0271/0272 or equivalent international specifications of copper conductor with PVC insulated or XLPE/PVC insulated and PVC sheathed. Conductors shall have 450/750 volt grade of PVC insulated and 600/1000 volt grade of XLPE/PVC insulated and PVC sheathed. All size size of cables shall be standard unless otherwise specified.

All flexible cables shall be as per BS 6004 unless other wise specified.

ii) Multicore Cables:

Multicore low voltage cable shall be XLPE/PVC insulated PVC sheathed non-armoured/aormoured type, termite proof, made and tested according to the specifications as mentioned above and the voltage raing shall not be less than 600/1000V.

b) Installation

i) Cables in Conduit

Single core cables (non-sheathed) are to be installed either in PVC or in metal for specially purpose conduits. The conduit sizes shall be as specified in the drawing. It must be ensured that cables are not scratched/damaged during pulling. For long length, pull boxes must be used even if not incicated in the drawings. Cable shall not be drawn round more than two 90⁰ bends (or their equivalent) between drawing-in-boxes, and any single bend must not be less than 90⁰.

ii) Cable Bending Radii:

The internal radius of every bend in a non-flexible cable shall be not less than the appropriate value stated below:

Insulation	Finish	Overall diameter	Factor to be applied to overall diameter of cable to determine minimum internal radius of bend
Rubber or PVC (circular copper or circular stranded copper or aluminium conductors)	Non-armoured	i) Not exceeding 10 mm	3
		Exceeding 10 mm but not exceeding 25 mm.	4
		iii) Exceeding 25mm	6

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	Armoured	Any	6
PVC (solid aluminium Or shaped copper conductors)	Around or Non-armoured	Any	8

iii) Cable termination and joints:

The cable upto 2.5 mm² size shall may be solid conductor and therefore, jointing of these cables are to be done through procelain connector and the connector shall be wound with PIB Tape before placing in the box. If connectors are not available twisting shall be allowed, and in that case every connection shall have at least 12mm of twisting (minimum 10 twists per 25mm) and the twisted protion bent at right angle to place it in parallel to the cable with a minimum of two layers of PIB tape wound over it for a length of 38mm. Termination of cable upto 2.5 mm² shall be done by making a hook at the end, and for higher size, brass cable terminals must be used. Tee-off joints in the cable to lighting point switches, etc shall not be made. Looping in system of wiring is to be followed and the joints are to be made in the switch boards only. All 3-4 core PVC cables shall be terminated using brass cable glands of proper size.

iv) Connection to switches

The phase wire should be connected to the switches and the neutral wire is to be kept solid in all switch connections.

v) Cable colour

All cables used must have colour as stated below:

Two wire single phase a.c. system:

Red or Yellow or Blue for phase line or switch wire.

Black for neutral.

Green/Green-Yellow for earth.

Three or four wire three phase a.c. system:

Red for first phase.

Yellow for second phase.

Blue for third phase

Black for neutral.

Green/Green-Yellow for earth.

Two wire d.c. system:

Red for positive or switch wire

Black for negative.

For two wire final sub circuits.

Whether a.c. or d.c. supplying lighting or power circuits, the neutral or 'middle' wire shall always be black, and the phase or outer wire (no matter which phase it is connected to) shall always be red. For lighting, the red wire shall always feed the switch, and a red wire shall always be used from the switch to the light.

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vi) Construction Joint Crossing

At construction joint crossing, a brass expansion joint fitting as per drawing is to be installed and the cables are to be run through such fitting.

vii) Cable trench

Unless otherwise stated in schedule generally the size of the trench shall be of minimum 825 mm depth and 450 mm width for each cable to be laid. Where more than one cable is to be laid in the trench, the width of the trench is to be increased by 150 mm for each extra cable for size below 70 mm² (3 ½ or 4 core) and 300 mm for bigger size cables.

A cushion of sand of F.M 1.5, 150 mm thick, is to be placed over the bed of the trench over which the cables are to be laid.

After laying the cable first class brick on edge of flat are to be placed as separators in between the cables. After installation of the brick separators, sand fitting is to be done upto 150mm from the top of the bigger cable. After sand filling, two layers of first class brick flats are to be placed along the length and breadth of the trench as a protection against injury and indication that a power cable is laid. The rest of the trench shall be filled with earth, watered and rammed at 150 mm layers. After cables are laid the original ground conditions shall be restored. But if brick pavement, drain, concrete road, or bituminous carpeted road are cut across or damaged, they shall be remedied and restored to the original specification.

The cable route shall be as direct as possible and shall receive the Consultant's approval before excavation.

All cable bends shall have a radius of not less 2 times the diameter of the cable drum, or 20 times the diameter of the cable, whichever is greater. GI pipes shall be provided for all road and drain crossing. These pipes shall be laid direct in the ground without any sand bed, sand layer, brick or cable covers.

Cables shall always be laid out or laid into the ground through GI pipe of suitable size as decided by the Consultant. The length of the pipes over the ground shall not be less than 1200 mm. The exposed end of the pipes shall be sealed using PVC or wooden plugs.

The contractor shall exercise great care in handling the cable and avoid forming "KINKS". The cable drums shall preferably be conveyed on wheeled cable drum carrier and unrolled and laid directly from the drum carrier. Carriage by trailer or trucks can be allowed only if proper care is taken during unloading the drum and unrolling is done after placing the drum or drum jacks and spindle. The cables be unrolled in the directions indicated on the drum by the manufacturer.

GI cable marker is to be installed at every turning point of the trench. No extra charge shall be allowed for the cable marker.

After the cable is laid, it shall be tested by the contractor in presence of the Consultant. If the test is unsatisfactory, the cost of all repairs and replacement shall be borne by the Contractor.

All surplus earth shall be removed to the indicated places by the Contractor at his own cost. No extra charges shall be allowed for it.

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Any damage done to any other services by the Contractor for cable laying operations shall be made good by the Contractor at his own cost.

All chasings and passages necessary for laying or cable indoor shall be done by the contractor and the same shall be made good to the satisfaction of the Consultant by the Contractor without any extra charge to the owner.

When trenches are left open overnight, and where road is to be cut, the Contractor shall exhibit suitable danger signal such as banners, red flags and red lamps at his own cost. Temporary arrangement by placing wooden sleepers, sheet steel etc. across the road cutting for vehicular traffic are also to be made by the Contractor at no extra cost. The Contractor shall be wholly responsible for any accident which may occur due to the negligence of the Contractor.

All road excavations shall be filled up in layers with powdered earth and suitably watered and rammed in such a manner that after completion of the work there is no land subsidence. The road top shall be reconstructed to match the existing road pavement.

No trench shall be dug until all cables meant for laying have been procured and brought at site store. Cost of any de-centering or shuttering and shoring of trench required to be done shall be borne by the Contractor.

viii) Insulation Test

Insulation test of the whole installation shall be carried out using Meggar as recommended by BNBC/IEE Regulations, in presence of authorized representative of the Engineer and results must be submitted to Consultant for approval.

34.2 Measurement

Measurement for payment shall be made for the actual member of linear meter measured along the cable laying route.

34.3 Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
1.i & 1.ii	CABLE WORKS & UNDERGROUND CABLE WORKS	Rm

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1.0 MATERIALS TESTING (Roadworks)

Notwithstanding the requirements stated in the detailed specifications for individual items, the following minimum tests shall be carried out in the BUET/LGED specific laboratories and in the field. In cases the testing facilities are not available in the LGED laboratory, the tests shall be performed elsewhere as directed by the Engineer-in-charge. All test types and quantities described in the following Article.3.1 to 3.4 are considered "Normal Testing", whereas anything beyond that in type and quantity is considered as "Special Testing". The Engineer may increase the frequency of testing as required.

1.1 Embankment and Pavement

1.1.1 Earthworks/Embankment Fill

Testing Frequency

The testing frequency shall be as follows:

ITEM & TYPES OF TESTS		TEST FREQUENCY
EMBANKMENT		
i)	Liquid limit/plastic limit	1 per Km but minimum 1 if it is less than 1 Km (Greater than one if soil character changes).
ii)	Maximum dry density (MDD)	1 per Km but minimum 1 if it is less than 1 Km (Greater than one if soil character changes).
iii)	Compaction test	1 per 500m ² per layer
iv)	Laboratory CBR	1 per contract (Greater than one if soil character changes).

1.1.2 Improved Sub-grade

Testing Frequency

ITEM & TYPES OF TESTS		TEST FREQUENCY
IMPROVED SUB-GRADE		
i)	Liquid Limit/Plastic Limit	1 per Km. (Greater than one if material character changes)
ii)	Gradation and F.M.	1 per Km (Greater than one if material character changes)
iii)	Laboratory MDD	1 set per Km (Greater than one if material character changes)
iv)	Laboratory CBR & Maximum Dry Density relationship.	1 per contract (Greater than one if material character changes)
v)	Field compaction Tests:	
By Sand Replacement Method/Core Cutter Method or any other method accepted by the Engineer-in-Charge		1 per 100m per layer

1.1.3 Sub-Base

Testing Frequency

ITEM & TYPES OF TESTS		TEST FREQUENCY
a)	For approval of materials to be used in works the following tests are to be done	
i)	Water absorption	1 per 500m
ii)	AIV (Aggregate Impact Value)/ LAA	1 per 500m

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		(Los Angeles Abrasion)	
	iii)	Laboratory CBR	1 per Km (Greater than one if material character changes).
	iv)	Laboratory MDD	1 per 500m
	v)	Gradation Test	1 per 500m (Greater than one if material character changes).
b)	Field Test (Additional samples may be taken from pavement if necessary)		
	(i)	Compaction (Sand replacement Method or any other method accepted by the Engineers-in-charge)	1 per 100m per layer

1.1.4 Water Bound Macadam base course and hard shoulder

Testing Frequency

ITEM & TYPES OF TESTS			TEST FREQUENCY
WATER BOUND MACADAM BASE COURSE AND HARD SHOULDER			
(a)	For approval of materials to be used in works the following tests are to be done		
	i)	Water absorption	1 per 500m
	ii)	AIV (Aggregate Impact Value)/ LAA	1 per 500m
	iii)	Laboratory CBR	1 per 500m (Greater than one if material character changes)
	iv)	Laboratory MDD (Additional samples may be taken from the pavement if necessary)	1 per 500m
	v)	Gradation Test	1 per 500m (Greater than one if material character changes).
(b)	Field Test		
	i)	Compaction (Sand replacement Method or any other method accepted by the Engineer-in-charge)	1 per 100m

1.2 Sealing and Surfacing

1.2.1 Bitumen Manufactures Certificates

The contractor shall provide the Engineer with Manufactures Certificates relating to separate batches of bituminous material provided for sealing and surfacing operations.

These should include, but may not be limited to the following:

- a) Penetration Grade
- b) Specific Gravity
- c) Softening Point
- d) Flash Point
- e) Solubility

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The contractor shall perform the above tests on bitumen or as directed by the Engineer-in-charge.

1.2.2 Bitumen Application Rates

- a) Prime Coat
- b) Tack Coat
- c) Bituminous Surface Treatment
- d) Otta Seal

Testing Frequency:

Manual Spray rates shall be measured in liters for each 10m² of spray area. Mechanical spray rates shall be measured in liters per square meter of spray area.

1.2.3 Aggregates

Gradation of Combined Aggregate (Fine and Course)

Testing Frequency:

1 test per 500m (or greater than one if material character changes).

1.2.4 Bituminous Carpeting

a) Bitumen Content

As per specification and on the basis of laboratory tests.

b) Stability of Mixture

c) Density of Mixture

As per specification and on the basis of laboratory tests.

1.2.5 Temperature Control

- a) Prime Coat
- b) Tack Coat
- c) Bituminous Carpet
- d) Bituminous Surface Treatment
- e) Otta Seal Coat

Testing Frequency

- i) Temperature shall be checked during each day Prime Coat or Tack Coat operations as frequently as required by the Engineer.
- ii) For Bituminous Carpeting temperature shall be checked before mixing with aggregates, at the time of laying and also during rolling

1.3 Concrete

1.3.1 Cement

- a) Setting Time
- b) Strength

Testing Frequency

Tests shall be carried out to determine the setting time and strength for each batch of cement prior to this cement being incorporated into the works.

1.3.2 Aggregates

a) Coarse Aggregate

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- (i) Gradation
- (ii) Water Absorption
- (iii) AIV or Los Angeles Abrasion
- (iv) Specific Gravity
- (v) Soundness test.

Testing Frequency

The above tests shall be carried out for each days casting or per 15m³ of concrete, which ever provides the greater number of tests.

b) Fine Aggregate

- (i) Grading
- (ii) F.M.

Testing Frequency

The above tests shall be carried out for each days casting or per 15m³ of concrete, which ever provides the greater number of tests.

1.3.3 Workability

- a) Slump

Testing Frequency

The above tests shall be carried out as frequently as required by the Engineer and not less than one per hour during concreting operations.

1.3.4 Concrete Strength

- a) Cube/Cylinder Strength at 7 days and 28 days
- b) Density/Unit weight

Testing Frequency

At least 6 cubes/cylinders shall be kept from each class of concrete for each days casting or 15m³ of concrete for testing at 7 days and 28 days. The location in the structure of the concrete from which the samples were taken should be recorded.

1.4 Reinforcement

1.4.1 Properties

- a) Diameter
- b) Unit/Weight
- c) Tensile Strength

Only test Certificates issued by BUET or BIT shall be accepted by the Engineer.

Testing Frequency

The above tests shall be carried out when requested by the Engineer, for each batch and diameter of reinforcing bar provided per structure or as directed by the Engineer.

1.5 Payment

1.5.1 Normal Testing

- a) The cost of providing and transporting samples to the Laboratory specified by the Engineer shall be borne by the contractor.
- b) The cost of all normal testing as specified in Para3.1 to 3.4 are to be borne by the contractor .

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Note:

In addition to the above Tests thickness of every items on pavements should be checked at an interval of 100m or may be increased as directed by the Engineer-in-Charge.

2.0 EARTHWORKS

2.1 Reporting & Monitoring

1. The Contractor shall keep a Site Order Book on site at all times
2. Instructions on the work and all site visits shall be recorded in the Site Order book.

2.2 Clearing and Grubbing

2.2.1 Description

This work shall consist of all clearing and grubbing necessary for the performance of the work covered by the Contract in accordance with the Specification.

The clearing and grubbing shall consist of clearing the designated areas of all down timber, vegetation, rubbish and objectionable materials and shall include grubbing roots and stumps and disposing of all material resulting from the clearing and grubbing.

Clearing shall be confined the areas enclosed within the Site. Grubbing shall be confined to areas covered by the works.

2.2.2 Preservation of Property

The contractor is responsible for preservation and protection of property, trees, shrubs, gardens and landscape and liable to compensate damage claims, if any.

2.2.3 Methods of Execution

2.2.3.1 Clearing

Clearing shall consist of the removal and disposal of everything above ground level including overhanging branches except those things the Engineer directs are to be left undisturbed. The material to be cleared shall include but not necessarily be limited to trees, stumps, logs, bush, undergrowth, grass, crops, loose vegetable matter and structures unless provided for elsewhere.

Within the limits of earthworks tree stumps shall be completely removed.

Clearing shall also include the removal of existing fences, remnants of buildings, pavements, etc.

2.2.3.2 Grubbing

The original ground surface shall be disturbed as little as possible. Grubbing shall, therefore, be confined to major roots beneath the road embankment, ditches, canal diversions and footing excavations. Topsoil shall be removed as agreed with the Engineer and will be measured as roadway excavation. Grubbing beneath the embankment shall be as per at the direction of the Engineer.

In agricultural areas where the ground has been formed into ridges of dikes, the ground shall be roughly leveled or graded to form a surface suitable for embankment foundation and to the satisfaction of the Engineer.

2.2.3.3 Ownership of Cleared Material

All cleared material shall, unless otherwise provided for in the Contract, be the property of the Department.

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2.2.3.4 Disposal of Cleared Material

Cleared material which is not required will be known as waste. Waste shall be the property of the Contractor. Waste shall be removed from the Site by the Contractor and shall be disposed of by the Contractor at his own expense.

2.2.3.5 Measurement

Clearing and grubbing will not be measured

Neither the work of clearing nor grubbing disposal sites, material sites, nor imported borrow pit sites shall be paid for when such sites are outside the areas designated for clearing or grubbing and the Contractor is permitted to exercise his own option as to whether he elects to use such disposal sites or borrow pit sites.

2.2.3.6 Payment

No separate payment will be made to the Contractors for the clearing and grubbing operations executed in accordance with this Clause of the specifications, The cost for the work shall be borne by the contractor

3.0 ROADWAY EXCAVATION

3.1 Description

The work shall consist of all the requirement excavation within the limits of the Site, the removal, hauling and proper utilization or disposal of all excavated materials and shaping of excavation and preparation of exposed surfaces of excavation on the entire length of the roadway, in accordance with these Specifications and to the lines, levels, grades, dimensions and cross section shown on the Drawings or as required by the Engineer.

Roadway excavation shall include the following:

- a) All excavation indicated on the Drawings within the faces of the cross sections and excavation of all materials for side roads and intersections.
- b) The removal and disposal of existing pavement, sidewalks, kerbs or kerbs and gutters, if any within the limits of construction.
- c) Excavations directed by the Engineer.

3.2 Materials

Excavated materials shall be the property of the Department and shall be classified as suitable and unsuitable soil and salvaged materials.

To be suitable as fill material as described above, the soil must not contain roots, sod or other deleterious materials and must satisfy some criteria developed by LGED or RHD. The Engineer will decide if the soil is suitable or unsuitable.

Different type of salvaged materials shall be stockpiled separately on site as directed by the Engineer and the Contractor shall remain responsible for these until such time as they are disposed off by the Engineer.

3.3 Construction Method

3.3.1 General

All roadway excavation shall be performed as specified here and shall conform to the required alignment, levels, grades and cross sections. In case of over excavation, the contractor has to refill with suitable materials and compact to its original degree at his own cost.

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3.3.2 Excavated Material used in the Works

Suitable soil from the roadway excavation may be used as fill material as shown on the typical cross sections and described in Section 6.2 of these Specifications provided that prior approval is obtained from the Engineer.

All suitable excavated material shall be used so far as practicable in constructing the roadway.

Where necessary, the excavated material to be reused for the Works shall be temporarily stockpiled in a suitable and safe area, in accordance with the instructions of the Engineer.

3.3.3 Waste

Unsuitable material and required roadway excavation in excess of that needed for construction of any part of the Works shall be known as waste. Waste material shall be disposed off in accordance with the instructions of the Engineer.

3.3.4 Unsuitable Materials

If unsuitable material is encountered at or below sub-grade level in cut areas it shall be excavated to limits as directed by the Engineer and be backfilled as directed by the Engineer.

3.3.5 Slopes

All slopes shall be finished in a neat and workmanlike manner and to accuracy appropriate to the material, and care shall be taken that no material is loosened below the required slopes.

3.3.6 Drainage

During construction, the road and ditches shall be maintained in such condition as to ensure proper drainage at all times. No excavation will be permitted in areas under water.

Ditches and channels shall be so constructed and maintained as to avoid damage to the roadway section.

3.3.7 Preparation of Excavated Area

The surface of the excavated areas shall be neat and workmanlike and shall have the required form, super elevation, levels, grades and cross section.

3.3.8 Measurement

All required and accepted roadway excavation including excavation of unsuitable soil shall be measured for payment in its original position and the area / volume determined in square meter / cubic meters according to BOQ items as computed from the original and final geometric cross sections of the required and completed work.

3.3.9 Payment

The quantities of roadway excavation measured as specified above will be paid for at the Contract unit price per square meter / cubic meter against relevant BOQ items. Such price shall include excavation, shaping and completion of all surfaces and for furnishing all labour, materials, tools, equipment and incidentals to complete the work including handling of excavated materials, stock piling and disposing off surplus excavated materials to a place as directed by the Engineer.

Waste roadway excavation shall be the property of the Contractor and shall be disposed off at his cost to the satisfaction of the Engineer.

Excavation in suitable material which is to be used as fill material shall not be measured separately.

Excavation in borrow pits whether within the Site or not shall not be paid under this item but shall be deemed to be included in the relevant fill item.

The above price and payment shall be full compensation for all works involved in performing the roadway excavation completely as shown on the Drawings and as specified in these Spec-

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ifications and as directed by the Engineer, including the cost of temporary stockpiling, selecting and protecting the materials to be reused.

4.0. IMPROVED SUB-GRADE

4.1 Description

This work shall consist of the preparation of improved sub-grade in cut by compacting and shaping of the surface of the cut area in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as instructed by the Engineer.

4.2 Materials

Material shall be of natural sand free from vegetable matter, from soft particles and from excess clay. F.M. of sand shall not be less than 0.8.

- a) **Plasticity:** The fraction passing the 425 micron sieve shall have a Plasticity Index not greater than 10.
- b) **CBR:** The material shall have a soaked CBR value not less than 8% when compacted to 98% of maximum dry density as determined.
- c) The material shall be free draining.

4.3 Construction Method

4.3.1 Preparation of Improved sub-grade

The improved sub-grade shall be shaped and compacted in conformity with the provisions of improved sub-grade and completed for at least 500 meters ahead of the placing of the sub-base materials. Notwithstanding any earlier approval of improved sub-grade, any damage to or deterioration of improved sub-grade shall be made good before sub-base is laid.

Preparation of the surface of the cut area shall be carried out, unless otherwise agreed by the Engineer, immediately prior to laying the improved sub-grade.

4.3.2 Spreading

All surface drainage shall be completed prior to spreading the improved sub-grade material.

Improved sub-grade shall be spread in layers, with a compacted thickness up to 150mm subject to the approval of the Engineer, and the layers shall be as nearly equal in thickness as possible.

Prior to spreading the improved sub-grade, a partial width of shoulder, not less than 750mm wide, shall be constructed to the elevation of the top of each uncompacted layer being placed and the inside edge made as straight as practicable. After the partial completion of the shoulders, the improved sub-grade shall be spread upon the compacted surface and against the previously formed shoulders, in layers of uniform thickness, as herein specified, to give the required compacted depth shown on the Drawings.

4.3.3 Sprinkling, Rolling and Compacting

Immediately after each layer has been spread and shaped to camber or super elevation satisfactorily, it shall be thoroughly compacted with mechanical compaction equipment approved by the Engineer. Rolling operations shall begin from the outer edge of roadbed toward the centre, gradually in a longitudinal direction, except on super-elevated curves, where rolling shall begin at the low side and progress towards the high side

The moisture content at the time of compaction shall be the optimum moisture content (Standard Compaction) $\pm 3\%$.

Each layer shall be compacted to at least 98% of the maximum dry density as determined by in situ density tests.

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If the density measurement checks fall below the specified density level then recompaction, shall be required, irrespective of the field compaction trial results.

In order to ensure uniform bearing capacity at the finished improved sub-grade level CBR measurements shall be made. The CBR shall be such that the Laboratory Value obtained at the specified compaction and after 4 days soaking, shall exceed 8 percent. In areas where these requirements are not met, correction shall be made by such measures as the Engineer deems necessary

Improved sub-grade material which does not contain sufficient moisture to be compacted in accordance with the requirements of this section shall be reworked and watered as directed by the Engineer. The Contractor shall carry out this work at his own expense.

Improved sub-grade material containing excess moisture shall be reworked and dried prior to or during compaction. Drying of wet material shall be performed by methods approved by the Engineer, at the expense of the Contractor.

The finished improved sub-grade at any point shall not vary more than 20mm above or below the planned grade or adjusted grade. The thickness of the finished improved sub-grade shall be on average not less than the required thickness and not thinner than 20mm less than the required thickness at any point and the average of five thickness measurements in any 100 meters of road shall be not thinner than 15mm less than the required thickness. Improved sub-grade which does not conform to the above requirements shall be reworked, watered and thoroughly recompacted to conform.

4.4 Measurement

Improved sub-grades described in this article shall be measured by the cubic meters of material compacted in place and accepted. Measurement shall be based on the average width and thickness of the improved sub-grade shown on the Drawings or instructed by the Engineer and actual length measured horizontally along the centerline of the surface of the road

4.5 Payment

This work measured as provided above shall be paid for at the Contract unit rate per cubic meter for improved sub-grade. The payment shall be full compensation for furnishing all materials, hauling, placing, compacting, sprinkling, finishing and shaping, and for all labour, equipment, tools and other incidentals necessary to complete the work specified.

5.0. BRICK ON END EDGING

5.1 Description

This work consists of providing and placing brick on end edging along the road adjacent to the side of the pavement of water bound macadam and bitumen carpet.

5.2 Materials

The materials shall consist of First Class or Picked Jhama Bricks which should meet the requirements given below.

(a) Bricks

First Class Bricks shall be made from good brick earth free from saline deposits, and shall be sand molded. They shall be thoroughly burnt by coal without being vitrified, of uniform and good colour shall be regular and uniform in size, shape and texture with sharp square edges and parallel faces. They must be homogeneous in texture and emit a clear metallic ringing sound when struck one against the other. They shall be free from flaws, cracks, chips, stones, modules of lime or canker and other blemishes. A first Class Brick shall not absorb more than 16% of its weight of water after being soaked for one hour, and shall show no sign of efflorescence on drying.

Picked Jhama bricks are those which are so over burnt as to become vitrified. Those bricks may be broken and used for aggregate in road works provided the vitrified mass has not be-

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come porous or spongy as a result of over burning and the aggregate satisfies the requirements of those Specifications.

First Class Bricks should have the following dimensions after burning: 250mm x 120mm x 70mm. Picked Jhama Bricks may have dimensions slightly below those for other brick but not less than 235mm x 110mm x 70mm. The unit weight of First Class Bricks shall not be less than 1100 kg per m³ and the unit weight of picked Jhama Bricks shall not be less than 1200 kg per m³.

The crushing strength of bricks shall be tested in accordance with ST 7.9. The average crushing strength of Bricks shall not be less than 17 N/mm².

5.3 Construction Method

Bricks shall be laid on end edging with their longest side vertical and 75mm/125mm side across the road including necessary excavation filling and ramming to the satisfaction of the Engineer. The completed work shall be true to line and level and grade as indicated on the Drawings. Interstices between brick edging and adjacent paving or soling shall be filled by brushing in sand until voids are filled; the edging shall be sprinkled then with water.

5.4 Measurement

This item shall be measured in linear meters of completed brick on end edging.

5.5 Payment

This work shall be measured as provided above and shall be paid for at the Contract unit price per unit of measurement. The prices and payment shall be full compensation for preparation of the edging including excavation, furnishing and placing of materials, backfilling, ranging including provision of labour, equipment, tools and incidentals necessary to complete the works as specified in this Section.

6.0. SUB BASE

6.1 Description

This work shall consist of providing, laying and compacting Graded Aggregate-Sand sub base course on the prepared and accepted improved sub-grade to the lines, levels, dimensions. and cross sections shown on the Drawings or as directed by the Engineer.

6.2 Materials

The sub base course material shall consist of a homogeneous mixture of crushed brick aggregate and local sand free from vegetation and excess clay. The FM of sand shall not be less than 0.8.

The aggregate shall be crushed First Class or Picked Jhama Bricks. The crushed bricks shall comply with the following requirements:

- Water absorption shall not exceed 18%
- Maximum size of aggregate shall be 38mm.,
- Aggregate Impact Value of not more than 35 or LAA 45 or as directed by the Engineer in the case of reuse of salvaged materials.

The resultant mixture shall meet the following requirements:

- a) **Plasticity:** The fraction passing the 425 micron sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6. (STP Section 3)
- b) **CBR:** The materials shall have a soaked CBR value not less than 25% when compacted to 100% of maximum dry density as determined by STP T 4.5.

Grading Requirements for sub-base material

Sieve Size	% Passing by Weight
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38mm	100
20mm	55-95
10mm	35-75
4.8mm	25-60
2.4 mm	15-50
600 micron	10-40
300 micron	10-25
75 micron	5-15

6.3 Construction Method

Sub-base materials shall be at or near the optimum moisture content (OMC) at the time of placing. The brick aggregate and sand shall be mixed thoroughly to obtain a homogeneous mix complying with the grading requirements of this Section before placing it on the sub-grade. The mixed materials shall be spread uniformly upon the prepared and approved sub-grade in such quantities that the thickness of the layer after compaction shall not exceed 150mm. The material shall be mixed or sprinkled with water to bring it to the correct moisture content. Total thickness required shall be in accordance with the drawings. The relationship between the loose thickness and compacted thickness shall be determined from field trials and used in controlling the loose thickness at the time of spreading the mix.

After spreading has been completed and the surface shaped according to the cross sectional requirements, rolling shall commence. Rolling should be done by a power roller weighing 8 to 10 tons or equivalent vibratory roller. Rolling shall begin at the outer edge towards the centre of the road with the rear wheel overlapping the shoulder. When the broken aggregates become firm, the roller will be shifted to the opposite side of the road and the operation will be repeated. After both edges rolled modestly firm, the roller will be gradually moved towards the centre by overlapping 150mm of the rolled width until the mix has attained the required density

The rolled surface shall be checked for correctness of levels and cross-falls and any irregularities therein shall be corrected by loosening the affected areas, adding or removing the necessary quantities of aggregate and re-rolling until the entire surface conforms to the correct levels and cross levels and cross-falls.

The dry density after compaction shall not be less than 1000/0 of the maximum dry density as determined by STP T4.5. The field density shall be checked at least once in every 100 linear meters of sub-base surface. The prepared sub-base layer shall be protected against damage until covered by the base course. Moisture content at the time of compaction shall be the optimum moisture content: $\pm 3\%$.

The finished surface shall be within a tolerance of $\pm 10\text{mm}$ or of the elevation shown in the drawings and it shall no where vary more than 10mm from the straight edge 3m long applied to the surface parallel to the centre line of the pavement and no more than 12mm from a template conforming to the cross-section.

The depth over each 100m shall be measured in at least 3 places by digging holes. The average depth should be as per drawings but the minimum depth shall not be less than 95% of the specified depth.

6.4 Measurement

Sub-base shall be measured in cubic meters. It shall be based on the average width and compacted thickness of sub-base as shown on the drawings and the actual length measured horizontally along the centre line of the surface of the road.

6.5 Payment

The work, measured as provided above, shall be paid for the contract unit price. The price and

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payment shall be full compensation for performing the work including furnishing and placing the materials, supplying all labour, equipment, tools and incidentals necessary to complete the work prescribed in the Section. Separate measurements should be taken at the bends if found necessary

7.0. AGGREGATE BASE

7.1 Description

This work shall consist of a base Type I or Type II, composed of crushed aggregate material placed and compacted on a prepared and accepted sub-base or other base course in accordance with these Specifications and the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer

7.2 Materials

Crushed aggregate shall consist of hard durable particles or fragment so frocks or gravel crushed to the required size, and a filler of coarse and (F.M. more than 1.5) or other finely divided mineral matter. Use of brick aggregate is not allowed in Base Type I; however, it may be used for Base Type II if it meets the Specifications requirements. When the stone is produced from crushed rock, it shall be from a source approved in writing by the Engineer, and crushed and screened to achieve the required grading. When produced from gravel, not less than 90% by weight of the coarse aggregate shall be particle shaving at least one fractured face and not less than 75% by weight of the coarse aggregate shall be particles having at least two fractured faces and, if necessary to meet this requirement or to eliminate an excess of filler, the gravel shall be screened before crushing.

Type of Base	ACV (%)	Los Angeles Abrasion Value (%)
Base Type-I	Less than 30%	Less than 35%
Base Type-II	Less than 35%	Less than 40%

The Contractor shall submit results of material tests on the proposed aggregate base material to the Engineer for his approval at least seven days in advance of its use. Fresh approval shall be required when the material is changed or as order of the Engineer.

The material for base shall conform to the requirements given below:

- a) Grading. The grading shall conform to one of the grading envelopes A or B, of Table 7.1. The material shall be well graded within the envelope with no excess or deficiency of any size. The grading (washed method) shall conform to grading envelope A of Table 7.1 for base type-I and either envelope A or B for base type-II.

The material shall be well graded within the envelope with no excess or deficiency of any size; the grading shall not vary from coarser side on one sieve to finer side on another sieve within the grading envelope. The fraction passing the 0.075 sieves shall be not greater than one-third of the fraction passing 0.425 mm sieve.

- b) Plasticity. The portion of material passing the 0.425 mm sieve shall be non-plastic, when tested in accordance with test procedure STP3.2.
- c) CBR. When tested in accordance with STP 5.1, the material shall have a minimum soaked CBR value at a compaction of 98% of the maximum dry density as determined by STP4.5 (Vibrating Hammer) as follows:

Base Type I - 80%

Base Type II - 50%

- d) Aggregate Crushing Value/ Los Angeles Abrasion Value (LAA). The coarse part of material sampled and tested in accordance with STP 7.7.1 and AASHTOT 96 shall have Aggregate Crushing Values (ACV) and Los Angeles Abrasion Value (LAA)

Table 7.1

Grading Requirements for Sub-base Material		
Sieve Size (mm)	Percentage by Weight Passing Sieves	
	Grading A	Grading B
50	100	-
38	90-100	-
20	50-85	100
10	30-65	80-100
5	25-50	50-80
2.5	15-38	36-65
0.600	8-22	15-40
0.300	6-16	10-30
0.075	2-8	5-10

7.3. Construction Method

7.3.1 Preparation of Sub-base

The sub-base or lower base shall be shaped and compacted in conformity with the provisions of sub-base, to the correct moisture content and be completed for at least 100 meters ahead of the placing of the base material, unless otherwise approved by the Engineer.

7.3.2 Spreading Base

The aggregate and sand shall be mixed thoroughly to obtain a homogenous mix complying with the grading requirements of this section. Water shall be added during mixing to keep the mixed material moist so as to prevent segregation during transportation.

Base shall be at or near the optimum moisture content at the time of placing and spread in layers of nearly equal thickness, subject to the approval of the Engineer. Spreading may be carried out by hand or using a motor grader or using a paving machine, but machine laying is preferred. After laying all areas of segregated coarse or fine material shall be corrected, or removed and replaced with material, which conforms to the Specification.

Where the material for shoulders is the same as that used for the base course, the material shall be evenly spread in layers, as herein specified, for the full width of the base course and the shoulders simultaneously.

Where the shoulders are not of the same material as the base course, then the base shall be spread to give the required compacted depth and the edge detail shown in the Drawings.

When the base course is spread contiguous to concrete kerbs or gutters, extreme care shall be exercised not to damage the kerbs or gutters. Any damage of kerbs or gutters resulting from carelessness or negligent construction methods by the Contractor shall warrant the removal and replacement of said kerbs or gutter at the Contractor's sole expense.

7.3.3 Sprinkling, Rolling and Compacting

Immediately after each layer has been spread and shaped satisfactorily, each layer shall be thoroughly compacted with suitable and adequate compaction equipment approved by the Engineer.

If the aggregate base material does not contain sufficient moisture to be compacted in accordance with the requirements of this Section water shall be sprinkled. The Contractor shall supply the necessary water at his own expense.

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Aggregate base material containing excessive moisture shall be dried prior to or during compaction. Drying of wet material shall be performed by methods approved by the Engineer, at the expense of the Contractor.

Rolling operations shall be in along the edges and overlap the shoulder at least 750 mm, or as close to the outer edge of the shoulder as practicable where a full width roadbed base course is specified on the Drawings, and progress toward the centre, gradually in a longitudinal direction. On super-elevated curves, rolling shall begin at the low side and progress toward the high side. The rolling operation shall continue until all roller marks are eliminated, and the course is thoroughly compacted.

Each layer shall be compacted to at least 98% of the maximum dry density as determined by STP 4.5 (Vibrating Hammer). Density of the compacted aggregate base course shall be determined in accordance with STP 6.2 (150mm or 200mm diameter depending on the layer thickness); with at least three tests being made for each 1,000 square-meters.

The final shaping and rolling of the shoulders to the full width shall be made after the base course is completed.

7.3.4 Surface Tolerance

The finished surface of the aggregate base shall be checked for level and cross fall and at any point shall not vary more than $\pm 10\text{mm}$ from the specified level. The surface shall also be checked for irregularities by a 3m long straight edge laid perpendicular and parallel to the road center line at intervals not exceeding 20m. The deviation from the straight edge shall not exceed 10mm. Any areas as found to be out of tolerance shall be corrected by loosening, adding or removing material, reshaping and re-compacting.

The thickness of the finished base shall be on average – not less than the required thickness when five thickness measurements are averaged in any 150m length of completed sub-base not thinner than 10mm less than the required thickness at any point.

The Contractor shall carry out at his own expense, the reconstruction of areas of aggregate-base which are too thin or too variable in thickness to meet this requirement.

7.4 Measurement

This item shall be measured as the number of cubic meters of material complete in place and accepted. Measurements shall be based on the thickness/cross section of the base shown on the Drawings and the length/area measured on the surface of the road.

7.5 Payment

This work measured as provided above shall be paid for at the Contract unit rates per cubic meter for aggregate base irrespective of the sources of material used. Payments shall be full compensation for furnishing all materials, hauling, placing, compacting, sprinkling, finishing and shaping and for all labour, equipment, tools and other incidentals necessary to complete the work.

8.0 GENERAL REQUIREMENTS FOR BITUMINOUS SURFACING

8.1 Description

8.1.1 General

This work shall cover the general requirements that are applicable to all types of bituminous bound surfacing irrespective of gradation of mineral aggregate, grade and amount of bituminous materials used. Deviations from these general requirements are indicated in the specific requirements as set forth in the respective sections for each type.

The work shall consist of one or more courses of pre-mixed bituminous mixtures constructed on a prepared and accepted base course or other road bed in accordance with these Specifications.

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tions and the specific requirements of the type under Contract, and in conformity with the required lines, levels, grades, dimensions and typical cross sections

8.1.2 Composition of Mixtures

The bituminous mix shall be composed basically of coarse mineral aggregate, fine mineral aggregate, filler and bituminous binder. The several mineral constituents shall be sized, uniformly graded and combined in such proportions that the resulting blend meets the grading requirements for the specific type under the Contract. To such composite blended aggregate shall be added bitumen within the percentage limits set in the specifications for the specific type.

8.2 Bituminous Mixtures

8.2.1 Weather Limitation

Bituminous mixtures shall be placed only when the surface is dry, when the weather is not rainy and when the prepared road bed is in a satisfactory condition. However, the Engineer may permit, in case of sudden rain, the placing of mixture then in transit if laid at proper temperature and if the road bed is free from pools of water.

Such permission shall in no way relax the requirements for quality and smoothness of surface.

8.2.2 Progress of Work

No work shall be performed when there is insufficient hauling, spreading or finishing equipment or labour to ensure progress at a rate consistent with meeting proper temperatures and rates of compaction.

8.2.3 Equipment

(a) Equipment for Preparation of Bituminous Binder

Tanks or kettles for storage of bituminous binder shall be capable of heating the binder under effective control at all times, to a temperature within the range specified. Bitumen shall not be heated in open pans or drums. Suitable means shall be provided for maintaining the specified temperature of the bituminous binder at all times. Generally Tar boilers with thermometer are used to heat the bitumen.

(b) Thermometric Equipment

Armoured thermometers in good condition reading from 50⁰C to 200⁰ C shall be available at the sites of mixing and laying at all times.

- (c) Equipment for hauling bituminous mixtures shall have tight, clean and smooth metal sides that have been sprayed with soapy water, thinned fuel oil, paraffin oil or lime solution to prevent the mixture from adhering to the beds. The amount of sprayed fluid shall however be kept to the practical minimum. Any equipment causing excessive segregation of material by its suspension or other contributing factors, or that shows oil leaks in detrimental amount or that causes undue delays, shall upon direction of Engineer in charge be removed from the site until such conditions are corrected
- (d) The equipment for spreading and finishing shall be capable of spreading and finishing the mixture true to the lines, grades, levels dimensions and cross sections
- (e) The Contractor shall provide suitable means for keeping all small tools clean and free from accumulation of bituminous material. He shall provide and have ready for use at all times enough tarpaulins or covers, as may be directed by the Engineer, for use in any emergency such as rain, chilling wind, or unavoidable delay, for the purpose of covering or protecting any material that may have been dumped and not spread.

8.2.4 Preparation and Placing

(a) Preparation of Existing Surface.

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Where the existing road bed is broken or shows instability, the unstable material shall be removed and disposed off as directed by the Engineer and be replaced with the same mixture as specified for the next course, compacted to the standard and elevation of the adjacent surface. The surface upon which the mixture is to be placed shall be swept thoroughly and cleaned of all loose dirt and other objectionable material immediately before spreading the bituminous mixture. If directed by the Engineer Tack coat is to be applied before placing the next layer. If this has become necessary due to delays caused by the contractor in starting the next layer this will not be paid.

(b) Preparation of Bituminous Binder

The bituminous binder shall be heated to the specified temperature (140°C-155°C for 60/70 or 80/100 penetration bitumen) in Tar boiler, kettle or tanks so designed as to avoid local overheating and to provide a supply of the bituminous binder at a uniform temperature at all times.

(c) Preparation of Mineral Aggregate

The aggregates produced, whether by machine or by manual methods should be screened into the major component sizes prior to recombining in the correct proportions.

The mineral aggregates for the mixture shall be dried and heated to a temperature of between 150°C - 170°C before mixing. The aggregates shall be heated to the temperature specified in the applicable section.

(d) Preparation of Mixture

The heated mineral aggregate prepared above, shall be combined in the amount of each fraction of aggregate required to meet the mix formula for the particular mixture. The bituminous material shall be measured or gauged and introduced into the mix in the amount determined by the Engineer. Only sufficient heat shall be applied during mixing to maintain the temperature of the mix without increasing the temperature. The proper amount of bituminous material shall be distributed over the mineral aggregate and the whole thoroughly mixed for a period of at least 60 seconds or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregate are coated uniformly. Mixing should not be carried out on fire.

(e) Transportation and Delivery of Mixture

The mixture shall be transported from the mixer to the point of use in equipment conforming to the requirements of Article 3.11.2.3. Loading and transporting shall be such that spreading, compaction and finishing shall all be carried out during daylight hours unless satisfactory illumination is provided by the Contractor.

(f) Spreading and Finishing

Upon arrival at the point of use, the mixture shall be spread and struck off to the grade, elevation, and cross-section shape intended, either over the entire width or over such partial width as may be practicable. The mixture shall be laid upon an approved surface and only when weather conditions are considered suitable by the Engineer.

(g) Compaction of Mixture

(i)	General: Immediately after the mixture has been spread and struck off, the surface shall be checked and any inequalities adjusted. The mixture shall then be thoroughly and uniformly compacted by rolling. Each course shall be rolled as soon after being placed as the material will support the roller without undue displacement or cracking.
(ii)	All rollers shall be self propelled, capable for being reversed without backlash. Each roller shall be in good condition and worked by a competent and experienced operator. Generally Tandem roller is suitable for B.C work; in addition Tyre roller is also

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	needed.
(iii)	Rolling shall start longitudinally at the sides and proceed toward the centre of the pavement except that on super-elevated curves rolling shall begin at the low side and progress toward the high side. Successive trips of the roller and alternative trips shall not terminate at the same point.

Rolling shall start with a temperature of at least 120⁰ C and shall be discontinued if temperature falls below 90⁰C.

The speed of the rollers shall not exceed 4 kilometers per hour for steel wheeled rollers and 6 kilometers per hour for pneumatic tired rollers and shall at all times be slow enough to avoid displacement of the hot mixture. Any displacements occurring as a result of reversing the direction of the roller or from any other cause shall at once be corrected with rakes and fresh mixture where required. Care shall be exercised in rolling not to displace the line and grade of the edges.

Rolling shall progress continuously as may be necessary to obtain uniform compaction while the mixture is in a workable condition and until all roller marks are eliminated.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excess water will not be permitted.

Heavy equipment or rollers shall not be permitted to stand on the finished surface until it has thoroughly cooled or set.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is caused for the removal and replacement of the contaminated pavement by the Contractor. The surface of the mixture after compaction shall be smooth and true to the established crown and grade within the tolerance specified. Any mixture that becomes loose and broken, mixed with dirt, or which is defective in any way, shall be removed and replaced with fresh hot mixture, which shall be compacted immediately to conform to the surrounding area. Any areas of one square meter or more showing an excess or deficiency of bituminous material shall be removed and replaced. All high spots, high joints, depressions, and honeycombs shall be adjusted as directed by the Engineer.

(h) Joints

Both longitudinal and transverse joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints shall be arranged so that the longitudinal joint in the top course shall be at the location of the line dividing the traffic lanes. Lateral joints shall be staggered a minimum of 250 millimeters and shall be straight.

The edges of the pavement shall be straight and true to the required lines. Any excess material shall be cut off after final rolling and disposed off by the Contractor at the end of a day's work.

Just prior to recommencing operations, the sides of all longitudinal and transverse joints shall be painted with hot bitumen to ensure a satisfactory bond between the old and new work.

8.3 Measurement

All work prescribed above shall be measured and paid for as provided in the respective sections for each type of pavement. The quantity measured and. paid for shall always be the quantity ordered with any permitted excess or the actual quantity used whichever is the less.

8.4 Payment

The work shall be paid for as provided in the respective section for each type of bituminous layer.

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9.0 PRIME COAT

9.1 Description

This work shall consist of the careful cleaning of the surface of the granular base material to be primed and furnishing and applying bituminous material in accordance with these Specifications to the areas shown on the Drawings and as directed by the Engineer.

9.2 Materials

9.2.1 Bituminous materials

Bituminous prime coat material shall be a cut back bitumen, conforming to the requirements of ASTM/ AASHTO.

Cut back bitumen may be prepared by cutting back 60/70 or 80/100 penetration grade straight run bitumen with kerosene/diesel in the ratio of 100 parts by volume of bitumen to 40-60 parts by volume of kerosene depending on the porosity of the surface and will be decided by field trials or as directed by the Engineer. The correct amount is the quantity that is completely absorbed within 24 hours. The spraying temperature of the cutback bitumen shall be 100°C to 120°C.

9.2.2 Blotting material

Blotting material shall be clean, dry, free-flowing sand not containing any cohesive materials or organic matter. Not more than 10 percent of the sand shall be finer than the 75 micron sieve.

9.3 Construction Method

9.3.1 Weather Limitations

Prime coat work shall not be carried out when the weather conditions are, in the opinion of the Engineer, likely to adversely affect the stability of wet prime coat material. Such conditions may include but shall not necessarily be limited to rain, low temperatures or storms

9.3.2 Cleaning Surface

Immediately before applying the prime coat material, all loose stones, dirt and other objectionable materials shall be removed from the surface with a broom or blower as appropriate. When so directed by the Engineer, a light application of water shall be made just before the application of the prime coat.

9.3.3 Application of Prime Coat

Prime coat material shall be applied by mechanical distributor or manually at a uniform rate between 1.00 and 1.20 liters/square meter as directed by the Engineer, and at a temperature between 100°C to 120°C. Additional primer shall be applied where surface conditions indicate this to be necessary, if the Engineer so directs. No further coatings shall be applied until the prime coat has been cured.

The contractor may be required to lay a trial section of prime coat for the approval of the Engineer with regard to the method of operations and to establish the optimum spray rate for the prime coat to achieve adequate penetration. Following the approval of the Engineer in writing of such trial section (s), the prime coat works may then be carried out strictly in accordance with the approved method and spray rates and the specification.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner as to prevent their being splattered or marred. No bituminous material shall be discharged into a borrow pit, gutter or kerb.

9.4 Maintenance and Opening to Traffic

After application of the prime coat there shall be a curing period of 48 hours or more, when traffic shall not be permitted on the coated surface. In case of any damage caused by traffic,

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the surface shall be redone at the cost of the contractor. The period of curing shall be extended if necessary till the bituminous material has penetrated and dried and, in the opinion of the Engineer, will not be picked up by traffic. At the end of the curing period, minor areas where prime coat material is still not dry shall be treated by sprinkling, blotting sand as necessary to avoid picking up of prime coat material before allowing traffic to use the coated areas. For existing roads, the work shall be done over half width at a time, the other half being used to carry the traffic.

9.5 Measurement

Prime coat shall be measured in square meter. Blotting material shall not be measured for payment and shall be considered to be included in the rate for prime coat

9.6 Payment

This work, measured as provided above, shall be paid at the Contract unit price. The price and payment shall be full compensation for preparation of the surface and furnishing and placing the materials including all labour, equipment, tools and incidentals necessary to complete the work prescribed in the Section.

10.0 TACK COAT

10.1 Description

This work shall consist of the cleaning and preparation of the bituminous surface specified, or otherwise as directed by the Engineer, together with the furnishing and application of the tack coat in accordance with these Specifications to the areas shown on the Drawings and as directed by the Engineer.

Tack Coat should be applied only in between two bituminous surfaces.

10.2 Materials

Bituminous tack coat material shall be 60/70 or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM / AASHTO.

10.3 Construction Method

10.3.1 Weather Limitations

Tack coat work shall not be carried out when the weather conditions are, in the opinion of the Engineer, likely to adversely affect the stability of wet tack coat material. Such conditions may include but shall not necessarily be limited to rain, low temperatures or storms:

10.3.2 Cleaning Surfaces

Immediately before applying the tack coat all loose stone dirt and other objectionable material shall be removed from the surface with a broom or blower as appropriate.

10.3.3 Application of Tack Coat

Tack coat material shall be applied by mechanical distributor or manually at a rate of 0.5kg - 0.75kg /m² and at a temperature between 140°C and 160°C. Additional tack coat shall be applied where surface conditions indicate this to be necessary, if the Engineer so directs.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner as to prevent their being splattered or marred. No bituminous material shall be discharged into a borrow pit, gutter or kerb.

10.4 Measurement

Tack coat shall be measured in square meter as shown on the Drawings or ordered by the Engineer, complete, in place and accepted.

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10.5 Payment

This work, measured as provided above, shall be paid for at the contract unit price per unit of measurement. The price and payment shall be full compensation for preparation of the surface and furnishing and placing the materials including supply of all materials, labour, equipment, tools and incidentals necessary to complete the work prescribed in this Section

11.0 50mm THICK PREMIX BITUMINOUS CARPETING

11.1 Description

This work shall consist of a premix bituminous carpet of a bituminous macadam type of material constructed on a prepared and primed granular base course in accordance with these Specifications and to the lines, levels, grades, dimensions and cross-sections shown on the Drawings and as directed by the Engineer. The bituminous carpeting shall consist of a compacted single layer of surfacing of thickness as shown on the drawings.

11.2 Materials

11.2.1 Bituminous material

Bituminous material shall be 60/70 or 80/100 penetration grade straight run bitumen complying with the requirement of ASTM / AASHTO.

11.2.2 Coarse aggregate

The coarse aggregate shall be the material component fully retained on a 4.75mm sieve and shall consist of clean crushed rock or crushed gravel or blended combinations of both, free from decomposed stone, organic matter, shale, clay and any other substances which, in the opinion of the Engineer, may be deleterious to the mixture. Coarse aggregate shall satisfy the following physical characteristics when tested:

- Aggregate Crushing Value or AIV of not greater than 30 or LAA value of 40.
- Bulk specific gravity not less than 2.50
- Flakiness index not greater than 35% except where specially approved by the Engineer.

The coarse aggregate shall have weight loss not more than 12% when subjected to 5 alternations of the sodium sulphate soundness test, AASHTO: T. 104.

Not less than 75% by weight of the particles of coarse aggregate shall have at least two fractured faces.

11.2.3 Fine aggregate

The portion of the aggregate passing a 4.75mm sieve shall be known as fine aggregate and shall consist of natural sand, stone screenings, or a combination of both. Fine aggregate shall be composed of clean, hard durable particles, rough surfaced and angular, free from vegetable matter, soft particles, clay balls or other objectionable material.

11.2.4 Overall aggregate grading

The mix of the coarse and fine aggregates combined shall comply with the following grading given in Table 11.1.

TABLE 11.1

Sieve Size	For 25mm B.C.	For 40mm B.C.
	% by Weight Passing	% by Weight Passing
25mm	100	100
20mm	100	75-100
16mm	100	-
12.5mm	75-100	60-80

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10mm	60-80	-
6.3mm	-	-
4.75mm	35-55	35-55
2.4mm	20-35	20-33
600 micron	10-20	6-18
75 micron	2-8	2-8
Bitumen Content %	5.5% \pm 0.3%	5.2% \pm 0.3%
by weight of total mix.	(5.2% to 5.8%)	(4.9% to 5.5%)

Required bitumen content should be determined by trials.

11.2.5 Bituminous Mixture Requirements

The resultant density of the compacted bituminous mixture shall be between 2250 and 2400 kg/m³. The bitumen content (Marshall test) and stability of mixture shall be as per specification or as decided by the Engineer.

11.3 Construction Method

11.3.1 Preparation of the road base

A prime coat shall be applied and cured to the surface of the granular base material before spreading the premixed aggregates.

11.3.2 Mixing of bituminous material

Prior to heating, the various sizes of aggregate shall be thoroughly mixed together to give a stockpile of aggregate of the required grading of sufficient quantity for at least one day's surfacing work.

The bitumen and the aggregates shall be separately heated to a temperature between 140°C to 155°C and 150°C to 170°C for bitumen and aggregate respectively before mixing. The temperature of bitumen aggregate mixture should be between 140°C to 160°C. Bitumen, or bitumen aggregate mixture, which has been overheated at any time, shall be rejected. The percentage of bitumen in the mix shall be between 5.2% and 5.8% by weight of total mix for 25mm BC and between 4.9% and 5.5% by weight of total mix for 40mm BC.

The final combined grading shall be within the limits of the specification and the actual bitumen content shall be determined on the basis of laboratory tests by the Engineer and the final grading of the combined aggregates and the bitumen content shall be approved by the Engineer.

The laying temperature of the mixture shall not be less than 130°C.

The mixed materials shall be laid to a uniform thickness. The thickness and proper camber shall be maintained by the use of steel angle screeds of the correct size. The sides of the angle shall be at least 25% greater than the compacted thickness specified and as shown on the drawings or as directed by the Engineer.

11.3.3 Rolling

After laying, the materials shall immediately be compacted using a power driven road roller. The initial pass of the roller on the bituminous premix shall be at temperatures specified above and shall be carried out with these steel angles in position. Subsequent passes of the roller may be made with these steel angles removed.

When the temperature of the bituminous premix falls below 90°C no further compaction should be permitted.

The bituminous premix shall be compacted using an approved roller (preferably a pneumatic tyre roller) and a minimum of five passes shall be made, or as directed by the Engineer from

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time to time. Material that falls below the minimum working temperature of 90°C, that has not been compacted as described, may be rejected and shall be replaced by new material to the required specification and compaction by the contractor at his own expenses.

The premix carpeting shall be fully compacted maintaining the proper grade and camber. The compacted thickness as shown in the drawing and as provided in the Bill of Quantities shall be uniformly maintained all along the road surface.

Rollers and other mechanical plant shall not be allowed to stand on newly laid material that may be deformed thereby. Sections of newly finished work shall be protected from traffic of any kind until the mixture has cooled to ambient air temperature.

The finished surface shall be within a tolerance of ± 5 mm or of the elevation shown in the drawings and it shall nowhere vary more than 5mm from the straight edge 3m long applied to the surface both longitudinally and transverse.

11.3.4 Open to traffic

When the initial rolling is completed, commercial traffic could be allowed in the surfaced area. The speed of traffic shall be temporarily reduced to avoid the damage to the surface. Maximum speed limit of 30-40 km/hour shall, therefore, be enforced during the first month after construction (by speed breaker as an example or any other method approved by the Engineer.)

11.4 Measurement

Premix bituminous carpeting shall be measured in square meters of finished surface of the specified thickness completed in place and accepted by the Engineer. Measurement shall be based upon the nominal width of surface course at its top surface as shown on the Drawings.

11.5 Payment

The quantities measured as provided above shall be paid for at the Contract unit price per unit of measurement. The price and payment shall be full compensation for furnishing, placing and compacting all materials, for all labour, equipment, tools and incidentals necessary to complete the work.

12.0 BITUMINOUS BINDER COURSE (Dense graded)

12.1 Description

Providing and Laying pre-mixed dense bituminous surfacing - wearing course with hot mix plant using coarse aggregate, fine aggregate, filler and bituminous binder as per design Job Mix Formula conforming Marshall Method as per specification, LAA value of aggregate should be $\leq 35\%$, water absorption not $> 2\%$, flakiness index not $> 35\%$ mixed with (60/70 or 80/100) penetration grade straight run bitumen satisfying the requirements of ASTM/AASHTO. including screening, cleaning of chips and preparing a uniform and quality mix in Hot Mix Plant and ensuring a homogenous mix, in which all particles of the mineral aggregates are coated uniformly, carrying the hot premixed materials by means of Dump/tipper truck, spreading the mixed materials at specified laying temperature with a hydrostatic paver finisher with sensor control to the required grade, level and alignment over the prepared surface tamping and finishing the mix at specified compacted thickness, maintaining specified camber, grade, super-elevation and cross section, through rolling with appropriate Steel Drum Roller & pneumatic multiple tire roller (8-10 tons) to full compaction, for break down, inter - mediate and finished rolling to achieve the desired density of at least 98% of that of Laboratory Marshall specimen, hand packing and pinning to give an even surface, including cost of all materials, their carriages, hire charges of Hot Mix Plant and all other machines, equipment for construction and quality control as per specification, fuels, lubricants and wages of operational staff etc. all complete as per the direction of the E-I-C

12.2 Measurement

Pre-mixed dense bituminous surfacing - wearing course shall be measured as the number of

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cum of finished surface of the specified thickness completed in place and accepted by the Engineer. Measurement shall be based upon the nominal width of surface course at its top surface as shown on the Drawings. Surface widening will be measured extra, if directed by the Engineer. Mean of the three measurements of thickness taken in any 100 meter long section shall at least equal to or more than the required thickness.

12.3 Payment

The quantities measured as provided above shall be paid for at the Contract unit price per unit of measurement. The price and payment shall be full compensation for furnishing, placing and compacting all materials, for all labour, equipment, tools and incidentals necessary to complete the work.

13.0 PREMIX BITUMINOUS SEAL COAT 7mm THICK

13.1 Description

This work shall consist of premix bituminous seal coat applied to a prepared and primed granular base course or over the bituminous surfacing in accordance with these Specifications or as directed by the Engineer. The thickness of premix bituminous seal coat shall be 7mm.

13.2 Materials

13.2.1 Bituminous material

Bituminous material shall be of 60/70 or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM AASHTO.

13.2.2 Aggregate

The aggregates shall consist of 6.3mm down graded stone or gravel free from any organic matter, clay and any other objectionable matter.

Where required to achieve the specified grading the aggregate shall be mixed with natural sand. Sand shall be non-plastic, clean and free from any deleterious substances. The minimum F.M. of sand for the sealing premix shall be between 2.00 to 2.50 and that of sand to be spread over the seal coat as blotting material shall be between 0.80 to 1.00.

13.2.3 Overall aggregate grading

The mix of the aggregates and sand combined shall comply with the following grading given in Table 13.1

Table 13.1 Grading Requirements for 7mm Premix Bituminous Seal Coat

Sieve Six	% by Weight Passing Sieve
6.3mm	100
4.75mm	80-100
2.4mm	70-95
600 micron	20-50
75 micron	5-15

13.3 Construction Method

Bitumen and aggregates shall be heated separately at the following temperatures:

Only Bitumen	between 140°C to 155°C (Max)
Only Aggregate	between 150°C to 170°C
Mix of Bitumen & Aggregate	between 140°C to 160°C

Material that has been over-heated at any time shall be rejected. No mixing of preheated bi-

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tumen and aggregate should be done on fire. 0.01 MIJ of aggregate will be mixed with 1 liter of bitumen and shall be laid on 1 (one) square meter of road surface.

The aggregate mixed with bitumen shall be laid over the bituminous carpeting or over the primed granular base to a uniform thickness which shall be at least 25% greater than the compacted thickness and immediately compacted fully with a power driven road roller to the satisfaction of the Engineer. Temperature of bitumen and aggregate mix at the time of starting of rolling should not be less than 130°C.

13.4 Measurement

Premix bituminous seal coat shall be measured in square meters completed and accepted by the Engineer. Measurement shall be based upon the nominal width of seal coat at its top surface as shown on the Drawings or as directed by the Engineer. The measurement will be exclusive of prime coat. Mean of the three measurements of thickness taken in any 100 meter long section shall at least equal to or more than the required thickness.

13.5 Payment

The quantities measured as provided above shall be paid for at the contract unit price per unit of measurement. The price and payment shall be full compensation for supplying, placing and compacting all materials, for all labour, equipment, tools and incidentals necessary to complete the work.

14.0 BRICK FLAT SOLING

14.1 Description

The item shall consist of supplying and laying bricks on top of the earth or sand bed to form a sub-base.

14.2 Construction Requirements

Bricks shall comply with requirements of First Class bricks. The binding sand will have a minimum Fineness Modulus of 1.0 and shall be clean, and free of any organic matters.

Bricks shall be laid flat in surface to surface contact with adjoining bricks and their joints shall be filled with sand. The sand shall be brushed in until the joints are filled. Flushing in of sand with water will not be done unless permitted. Bricks shall not be laid on the floor or foundation bed until the floor or foundation bed is inspected and approved by the Engineer's representative.

In case of Multi-layer Soling, care shall be taken to stagger or "break" all joints in placing subsequent courses of soling. No brick shall be laid on loose earth or earth filling which are not compacted to the desired degree.

14.3 Measurement

Brick soling shall be measured in square meter.

14.4 Payment

The amount of completed and accepted work, measured as provided above, will be paid for at the contract unit price per Square metre which price shall be in full compensation for all material, transporting, placing, and all labour Mason, equipment, tools, and incidentals such as overhead, profit, taxes, VAT etc. necessary to complete the work as per BoQ item.

15.0 PUMPING AND BAILING OUT WATER/DE-WATERING

15.1 Description

Where water is met with in excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, cofferdams and other necessary works to keep the

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foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements and for the quality and safety of the Works.

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

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.

At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.

The Contractor shall take all precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property.

15.2 Measurement

The method of measurement for bailing out water shall be the running of single or multiple water pumps per hour.

15.3 Payment

Rates for bailing out water shall be the running of single or multiple water pumps per hour. All these rates shall also cover all fuel, electric charge, labour necessary for any part of the works as specified per BOQ item

16.0 KERB STONE

16.1 Description

This work shall consist of kerb made of concrete and constructed in accordance with these Specifications at the locations and in accordance with the lines, levels, grades, dimensions and types shown on the Drawings.

16.2 Materials

Concrete shall be of the grades and types indicated on the Drawings and shall conform to the requirements of Section RCC.

Sand for bedding and infilling gaps between bricks shall be non plastic and free from vegetable matter, soft particles and clay.

16.3 Concrete Kerb

Excavation shall be made to the required depth, and the base upon which the kerb is to be set shall be compacted to a firm, even surface. All soft and unsuitable material shall be removed and replaced with suitable material.

Kerb shall be cast in sections 3 metres or less with preformed filler 20 mm in thickness, to the size as shown on the Drawings.

Concreting shall be in accordance with the requirements of c-25

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Forms shall be removed not less than 24 hours after concrete has been placed. Minor defects shall be repaired with mortar containing one part of Portland cement and two parts of fine aggregate.

Repair will not be permitted on the faces and rejected portions shall be removed and replaced at the Contractor's expense.

The finished work shall be true to line, grade and level to within 5 mm and shall present a smooth appearance free from kinks and distortion visible to the eye.

When kerbs are to be placed on minor structures or on rigid pavement, tie bars shall be inserted in the concrete as shown on the Drawings.

16.4 Edge Detail

The edge detail shall be as shown in the Drawings or as specified by the Engineer. The edge of the pavement hard shoulder and soft shoulder must all be adequately compacted. Any damage caused to the pavement materials by compaction equipment due to the contractor's method of working shall be made good at the Contractor's expense.

16.5 Measurement

The quantity measured for payment shall be the number of sqm of the several types and sizes of concrete kerb completed in place and accepted. Concrete kerb shall be measured in place along the front face of the kerb. No deduction shall be made for flattening of kerbs.

16.6 Payment

This work measured as provided above, will be paid for at the Contract unit price per sqm for each particular item which prices and payments shall be full compensation for all excavation, backfilling and tamping, furnishing and placing all materials, including all labour, tools, equipment, forms, false work, centring and incidentals necessary to complete the work.

17.0 CEMENT CONCRETE

17.1 Description

The work covered by this item shall consist of constructing in floor or elsewhere, **100mm to 38mm** thick cement concrete with 1:2:4 mix of cement, sand of FM 1.5 and 12mm down graded bricks or stone chips as specified in schedule of items. Or Cement, sand (F.M. 1.2) and 20mm down well graded crushed stone chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days etc. all complete as per drawing and direction of Engineer in charge.

17.2 Construction Requirements

Construction shall be done as per requirements of drawing.

17.3 Measurement

Cement concrete in floor at plinths level shall be measured in cubic meter in place.

17.4 Payment

The amount of completed and accepted work, measured as provided above, shall be paid for at the contract unit price of cum which payment shall constitute full compensation for furnishing all materials, labour, mason, tools and equipment in mixing, placing and curing concrete, application of bituminous coats and sand blinding and for all incidentals such as overhead, profit, taxes, VAT etc. necessary to complete the work according to the applicable plans.

18.0 WATER PROOFING POLYTHENE SHEET

18.1 Description

The work covered under this item shall consist of supplying and laying in place polythene sheets over brick flat soling in floor of buildings and where needed in accordance with the applicable Plans, Schedules and Specification.

18.2 Construction Requirements

The sheets shall be laid within the building covering the entire inside floor area. Before laying the sheets the brick surface shall be cleaned with a duster to give the surface a free of extraneous particles. The sheets shall be free of damage, tear or other imperfection and shall be laid such that there is a minimum of 225 mm overlap between adjacent strips. The second layer shall be laid over the first in the same direction but with a stagger of half the strip width.

18.3 Measurement

Measurement for payment shall be made in square meter of area covered by the sheet. No allowance will be made for overlaps.

18.4 Payment

The amount of completed and accepted work measured as provided above shall be made on the contract unit price per sq. meter which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage, handling and transport of materials, cleaning, preparing, cutting, laying, fixing overhead, profit, taxes, vat etc. as well as all incidentals necessary to complete the work as per BOQ item.

19.0 EARTH WORK IN EXCAVATION FOR STRUCTURE

19.1 Description

The item shall consist of setting out true lines to all foundations for structures, performing the excavations to the required levels and grades in any kind of soil encountered, removing the spoils and backfilling of original ground line as provided in these specifications or as directed by the Engineers.

19.2 Construction Requirements

The Contractor shall comply with all safety regulations and shall furnish, erect and maintain suitable barricades and warning signs and take such other measures as necessary to prevent personal injury or property damage.

19.3 Measurement

All excavation shall be measured net between the vertical plans of outsides of structures and no allowance shall be made for the extra excavation for working space, etc. Any extra excavation beyond depth and dimension which is carried out through error and detrimental for the structure, must be compensated by the contractor at his own expenses by furnishing compacted sand fill or concrete as directed by the Engineer.

19.4 Payment

Payment for excavation will be made at the contract unit price per cubic meter (Cum) measured as provided above, which price shall constitute full compensation for furnishing all labour, equipment and materials, including setting out of pits and trenches, establishing and securing bench marks, excavating, handling of excavated materials, backfilling and compacting of the same, shoring, dewatering, and disposing of surplus excavated materials and debris by hauling to any distance at approved locations inside/outside the site, as well as all incidentals such as overhead, profit, taxes, VAT etc. necessary to complete the work according to the applicable plans as per BoQ item.

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20.0 REINFORCED CEMENT CONCRETE WORK (RCC)

As per SECTION 3.5 of Specifications of Part-1

21.0 REINFORCING STEEL IN CONCRETE

As per SECTION 3.6 of Specifications of Part-1

22.0 UNI-BLOCK FOR PAVING

22.1 Description

The work covered by this item shall consist of supplying and laying paving tiles 60 mm/80 mm of approved quality, colour and size on floor in accordance with the applicable plans, schedules and these specifications.

22.2 Construction Requirements

Paving tiles works in floor or pavement with machine made pressed tiles in cement sand (F.M. 1:2) mortar (1:4) on minimum 12 mm thick cement sand (F.M. 1:2) mortar (1:4) including raking out joints, cutting the bricks to required size soaking the same 24 hours before use including high class flush pointing in cement mortar (1:2), cleaning, curing at least for 7 days, having compressive strength of 49 N/mm² on compacted sand bed of 50 mm on stabilized soil base, and filling all interstices with sand, cleaning etc.. all complete in all respect as per practice and accepted by the Engineer.

22.3 Measurement and Payment

Measurement shall be made in square meter (sqm) and paid at contract unit price mentioned in the bill of quantities

23.0 GEO-TEXTILE SAND BAGGING

As per SECTION 3.3 of Specifications of Part-1

24.0 EARTH FILLING

As per SECTION 3.4 of Specifications of Part-1

25.0 CHEMICAL ADMIXTURE

25.1 Description

Supplying and mixing specified type chemical admixture delivered from an authorized local agent or manufacturer, comply with the ASTM C-494 requirements, confirming the current compliance of the admixture to specification requirements like physical properties, uniformity and equivalence in composition etc., performance (water content, fresh concrete setting time and compressive strength) requirements, delivered in sealed water-tight containers having and confirming plainly marked the proprietary name of the admixture type under this specification, net weight and /or volume, manufacturing and expiry date, non aggressiveness to environment, aggregates and metals in concrete etc. and mixing the admixture in non pre-stressed cement concrete mixture in the field under the strict accordance with manufacturers recommendation and instruction, providing safety provisions in all respects etc. all complete as per instruction and approved by the Engineer.

Dose (quantity in milliliters per 50 kg bag cement) and brand/origin/ manufacturer with respect to particular brand of cement and particular stock of aggregates and method of use to be determined by mix design / trial mix at the cost borne by the Contractor and approved by the Engineer.

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Supply and use of water-reducing high range and retarding chemical admixture ASTM C-494 Type - G of approved brand/origin/manufacture in concrete: The admixture required to produce concrete of consistency by 12% or greater (flowing concrete) and for higher strength of concrete and intend to retard setting time of concrete.

25.2 Measurement

Measurement for payment shall be made in liter.

25.3 Payment

The amount of completed and accepted work measured as provided above shall be made on the contract unit price per liter which payment shall constitute full compensation for furnishing all materials, equipment and labour including storage, handling and transport of materials as well as all incidentals necessary to complete the work.

26. SAND FILLING

As per SECTION 3.1 of Specifications of Part-1

27. MECHANICAL COMPACTION OF FILLING SAND

As per SECTION 3.2 of Specifications of Part-1

28.0 ELECTRICAL WORKS

28.1 PVC Conduit Works

a) Material

The work under this item consists of supply and installation of rigid, water grade PVC conduit, with G.I. pull wire and necessary accessories of concealed or exposed in/on floors, roof slabs, walls and columns where necessary in accordance with the drawing, specification as stated here under and as per direction of the Engineer-in-Charge. Approved type of galvanised saddle for surface installation of the PVC conduit shall be used. PVC conduit shall be of standard manufacture to meet the requirement of MEMA TC-2 and WC-1094. Water grade rigid PVC conduit (upto 25mm dia) must have minimum 1.5mm wall thickness and pressure tolerance 217 P.S.I. rated for 90°C. More than 25mm dia all conduit must be water grade rigid PVC conduit with wall thickness as recommend by BS3505. Junction box, pull box, circular box, bends, sockets, elbows etc. Shall be of PVC or other similar inert synthetic materials press fitted and then sealed with PVC solvent cement or by any other standard glue as prescribed by the manufacturer. When sheet steel accessories are used except pull or junction boxes shall be fabricated from 16 S.W.G. plain sheet either galvanised or black enameled over two prime coats.

Rubber bushes are to be fixed at the conduit and where it enters the sheet steel boxes through knock nuts. Each junction or pull box shall have an earth point where earth continuity conductor can be connected. Plain sheet box will be used at light fixture/fan outlets. No PVC circular boxes shall be used. Pull wires, to draw the copper conductors through conduits shall be of 10 SWG and galvanised.

b) Installation

For new installation, the conduits to be concealed in slabs shall be installed along with GI pull wire in between top and bottom bar immediately after placement of reinforcement bar as per applicable routing shown on the drawing. Conduits shall be tied with reinforcement 2x20 SWG, GI wire @ 450mm c/c. Surface conduit shall be installed using prior approved galvanised saddle. The saddle shall be of spacer bar or as approved by the Engineer and shall be fixed by using rawl plug of approved type. The surface conduit shall be secured with wall/column by saddle @ 450mm c/c.

The concealed conduit in wall shall be installed by cutting groove of proper size.

Concealed conduits in concrete wall or column surface shall be placed along with shuttering or form work before concrete poured in.

Any change in routing necessitated because of site condition shall have prior approval of the Engineer. All such changes shall be marked on the plans as field records. Conduits in brick wall shall be installed during construction or by cutting of wall. **No chasing in masonry wall shall be allowed without prior approval of the Engineer.**

PVC pipes shall be bent either by using a hot box bender or by using flame. In any event bending radius shall be 150mm minimum.

The conduit run shall be continuous throughout its length and kept straight as far as possible. It shall have either horizontal or vertical run but shall never run at an angle. Routing of conduits in between walls at right angle shall be not allowed. All conduit run shall be kept at least 150mm clear of Gas, Sewer water and other services pipes. Where necessary it shall be re-routed or set out to maintain the specified separation.

In installing the conduits particular care shall be taken in cutting them to the proper lengths so that the ends will fit exactly into the outlet boxes. After installation the open end shall carefully be plugged with a bush to prevent intrusion of plaster, dust etc.

All conduits along with accessories (pull box, junction box, circular box, ebonite cover) required for complete installation shall be furnished and installed in a best workmanship manner.

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28.1.2 Method of Measurement

Measurement for payment shall be made for the actual member of linear meter measured along the piping axis including all accessories such as pull/junction box, bends, tees, fixing material etc.

28.1.3 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials like pipes, all complete for this item of work. All equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
3	PVC CONDUIT WORKS	Rm

28.2 Cable Works

a) Materials

i) Single core cable and conductors:

Single core low voltage cables and conductors shall be as per BS 6004/6346 or IEC 60502-1/60502-2 or VDE 0271/0272 or equivalent international specifications of copper conductor with PVC insulated or XLPE/PVC insulated and PVC sheathed. Conductors shall have 450/750 volt grade of PVC insulated and 600/1000 volt grade of XLPE/PVC insulated and PVC sheathed. All size size of cables shall be standard unless otherwise specified.

All flexible cables shall be as per BS 6004 unless other wise specified.

ii) Multicore Cables:

Multicore low voltage cable shall be XLPE/PVC insulated PVC sheathed non-armoured/aormoured type, termite proof, made and tested according to the specifications as mentioned above and the voltage raing shall not be less than 600/1000V.

b) Installation

i) Cables in Conduit

Single core cables (non-sheathed) are to be installed either in PVC or in metal for specially purpose conduits. The conduit sizes shall be as specified in the drawing. It must be ensured that cables are not scratched/damaged during pulling. For long length, pull boxes must be used even if not incicated in the drawings. Cable shall not be drawn round more than two 90° bends (or their equivalent) between drawing-in-boxes, and any single bend must not be less than 90°.

ii) Cable Bending Radii:

The internal radius of every bend in a non-flexible cable shall be not less than the appropriate value stated below:

Insulation	Finish	Overall diameter	Factor to be applied to overall diameter of cable to determine minimum internal radius of bend
Rubber or PVC (circular copper or circular stranded copper or aluminium conductors) ii)	Non-armoured	i) Not exceeding 10 mm	3
		Exceeding 10 mm but not exceeding	

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		25 mm.	4
	iii)	Exceeding 25mm	6
	Armoured	Any	6
PVC (solid aluminium Or shaped copper conductors)	Around or Non-armoured	Any	8

iii) Cable termination and joints:

The cable upto 2.5 mm² size shall may be solid conductor and therefore, jointing of these cables are to be done through procelain connector and the connector shall be wound with PIB Tape before placing in the box. If connectors are not available twisting shall be allowed, and in that case every connection shall have at least 12mm of twisting (minimum 10 twists per 25mm) and the twisted protion bent at right angle to place it in parallel to the cable with a minimum of two layers of PIB tape wound over it for a length of 38mm. Termination of cable upto 2.5 mm² shall be done by making a hook at the end, and for higher size, brass cable terminals must be used. Tee-off joints in the cable to lighting point switches, etc shall not be made. Looping in system of wiring is to be followed and the joints are to be made in the switch boards only. All 3-4 core PVC cables shall be terminated using brass cable glands of proper size.

iv) Connection to switches

The phase wire should be connected to the switches and the neutral wire is to be kept solid in all switch connections.

v) Cable colour

All cables used must have colour as stated below:

Two wire single phase a.c. system:

Red or Yellow or Blue for phase line or switch wire.

Black for neutral.

Green/Green-Yellow for earth.

Three or four wire three phase a.c. system:

Red for first phase.

Yellow for second phase.

Blue for third phase

Black for neutral.

Green/Green-Yellow for earth.

Two wire d.c. system:

Red for positive or switch wire

Black for negative.

For two wire final sub circuits.

Whether a.c. or d.c. supplying lighting or power circuits, the neutral or 'middle' wire shall always be black, and the phase or outer wire (no matter which phase it is connected to) shall always be red. For lighting, the red wire shall always feed the switch, and a red wire shall always be used from the switch to the light.

vi) Construction Joint Crossing

At construction joint crossing, a brass expansion joint fitting as per drawing is to be installed and the cables are to be run through such fitting.

vii) Cable trench

Unless otherwise stated in schedule generally the size of the trench shall be of minimum 825 mm depth and 450 mm width for each cable to be laid. Where more than one cable is to be laid in the trench, the width of the trench is to be increased by 150 mm for

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each extra cable for size below 70 mm² (3 ½ or 4 core) and 300 mm for bigger size cables.

A cushion of sand of F.M 1.5, 150 mm thick, is to be placed over the bed of the trench over which the cables are to be laid.

After laying the cable first class brick on edge of flat are to be placed as separators in between the cables. After installation of the brick separators, sand fitting is to be done upto 150mm from the top of the bigger cable. After sand filling, two layers of first class brick flats are to be placed along the length and breadth of the trench as a protection against injury and indication that a power cable is laid. The rest of the trench shall be filled with earth, watered and rammed at 150 mm layers. After cables are laid the original ground conditions shall be restored. But if brick pavement, drain, concrete road, or bituminous carpeted road are cut across or damaged, they shall be remedied and restored to the original specification.

The cable route shall be as direct as possible and shall receive the Consultant's approval before excavation.

All cable bends shall have a radius of not less 2 times the diameter of the cable drum, or 20 times the diameter of the cable, whichever is greater. GI pipes shall be provided for all road and drain crossing. These pipes shall be laid direct in the ground without any sand bed, sand layer, brick or cable covers.

Cables shall always be laid out or laid into the ground through GI pipe of suitable size as decided by the Consultant. The length of the pipes over the ground shall not be less than 1200 mm. The exposed end of the pipes shall be sealed using PVC or wooden plugs.

The contractor shall exercise great care in handling the cable and avoid forming "KINKS". The cable drums shall preferably be conveyed on wheeled cable drum carrier and unrolled and laid directly from the drum carrier. Carriage by trailer or trucks can be allowed only if proper care is taken during unloading the drum and unrolling is done after placing the drum or drum jacks and spindle. The cables be unrolled in the directions indicated on the drum by the manufacturer.

GI cable marker is to be installed at every turning point of the trench. No extra charge shall be allowed for the cable marker.

After the cable is laid, it shall be tested by the contractor in presence of the Consultant. If the test is unsatisfactory, the cost of all repairs and replacement shall be borne by the Contractor.

All surplus earth shall be removed to the indicated places by the Contractor at his own cost. No extra charges shall be allowed for it.

Any damage done to any other services by the Contractor for cable laying operations shall be made good by the Contractor at his own cost.

All chasings and passages necessary for laying or cable indoor shall be done by the contractor and the same shall be made good to the satisfaction of the Consultant by the Contractor without any extra charge to the owner.

When trenches are left open overnight, and where road is to be cut, the Contractor shall exhibit suitable danger signal such as banners, red flags and red lamps at his own cost. Temporary arrangement by placing wooden sleepers, sheet steel etc. across the road cutting for vehicular traffic are also to be made by the Contractor at no extra cost. The Contractor shall be wholly responsible for any accident which may occur due to the negligence of the Contractor.

All road excavations shall be filled up in layers with powdered earth and suitably watered and rammed in such a manner that after completion of the work there is no land subsidence. The road top shall be reconstructed to match the existing road pavement.

No trench shall be dug until all cables meant for laying have been procured and brought at site store. Cost of any de-centering or shuttering and shoring of trench required to be done shall be borne by the Contractor.

viii) Insulation Test

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Insulation test of the whole installation shall be carried out using Meggar as recommended by BNBC/IEE Regulations, in presence of authorized representative of the Engineer and results must be submitted to Consultant for approval.

28.2.1 Method of Measurement

Measurement for payment shall be made for the actual member of linear meter measured along the cable laying route.

28.2.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
1 & 2	CABLE WORKS & UNDERGROUND CABLE WORKS	Rm

28.3 Earth Continuity Conductors (ECC)

a) Material

Earth continuity conductor for lighting & power circuit shall be PVC insulated multistrand cable of green coloured. The earthing lead shall be electrolytic annealed copper of 100% conductivity at 20°C (68°F) (International Annealed copper standard) with weight resistivity of 0.15328 ohm-gram/m² at 20°C (68°F) and density of 0.32117 lb/in³, for meeting the requirements of BS 6360:1969 or its metric adoption.

b) Installation

The earth continuity conductor and earthing lead shall run in accordance with the drawings and direction, and all metal fittings shall be earthed with continuity conductors. All the earth continuity conductors from the various circuits, sockets, etc. shall be connected to the earthing block located near the DB/SDB. Sizes of earth continuity conductors shall be as stated in the drawings. All DB/SDB/SB shall be interconnected with earth continuity conductor. The earth continuity conductor shall be drawn along with the cables and no joint shall be allowed from earthing block to the respective earth point.

28.3.1 Method of Measurement

Measurement for payment shall be made for the actual member of linear meter measured along the laying route.

28.3.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement

28.4 Light Fitting

All luminaire shall be weatherproof, dust-tight, enclosed type and shall comply with BS 4533, having protection class IP-65 and shall be complete with all necessary integral lamp control gear for proper operation of a High Pressure Sodium lamp, High Pressure Mercury lamps or other special lamps.

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The luminaires shall be constructed of die cast aluminum or heavy gauge reinforced aluminum sheet. Where reflectors are used to control the light distribution they shall be constructed of high purity aluminum which has been chemically polished and anodized. The design of the optical system and the bowl sealing arrangement shall provide easy and minimal maintenance. The gasket between the lamp compartment and bowl shall be resilient and non-deteriorating, and it shall be positively retained in its seating, with not more than one joint, and shall not work loose or deform in normal operation or during maintenance of the lanterns.

The refractor bowl or front visor shall be hinged and secured by an adequate number of stainless steel fasteners. The hinge assembly should permit easy removal of the bowl for replacement purposes. In the closed position, the bowl shall be firmly attached to the body of the lantern, bearing uniformly on the gasket. When the bowl is allowed to swing under its own weight from the closed position it shall not become detached or knock against the body of the lantern column or supporting structure.

Ballast Units

Ballast units comprising lamp control gear, capacitors, radio interference suppression devices and all other auxiliaries shall in each case be of the built-in type and fitted within the lantern's body.

The ballast units shall have a maximum of 20% harmonics and shall comply with BS 4782 or BS 2812 as applicable. They shall be of the solid filled type and have voltage toppings in 10 volt steps from 230 to 180 volts. All toppings shall be brought to suitable marked terminals to which lamp and supply connections can be made. Capacitors shall be totally enclosed and shall be designed to give an overall circuit power factor of not less than 0.85 lagging.

The ballast units shall be so designed that the operation of the lighting installation does not produce a level of radio interference exceeding the limits given in BS 800. The recommendations of the British Standard code of Practice, CP 1006, for the control and suppression of radio interference, shall also be adhered to.

a) Pole Mounted Lanterns (LED 100W)

Lanterns for mounting on 10.55m high columns (including projection height of over-hanging part) shall have a principal transverse optical axis parallel to the road surface. The lanterns shall be of the side entry type and shall be securely locked to the bracket arm spigots to prevent movement by vibration or wind effects.

The lantern shall be fitted with an asymmetrical optical system of special design, made of high purity aluminum, which has been chemically polished and anodized.

In an absolute horizontal position the column mounted lantern shall keep all the distributed light below the horizontal plane providing a cut of light distribution with perfect glare limitation in accordance with CIE (International Commission on Illumination) recommendation.

28.4.1 Method of Measurement

Measurement for payment shall be made for the actual member of fixture installed complete in all respect including consumable materials and lamp.

28.4.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
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4.04	LIGHT FITTINGS	each
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28.5 Lighting Pole

- a) 10500mm long hot dip galvanized G.I light pole having bottom dia 150mm (6") and top dia 75mm (3") complete with welded base plate suitable for bolting with concrete foundation including 50mm (2") dia bracket arm shall be fixed to the light column as per drawing. The length of the bracket shall be such that the end of light fixture will be 1.5meter (approx.) from the light column. A junction box to be installed at bottom level of the pole fabricated from 2.0mm (min.) mild steel sheet and hot deep galvanized complete with cover including termination unit, circuit breaker and earthing terminal etc. The work shall be completed as per drawing and direction of the Engineer.

28.5.1 Method of Measurement

Measurement for payment shall be made for the actual member of fixture installed complete in all respect including consumable materials and lamp.

28.5.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
4.5	LIGHT POLE	each

28.6 Distribution & Sub-Distribution Boards

a) Material

- i) The DB/SDB/Panel Board shall be as per schedule with bus bars & arrangement to fix and shall be designed for operation on a 240/415V, 50Hz, 3 phase, 4 wire system. The DB/SDB/Panel shall be a totally enclosed dust and vermin protected, factory fabricated (machine made) epoxy powder coated finish, heavy gauge sheet steel enclosure of ample size with a hinged gasketed. The panel shall have adequate rated bus bars for phases and neutral, and an earth terminal block. The panels shall be constructed as per schedule, and shall comply with relevant requirements of applicable BS including BS 4649, where applicable with standard concentric knockouts of required sizes all around. The panels shall have directory frames and printed directory on/in side of door. The door is to be provided with flush lock handle. All doors are to be keyed alike, all hinges shall be concealed. Adequate clearance shall be maintained between phases and non-conducting metals. Each board shall be fitted with identifying cables as specified.
- ii) The MCB/MCCBs shall be quick-make, quick-break type, and shall have inverse-time limit characteristics with thermal instantaneous magnetic trip elements. All circuit breakers shall be trip-free and shall be of indicating type. Ratings and frame sizes of breakers shall be in accordance with schedule. All lugs must be of the shoulderless mechanical type. The MCB must comply with BS 3871. AE at rated voltage 240/415V, A.C. 50Hz, interrupting capacity minimum 6 KA as specified in the schedule and capable of providing overload and short circuit protection, through thermal and magnetic trip actions respectively, temperature rating, 40°C preferably with contacts of silver alloy.
The MCCB shall fully comply with BS 3871. Rated voltage 600V AC, 50Hz with overload and short circuit protection with thermal and magnetic tripping action.

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Temperature rating 40°C preferably tropicalised (moisture fungus corrosion treated).

The MCCB's shall have the following minimum symmetrical interrupting capacity as per B.S. and IEC, at 415V A.C. if not indicated otherwise:

Up to 50A TP	:	16 KA
51A TP to 100A TP	:	25 KA
101A TP to 300A TP	:	35 KA
301A TP to 800A TP	:	50 KA
801A TP to 1500A TP	:	65 KA
1600A TP to above	:	80 KA

MCB up to 63A TP shall have 16KA rating and SP shall have 6 KA rating. The MCCB from 100A TP shall be adjustable type.

The MCCB's shall have the symmetrical interrupting capacity as mentioned in the schedule at 480V a.c.:

The continuous current ratings of individual MCB/MCCB's may be varied within + 15% at the time of installation without any cost implication.

b) Installation

- i) The Board shall be installed in accordance with applicable layout drawings. Minimum height to bottom of the Boards from the floor level shall be 600mm and maximum height of any circuit breaker/switch shall be 1800mm from the same level or as specified in the drawing.
- ii) The location of DB/SDB shown on diagrammatic wiring plans shall be considered as approximate and it shall be incumbent upon the Contractor before installation of DB to study all pertinent drawings and obtain precise information from the architectural schedule scale drawings, large scale and full size details of finished rooms and approved shop drawings of other trades. In centering line, DB/SDB due allowance shall be made for overhead piping, ducts, window and door trim, variations in thickness of plastering etc. as erected, regardless of conditions which may be otherwise shown on small drawings. DB/SDB incorrectly located shall be properly relocated at the contractor's expense.

28.6.1 Method of Measurement

Measurement for payment shall be made for the actual number of DB/SDB installed complete in all respect including consumable materials.

28.6.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
4.6	DISTRIBUTION BOARD, MCB/MCCB	Set

28.7 Earthing

a) Material

- i) Earth Electrode
 - a) G.I. Pipe Electrode (where applicable)

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This would be 38 mm dia G.I. pipe with two 3 mm (min.) dia holes across the diameter at every 1200 mm of the pipe.

- ii) Copper rod (where applicable)
Solid drawn high conductivity copper rod of 15 mm dia and 1.2 M section length with internal screw and socket joint complete with harden steel tip and driving caps to keep the earthing resistance less than 1.0 ohm. Depth of drive rod shall be at least 12 M and spacing shall be at least equal to their length. Connections shall be made by purpose made clamps of the same manufacturer.
- iii) Earthing Lead
 - a) Earthing lead shall consist of PVC insulated copper conductor as per specification given in 2.4a. All terminal lugs shall be of copper and nut bolts of brass.
 - b) Same as Spec. 2.4b.
- iv) Earthing Block
The earthing block shall be of solid electrolytic copper with drilled holes for accommodating the terminal of the earth continuity conductor. Requisite number of brass nuts and bolts shall also be provided.
- v) Earth Inspection Pit
Bricks used shall be 1st class. Only approved quality cement shall be used. Khoya for 75mm RCC cover shall be 19mm down graded with 12mm dia MS Reinforcement @ 250mm with two 10mm MS hook (of 50mm dia) shall be provided in the cover slab.

b) Installation

- i) G.I Pipe Electrode
The pipe earth electrode shall be buried below ground level, as per schedule by tubewell sinking method. The earth lead from the DB to the main earth electrode shall be installed in G.I. pipe of specified diameter. The terminal connected to the earth electrode shall use a brass clamp. After making the connection, the clamp shall be covered with bitumen poured hot, and covered with jute cloth.
- ii) Copper Rod Electrode
The copper rod electrode (if applicable) shall be buried below ground level as per schedule and as per manufacturer's instruction. Connection with rod and earth lead shall be as per recommendation of the manufacturer.
- iii) Earthing Leads
The earthing leads from the earth electrode shall be connected to the earthing block in DB/SDB. A double run of specified copper conductor (preferably tinned) shall be brought out of specified lead for the earth electrode through G.I. pipe from the electrode and connected to the earth block. There shall be no joint in the copper earth lead. All earthing lead shall follow the shortest and most direct route to earth electrode and sharp bends and joints shall be avoided. The earthing leads shall be made mechanically strong and electrically continuous with minimum of resistance.
- iv) Earth Inspection Pit
The earth inspection pit shall be constructed as per schedule and direction of the Engineer-in-charge. The slab shall have level surface and the pit shall have

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well formed regular sides. Water curing for the slab and the pit shall be done for a minimum of 6 days.

- v) **Maximum Earth Loop Resistance**
The maximum earth loop resistance from any point in the installation including earthing lead to the earth electrode shall not exceed one ohm or specified in the schedule, or that indicated by the Consultant. The contractor must ensure that the leads are efficiently bonded to all metal works other than the current carrying parts, so that the above resistance level is not exceeded. It will be the duty of the Contractor to provide earth tester, test the installation in presence of the authorised representative of the Authority and submit earth test report to the Authority for approval.

28.7.1 Method of Measurement

Measurement for payment shall be made for the actual member of earthing set completed as per drawing, schedule and specification. Separate measurement shall be taken for the actual set of earth inspection pit completed in all respect including consumable materials.

28.7.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
4.7 & 4.9	EARTHING SYSTEM	set

28.8 Pole Mounted Transformer

Supply of following oil-immersed, natural air cooled, 1-phase, 50-Hz, 6.35 KV /0.24 KV outdoor type distribution transformer having percentage impedance 3-3.5%, basic insulation level (BIL) 75 KV, HT & LV porcelain bushings, transformer tank, oil inlet & outlet valves, earthing terminals, data plate etc. in/c painting, suitable for connection with 11 KV line at 40°C ambient temperature with maximum temperature rise 60°C, manufactured and tested as per NEMA/VDE/IEC/BS standard and as per accepted/approved by the Engineer.

Capacity: 25KVA
No load loss: 50W
Full load loss: 160W

28.8.1 Method of Measurement

Measurement for payment shall be made for the actual member of energy meter installed complete with meter board including necessary accessories.

28.8.2 Basis of Payment

The amount of completed and accepted work measured as provided above shall be paid for at the corresponding contract price for which payment shall constitute full compensation for furnishing all materials for this item of work, all equipment and labour including storage, handling and transport of materials, installation and fixing.

Pay Item Number	Description	Unit of Measurement
8	POLE MOUNTED TRANSFORMER	set

29.0 NETWORK EQUIPMENT AND FIBER OPTIC NETWORK

1 Core Router

Principal

1. **Quality:** ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance
2. **Brand:** CISCO/JUNIPER or equivalent
3. **Model:** To be mentioned by the Tendered
4. **Manufacturer:** To be mentioned by tenderer
5. **Country of the origin:** USA/UK/CANADA or equivalent
6. **Encloser Type:** Rack-mountable Modular Chassis
7. **Quantity:** 01 (one)
8. **Performance:** 400 Mbps
9. **RAM:** 4 GB upgradable 16 GB & 1x250GB SSD drives for ISR-WAAS with NIM carrier for SSDs
10. **Flash Memory:** 4 GB upgradable 16 GB
11. **Interfaces Requirements:** RJ-45 3 x 10/100/1000 Base-T, Expansion slot: 1 interface card; 1x SFP (mini-GBIC); Management: Yes (1 GE); 1 x console; Serial: 1 x auxiliary; USB : 2 x USB 2.0
12. **Security:** Device should support hardware-based cryptography acceleration (IPSec + Secure Sockets Layer [SSL]); Should Dynamic VPN to connect remote VPN devices;
13. **Data Link Protocol:** Ethernet, Fast Ethernet, Gigabit Ethernet, Fiber Optics
14. **Interface support:** 10Base-T/100Base-TX/1000Base-T, SFP (mini-GBIC), auxiliary, console
15. **Protocols:** IPv4, IPv6, static routes, Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), BGP Router Reflector, Intermediate System-to-Intermediate System (IS-IS), Multicast Internet Group Management Protocol (IGMPv3), Protocol Independent Multicast sparse mode (PIM SM), PIM Source Specific Multicast (SSM), policy-based routing (PBR), IPv4-to-IPv6 Multicast, MPLS, Layer 2 and Layer 3 VPN, IPSec, Layer 2 Tunneling Protocol Version 3 (L2TPv3), RIP-1, RIP-2.
16. **Compliant Standards:** ANSI T1.101, IEEE 802.1Q, IEEE 802.1ag, IEEE 802.3, IEEE 802.3ah, ITU-T G.823, ITU-T G.824
17. **Monitoring:** Should have Telnet , SSH, SNMP, Remote Monitoring (RMON), syslog; Should have IPv4 and IPv6 Packet Capture for analysis using an external tool such as Wireshark features for troubleshooting, Support application performance monitoring
18. **Manufacturer part number:** Bidder should submit BOQ of proposed device including the details part numbers and Manufacturer Warranty.
Bidder should submit the required performance document for the proposed device.

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Warranty

1 (One)-Year full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

2 **Next Generation Firewall**

Principal

1. Quality: ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance

2. Brand: CISCO/JUNIPER or equivalent

3. Model: To be mentioned by the Tendered

4. Manufacturer: To be mentioned by tenderer

5. Country of the origin: USA/UK/CANADA or equivalent

6. Encloser Type: Rack-mountable Modular Chassis

7. Quantity: 01 (one)

8. Architecture: The Firewall Should support Min. 750 IPsec VPN peers and Min. 2 SSL VPN peers; Tendered should provide Security Contexts 2 but the device should support upto 20; Form factor should be Rack-mountable; The device should have the High Availability option; Device should have 1 free Expansion Slot and 1 memory slot for future; Device should have support Expansion I/O 6 GE copper or 6 GE Small Form-Factor Pluggable (SFP) if required near future; Device should have installed Min. **8 GB RAM** and Device should have installed Min. **8 GB Flash** Memory and Multibus architecture etc.

9. Interface Cards: The device should have Min. 4 Gigabit Ethernet ports and 1 Fast Ethernet port; 1 network - Ethernet 10Base-T/100Base-TX - RJ-45, 1 management - console - RJ-45, 2 Hi-Speed USB - 4 PIN USB Type A and 1 serial - auxiliary - RJ-45; Load sharing of traffic as well as protection against link failure by using Ether-Channel.

10. Firewall Performance: Firewall throughput: 2 Gbps; VPN throughput (3DES/AES): 300 Mbps; Connection rate: 20000 connections per second; Firewall + intrusion prevention throughput: 600 Mbps; Concurrent sessions: 500000; Virtual interfaces (VLANs): 200; New connections per second: 20000 and Security contexts: 2;20, Cloud Web Security users: 500 etc

11. Firewall Features: Have specific protection for UC, WLAN, routing and switching Up to layer 7 protection; Firewall Protection: Access Control, Anti-spyware, Antivirus, Application Layer Filtering, Content Filtering, Intrusion Prevention, Malware Protection, Remote Access Authentication, Worm Scanning, Fast Ethernet Port: Yes, Gigabit Ethernet Port: Yes, Traffic filter, Support IP Sec data encryption; Support client based IP Sec VPN Tunnels; Support IP Sec NAT Traversal; Support for Standard Access Lists and Extended Access Lists to provide supervision and control. Control SNMP access through the use of SNMP with MD5 authentication, Support for Remote Authentication Dial-In User Service (RADIUS) and AAA or similar protocol, Firewall protection, High Availability, VLAN support, VPN support etc.

12. Management Features: Support for Built-in Management Software for simple, secure remote management of the security appliances through integrated, Web-based GUI. Support accessible through variety of methods, including console port, Telnet, and SSHv2. Support for both SNMPv2 and SNMPv2c, providing in-depth visibility into the status of appliances. Support real time monitoring of the firewall through the management console or through external syslog servers. Should ensure critical messages are not lost under busy network conditions by providing message buffering locally on the appliance. Should have capability to import configuration and software files for rapid provisioning and deployment using Trivial File Transfer Protocol (TFTP), HTTP, HTTPS Support for using both SSHv1 and SSHv2 to remotely manage the security appliances, providing improved compatibility with third-party SSH tools. Should be capable to perform configuration rollback and offers the ability to store and use multiple configurations and software images in compact flash memory. Support prevention of unauthorized access to sensitive configuration data, certificates, and key material stored on the security appliance by automatically wiping flash memory contents if an asset recovery or password reset procedure occurs. Support Packet Capturing for powerful troubleshooting capabilities by providing robust packet-capturing facilities on each interface. Support for several methods of accessing captured packets, including through the console, secure Web access, or a file exported to a TFTP server. Should be capable to provide a convenient method for alerting administrators when critical events are encountered, by sending e-mail alert messages to administrator defined e-mail

13. Console Cable: Tenderer should supply Console Cable with RJ-45 Interface

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Warranty

Section VI: Works Requirements
Specification Part-2: Access Road

1 (One)-Year full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

3 Bandwidth Manager

Principal

1. Quality: ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance

2. Brand: To be mentioned by the Tendered

3. Model: To be mentioned by the Tendered

4. Manufacturer: To be mentioned by tenderer

5. Country of the origin: USA/CANADA or equivalent

6. Encloser Type: 19-in rack mountable

7. Quantity: 01 (one)

8. Architecture: Minimum 12 Gigabit Ethernet ports; Device should handle 200 users bandwidth control features; Core 2 GHz PPC processor

9. Firewall: Statefull filtering; Source and destination NAT; NAT helpers (h323, pptp, quake3, sip, ftp, irc, tftp); Internal connection, routing and packet marks; Filtering by IP address and address range, port and port range, IP protocol, DHCP and many more; Address lists; Custom Layer7 matcher; IPv6 support

10. Routing: Static routing; Virtual Routing and Forwarding (VRF); Policy based routing; Interface routing; ECMP routing; IPv4 dynamic routing protocols: RIP v1/v2, OSPFv2, BGP v4; IPv6 dynamic routing protocols: RIPng, OSPFv3, BGP

11. QoS: Hierarchical Token Bucket (HTB) QoS system with CIR, MIR, burst and priority support; Simple and fast solution for basic QoS implementation - Simple queues; Dynamic client rate equalization (PCQ)

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Warranty

1 (One)-Year full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

4 Network Switch

Principal

1. Quality: ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance

2. Brand: CISCO/JUNIPER or equivalent

3. Model: To be mentioned by the tendered

4. Manufacturer: To be mentioned by tenderer

5. Country of the origin: USA/UK/CANADA or equivalent

6. Encloser Type: Rack-mountable Modular Chassis

7. Quantity: 02 (two)

8. Architecture: 1RU rack mountable Gigabit Routed Access Edge PoE+ switch .

Port Density : 48 x 10/100/1000 Base T PoE+ ports (as per 802.3at Standdard), 4 1000BASE-X SFP ports(SFP Ports Combo Shared with 10/100/1000 Base T Ports) with Line-rate traffic throughput for (both Layer 2/3) on all ports.

Expansion : Should have Dedicated 2 stacking or expansion ports for close loop 40Gbps stacking per node with support for 8 or more Switches per stack. Single mode long distance copper module must be installed from day 1.

9. Optics supported: 100FX, 1000 SX, 1000 LX/LH. All optics installed should be from switching OEM

10. Operating System: Purpose-built on Operating system with comprehensive, proven innovations

11. Managment Port: 10/100/1000-Mbps management port and serial console port

12. L2 Features: Should have VLAN, IEEE 802.1Q Trunking, QinQ, LACP, MSTP, RSTP, spanning-tree guards, MVRP/VTP, IGMP Versions 1, 2 and 3, MLDv1, v2 , IGMP & MLD snooping and 9216 bytes jumbo frames

13. Layer 3 IP routing: Lite routing: Should have inter-VLAN routing (IVR), static routes, Bidirectional Forwarding Detection, RIPv2 and RIPv2.

Intermediate routing: Should support Routed Access Edge deployments for OSPF, PIM, VRRP etc with upgrades

14. Performance: Fabric ≥ 88 Gbps and Throughput ≥ 65 Mpps

15. Capacity: 1K Vlans, 16K MAC, ACL/QoS entries : 1K , BootFlash - 500MB or higher, DRAM - 500MB or higher, upto 30W PoE+ per port, upto 380W PoE+ budget

16. Security: Should have Radius/TACACS+ Auth, ACLs, DHCP snooping, storm control, PVLAN, Control-Plane Protection, SPAN, Multiple destination ports in SPAN and RSPAN, Local authentication database for 802.1x login and RADIUS Authentication for 802.1x login

17. Certifications: CE Markings 2004/108/EC and 2006/95/EC, UL 60950-1 Second Edition, IEC/ISO 15408 Common Criteria EAL 3 or higher certified and ROHS Compliant

18. High Availability: Optional external redundant power supply

19. Management and Maintenance: Should have SSHv2 access, CDP,LLDP, SNMP, Programmatic XML interface, sFlow, syslog, Embedded Event Manager (EEM) & scripting to enable automation.

Tendered should supply Console Cable with RJ5 Interface to configure the device

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Warranty

1 (One)-Year full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

**5 AirNet 3600 Series
Access Point**

Principal

- 1. Quality:** ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance
- 2. Brand:** CISCO/JUNIPER or equivalent
- 3. Model:** To be mentioned by the Tendered
- 4. Manufacturer:** To be mentioned by tenderer
- 5. Country of the origin:** USA/UK/CANADA or equivalent
- 6. Encloser Type:** Rack-mountable Modular Chassis
- 7. Quantity:** 08 (Eight)
- 8. General Features:** Dual-band controller based 802.11a/g/n, 3X4 MIMO with two spatial streams, 20 and 40 MHz Channels, data rates up to 405 mbps, A-MPDU (Tx/Rx), A-MSDU (Tx/Rx), Dynamic Frequency selection, CSD support; Must support 16 WLANs per AP for SSID deployment flexibility
- 9. Data Rates Supported:** 802.11a (6, 9, 12, 18, 24, 36, 48, and 54 Mbps), 802.11g (1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps) and 802.11n (2.4 GHz and 5 GHz)- 405 Mbps (Guard Interval-400ns/40MHz)
- 10. Frequency Band and Operating Channels:** 2.412 to 2.462; 11 channels, 5.180 to 5.320 GHz; 8 channels and 5.745 to 5.825 GHz; 5 channels
- 11. Antenna:** 2.4 GHz, Gain 2 dBi, internal omni, horizontal beamwidth 360° and 5 GHz, Gain 5 dBi, internal omni, horizontal beamwidth 360°
- 12. Interfaces:** 10/100/1000BASE-T autosensing (RJ-45) and Management console port (RJ-45)
- 13. Memory:** 512-MB DRAM and 128-MB flash
- 14. Power:** 100 to 240 VAC; 50 to 60 Hz and 44 to 57 VDC device should have IEEE802.3a, 802.3f compatible PoE option.
- 15. Standards:** UL 60950-1, CAN/CSA-C22.2 No. 60950-1, UL 2043, IEC 60950-1, EN 60950-1, EN 50155
- 16. Radio Standard:** FCC Part 15.247, 15.407, 15. 107 and 15.109; EN 60601-1-2 EMC requirements for the medical directive 93/42.EEC
- 17. Security:** Wi-Fi Protected Access 2 (WPA2), WPA, AES, TKIP, EAP-TLS, TTLS, MSCHAPv2, PEAP or EAP-MSCHAPv2, EAP-FAST, GTC, EAP Subscriber Identity Module
- 18. Multimedia:** Support Wi-Fi Multimedia

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Software

Unified Wireless Network Software

Supported Wireless LAN Controllers

Cisco Wireless Controllers, Cisco Wireless LAN Controller Module (WLCM) on Cisco Services-Ready Engine (SRE) for Cisco Integrated Services Router Generation 2 (ISR G2), Cisco Wireless Services Module 2 (WiSM2), Cisco 5500 Series Wireless Controller, Cisco Flex 7500 Series Wireless Controllers

Warranty

1 (Three)-Years full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

6 **Wireless LAN Controller**

Principal

1. **Quality:** ISO 9001/9002 for manufacturer, FCC Class A/B for quality assurance

2. **Brand:** CISCO/JUNIPER or equivalent

3. **Model:** To be mentioned by the Tendered

4. **Manufacturer:** To be mentioned by tenderer

5. **Country of the origin:** USA/UK/CANADA or equivalent

6. **Encloser Type:** Rack-mountable Modular Chassis

7. **Quantity:** 01 (one)

8. **Features:** This controller must have centralized security policies, wireless intrusion prevention system (wIPs) capabilities, award-winning RF management and quality of service (QoS) for voice and video. Delivering 802.11n/g/a performance and scalability with 6 AP License from Day 1.

9. **Comprehensive Security:** Offers control and provisioning of wireless access points (CAPWAP)-compliant DTLS encryption to help ensure full-line-rate encryption between access points and controllers across remote WAN/LAN links. Equips administrators for IPv6 troubleshooting, planning, and client traceability from a common wired and wireless management system.

Management frame protection detects malicious users and alerts network administrators.

10. **Access Point must be Supported:** Min^m 120 access points.

11. **Access Point should be Scalable:** Min^m 300 access points

12. **User Support:** Min^m 600 user access

13. **Bandwidth Support:** Min^m 600 Mbps support 802.11n/g/a

14. **Connectivity Standards:** IEEE 802.11a, 802.11b, 802.11g, 802.11d, WMM/802.11e, 802.11h, 802.11k, 802.11n, 802.11r, 802.11u, 802.11w, 802.11ac.

15. **Wired/Switching/Routing:** IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, 1000BASE-T. 1000BASE-SX, 1000-BASE-LH, IEEE 802.1Q Vtagging, and IEEE 802.1AX Link Aggregation.

Section VI: Works Requirements
Specification Part-2: Access Road

16. Interfaces: Uplink: 8 (5508) 1000BaseT, 1000Base-SX and 1000Base-LH transceiver slots; Service Port: 10/100/1000 Mbps Ethernet (RJ45); Service Port: 10/100/1000 Mbps Ethernet (RJ45) For High Availability for future use; Expansion Slots: 1; Console Port: RS232 (DB-9 male/RJ-45 connector included), mini-USB

17. Max^m Throughput: 8 Gbps

18. Mobility: L2 & L3

19. Redundant Power & Fans: Yes

20. Management: RFC 1155 Management Information for TCP/IP-Based Internets, RFC 2616 HTTP, RFC 854 Telnet, RFC 1157 SNMP, RFC 1350 TFTP, RFC 2665 Ethernet-Like Interface types MIB etc.

21. Management Interfaces: Web-based: HTTP/HTTPS, Command-line interface: Telnet, Secure Shell (SSH) Protocol, serial port & Wireless Control System (WCS)

22. Security Standards: WPA, IEEE 802.11i (WPA2, RSN), RFC 1321 MD5 Message-Digest Algorithm, RFC 1851 The ESP Triple DES Transform, RFC 2104 HMAC: Keyed Hashing for Message Authentication, RFC 2246 TLS Protocol Version 1.0, RFC 2401 Security Architecture for the Internet Protocol, RFC 2403 HMAC-MD5-96 within ESP and AH, RFC 2404 HMAC-SHA-1-96 within ESP and AH, RFC 2406 IPsec, RFC 2407 Interpretation for ISAKMP, RFC 3686 Using AES Counter Mode with IPsec ESP, RFC 4347 Datagram Transport Layer Security, RFC 3280 Internet X.509 PKI Certificate and CRL Profile

23. Radio Standard: FCC Part 15.247, 15.407, 15. 107 and 15.109; EN 60601-1-2 EMC requirements for the medical directive 93/42.EEC

24. Security: Wi-Fi Protected Access 2 (WPA2), WPA, AES, TKIP, EAP-TLS, TTLS, MSCHAPv2, PEAP or EAP-MSCHAPv2, EAP-FAST, GTC, EAP Subscriber Identity Module

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Software

Unified Wireless Network Software

Warranty

1 (Three)-Years full warranty should be provided for this unit from the date of successful commissioning and onsite support.

Related Service

Yes

7 Media Converter

Principal

1. Brand: To be mentioned by tenderer

2. Model: To be mentioned by tenderer

- 3. Manufacturer:** To be mentioned by tenderer
- 4. Country of Origin:** To be mentioned by tenderer
- 5. Country of Assemble:** To be mentioned by tenderer
- 6. Quantity:** 04 (Four)
- 7. No. of Slot:** 14 bays to house up to 14 media converters
- 8. Box Type:** PVC folding type Box
- 9. Rack mount:** Standard 19-inch rack-mountable, 2U height
- 10. Power Supply:** Input: 100-240V~50/60Hz 3.0A(Max)
Output: +9.5VDC, 9.5A(Max.)
-Hot swappable redundant power supplies
- 11. Operating Temperature:** 0 °C ~40°C
- 12. Fan:** Cooling fans on back side (together with power supplies)

8 Fiber Optic Cable
i) Armored 24 Core Single Mode Fiber Optic Cable

Principal

- 1. Brand:** FUJIKURA/SYSTIMAX/USHAMARTIN/LINKBASIC or reputed international brand
- 2. Model:** To be mentioned by the bidder
- 3. Country of Origin:** To be mentioned by the bidder
- 4. Quantity:** 250 meters
- 5. Type of the cable:** Indoor Armored cable, Duct Cable
- 6. Fiber Mode:** 24 Core Single Mode Fiber
- 7. Number of fiber:** 6 fiber
- 8. Fiber Type:** ITU-T G 652, G 655
- 9. Loose Tube Material:** PBTP
- 10. Water Resistance:** Thixotropic Jelly
- 11. Strength:** Glass Reinforcement fiber Yarn
- 12. Moisture Barrier:** Water Swellable tape
- 13. Armouring Material:** Copolymer Coated S. S. Tape, Copolymer Coated Chrome Plated MS Tape.
- 14. Jacket Compound:** HDPE (anti-termite or Normal)
- 15. Attenuation at 1310 nm (dB/km):** < 0.36 for G 652 fiber
- 16. Attenuation at 1550 nm (dB/km):** < 0.25 for G 652 fiber
- 17. Temperature of Operation (°c):** - 20 to +70
- 18. Tensile Strength (Newton):** 1.3 W/ 2.0*W/ 2.5 *W or as per requirement.
- 19. Crush Resistance (Newton):** 2000, 4000 or as per requirement.
- 20. Impact Resistance (Newton*Meter):** 25
- 21. Torsion Test:** 360°; 10 cycles
- 22. Minimum Bending Radius (mm):** 20*D
- 23. Repeated Bending:** 20 * D, 30 Cycles
- 24. Static bending (mm):** 10* D
- 25. Water Penetration Test:** No seepage
- 26. Drip test:** No drainage at 70 °C
- 27. Kink Resistance (mm):** No kink at minimum bending radius

Warranty

5 (Five)-Years full warranty

Related Service

Yes

Section VI: Works Requirements
Specification Part-2: Access Road

**ii) Armored 12 Core
Single Mode Fiber
Optic Cable**

- 1. Brand:** FUJIKU-RA/SYSTIMAX/USHAMARTIN/LINKBASIC or reputed international brand
- 2. Model:** To be mentioned by the bidder
- 3. Country of Origin:** To be mentioned by the bidder
- 4. Quantity:** 500 meters
- 5. Type of the cable:** Indoor Armored cable, Duct Cable
- 6. Fiber Mode:** 12 Core Single Mode Fiber
- 7. Number of fiber:** 6 fiber
- 8. Fiber Type:** ITU-T G 652, G 655
- 9. Loose Tube Material:** PBTP
- 10. Water Resistance:** Thixotropic Jelly
- 11. Strength:** Glass Reinforcement fiber Yarn
- 12. Moisture Barrier:** Water Swellable tape
- 13. Armouring Material:** Copolymer Coated S. S. Tape, Copolymer Coated Chrome Plated MS Tape.
- 14. Jacket Compound:** HDPE (anti-termite or Normal)
- 15. Attenuation at 1310 nm (dB/km):** < 0.36 for G 652 fiber
- 16. Attenuation at 1550 nm (dB/km):** < 0.25 for G 652 fiber
- 17. Temperature of Operation (°c):** - 20 to +70
- 18. Tensile Strength (Newton):** 1.3 W/ 2.0*W/ 2.5 *W or as per requirement.
- 19. Crush Resistance (Newton):** 2000, 4000 or as per requirement.
- 20. Impact Resistance (Newton*Meter):** 25
- 21. Torsion Test:** 360°; 10 cycles
- 22. Minimum Bending Radius (mm):** 20*D
- 23. Repeated Bending:** 20 * D, 30 Cycles
- 24. Static bending (mm):** 10* D
- 25. Water Penetration Test:** No seepage
- 26. Drip test:** No drainage at 70 °C
- 27. Kink Resistance (mm):** No kink at minimum bending radius

Warranty

5 (Five)-Years full warranty

Related Service

Yes

**iii) Armored 4 Core
Single Mode Fiber
Optic Cable**

- 1. Brand:** FUJIKU-RA/SYSTIMAX/USHAMARTIN/LINKBASIC or reputed international brand
- 2. Model:** To be mentioned by the bidder
- 3. Country of Origin:** To be mentioned by the bidder
- 4. Quantity:** 350 meters
- 5. Type of the cable:** Indoor Armored cable, Duct Cable
- 6. Fiber Mode:** 4 Core Single Mode Fiber
- 7. Number of fiber:** 6 fiber
- 8. Fiber Type:** ITU-T G 652, G 655
- 9. Loose Tube Material:** PBTP
- 10. Water Resistance:** Thixotropic Jelly
- 11. Strength:** Glass Reinforcement fiber Yarn

Section VI: Works Requirements
Specification Part-2: Access Road

- 12. Moisture Barrier:** Water Swellable tape
- 13. Armouring Material:** Copolymer Coated S. S. Tape, Copolymer Coated Chrome Plated MS Tape.
- 14. Jacket Compound:** HDPE (anti-termite or Normal)
- 15. Attenuation at 1310 nm (dB/km):** < 0.36 for G 652 fiber
- 16. Attenuation at 1550 nm (dB/km):** < 0.25 for G 652 fiber
- 17. Temperature of Operation (°c):** - 20 to +70
- 18. Tensile Strength (Newton):** 1.3 W/ 2.0*W/ 2.5 *W or as per requirement.
- 19. Crush Resistance (Newton):** 2000, 4000 or as per requirement.
- 20. Impact Resistance (Newton*Meter):** 25
- 21. Torsion Test:** 360°; 10 cycles
- 22. Minimum Bending Radius (mm):** 20*D
- 23. Repeated Bending:** 20 * D, 30 Cycles
- 24. Static bending (mm):** 10* D
- 25. Water Penetration Test:** No seepage
- 26. Drip test:** No drainage at 70 °C
- 27. Kink Resistance (mm):** No kink at minimum bending radius

Warranty

5 (Five)-Years full warranty

Related Service

Yes

**42U Floor Mount
 11 Server/Network Cabinet Rack**

Principal

- 1. Brand:** PANDUIT/LINKBASIC/SYSTIMAX/APC or any reputed international brand
- 2. Model:** To be mentioned by tenderer
- 3. Manufacturer:** To be mentioned by tenderer
- 4. Country of Origin:** USA/CANADA or equivalent
- 5. Quantity:** 01 (One)
- 6. Standard:** Comply with ANSI/EIA RS-310-A, DIN41491; Part1, IEC297-2, DIN41494; Part7, GB/T3047.2-92 standard. Compatible with metric, ETSI and 19" international standard.
- 7. Materials:** Cold-rolled steel sheet. Thickness for frame 2.0, mounting rail 1.5mm, side panel 1.5mm, fixed shelf 1.5mm
- 8. Application:** Widely applied in Finance, Securities and data Centre and adapted by professional servers network providers as IBM, SUN, HP, Compaq, Dell etc.
- 9. Surface finish:** Degreasing, pickling, phosphoric, powder coating, the thickness of power coating.
- 10. Height:** 42U/2055mm
- 11. Type:** Floor mount
- 12. Width:** 600mm
- 13. Depth:** 1000mm
- 14. Color:** Black
- 15. Front Door & Rear door:** Front door glass with perforated punch and rear door ventilation with advance lock.

- 16. Side panels:** Side panels, each panel can be easily assembled separately.
- 17. Adjustable kit & load capacity:** Adjustable feet and heavy duty castors are available at the same time static loading: 800kg.
- 18. Cooling Fan:** 4 NOS with UK Power Cord
- 19. Power Distribution Unit (PDU)*1pcs:** 6 Point Power Strip Unit, 13AMP
- 20. Digital Temperature Meter:** 1U*1/pcs Digital Temperature Meter. (Rackmounted)

Warranty

5 (Five) years full warranty

Related Service

Yes

12 Online UPS

Principal

- 1. Brand:** APC/APOLLO or equivalent
- 2. Model:** To be mentioned by the Tendered
- 3. Manufacturer:** To be mentioned by tenderer
- 4. Country of the origin:** USA/UK/CANADA or equivalent
- 5. Encloser Type:** Rack-mountable Modular Chassis
- 6. Quantity:** 01 (One)
- 7. General Data:** Rated Capacity- 5 KVA pure sine wave; Output Power Factor- 0.8; Transfer Time- Zero.
- 8. Input:** Nominal input voltage- 200 to 240Vrms; Voltage tolerance- 110-276 Vac (depending on the load); Frequency- 48-52 Hz; Power factor- ≥ 0.99 .
- 9. Output:** Nominal input voltage- 220 to 240VAC pure sine wave; Frequency- 48 to 52 Hz; Frequency Tolerance- 45-55 Hz; Overload capability- Normal mode: 1 min.: 105 % – 110 % or 30 s.: 110 % – 120 % Battery mode: 10 s.: 125 % – 150 % or 1 s.: > 150 %
- 10. Efficiency:** AC to AC- Up to 88 % and In eco-mode configuration- Upto 94%
- 11. Battery:** Type- Sealed Maintenance Free-VRLA; Backup Time- At least 15 minutes at 100% load
- 12. Communication:** LCD display- LCD Display should show all necessary information. Brand name must be shown when UPS starts.
Communication ports- USB, RS-232, SNMP slot, potential-free contacts
- 13. Software and Interface:** Remote Monitoring & Management- UPS Monitoring and Management Software and Ethernet interface from ups.
Software- Provided software's functions should include monitoring and Controlling the UPS remotely through TCP/IP

Section VI: Works Requirements
Specification Part-2: Access Road

14. Standards: ESD- IEC 61000-4-2 Level 3
RS- IEC 61000-4-3 Level 3
EFT- IEC 61000-4-4 Level 4
Surge- IEC 61000-4-5 Level 4
Conduction- IEC 62040-2 Category C3
Radiation- IEC 62040-2 Category C3
Safety- IEC 62040-1-1
Protection- IP20 (static)
Weight- Should not exceed 13 Kg without battery

Associated

(required ratings are indicative only; tendered rating shall conform to manufacturers standard aforementioned model design)

Others

(shall conform to manufacturers standard design)

Software

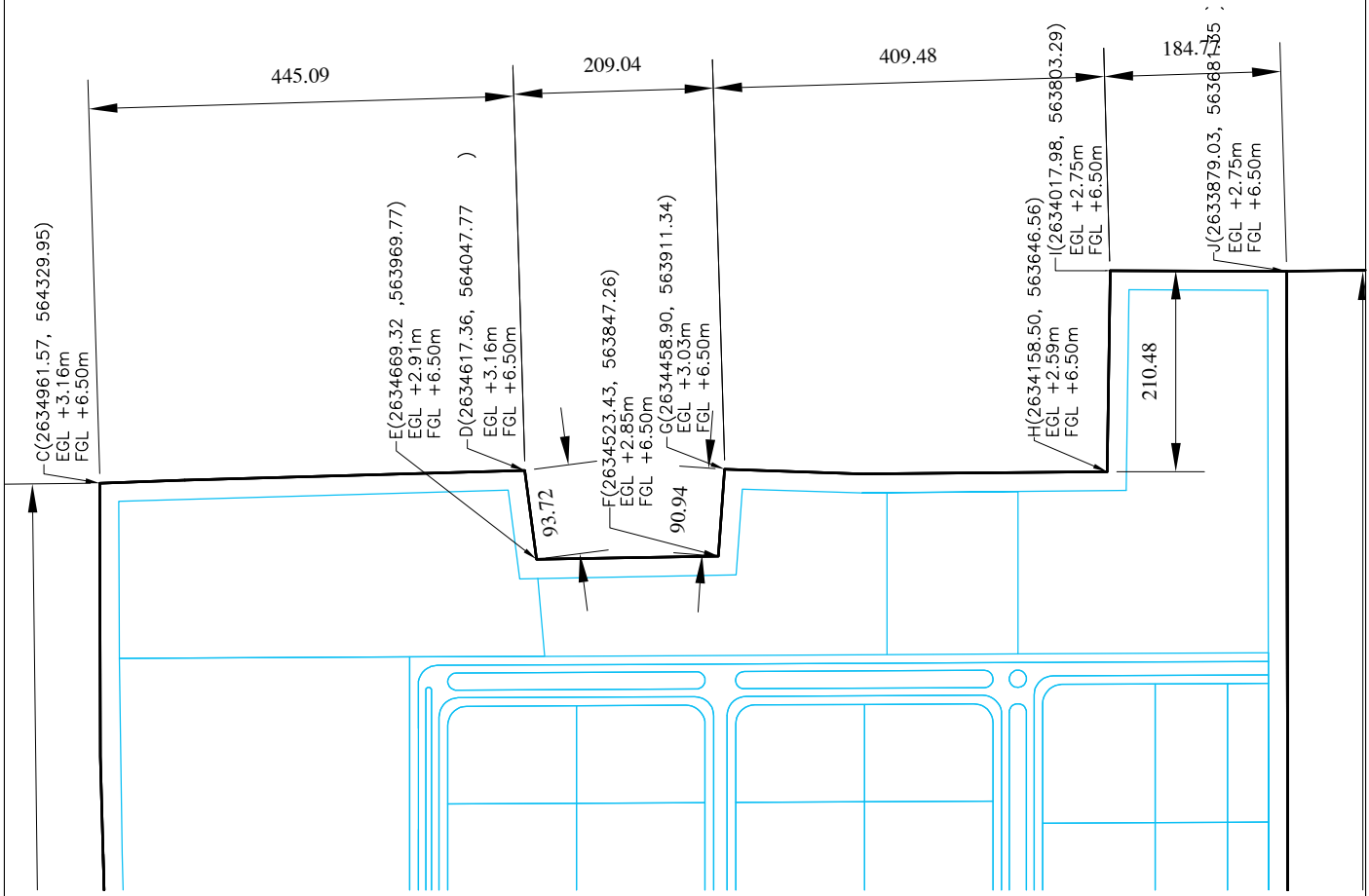
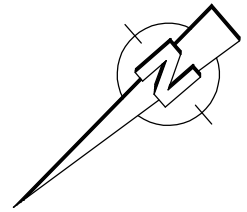
Unified Wireless Network Software

Warranty

1 (Three)-Year full warranty including battery should be provided for this unit from the date of successful commissioning and onsite support.

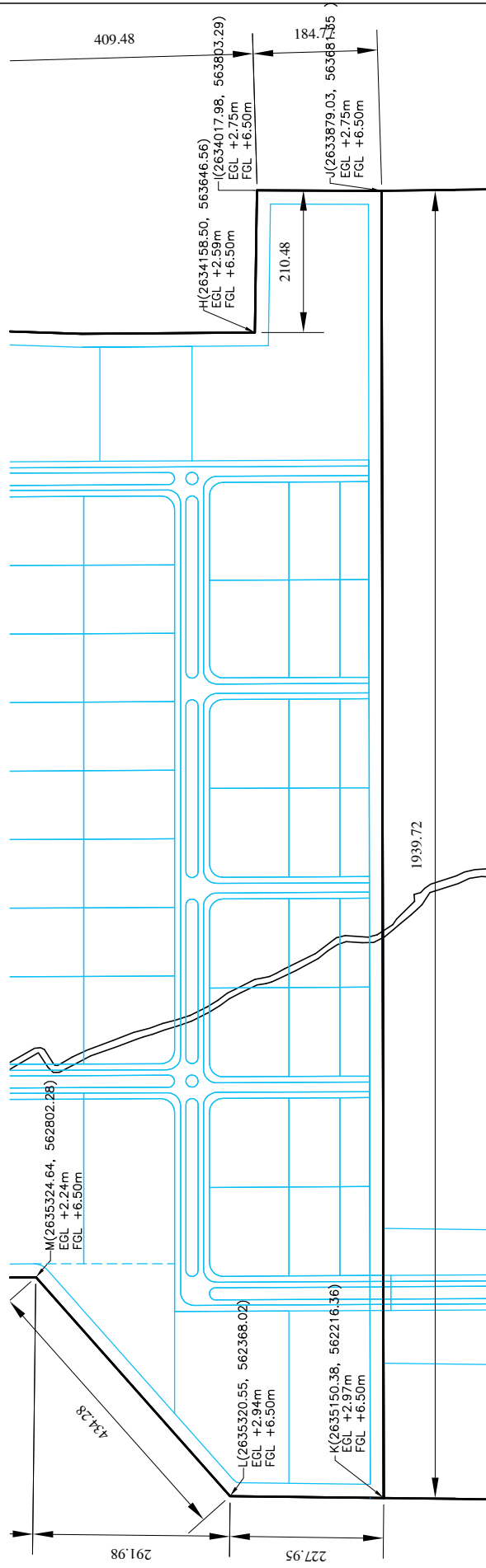
Related Service

Yes

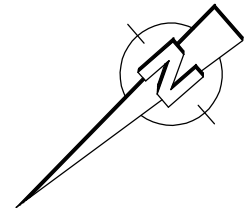


LAND DEVELOPMENT, BOUNDARY PLAN (2/4)
SCALE : 1:6

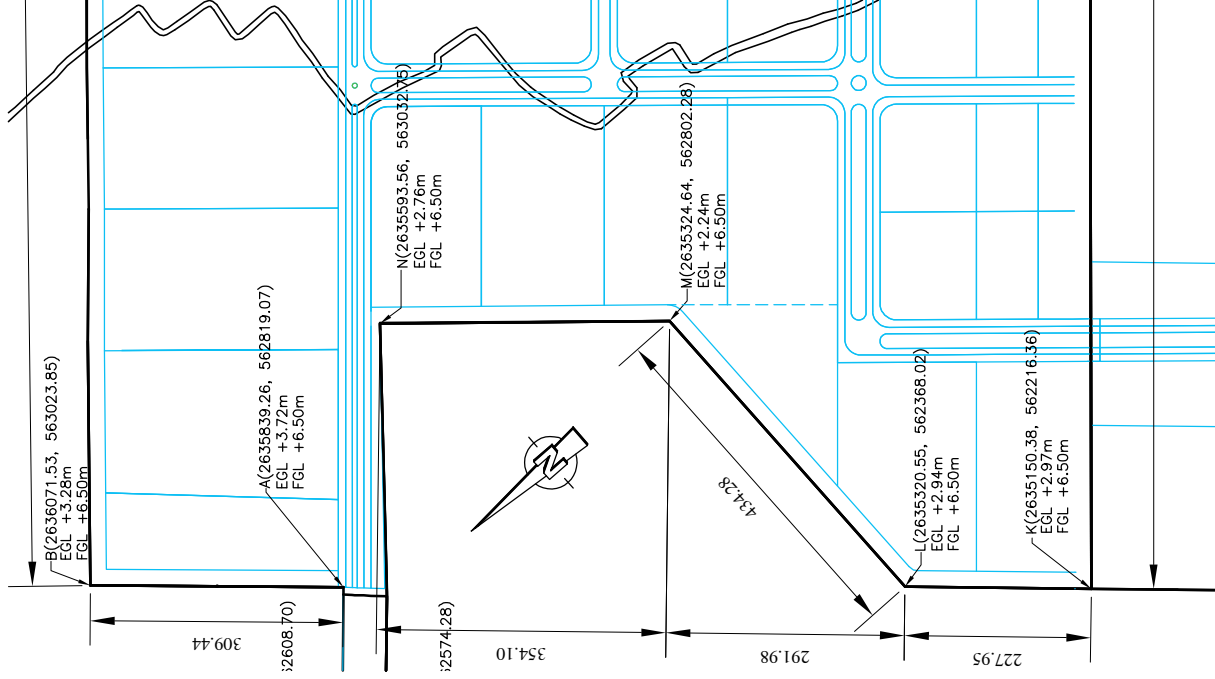
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	LD-03
Drawing Title	Land Development, Boundary Plan (2/4)
Scale	As Shown
JICA SAPI Team	



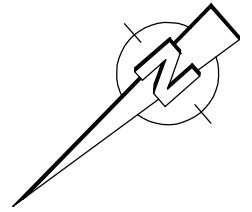
LAND DEVELOPMENT, BOUNDARY PLAN (3/4)
SCALE : 1:8



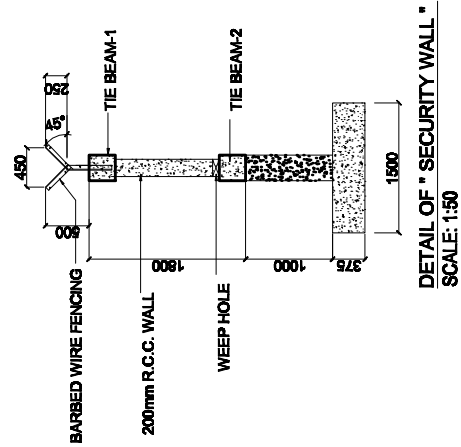
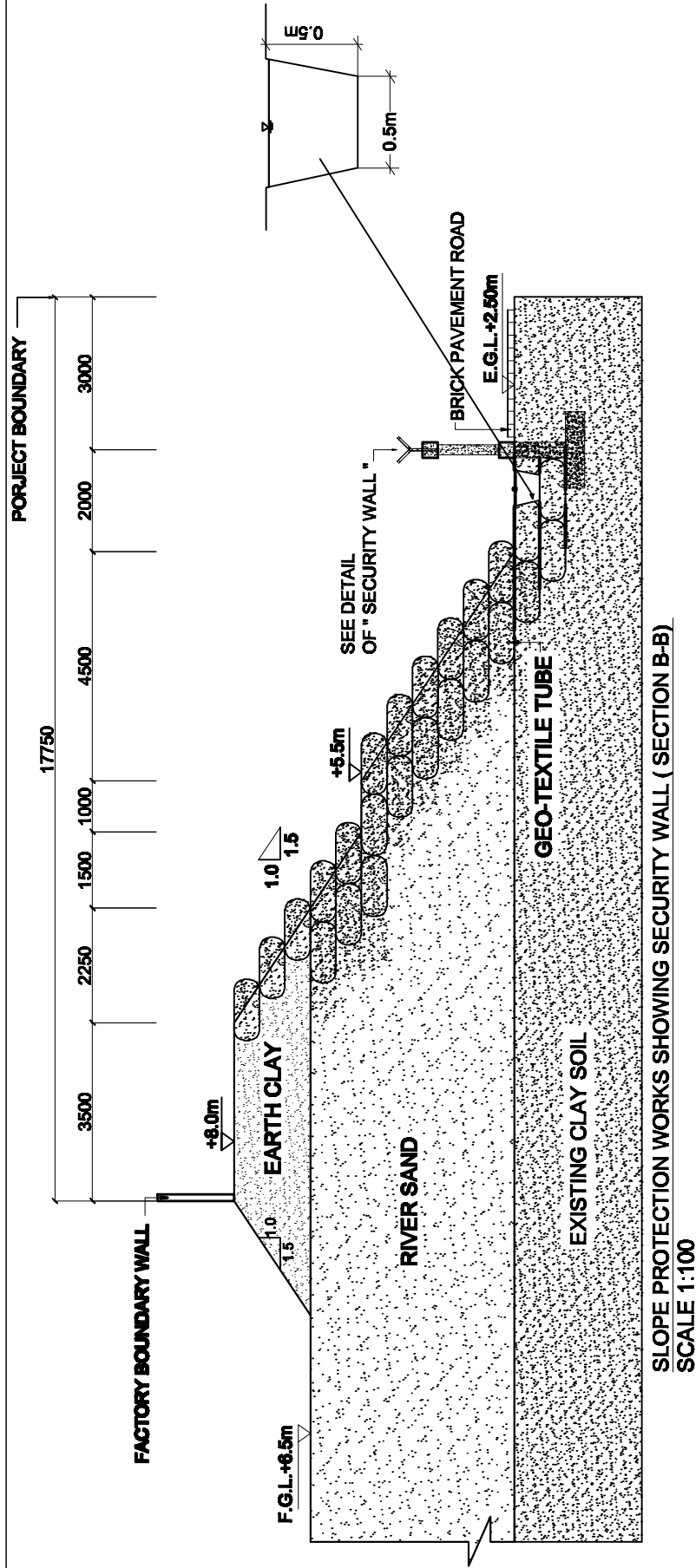
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Arathazar Upazila, Narayanganj District
Drawing No.	LD-04
Drawing Title	Land Development, Boundary Plan (3/4)
Scale	As Shown
JICA SAPI Team	



LAND DEVELOPMENT, BOUNDARY PLAN (4/4)
SCALE : 1:6



Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	LD-05
Drawing Title	Land Development, Boundary Plan (4/4)
Scale	As Shown
JICA SAPI Team	



DETAIL OF "SECURITY WALL"
SCALE: 1:50

SLOPE PROTECTION WORKS SHOWING SECURITY WALL (SECTION B-B)
SCALE 1:100

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Avadhut Upadhyay, Narsingpur District
Drawing No.	As per the drawing sheet
Drawing Title	SECURITY WALL (SECTION B-B)
Scale	As Shown
JICA BAPZ Team	

VOLUME IV: DRAWINGS

LAND DEVELOPMENT WORKS FOR ARAIHAZAR ECONOMIC ZONE DEVELOPMENT UNDER FOREIGN DIRECT INVESTMENT PROMOTION PROJECT (FDIPP)

No.	DWG. No.	DWG. Title
0. GENERAL		
1	G-01	Topographic Survey with Contour Map
2	G-02	Landuse and Plot Plan, Phase-1
3	G-03	Existing Gas Transmission Pipelines
1. LAND DEVELOPMENT		
4	LD-01	Land Development, General Plan
5	LD-02	Boundary Plan (1/4)
6	LD-03	Boundary Plan (2/4)
7	LD-04	Boundary Plan (3/4)
8	LD-05	Boundary Plan (4/4)
9	LD-06	Slope Protection Works
2. ACCESS ROAD		
10	RD-01	Access Road, General Plan & Sections
11	RD-02	Plan & Longitudinal Profile
12	RD-03	Cross Section
13	RD-04	Details of Retaining Wall
14	RD-05	Plan & Section of Underpass

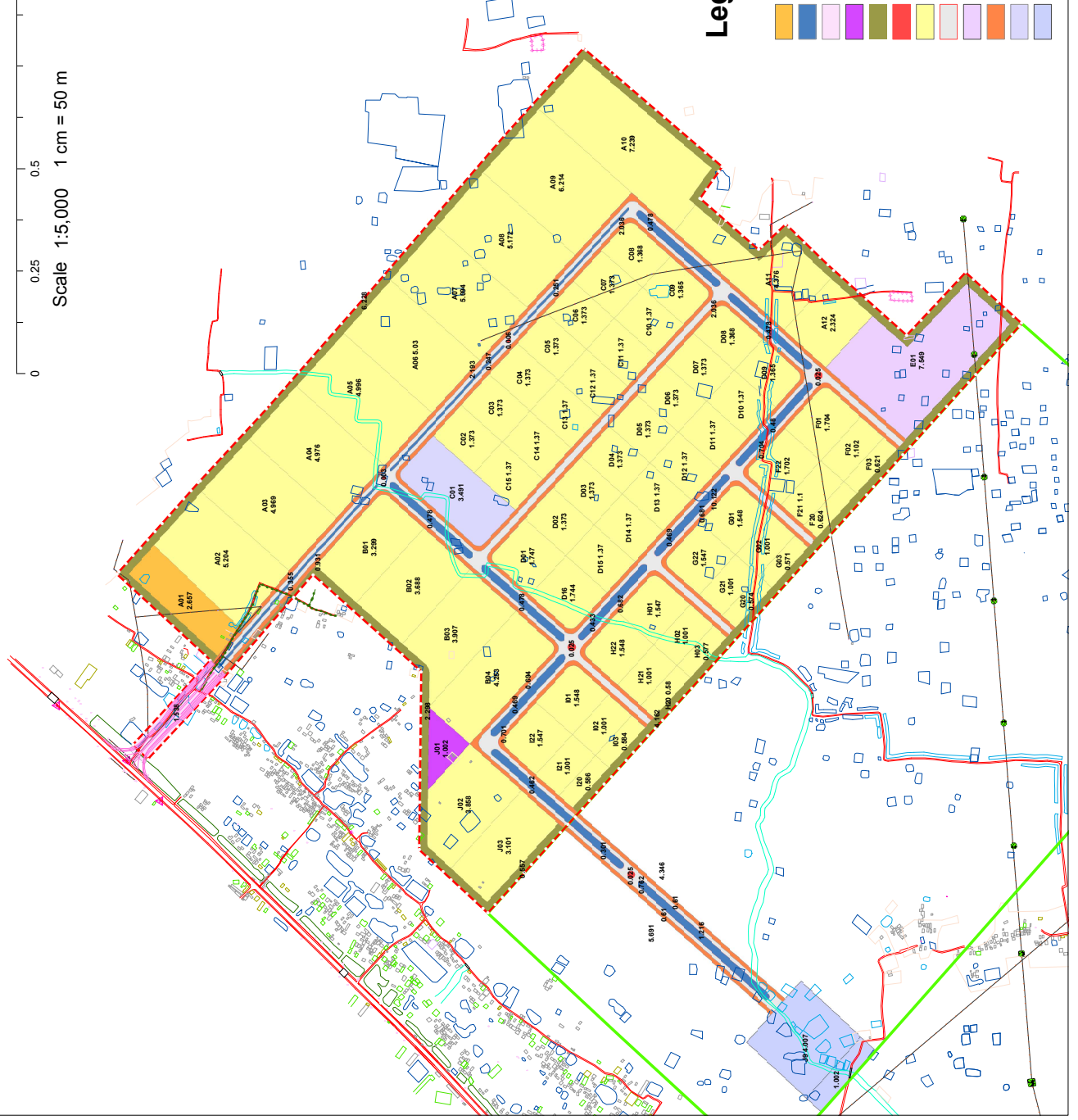
No.	DWG. No.	DWG. Title
3. RETENTION CANAL & POND w/ PUMP STATION		
15	RP-00	General Note
16	RP-01	Master Plan
17	RP-01A	General Plan
18	RP-02	Section: Retention Pond (Section A-A)
19	RP-03	Section: Retention Pond (Section B-B)
20	RP-03A	Blow Up Section: Retention Pond (Section B-B)
21	RP-04	Section: Retention Canal (Section C-C)
22	RP-13	Plan: Pump Station
23	RP-14	Elevation & Section: Pump Station (1/2)
24	RP-15	Elevation & Section: Pump Station (2/2)
25	RP-16	Column Layout Plan: Pump Station
26	RP-17	Footing Layout Plan: Pump Station
27	RP-18	Detail of Footing
28	RP-19	Detail of Column
29	RP-20	Grade Beam Layout Plan
30	RP-21	Roof Beam Layout Plan
31	RP-22	Detail of Grade Beam
32	RP-23	Detail of Roof Beam
33	RP-24	Reinforcement Detail of Roof Slab
34	RP-05	Plan: Sluice Gate
35	RP-26	Slab Outline +5.35m
36	RP-27	Slab Outline +9.00m
37	RP-28	Slab Outline +12.00m
38	RP-06	Section: Sluice Gate (Section A-A)
39	RP-07	Section: Sluice Gate (Section B-B)
40	RP-08	Reinforcement Detail of Bottom Slab
41	RP-32	Reinforcement Detail of Gate

LANDUSE AND PLOT PLAN OF ARAIHAZAR ECONOMIC ZONE PHASE - 01



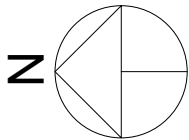
0 0.25 0.5 1 Km

Scale 1:5,000 1 cm = 50 m

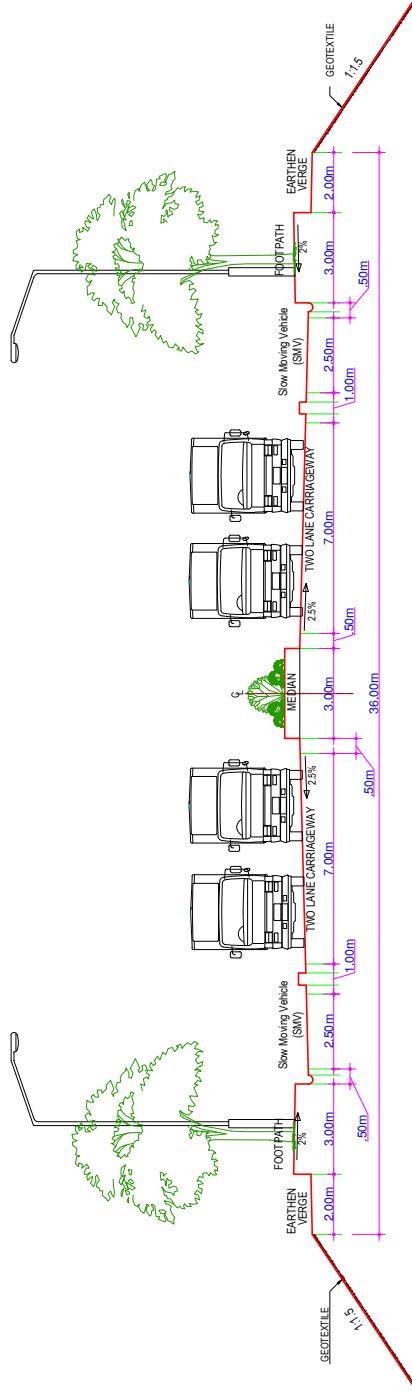
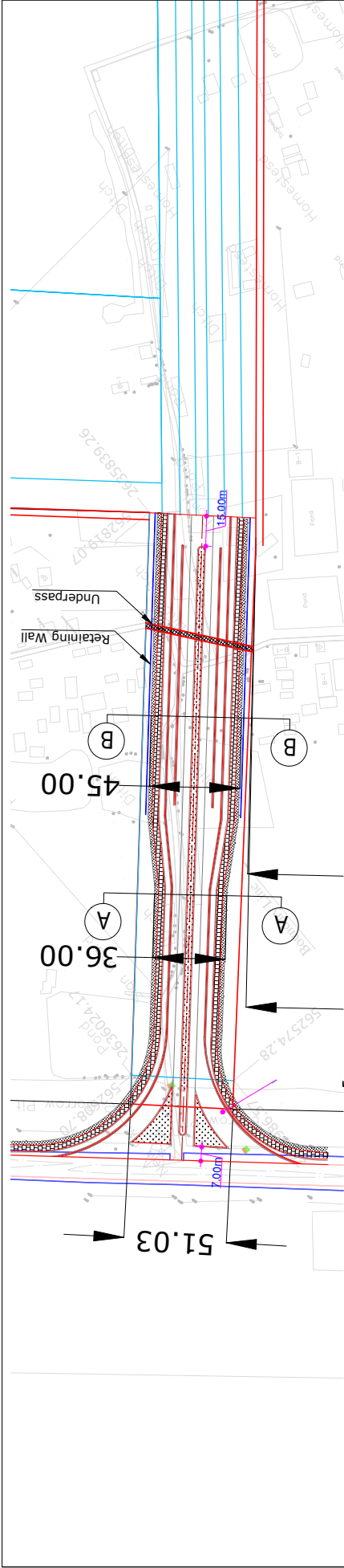


Legend

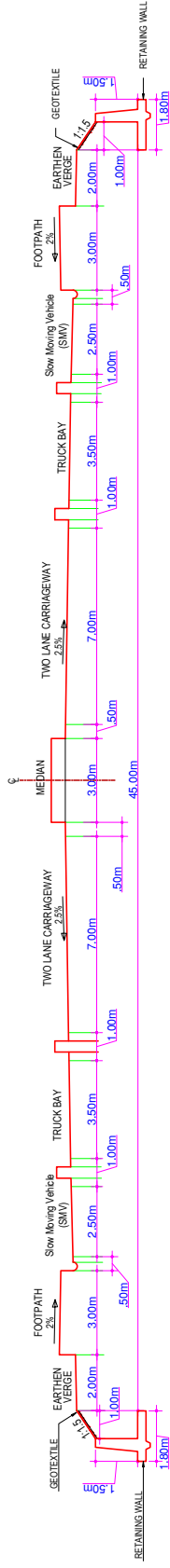
- | | | |
|--------------------------|------------------------|---------------------|
| Administration Area | Boundary Line Phase 1 | Electric Cable |
| Canal | Road | Electric Tower |
| Access Road | Boundary Line phase 2 | Grave Yard |
| Fire Station | Bridge/Culvert | Gas Pipe Line |
| Green Area (ROW to Plot) | Bench Marks | Homestead |
| Green Area (along road) | Borrow Pit | Plantation Area |
| Plot | Canal; KHAL | Pond |
| Road | DITCH | Semi Pucca Building |
| Sub Station & Generator | Utility Area/Road Side | Pucca Building |
| WTP STP | Existing Road | Tinshed House |
| Water retention area | Electric Post | |



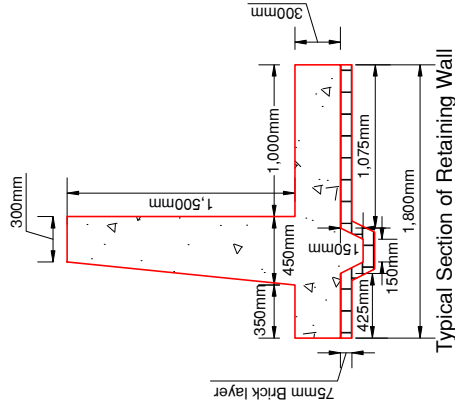
Project Name: JEZ Gas Line Trial Pit Survey			
DWG. Title: Index Map of Trial Pit Locations	Issue	Date	Amendment
Survey: TK	A	17.09.18	None
Validated: DMK			
Drawn: MSH			
Scale: 1:10,000 @ A3			
Approved			
DMK			



CROSS SECTION (A-A) OF ACCESS ROAD

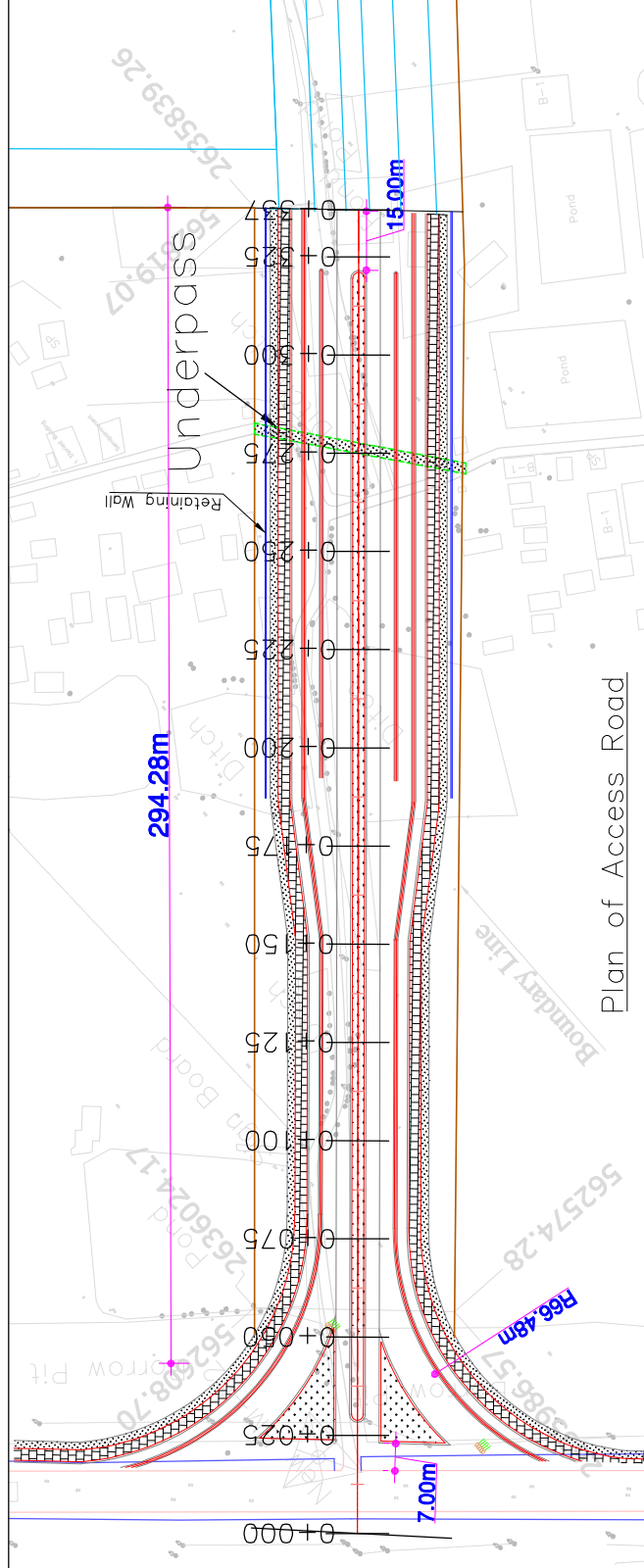


CROSS SECTION (B-B) OF ACCESS ROAD

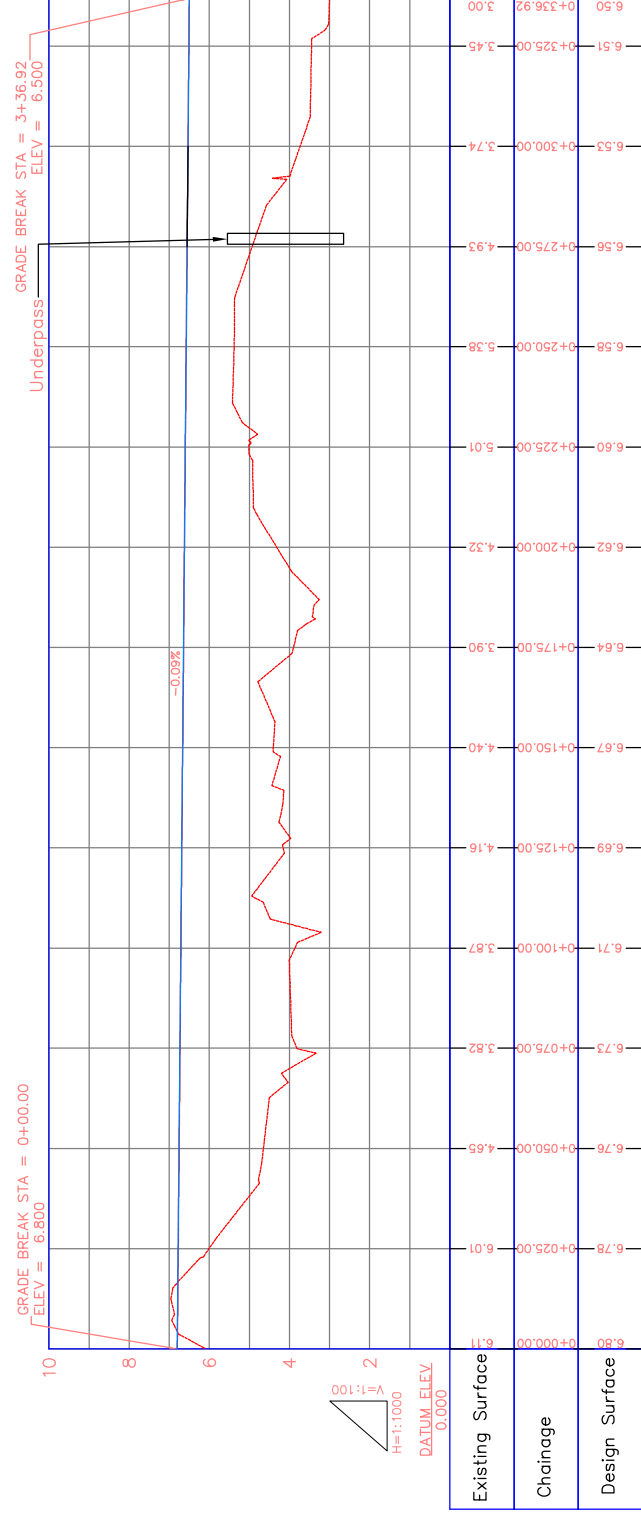


Typical Section of Retaining Wall

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDJPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RD-01
Drawing Title	Plan & Section of Access Road
Scale	As Shown
JICA SAPI Team	

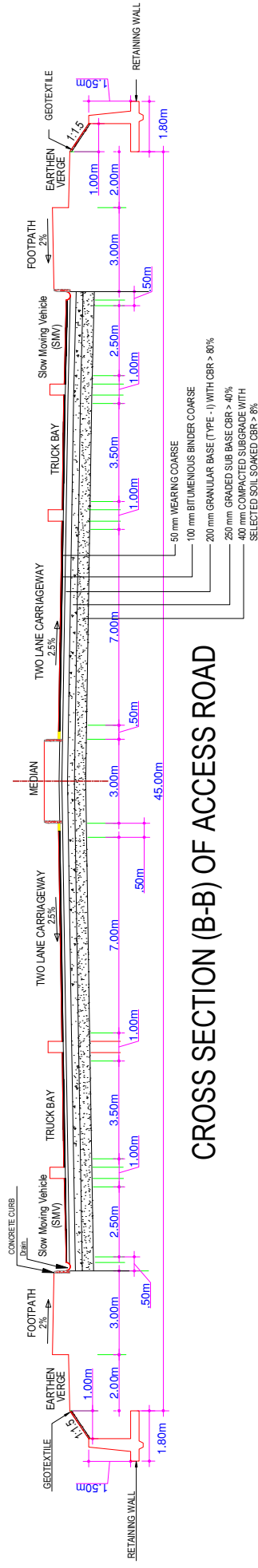
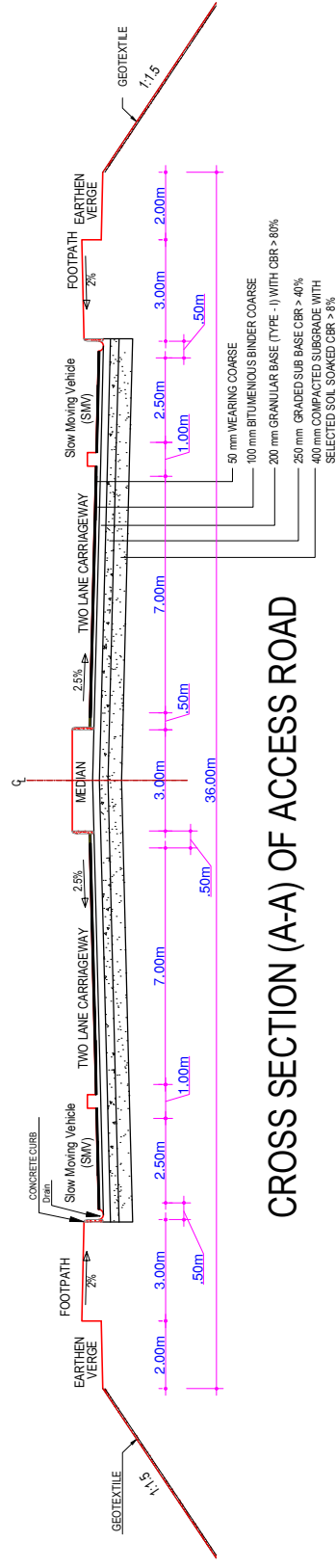


Plan of Access Road

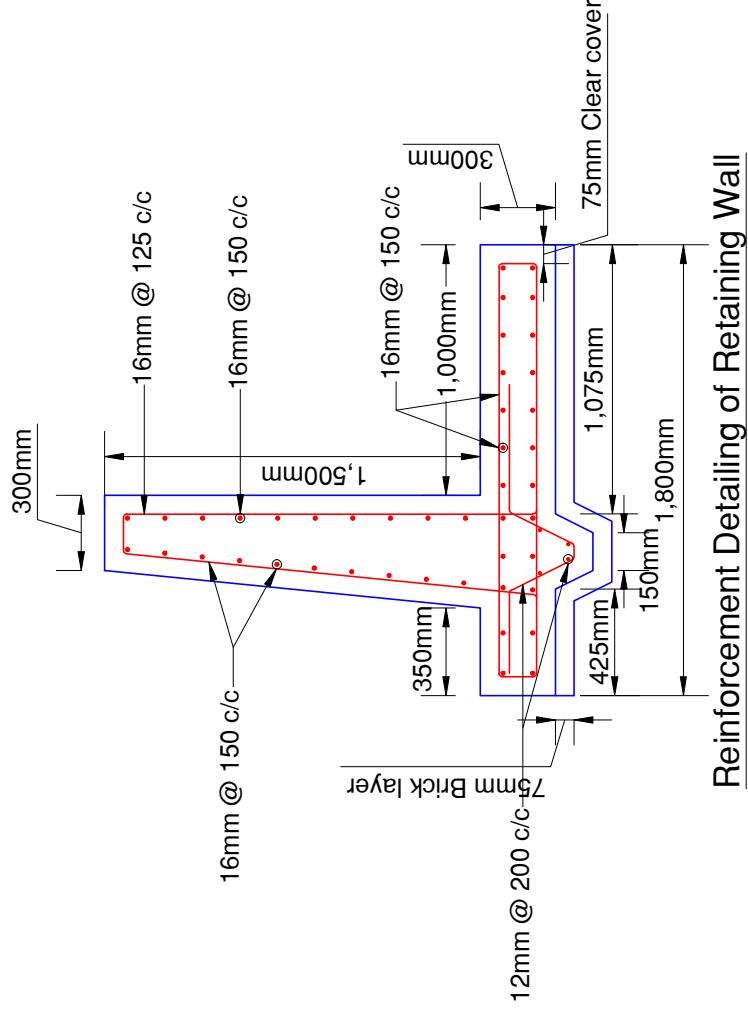
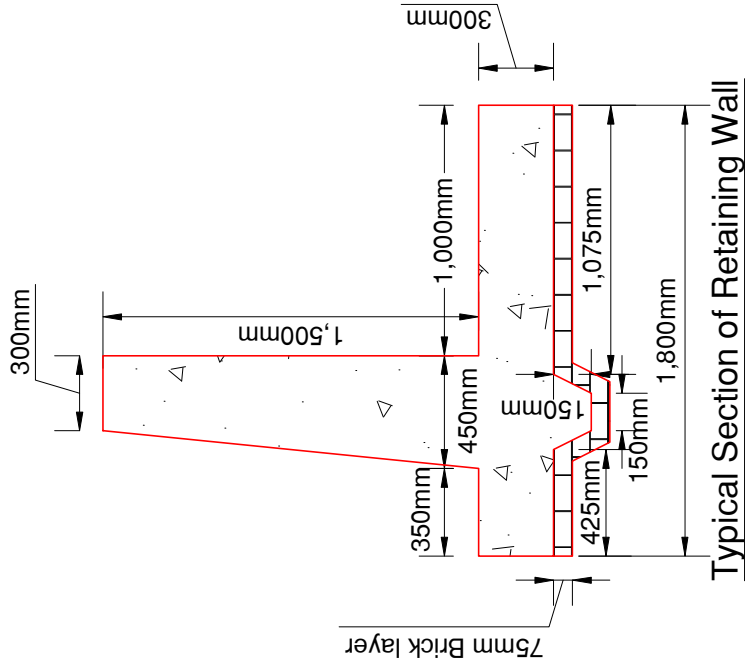


Longitudinal Profile of Access Road

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Aralhazar Upazila,Narayanganj District
Drawing No.	RD-02
Drawing Title	Longitudinal Profile Of Access Road
Scale	As Shown
	JICA SAPI Team



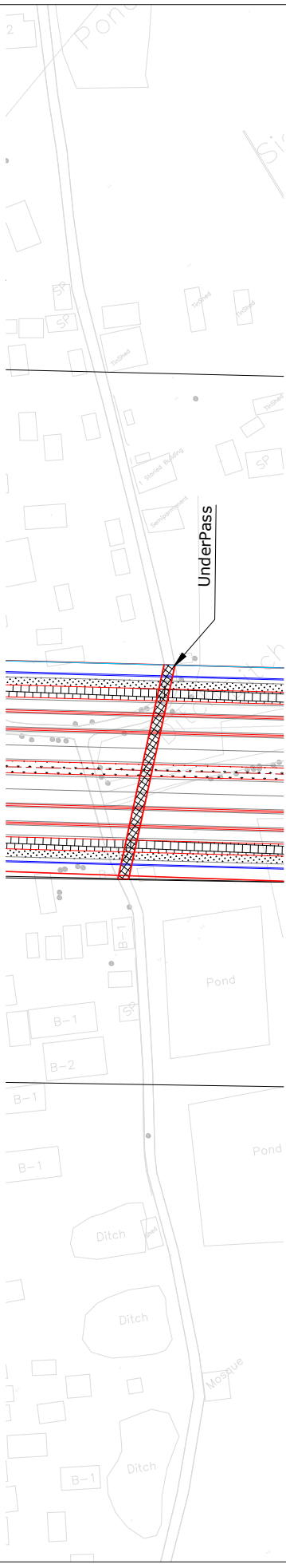
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila,Narayanganj District
Drawing No.	RD-04
Drawing Title	Access Road Detail Section
Scale	As Shown
	JICA SAPI Team



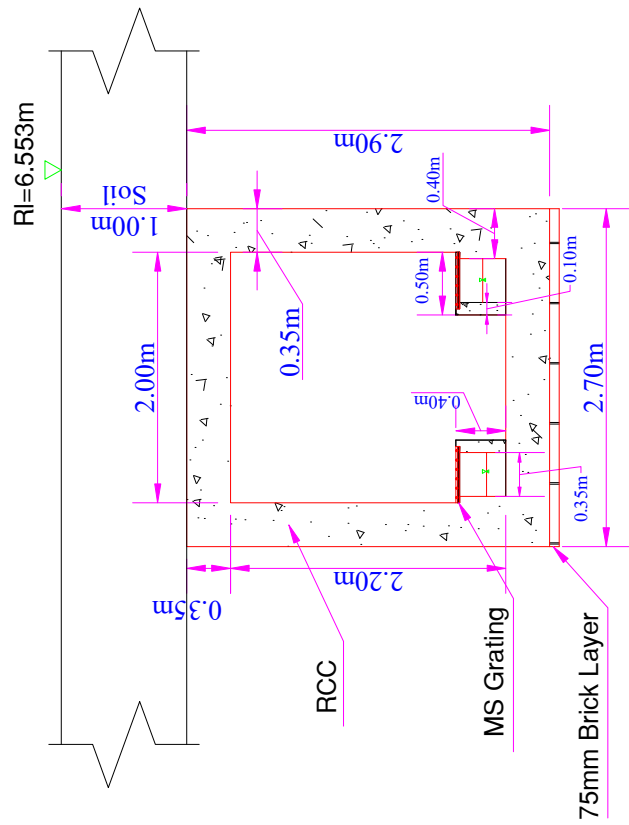
Typical Section of Retaining Wall

Reinforcement Detailing of Retaining Wall

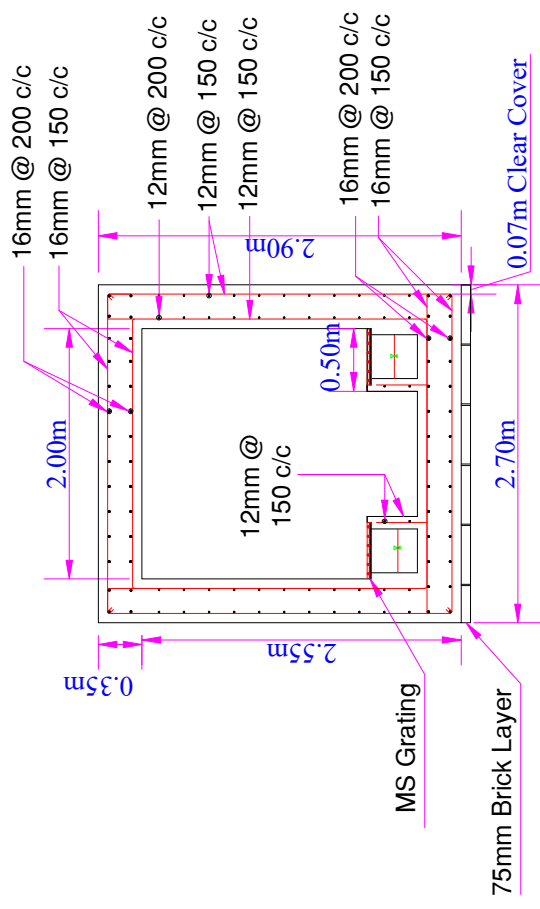
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDJPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RD-05
Drawing Title	Detailing of Retaining wall
Scale	As Shown
JICA SAPI Team	



Plan of Underpass



Typical Cross Section of Underpass



Reinforcement Detailing of Underpass

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDJPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RD-06
Drawing Title	Plan & Detailing of Underpass
Scale	As Shown
JICA SAPI Team	

GENERAL NOTERP

1. GENERAL

- DESIGN METHOD UPDPP ARE UPDPP ACCORDING TO INDIA'S DESIGNATIONAL BUILDING CODE (BCC) 1987, IS: 10137 AND IS: 456.
- ALL THE REINFORCEMENT DRAWINGS SHALL BE READ IN CONJUNCTION WITH RELEVANT ARCHITECTURAL DRAWINGS.
- FOLLOWING BUILDING FOR REINFORCEMENT STRUCTURAL REQUIREMENTS NOT MENTIONED IN THE DRAWINGS OR IN THEIR NOTE SHEET.
- ANY DETAIL NOT SHOWN IN THE DRAWING SHOULD BE DONE ACCORDING TO ACI DETAILING MANUAL.
- BARING WIND SPEED = 210 km/hr
- REINFORCING ZONE - 2
- OTHER LOADS ARE PER IS: 800

2. CONCRETE :

- TYPE : CONCRETE COMPRESSION STRENGTH CONSIDERED ARE FOLLOWING :

1) ALL COLUMN, WALL, f_{ck} = MINIMUM 20 MPa (M20) FOR
WALL, RAMP, BEAM, RPTLR & ETC, f_{ck} = 25 MPa (M25) FOR

WHICH ARE TO BE CONFORMED BY TRUL MIX DESIGN.

- MINIMUM CYLINDER STRENGTH : BASED ON CYLINDER TEST OF

DIAMETER, $D = 150\text{mm}$ & HEIGHT, $H = 300\text{mm}$

1) 28TH DAY STRENGTH, $f_{ck} = 25\text{ N/mm}^2$ (3.5 Mpa)

1) 7TH DAY STRENGTH, $f_{ck} = 24\text{ N/mm}^2$ (2.0 Mpa)

- CURING OF R.C.C. WORK :

1) DURING THE MINIMUM 14 DAYS

- METHOD OF CURING :

* HORIZONTAL SURFACE - BY FLOODING OF WATER
* OTHER SURFACES - BY WRAPPING MOIST JUTE FABRIC AND
REFILLING WATER BY HOOPER PIPE FREQUENTLY.

3. CEMENT

CEMENT PORTLAND CEMENT CONFORMING TO IS: 800 : MINIMUM CLASS

4. CONCRETE AGGREGATE

- TYPE AGGREGATE : RAMP OF F.A. 2.5 (MIL.)
- COARSE AGGREGATE : 20mm DOWN WELL GRADED CRUSHED RPTONE CHIPP TO BE USED ARE COARSE AGGREGATE IN ALL R.C.C. WORK EXCEPT RAILING, DROPWALL, FRRP FOR WHICH 12mm DOWN GRADED RPTONE CHIPP TO BE USED.

5. WATER

POTABLE WATER TO BE USED IN ALL CONCRETE MIX.

6. RPTLR REINFORCEMENT

- ALL PILE, RPTLR, PILE, MAT, COLUMN, WALL, R & BEAM REINFORCEMENT ARE OF 60 GRADE HIGH RPTLR DEFORMED BAR MADE FROM BILLET RPTLR.
- RPTLR, WATER TANK, RPTLR, LINTEL, ETC. REINFORCEMENT ARE OF 60 GRADE HIGH DEFORMED BAR MADE FROM BILLET RPTLR.
- YIELD STRENGTH OF RPTLR $f_y = 415\text{ MPa}$ (60000 RPTLR) CONFORMED TO ONE OF THE FOLLOWING SPECIFICATIONS: 1) IS: 1786, 2) ASTM A1786
- THE FOLLOWING TESTS FOR REINFORCING BARR FROM RANDOM RPTLR SHALL BE CONDUCTED AT BUREAU PER IS: 1786 AND TEST REPORT SHALL BE SUBMITTED TO THE ENGINEER FOR CHECKING AND RECORD :
 - TENSILE STRENGTH TEST
 - TENSILE ELONGATION TEST
 - BEND TEST

7. LAP LENGTH

LAP LENGTH OF BARRS MENTIONED IN THE DRAWING, LAP LENGTH OF BARR SHALL BE :

BAR DIA (mm)	TENSION (mm)	COMPRESSION (mm)
100	350	300
120	475	350
150	600	450
200	800	600
250	1000	800
300	1175	950
350	1350	1100

COLUMN LAP SHALL BE TENSION LAP

8. HOOKUP OF BARR

- FOR ALL BARR : PROVIDE 90° BENT (HOOKUP) IF NOT SHOWN IN THE DRAWING.

9. REINFORCING BARR

TO REINFORCE RPTLR LAYER BARR IN BEAM, RPTLR AND RPTLR BARR @ 1000 C/C WHERE REQUIRED.

10. CHAIRS

USE CHAIRS OF REINFORCEMENT DIMENSION MADE OF 200 RPTLR BARR TO REINFORCE TOP BARR OF MAT @ 1000 C/C.

11. DEVELOPMENT LENGTH

ALL BEAM AND RPTLR BARR SHOULD BE EXTENDED INTO THE RPTLR UP TO DEVELOPMENT LENGTH.

12. APPROVAL

APPROVAL BY THE DESIGN ENGINEER.

13. WATER RPTLR

25mm. WIDE PVC WATER RPTLR TO BE USED AT ALL CONSTRUCTION JOINTS BELOW GROUND IN MAT, RETAIN WALL & WATER TANK WALL.

14. CORNER REINFORCEMENT (CR)

CORNER REINFORCEMENT FOR BEAM RPTLR 2-WAY RPTLR
15. CONCRETE CLEAN COVER FOR REINFORCING BARR

Member	Location/Condition	Cover (mm)	Figure
Wall	Above Mat	40	40
Resisting Wall	Exterior	65	65
	Interior	40	40
Water Tank	Water Side	65	65
	Other Side	65	65

* FROM 50
* FROM RPTLR

16. MAXIMUM BARR IN BEAM IN RPTLR LAYER

MAXIMUM NUMBER OF BARR ARE A SINGLE LAYER IN BEAM

RPTLR SHALL BE PER ACI DETAILING MANUAL.

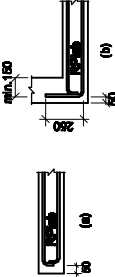
17. MINIMUM BARR RPTLR OF COLUMN

LONGITUDINAL BARR

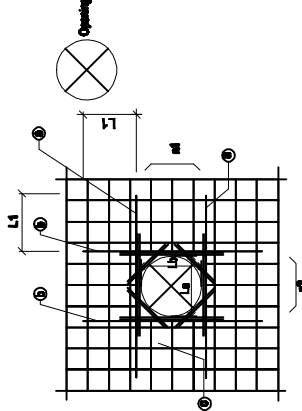
CLEAR DISTANCE BETWEEN LONGITUDINAL BARR RPTLR NOT BE LESSER THAN 1.5 TIMES BAR DIAMETER, 1.5 TIMES OF THE MAXIMUM SIZE OF COARSE AGGREGATE NOT 40mm.

18. RPTLR END REINFORCING DETAIL

- FREE END OF RPTLR IS CAPABLE OF EMBEDDING OF RPTLR BAR IN BEAM WALL
- OTHERS



19. REINFORCEMENT DETAIL FOR RPTLR OPENING



NOTE: The number of bars which are cut off for example

- The number of bars $n/2$ for example
- The number of bars $n/2$ for example
- The number of bars $n/2$ for example
- The number of bars $n/2$ for example
- The number of bars $n/2$ for example

20. RECOMMENDED END HOOK

Bar Hook	Form and Extension	Bend Angle (Degree)	Bend Radius (mm)	Length (mm)	Location
Primary Hook		180°	$r = 4d$	25	Lap splice end of column
Top Hook		135°	$r = 1.5d$	25	Top of column for lap splice
Primary Hook		180°	$r = 4d$	25	End of column
RPTLR		180°	$r = 5d$	25	End of column

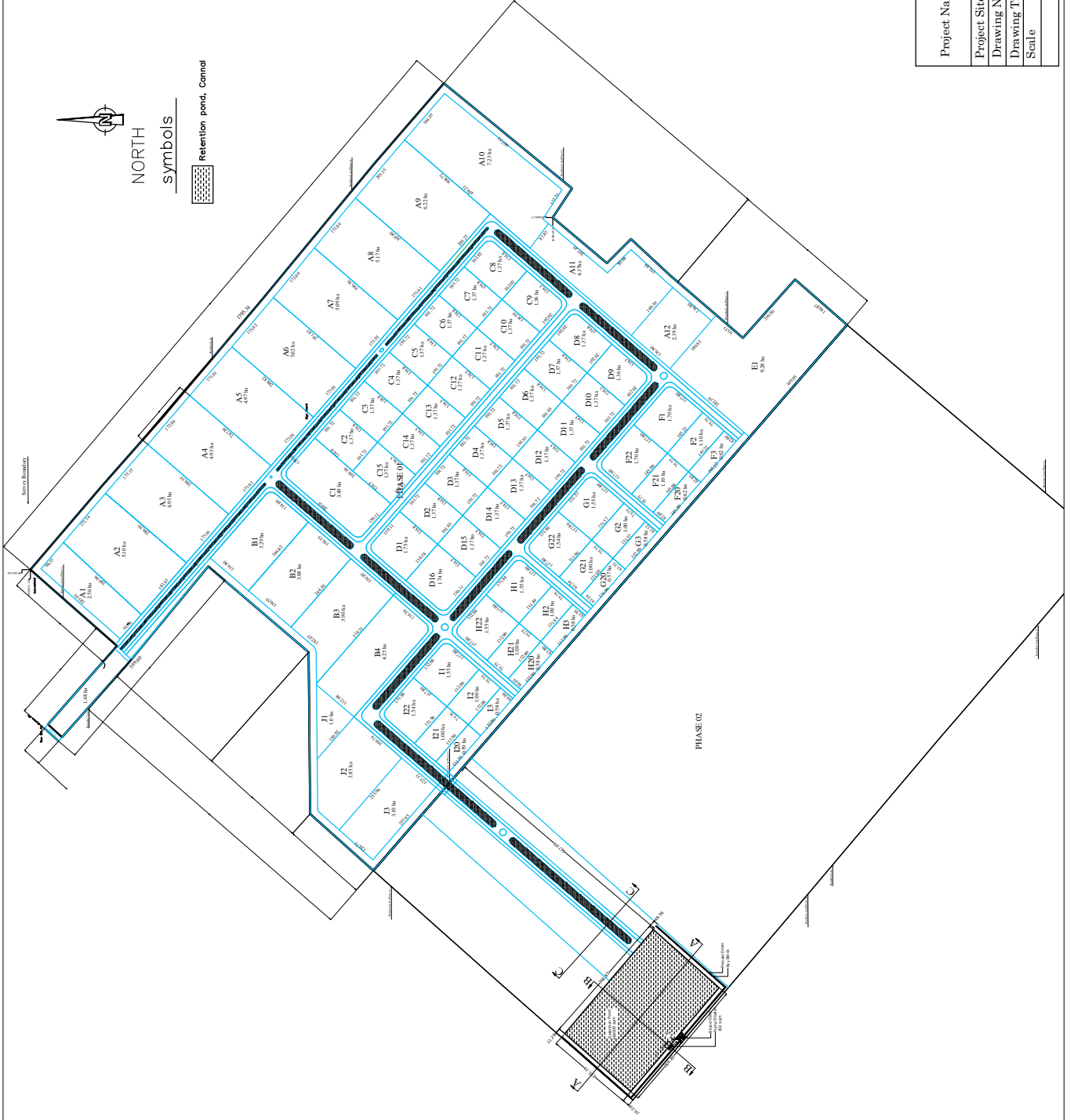
Project Name	RPTLR RPTLR for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project RPTLR	Aravind Upadhyaya, Narayana DTP
Drawing No.	RPTLR-02
Drawing Title	General Note
RPTLR	1:100 A8 RPTLR
	JICA RPTLR Team



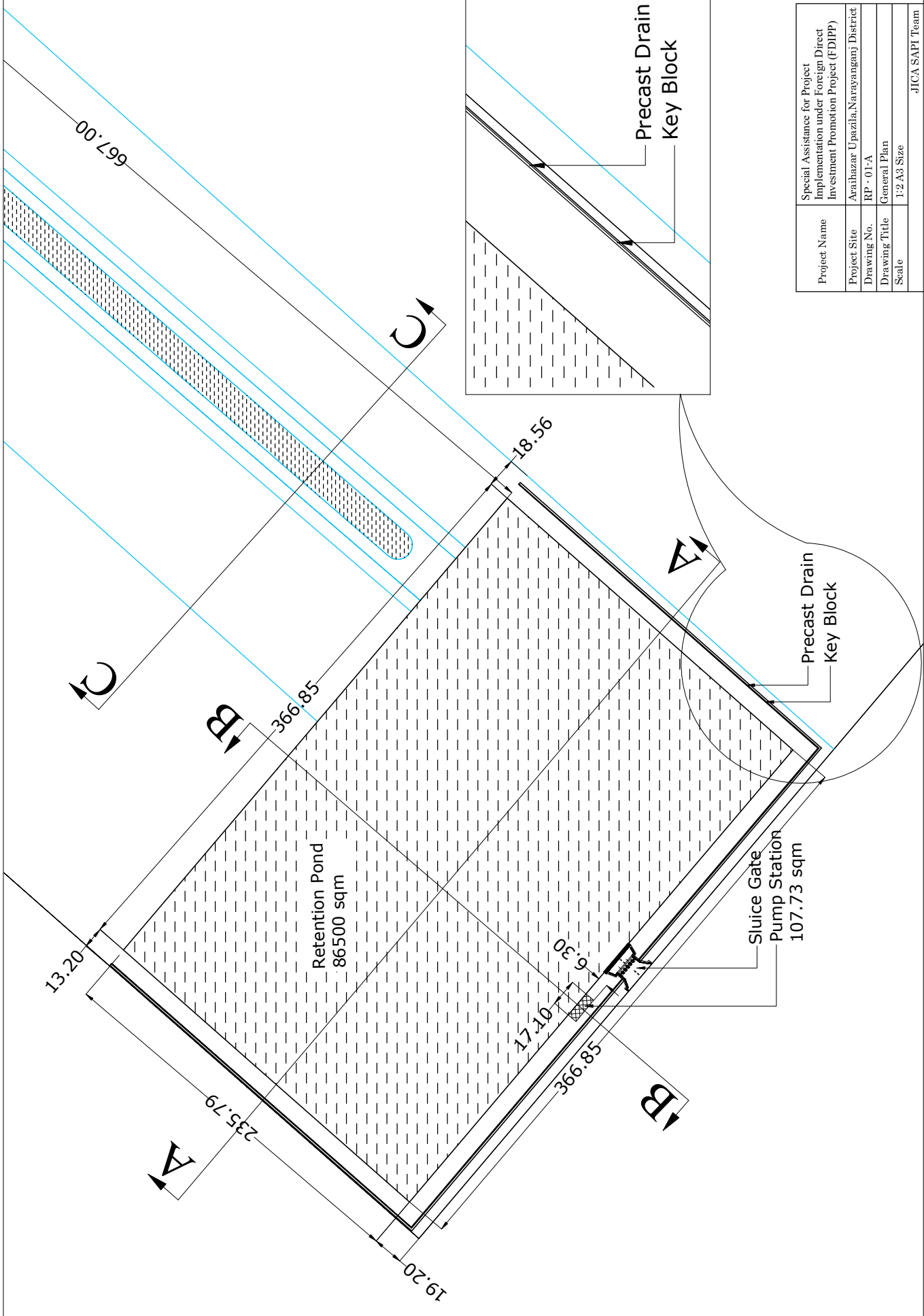
NORTH
symbols



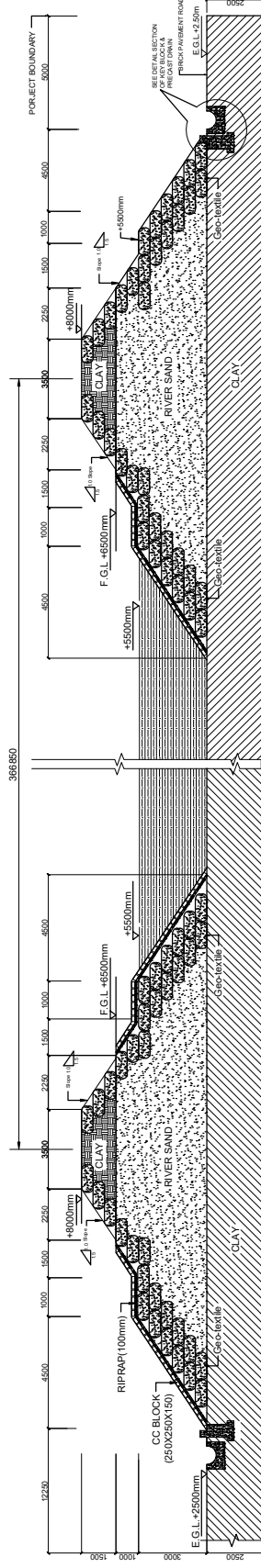
Retention pond, Canal



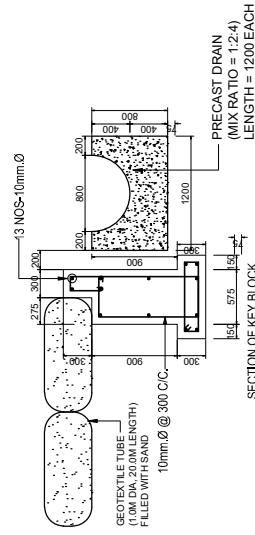
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Aravahaz Upazila, Narayanganj District		
Drawing No.	RP-01		
Drawing Title	General Plan		
Scale	1:10 A3 Size		
JICA SAPI Team			



Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Araibazar Upazila,Narayanganj District		
Drawing No.	RP - 01-A		
Drawing Title	General Plan		
Scale	1:2 A3 Size		
JICA SAPI Team			

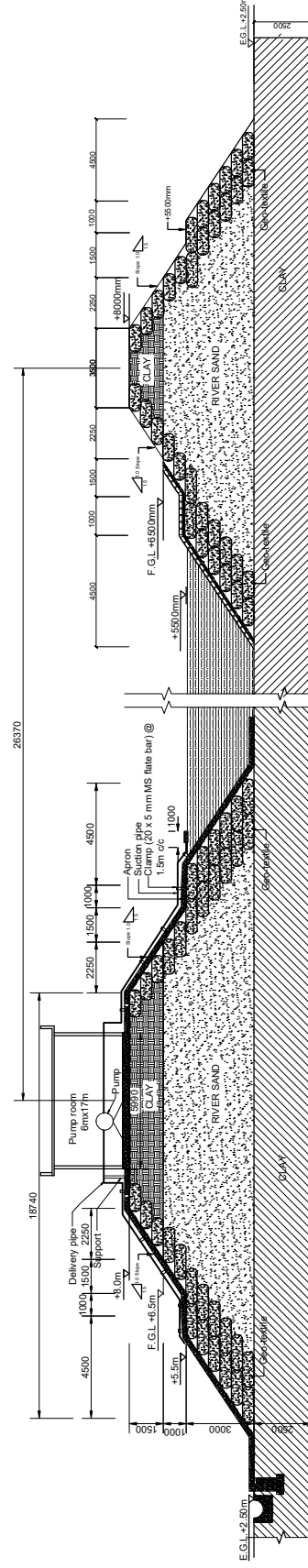


Slope Protection Works - Retention Pond
(Section A-A)
Scale:- 1:200



DETAIL SECTION OF KEY BLOCK & PRECAST DRAIN
SCALE: 1:50

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP - 02
Drawing Title	Section A-A
Scale	As Shown A3 Size
	JICA SAPI Team

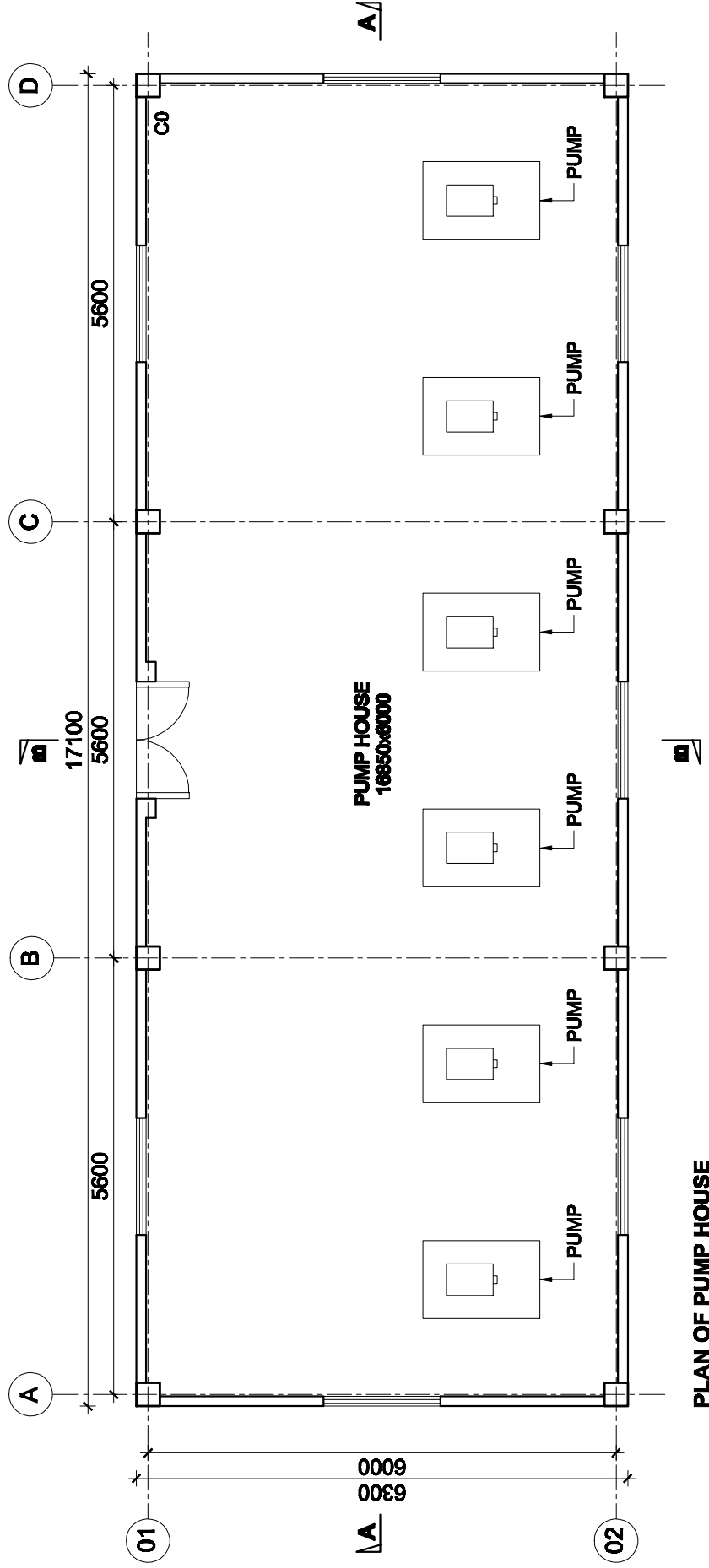


Slope Protection Works - Retention Pond
(Section B-B)
Scale:- 1:200

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Araihazar Upazila, Narayanganj District		
Drawing No.	RP-03		
Drawing Title	Section B-B		
Scale	1:200 A3 Size		
JICA SAPI Team			

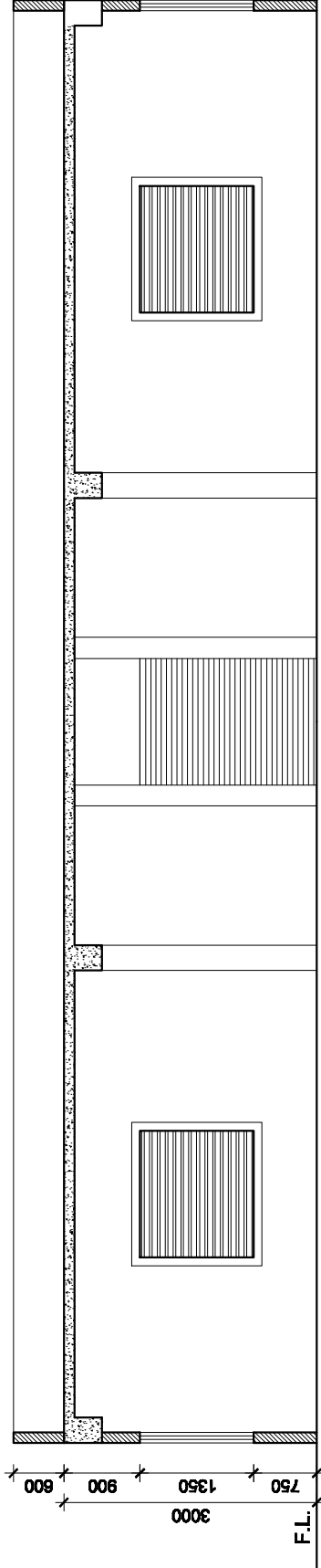


Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site Drawing No.	Ara-hazur Ujuzilaz, Narayanganj District RP-04
Drawing Title Scale	Section C-C 1:2000 A3 Size
	JICA SAPI Team

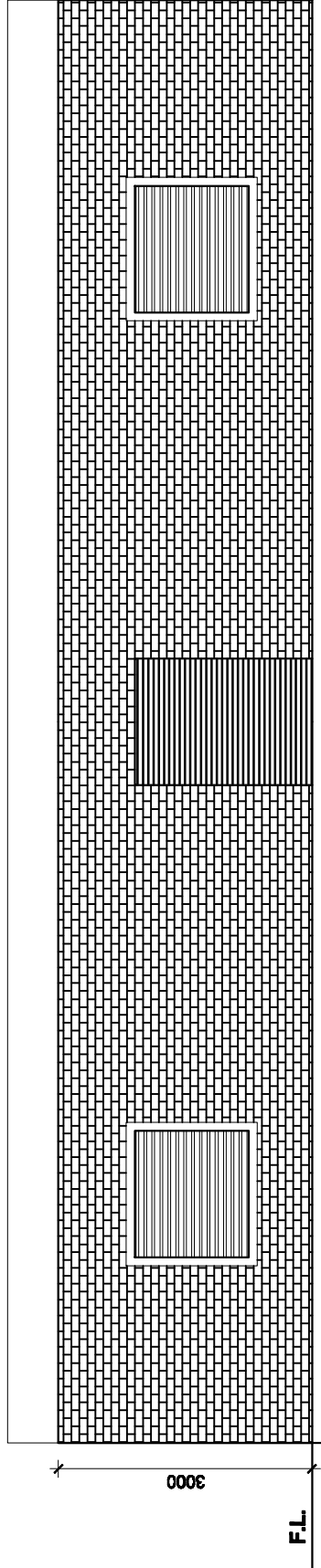


PLAN OF PUMP HOUSE

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP-13
Drawing Title	Plan of Pump House
Scale	1:100 A8 Size
JTCA SAPT Team	

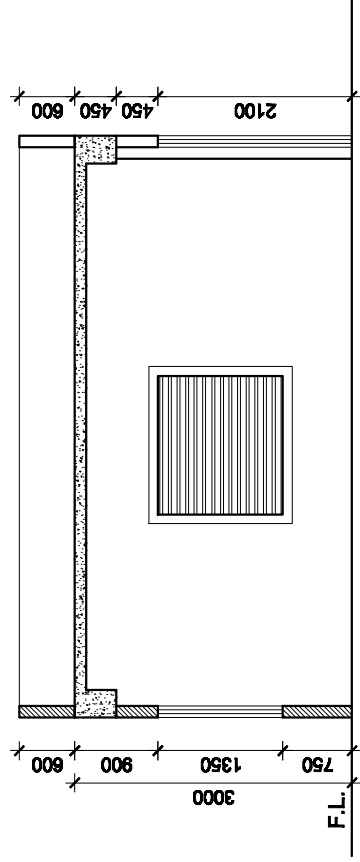


SECTION A-A

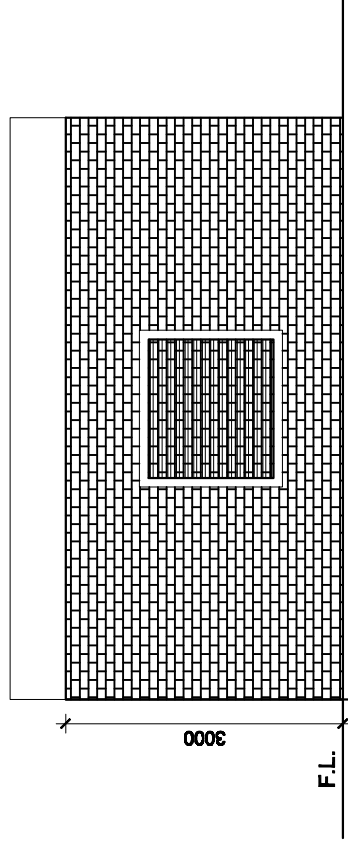


FRONT ELEVATION

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Aravahazar Upazila, Narayanganj District
Drawing No.	RP-14
Drawing Title	Elevation & Section
Scale	1:1000 A3 Size
JTCA SAPT Team	

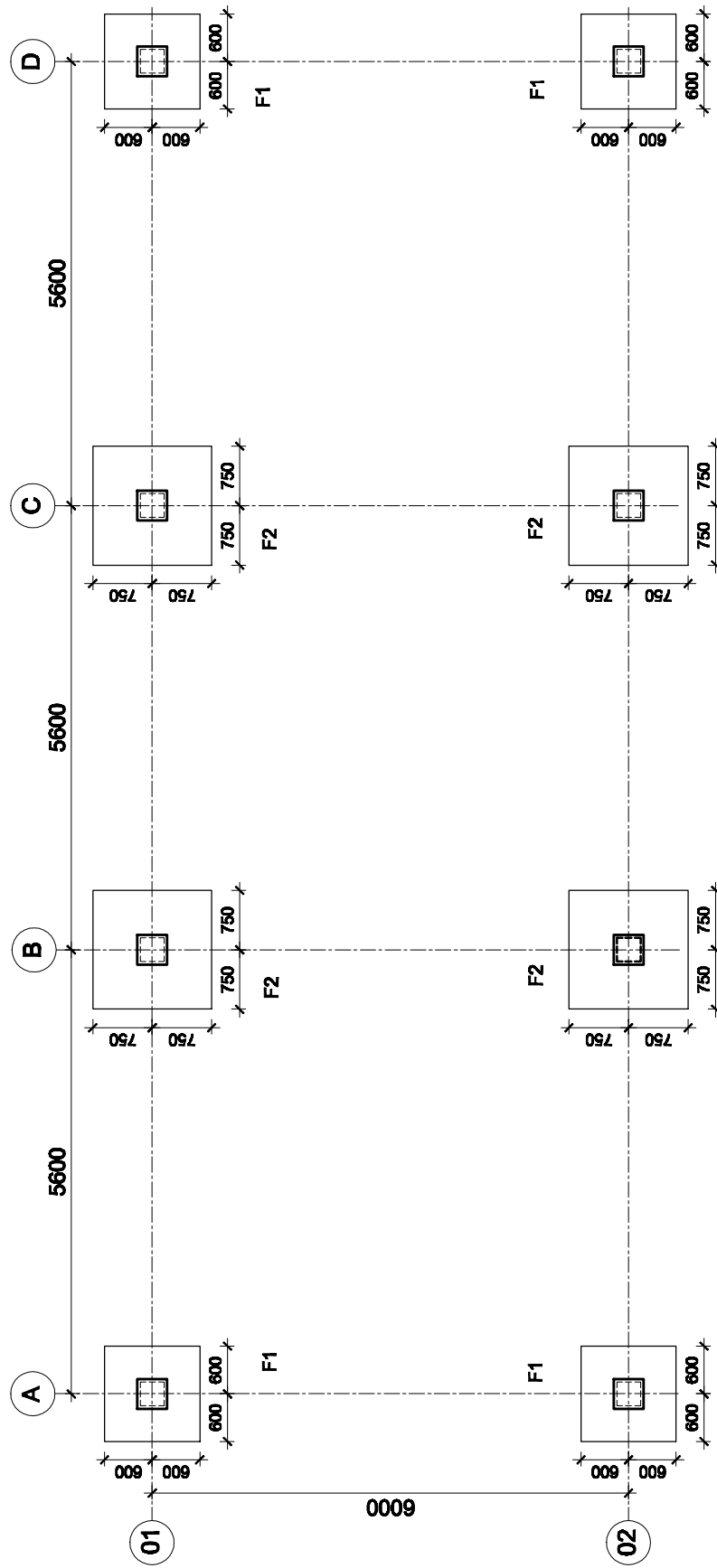


SECTION B-B



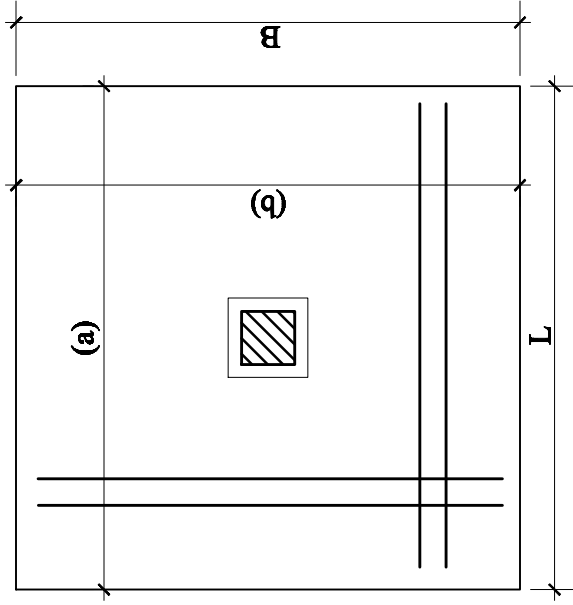
SIDE ELEVATION

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Aravahazar Upazila, Narayanganj District		
Drawing No.	RP-15		
Drawing Title	Elevation & Section		
Scale	1:1000 A3 Size		
JTCA SAPT Team			



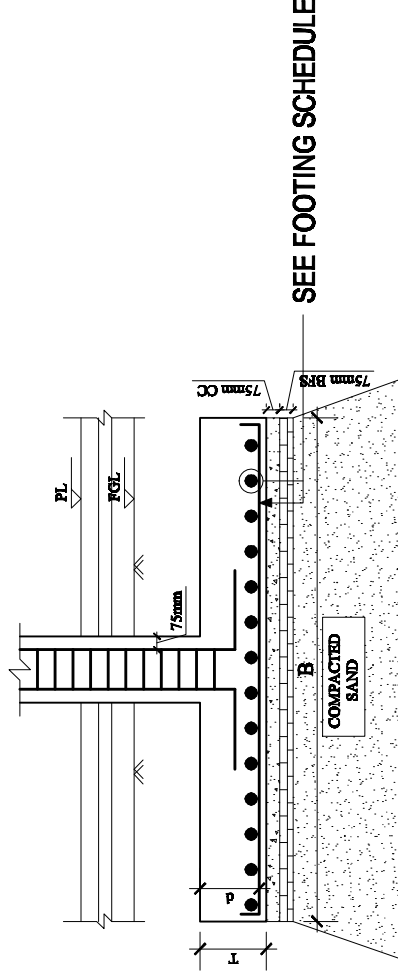
FOOTING LAYOUT PLAN

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP-17
Drawing Title	Feeding Layout Plan
Scale	1:100 A3 Size
JTCA SAPIT Team	



TYPICAL PLAN OF FOOTING

FOUNDATION SCHEDULE

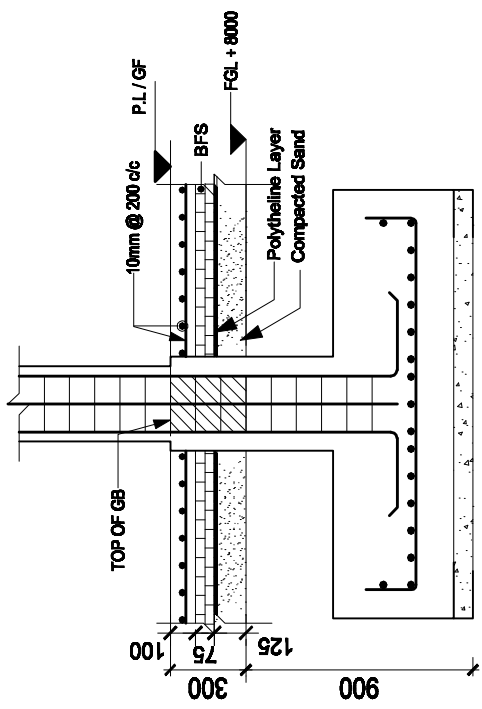
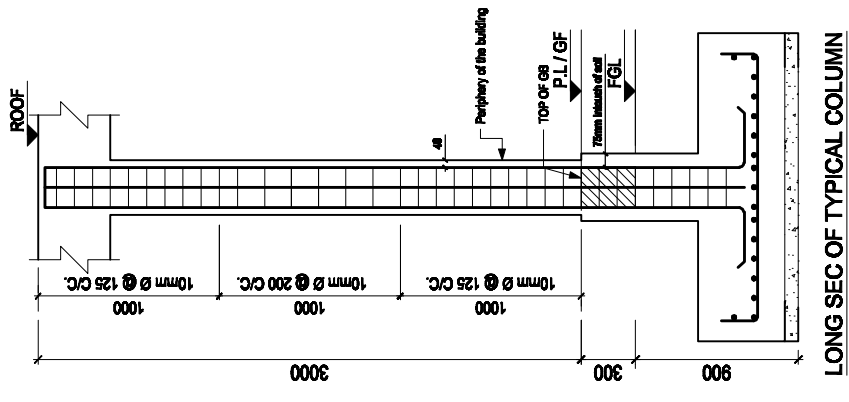


TYPICAL LONG SECTION OF FOOTING

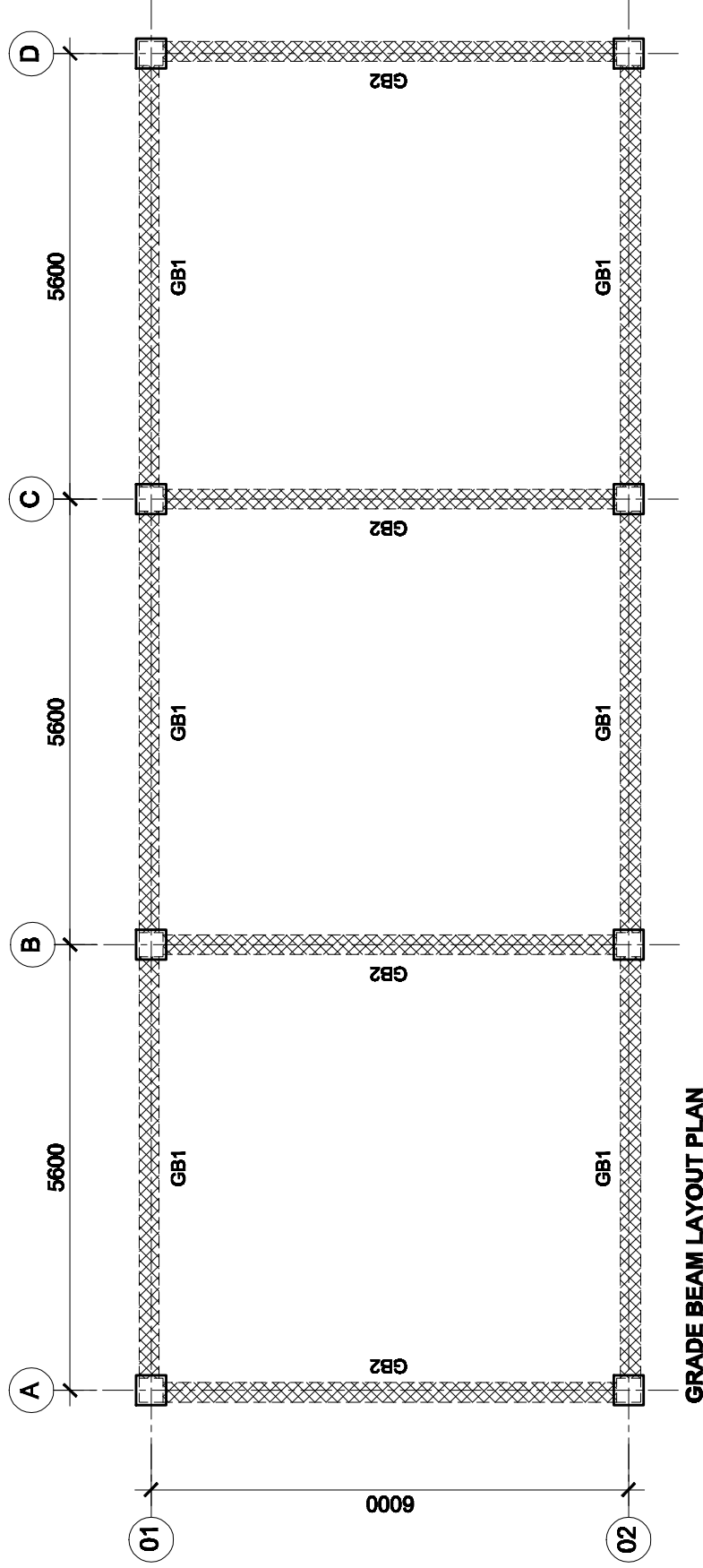
Footling Type	No	L (mm)	B (mm)	T (mm)	BOTT. REINFORCEMENT (EACH DIRECTION)
F1	4	1200	1200	300	16mmØ @ 125mm C/C
F2	4	1500	1500	375	16mmØ @ 100mm C/C

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIIPP)
Project Site	Arethasur Upazila, Narayanganj District
Drawing No.	RF-18
Drawing Title	Detail of Footing
Scale	1:100 A3 Size
JTCA BAFT Team	

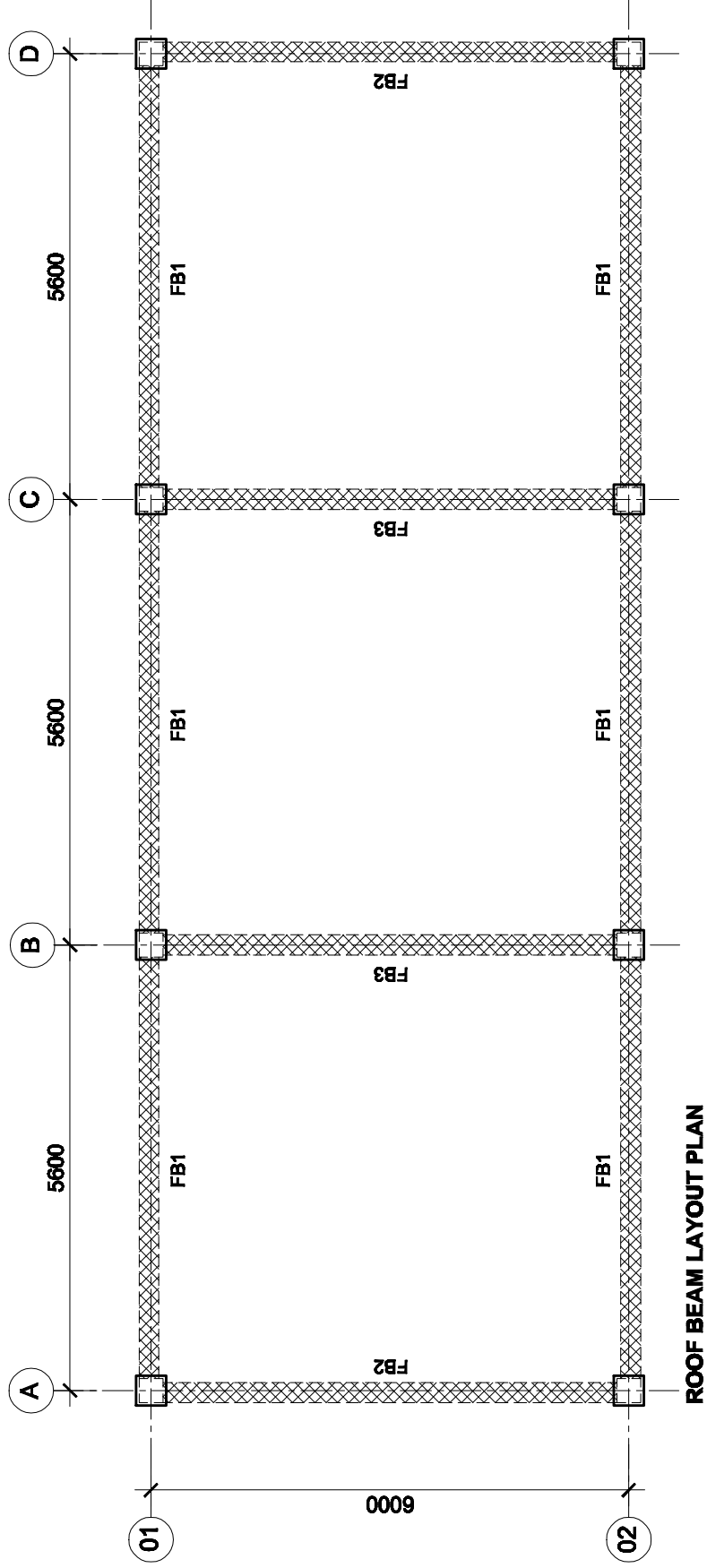
COLUMN SCHEDULE		
TYPE OF COLUMN	FROM FOUNDATION TO GROUND FLOOR	GROUND FLOOR TO 1ST FLOOR
C1		



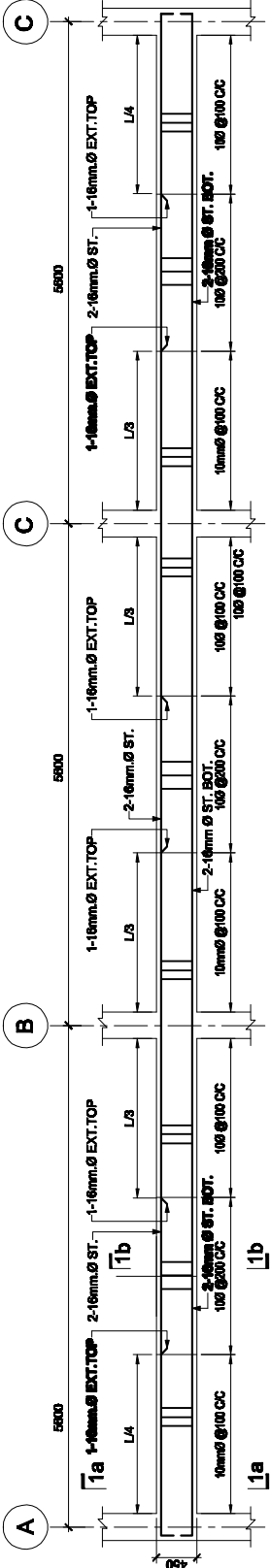
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Aashirwaad Upazilla, Narayanganj District
Drawing No.	RP-19
Drawing Title	Reinf. Detail of Column
Scale	1:100 AS Bm
JICA BAPF Team	



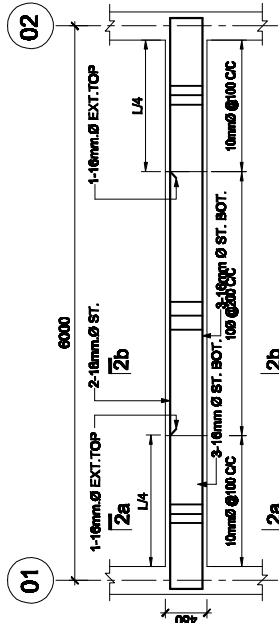
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP-20
Drawing Title	Grade Beam Layout Plan
Scale	1:100 A3 Size
JTCA SAPT Team	



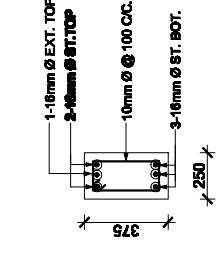
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Araihazar Upazila, Narayanganj District		
Drawing No.	RP-21		
Drawing Title	Roof Beam Layout Plan		
Scale	1:100 A8 Size		
JTCA SAPT Team			



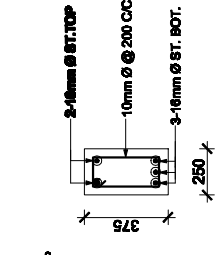
LONG SECTION OF GRADE BEAM-GB1 (250X375)



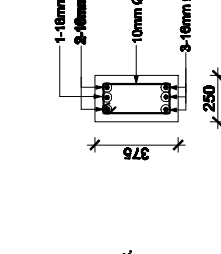
LONG SECTION OF GRADE BEAM-GB2 (250X375)



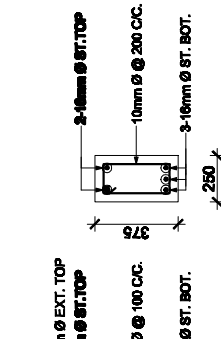
GB1 SECTION 1a-1a



GB1 SECTION 1b-1b

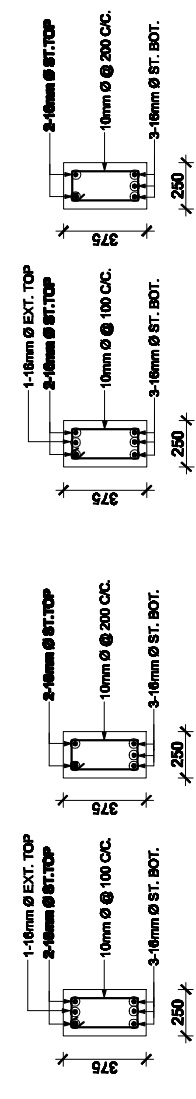
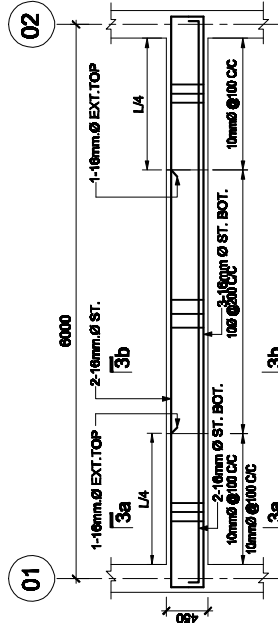
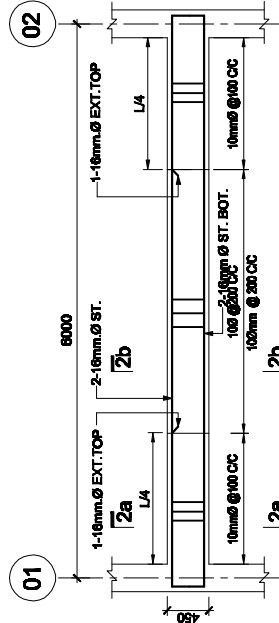
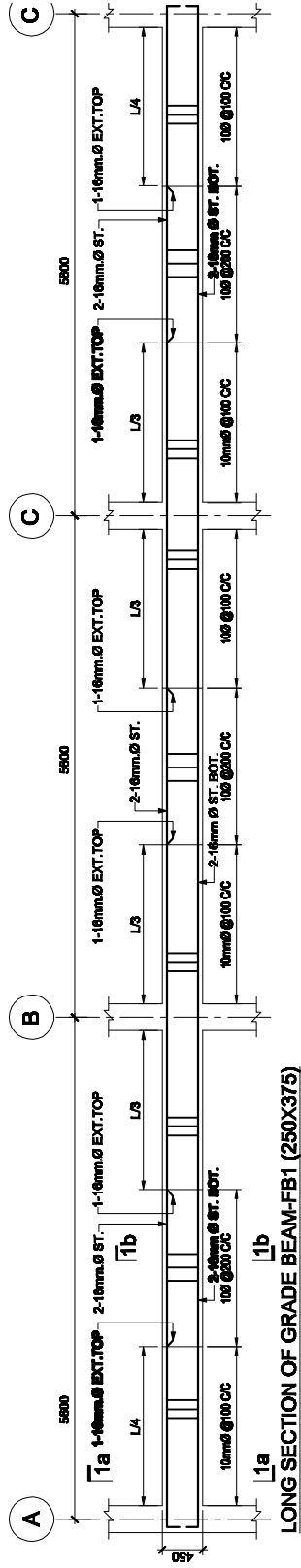


GB1 SECTION 2a-2a

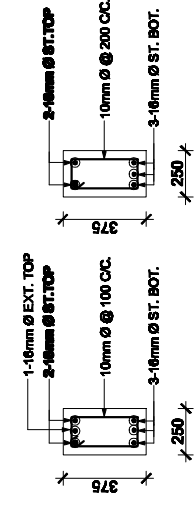


GB1 SECTION 2b-2b

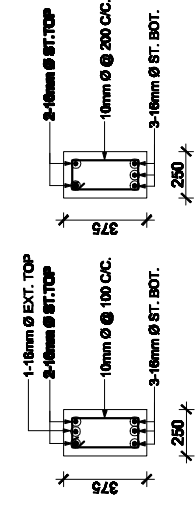
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP-22
Drawing Title	Detail of Grade Beam
Scale	1:100 A3 Size
JTCA SAPT Team	



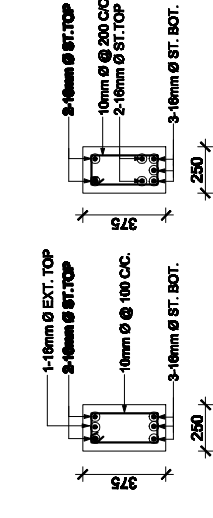
FB1 SECTION 1b-1b



FB1 SECTION 2b-2b

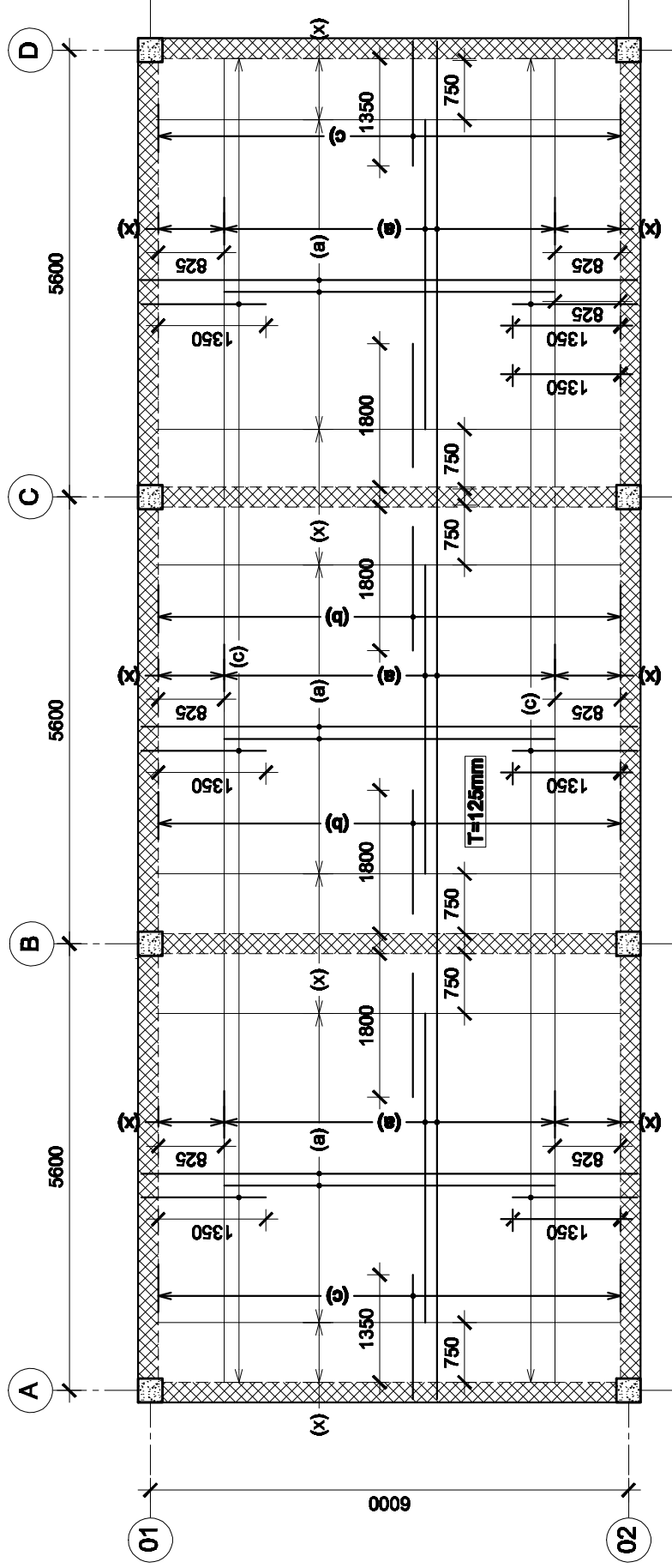


FB1 SECTION 3b-3b



FB1 SECTION 3b-3b

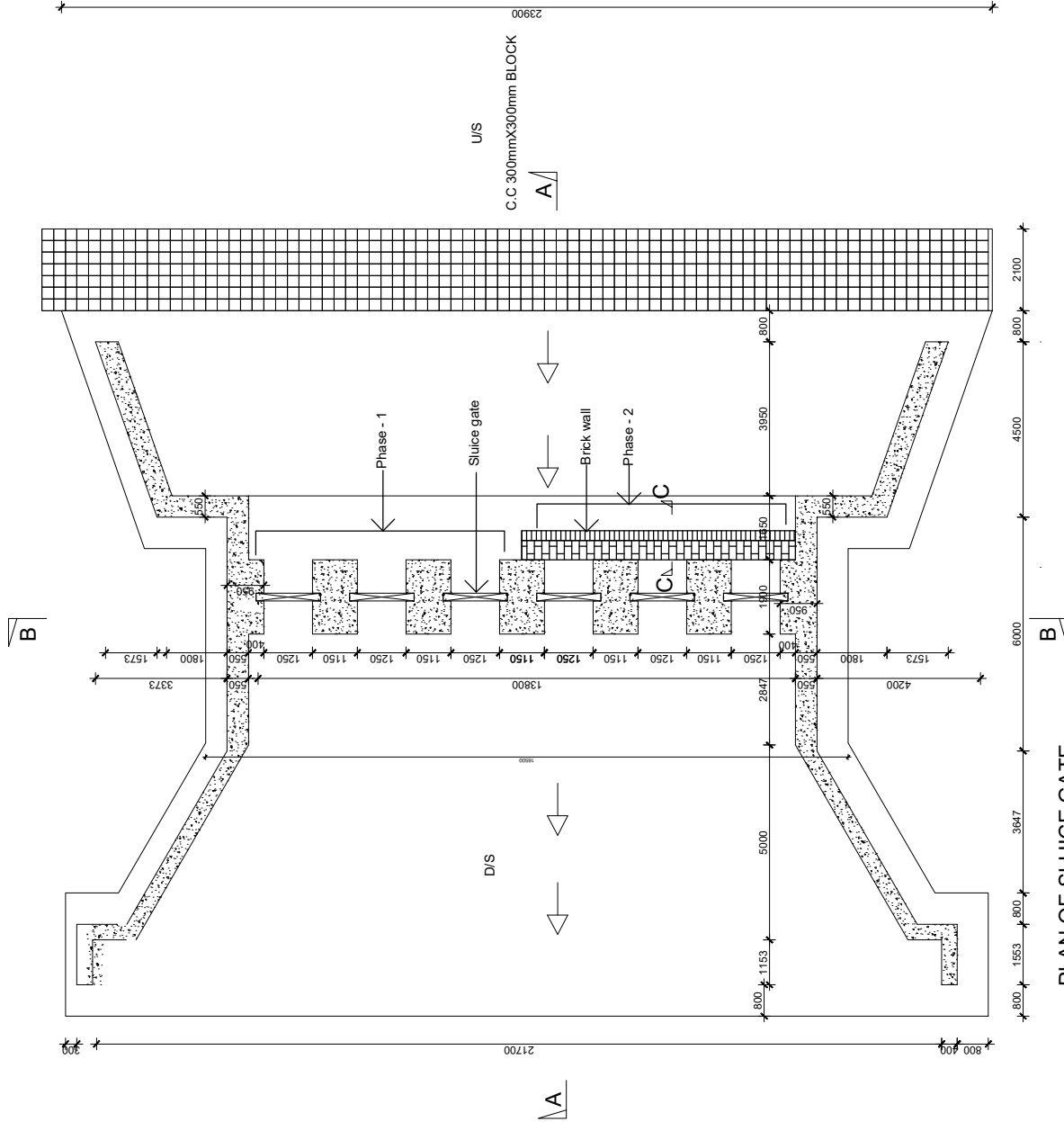
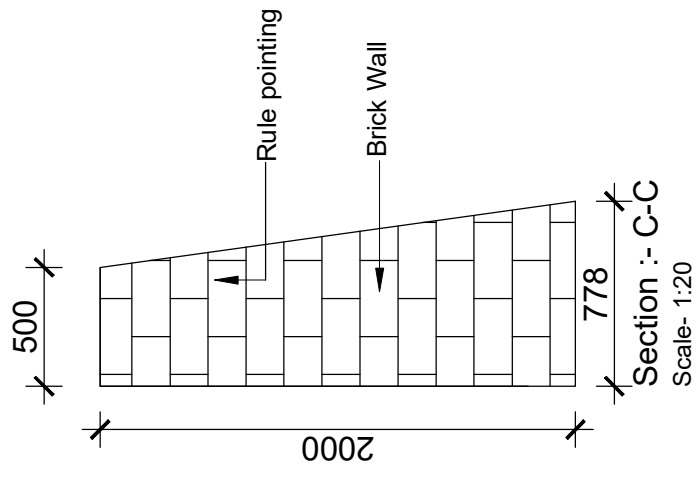
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araihazar Upazila, Narayanganj District
Drawing No.	RP-23
Drawing Title	Detail of Roof Beam
Scale	1:100 A3 Size
JTCA SAPT Team	



REINF. DETAILS OF ROOF SLAB

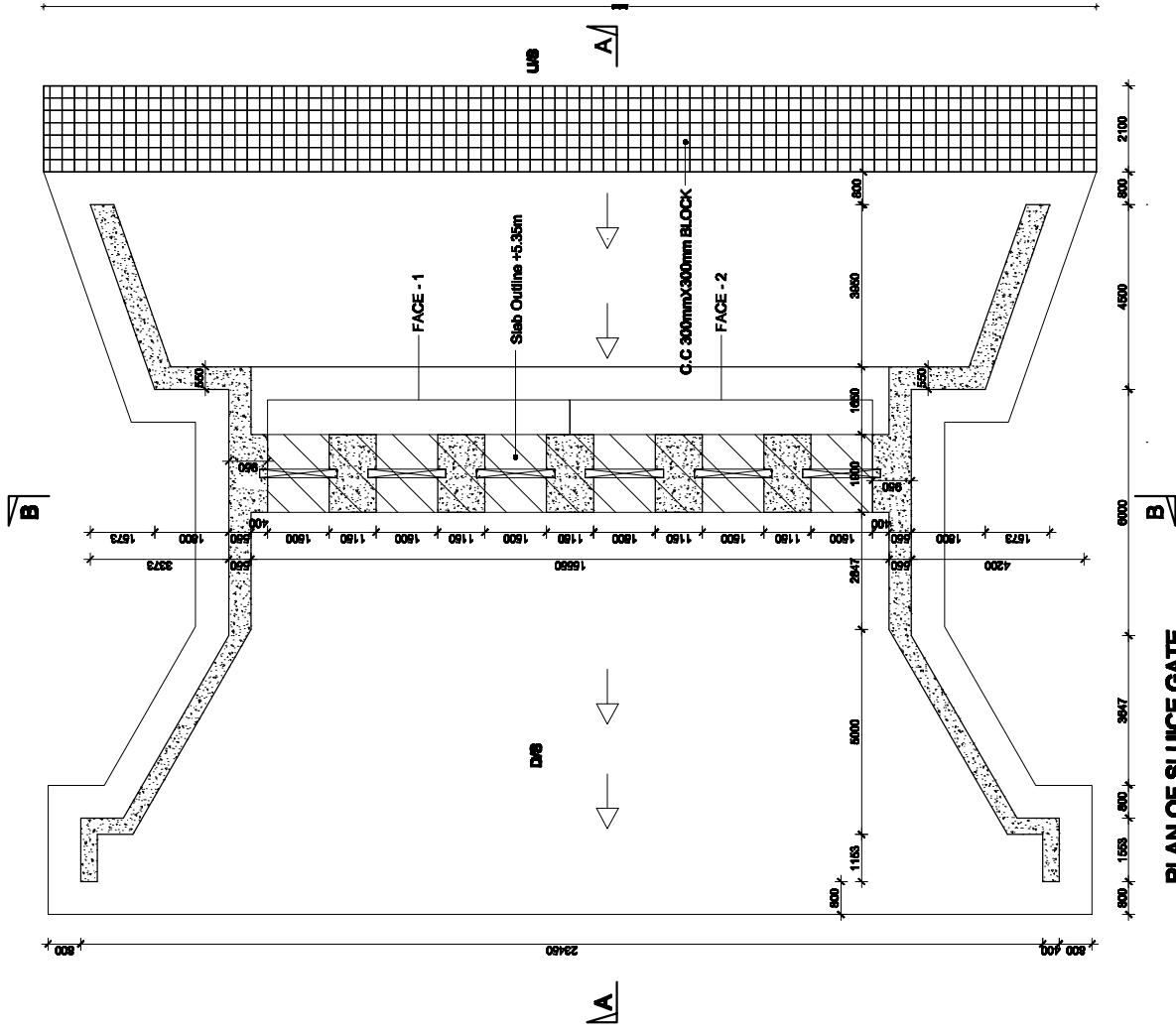
REINF. SCHEDULE OF SLAB
 (a)=10mm ϕ @ 150mm C/C Alt. out.
 (b)=12mm ϕ @ 125mm C/C Ext. Top.
 (c)=10mm ϕ @ 200mm C/C Ext. Top.
 (x)=10mm ϕ @ 250 mm C/C AS
 TOP & BOTTOM BINDER.

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Aravindhar Upazila, Narayanganj District
Drawing No.	RP-24
Drawing Title	Reinf. Detail of Roof Slab
Scale	1:100 A8 Size
JTCA SAPT Team	



PLAN OF SLUICE GATE
SCALE 1:100

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)		
Project Site	Araibazar Upazila, Narayanganj District		
Drawing No.	RP-05		
Drawing Title	Plan of Sluice Gate		
Scale	As Shown A3 Size		
JICA SAPI Team			



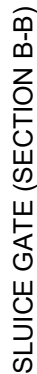
Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araluwa Upazila, Narayanganj District
Drawing No.	RP-28
Drawing Title	Slab Outline +5.35m
Scale	1:100 AS SHS
	JICA S&PT Team



	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Name	
Project Site	Aashirvaad Upastalla, Narayanganj District
Drawing No.	RP-27
Drawing Title	Slab Outline +9.00m
Scale	1:100 A3 Size
	JICA SAFI Team



Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Aashirvaad Upasalla, Narayanganj District
Drawing No.	EP-28
Drawing Title	Slab Outline +12.00m
Scale	1:100 AS Ems
JICA SAFI Team	

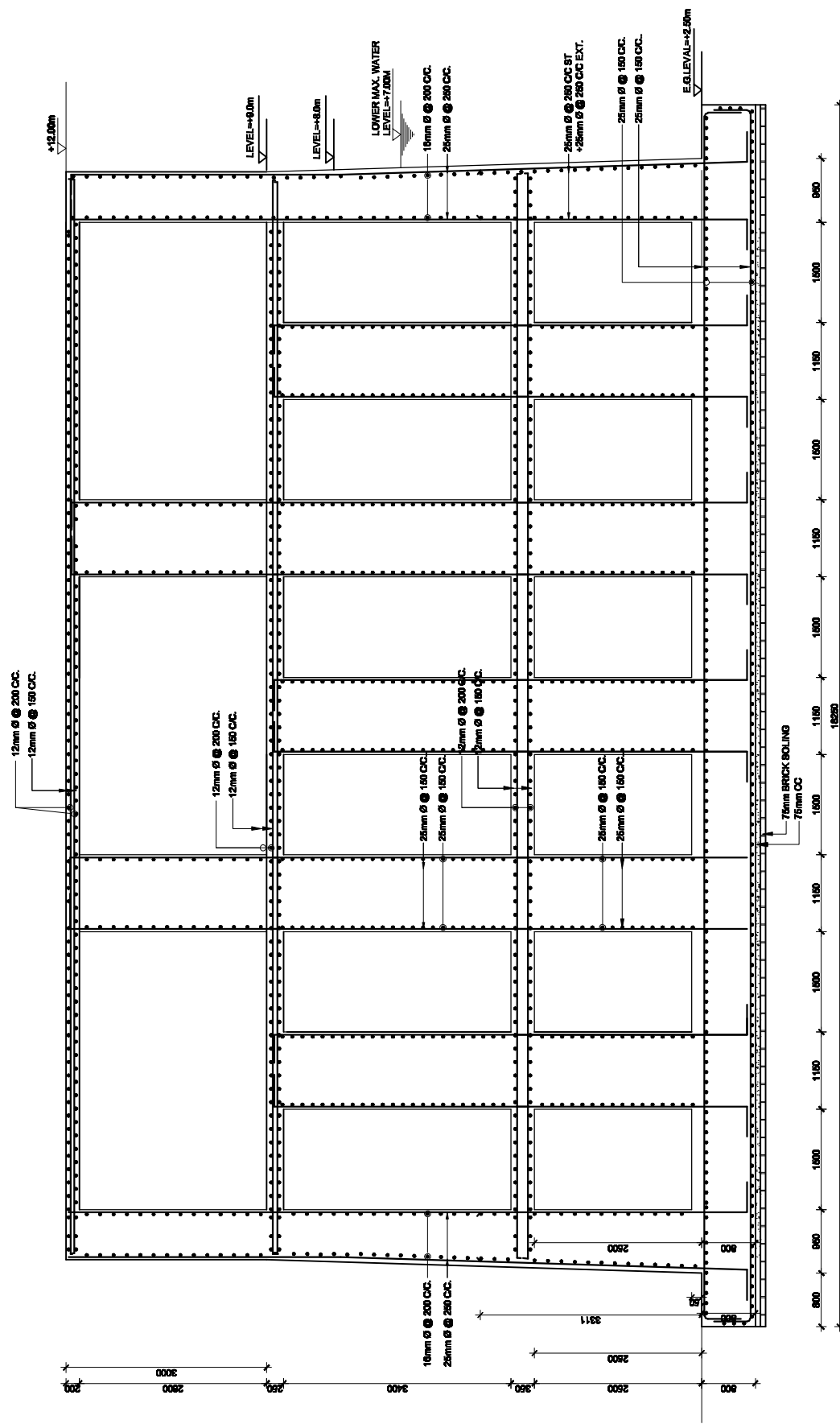


Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Araibazar Upazila, Narayanganj District
Drawing No.	RP-07
Drawing Title	Sluice Gate - Section B-B
Scale	As Shown A3 Size
	JICA SAPI Team



SCALE 1:100

Project Name	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site Drawing No.	Aravahazar Upazila, Narayanganj District RP-08
Drawing Title	Reinf. Detail of Bottom Slab
Scale	As Shown A3 Size
	JICA SAPI Team



REINF. DETAILS OF GATE

Project Names	Special Assistance for Project Implementation under Foreign Direct Investment Promotion Project (FDIPP)
Project Site	Arafuram Upadulla, Naryanangudi District
Drawing No.	RP-32
Drawing Title	Reinf. Detail of Gato
Scale	1:100 AS 13mm
	JICA S&PT Team

SUMMARY OF BILL OF QUANTITIES

ITEM NO.	PAY ITEM	LOCAL (BDT)	FOREIGN (JPY)
Part-1: Land Development			
1000	GENERAL, MOBILIZATION & TEMPORARY WORKS		
2000	EXCAVATION AND FILLING		
3000	SOILING AND SLOPE PROTECTION		
4000	OTHER RELATED FACILITIES		
	Subtotal of Bills (Item No. 1000 to 4000)	A	
TR	Total for Daywork	B	
PS	Specified Provisional Sum	C	805,230,000
	BID PRICE-1 (D=A+B+C)	D	
Part-2: Access Road			
2000	EXCAVATION AND FILLING		
A-1	ACCESS ROAD WORKS		
A-2	STREET LIGHTENING		
	BID PRICE-2 (G)	E	
Part-3: Retention Canal, Retention Pond with Pumping Station			
B-1	RETENTION CANAL		
B-2	RETENTION POND		
B-3	SLUICE GATE		
B-4	PUMPING STATION		
B-5	OTHER RELATED FACILITIES		
	BID PRICE-3 (H)	F	
	Sub Total of Part 1 - 3 (G=D+E+F)	G	
	Price Contingency (15% of A+E+F)	H	
	Physical Contingency (10% of G+H)	I	
	Sub Total (G+H+I)	J	
	VAT (7% of J)	K	
	Income Tax (7.5% of J)	L	
	TOTAL BID PRICE (J+K+L)		

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

1000 GENERAL, MOBILIZATION & TEMPORARY WORKS

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE			AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)		LOCAL (BDT)	FOREIGN (JPY)
1100 Mobilization and Demobilization								
1110 Mobilization Contractor's Plants, Equipment and Personnel with Insurance		Is	1					
1120 Demobilization Contractor's Plants, Equipment and Personnel with Insurance		Is	1					
1200 Contractor & Engineer's Temporary Facilities								
1210 Contractor's and Engineer's Office on Site								
	Erection and maintenance of site office with toilet facilities and removal of the same after completion of work in accordance with the conditions of contract i.e. Clause no.1.10 of Specifications under Part 2: Works Requirements. In addition to the office required for his own use, the Contractor shall provide and maintain furnished field office of min. 100 sqm floor area with airconditioning, freshwater supply , electrical power supply, furnitures , internet connection systems and stationaries for the use of construction management unit of the Employer and the Consultant. The field office is to have a concrete floor with tiles on it, adequate foundation, brick walls, CI Sheet/Profile roofing on steel frame, false ceiling of hard board with seasoned Garjan wood frame and painted, and all windows are to be glazed and provided with steel grill. Outside and inside wall surface are to be plastic painted on plaster acceptable to the Engineer.	Is	1					

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

1000 GENERAL, MOBILIZATION & TEMPORARY WORKS

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
1220	Running and Maintenance for Contractor & Engineer's Temporary Facilities The field office shall be maintained in a secure and watertight condition by the Contractor until the completion of the contract and shall be provided with electricity including emergency power supply, running water and sewerage. All doors shall be fitted with approved locks and windows shall be provided with screen/blinds. Before construction the Contractor shall submit plans and drawings showing proposed details and location for the field office, including foundations, access roads, shades, layout of electrical and water supply and hard standings thereto for the approval of the engineer. The Engineer may require revision of the plans prior to giving approval for construction. The Contractor shall also submit details proposed furniture, fittings and other items of equipment and plant as mentioned in the specifications to the engineer for approval.	mon	30				
1230	Vehicles for the Engineer's and Employer's Use						
1)	Type A including driver, running and maintenance cost	mon	90				
1300	Site Clearance Works and Other Temporary Works						
1310	Site Clearance of the construction yard and Temporary works	Ha	200				
1400	Survey Works specified in the specifications						
1410	Topographic Survey	Ha	220.0				
1420	Settlement Monitoring Survey	Nos	50				

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

1000 GENERAL, MOBILIZATION & TEMPORARY WORKS

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
1500	Expense for Bank Guarantee and Insurance						
1510	Expenses for Performance Bond/ Guarantee	Is	1				
1520	Expenses for Insurance of the Construction Works (for 30 months)	Is	1				
1530	Expenses for Insurance of Contractor's Equipment	Is	1				
1540	Expenses for Third-party Insurance (2%) of Project Contract Amount	Is	1				
1600	Land rent for laying service pipe lines for filling sand transportation	L's	1				
1000	Total of GENERAL, MOBILIZATION & TEMPORARY WORKS						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

2000		Excavation and Filling					
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
2100	Site improvement by carted earth or dredged sand for filling work						
	Site improvement by carted earth or dredged sand by Dredging including necessary systems, sandy silt (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finishd level etc. all complete as per direction and accepted by the engineer-in-charge.	Cu.m	7,824,156				
2200	Mechanical Compaction of Earth or Sand/ Transporation						
	Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 85% with optimum moisture content (standard dry density test) up to finished level all complete and accepted by the engineer subject to submission of the method statement. In case of hydraulic filling by sand water pumps, the 2m layers shall be tested by using cone prentation tests to achieve minimum dry density of 85% with optimum moisture content (standard dry density test), final layer having 150mm under Formation Grand Level (FGL) shall be done the mechanical compaction to achieve minimum dry density of 90% with optimum moisture content (standard dry density test) aproved by the Engineer.	Cu.m	7,824,156				
2000	Total of Excavation and Filling						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

3000 SOILING AND SLOPE PROTECTION							
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (YEN)	LOCAL (BDT)	FOREIGN (JPY)
3100	Geo-Textile Bag (Geo-Cube) Installation						
3110	Supply, making & laying 2 mm thick Geo-textile bags filled with 12.5 cum of sand per bag (size of each bag: perimeter 3.143m x Length 20m as per drawing). Geo-textile is of approved quality and origin/manufacturer as per manufacturer's instructions approved and accepted by the Engineer.Before commencing laying of Geo-textile sand filled bags, the Contractor must submit the method statement for carrying out this work including sample with evidence of origin and compliance certificate from independent testing laboratory for approval.	Nos	11,060				
3400	Carted Earth (Clay) Installation						
	Site improvement by carted earth (Clay) (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finish level etc. all complete as per drawing and direction and accepted by the engineer-in-charge. (Surrounding bund) By Other than dredging	Cu.m	70,620				
3000	Total of SOILING AND SLOPE PROTECTION						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

4000 OTHER RELATED FACILITIES							
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (YEN)	LOCAL (BDT)	FOREIGN (YEN)
4100	Permanent Fence at the Project Boundary						
4110	Supply and installation of hollow block fencing around the boundary (Height = 2.3m)	m	7,000				
4120	Supplying, fitting and fixing 3 lines of barbed wire with Angle Post on the Top of the Fence	m	7,000				
4000	Total of OTHER RELATED FACILITIES						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

TR SCHEDULE OF DAYWORK RATES							
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (YEN)	LOCAL (BDT)	FOREIGN (YEN)
TR100	Labour						
TRF90	Foreign Operator (Heavy duty)	hr	480				
TRF91	Foreign Supervisor (Special Works)	hr	480				
TR101	Foreman	hr	480				
TR102	Skilled Labor	hr	720				
TR103	Common Labor	hr	1,440				
TR104	Rebar Worker	hr	720				
TR105	Operator (Heavy duty)	hr	720				
TR106	Operator (General)	hr	720				
TR107	Formwork Builder	hr	720				
TR108	Carpenter	hr	720				
TR109	Plasterer	hr	720				
TR110	Painter	hr	720				
TR111	Welder	hr	720				
TR112	Electrician	hr	720				
TR113	Mechanic	hr	720				
TR114	Plumber	hr	720				
TR115	Bricklayer	hr	1,440				
TR116	Chief Boat Crew	hr	240				
TR117	Boat Crew	hr	240				
	Total Daywork for Labour						
TR200	Materials						
TR201	Portland cement	ton	300				
TR202	Reinforcement steel bar	ton	150				
TR203	Shaped structural steel	ton	150				
TR204	Fine aggregate	cu.m	900				
TR205	Coarse aggregate / Crushed Stone	cu.m	1,200				
TR206	Sand for filling	cu.m	1,500				
TR210	Filter cloth (t=2mm)	sq.m	1,200				
TR213	Plywood (t=12mm)	sq.m	300				
TR214	Timber	cu.m	90				
TR216	Concrete drainage pipe (dia. 800mm)	m	300				
TR217	Fresh concrete (21MPa)	cu.m	300				
TR218	Fresh Concrete (25MPa)	cu.m	300				
	Total Daywork for Materials						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

TR SCHEDULE OF DAYWORK RATES									
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT			
				LOCAL (BDT)	FOREIGN (YEN)	LOCAL (BDT)	FOREIGN (YEN)		
TR300	Equipment								
TR301	Bulldozer (21ton)	hr	960						
TR302	Excavator (1.4/1.0m ³)	hr	960						
TR303	Dump truck (20t)	hr	960						
TR304	Trailer truck (40t)	hr	120						
TR305	Truck crane (25t)	hr	240						
TR306	Motor Grader (3.1m)	hr	960						
TR307	Macadam / Vibration/ Tire Roller (10t)	hr	960						
TR308	Hand Guided Small Roller (0.5t)	hr	480						
TR309	Vibrating Compactor (50-60kg)	hr	480						
TR310	Hopper Barge (500 m ³ ~1,000m ³)	hr	960						
TR311	Tugboat (500 ~ 1000 HP)	hr	960						
TR312	Generator (500KVA)	hr	960						
TR313	Wheel Loader (2.0-3.0m ³)	hr	480						
TR314	Sand pump (300mm discharge pipe or 500mm discharge pipe)	hr	960						
TR315	Booster Pump (300mm discharge pipr or 500mm discharge pipe)	hr	960						
	Total Daywork for Equipment (including Fuel)								
	Total for Daywork								

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

PS SPECIFIED PROVISIONAL SUMMS							
ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (YEN)	LOCAL (BDT)	FOREIGN (YEN)
PS100	Laboratory Operation and Assistance Staffs						
1)	Provision of laboratory (30m2) and Equipment necessary to test for concrete and soil including running cost and assistance Staff	PS				3,300,000	450,000
PS200	Prevention of HIV/AIDS Programs						
	Activities of Education, Workshop, Clinic, Advertisement, Relation with BEZA/ NGO and etc.	PS				1,400,000	1,120,000
PS300	Dispute Board						
	Employment of Members of Dispute Board as the Employer's Cost	PS				0	30,000,000
PS400	Entrance Gates proposed and designed by Contractor	PS				3,000,000	600,000
PS500	Special Safety and Security Arrangement	PS					
1)	All of Special Safety Arrangement excluding Provision of security armed (or/ authorized security company's) guardsman and Security temporary boundary fence and including security concrete block fence for offices and temporary facilities	PS				21,000,000	15,000,000
2)	Provision of security armed (or/ authorized security company's) guardsman (including necessary equipment, facilities and transportation) and Security temporary boundary fence (fixing 8 lines of barbed wire steel post horizontally fence : 7,850 m2)	PS				81,782,500	560,000
SP600	Environmental Management and Monitoring						
	(Environmental Monitoring Survey, Investigation, Tests and Reports)	PS				12,000,000	1,500,000
PS700	Soil Improvement for soft silty layer	PS					
1)	Geographic Investigation (SPT) and Laboratory Tests (Consolidation Tests) and Analysis Report	PS				775,000	6,000,000
2)	Soil Improvement Works	PS				170,000,000	750,000,000
	SPECIFIED PROVISIONAL SUMMS					293,257,500	805,230,000

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

ACCESS ROAD

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
2100	Site improvement by carted earth or dredged sand for filling work						
	Site improvement by carted earth or dredged sand by Dredging including necessary systems, sandy silt (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finishd level etc. all complete as per direction and accepted by the engineer-in-charge.	Cu.m	53,034				
2200	Mechanical Compaction of Earth or Sand/ Transporation						
	Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) up to finished level all complete and accepted by the engineer subject to submission of the method statement. In case of hydraulic filling by sand water pumps, the 2m layers shall be tested by using cone pnetration tests to achieve minimum dry density of 90% with optimum moisture content (modified proctor test), final layer having 300mm under Formation Grand Level (FGL) shall be done the mechanical compaction to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) aproved by the Engineer.	Cu.m	53,034				
2000	Total of Excavation and Filling						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH

Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

ACCESS ROAD

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
A-1:	Road Network						
2.01	Providing layout and carry over PWD Bench-Mark (BM) at site from nearby BM pillar, Property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	Sqm	12,591				
2.02	BC&SGC(450mm): Earth work in box cutting on road crest up to 450mm depth, maintaining proper grade, camber and alignment, super elevation on curves, removing soils to a safe distance or if necessary, spreading the excavated earth on road flanks and slopes uniformly including leveling, dressing, watering to bring moisture content \pm 2% of OMC & compacting the sub-grade by appropriate mechanical means to attain design CBR at minimum compaction 98% of MDD (Standard) etc. all complete as per direction of the E-I-C.	Sqm	12,591				
2.03	Sand (FM 0.80) filling on the road bed in the improved sub-grade with sand free from dust, earth, other vegetable growth and foreign materials including supplying all materials, spreading, watering, compacting by appropriate mechanical means to obtain a minimum soaked CBR 8% at minimum compaction 98% of MDD (Modified), etc. all complete as per direction of the E-I-C.	Cum	5,037				

2.04	Site improvement by carted earth (Clay) (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finishd level etc. all complete as per drawing and direction and accepted by the engineer-in-charge. (Surrounding bund) By Other than dredging For Chittagong/Sylhet/Narayanganj Area	Cum	2,844				
2.05	Supply, making & laying 2 mm thick Geo-textile bags filled with 12.5 cum of sand per bag (size of each bag: perimeter 3.143m x Length 20m as per drawing). Geo-textile is of approved quality and origin/manufacturer as per manufacturer's instructions approved and accepted by the Engineer. Before commencing laying of Geo-textile sand filled bags, the Contractor must submit the method statement for carrying out this work including sample with evidence of origin and compliance certificate from independent testing laboratory for approval.	Nos	200				
2.06	Labour for spreading & compaction of Improved Subgrade consisting of sand having compacted thickness as per specifications including local handling, hand packing, watering, dry rolling followed by wet rolling in layers of specified loose thickness with 8~10 tonne road roller to achieve soaked CBR not less than 8% at a degree of compaction to minimum 98% (Modified Proctor) etc all complete as per direction of the Engineering-in-charge. Thickness of each layer should not be more than 125mm loose and Payment will be made on compacted thickness. (The rate excludes the cost of sand)	Cum	5,037				

2.07	SBBC(70:30): Providing compacted aggregate sand sub-base course with 38mm down brick chips made of 1st class /picked brick (LAA value not exceeding 40) mixed thoroughly with sand of requisite FM (FM not less than 0.8) to obtain a homogeneous mix complying with the specified grading requirement of the relevant item of Road Design standards – 2005, (Suggested mixing ratio Brick Chips 38mm down graded 25% and 20mm down graded 45% with 30% sand) including mixing, carrying, placing and spreading uniformly in appropriate layer to give specified compacted thickness not more than 100mm in a single layer, watering, compacting by 8~10 tonne road roller at OMC±3% to obtain a minimum soaked CBR 50% or Design CBR at minimum compaction 98% of MDD (Modified), including supplying of all materials, their carriage, labourers tools and equipment etc. all complete as per direction of the E-I-C.	Cum	3,148					
2.08	<p>Providing compacted Granular Base (Type-I) Stone aggregate base course by supplying, spreading and compacting 50mm down graded crusher run stone chips (LAA value not exceeding 35%) including supplying of required amount of 12mm down graded chips made of same quality stone, including spreading uniformly in layers of specified loose thickness on road surface maintaining grade, camber and super elevation including local handling, hand packing, booming, watering, dry rolling followed by wet rolling in layers with 8~10 tonne road roller to achieve soaked CBR not less than 80% at a degree of compaction to minimum 98% (Modified Proctor) blinding withchoking material as filter material @0.018cum/sqm including cost of materials, labours etc. all complete as per direction of the E-I-C.</p> <p>After adequate dry rolling spreading choking material on the surface, sprinkling water and rolling is to be continued until all the voids are filled, wave of grout/slurry flushes ahead of the roller. Thickness of each layer should not be more than 100mm loose and measurement for Payment will be made on compacted thickness.</p>	Cum	2,519					

2.09	<p>TCHD@0.75: Providing tack coat @0.75kg/sqm with 60/70 or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM/AASHTO applied by appropriate hand device at a temperature between 175°C and 185°C including heating bitumen, surface cleaning, etc. all complete as per direction of the E-I-C.</p>	Sqm	12,591					
2.10	<p>DCPM: Providing and Laying pre-mixed dense bituminous surfacing - wearing course with hot mix plant using coarse aggregate, fine aggregate, filler and bituminous binder as per design Job Mix Formula conforming Marshall Method as per specification, LAA value of aggregate should be <=35%, water absorption not >2%, flakiness index not >35% mixed with (60/70 or 80/100) penetration grade straight run bitumen satisfying the requirements of ASTM/AASHTO. including screening, cleaning of chips and preparing a uniform and quality mix in Hot Mix Plant and ensuring a homogenous mix, in which all particles of the mineral aggregates are coated uniformly, carrying the hot premixed materials by means of Dump/tipper truck, spreading the mixed materials at specified laying temperature with a hydrostatic paver finisher with sensor control to the required grade, level and alignment over the prepared surface tamping and finishing the mix at specified compacted thickness, maintaining specified camber, grade, super-elevation and cross section, through rolling with appropriate Steel Drum Roller & pneumatic multiple tire roller (8-10 tons) to full compaction, for break down, inter - mediate and finished rolling to achieve the desired density of at least 98% of that of Laboratory Marshall specimen, hand packing and pinning to give an even surface, including cost of all materials, their carriages, hire charges of Hot Mix Plant and all other machines, equipments for construction and quality control as per specification, fuels, lubricants and wages of operational staff etc. all complete as per the direction of the E-I-C</p>	Cum	1,260					
	[Bitumen Grade 60/70]							

2.11	<p>50mmBC: Providing 50mm thick (minimum) compacted pre-mixed bituminous carpeting to be prepared using 25mm down graded stone-chips (LAA value <= 35%) of gradation as specified, mixed with heated bitumen of 60/70 (Preferable) or 80/100 penetration grade heated straight run bitumen satisfying the requirements of ASTM/AASHTO. The bitumen and stone-chips shall be separately heated to a temperature 140°C – 155°C and 150°C – 170°C respectively before mixing. The mixing shall be done at temperature between 140°C – 160°C at a separate place away from the fire.</p> <p>The bitumen and stone-chips mixture shall be laid uniformly in proper camber, grade and super-elevation only on the prepared and accepted base or surface in a single appropriate layer to give the specified compacted thickness. The mixture should be rolled with appropriate Steel Drum Roller (3-5 tons) & pneumatic multiple tire roller (8-10 tons) to full compaction. The rolling temperature shall be maintained not below 90°C including supplying of all materials, their carriage, labourers, tools and equipment etc. all complete as per direction of the E-I-C. The bitumen in the mix shall be @4.5% to 5.5% by weight of total mix or as determined by job mix design. (In order to achieve the specified grading a blending of nominal maximum size of 25mm, 12mm, 6mm crushed stone chips and stone dust is suggested and proportion will have to determine by the laboratory analysis).</p>	Sqm	12,591				

2.12	7mmSC: Providing 7mm thick (minimum) compacted pre-mixed bituminous Seal Coat to be prepared using 6.33mm down crushed stone chips & stone dust blended together to comply the gradation as specified in the relevant item of Road Design Standards – 2005, mixed with 80/100 or 60/70 (Preferable) penetration grade minimum @5.0% by weight of total mix or as determined by job mix design. The bitumen and chips shall be separately heated to a temperature 140°C – 155°C and 150°C – 170°C respectively. The mixing shall be done at temperature between 140°C – 160°C at a separate place away from the fire. The mixture of bitumen and chips shall be laid uniformly on the road surface in appropriate layer so as to produce the specified compacted thickness, rolling at a temperature not below 90°C with appropriate Steel Drum Roller (3-5 tons) & pneumatic multiple tire roller (8-10 tons) to the desired compaction, including supplying of all materials, their carriage, labourers tools and equipment etc. all complete as per direction water, electricity, testing and other charges etc. all complete	sqm	12,591				
2.13	PCHD@1.2: Providing Prime Coat @1.2 liter/sqm with cut back bitumen to be prepared by cutting back 60/70 or 80/100 penetration grade straight run bitumen (conforming to the requirements of ASTM/AASHTO in the ratio of 100 parts by volume of bitumen to 40-60 parts by volume of kerosene depending on the porosity of the surface and will be decided by field trials, the correct quantity that is completely absorbed within 24 hours including carefully cleaning of the surface of the granular base material to be primed and spraying cut back bitumen at a temperature from 100°C to 120°C by appropriate hand device, etc. complete as per direction of the E-I-C.	Sqm	12,591				
	Rate in words						
2.13	Brick on End Edging (75mm across the road) with 1st class picked jhama bricks and filling the gaps with fine sand FM 0.5 including cutting trenches true to level and grade, removing earth, refilling and ramming the sides property including cost of all materials and accepted by the engineer.	Rm	313				

2.18	<p>RCC WORKS ($f_c = 25\text{MPa}$, minimum $f_{cr} = 30\text{ MPa}$ in nominal mix 1 : 1.5 : 3) Stone Chips using Steel Shutter (100% Sand of F.M. 2.2)</p> <p>Reinforced cement concrete works using steel shutter with minimum cement content relates to mix ratio 1:1.5:3 having minimum $f_{cr} = 30\text{ Mpa}$, and satisfying a specified compressive strength $f_c = 25\text{ Mpa}$ at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & Cement conforming to BDS EN-197-1-CEM 1 (32.5 to 52.5 N) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33; making, placing shutter in position and maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing with standard mixer machine with hopper, fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering including cost of water, electricity, testing and other charges etc. all complete approved and accepted by the Engineer. (Rate is excluding the cost of reinforcement and its fabrication, binding, welding and placing)</p> <p>(Rate is excluding the cost of reinforcement and its fabrication, placing and binding)</p>								
a)	Footing								
i)	Concrete	Cum		271					
ii)	Formwork/shuttering, prop and necessary supports etc. (wooden)	Sqm		851					
b)	Wall								
i)	Concrete	Cum		498					
ii)	Formwork/shuttering, prop and necessary supports etc. (wooden)	Sqm		498					

3.03	Supplying and laying of Single layer polythene sheet , each layer weighing 0.5 kilogram per 6.5 square meter in floor or any where below cement concrete complete with 250 mm over lapping of polythene sheet at junction in all respect as per drawing, specification and direction of the Engineer.	Sqm	1,878					
3.04	Supplying and placing of approx 60mm thick grey Uni-Block for paving walk way having compressive strength of 15 N/mm ² on compacted sand bed of 50 mm on stabilized soil base, and filling all interstices with sand, cleaning etc. accepted by the Engineer.	Sqm	1,878					
3.05	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer.	Sqm	2,461					
		Sub-Total =						
		Sub-Total (A-1) =						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH

Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

ACCESS ROAD (Lighting work)

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
4.00	CABLE WORKS Supply and installation of following sizes XLPE insulated & PVC sheathed single-core cable in pre-installed pipe, cable duct and cable trench as per drawing, specification and direction of the Engineer.						
	With cable manufactured by M/S BRB/Paradise/Poly/Citizen/BBS/Supersign cables Ltd.						
	1C-2x 2.5mm ² (N2XY) & 1C-1x 2.5mm ² PVC insulated (BYA-green) cable as ECC (for pole wiring)	m	240				
	UNDERGROUND CABLE WORKS Providing & laying of the following XLPE insulated & PVC sheathed cable (N2XY) with PVC insulated green/white coloured ECC wire (BYA) connecting at both ends, through PVC pipe & accessories in the following manner: All electrical contacts shall be of brass/copper connected through connector or soldering (no twisting shall be allowed) and cables shall be manufactured and tested according to relevant IEC/BDS/ BS/ VDE standards and as per detailed specification mentioned in Annexure-A. The work shall be carried out as per direction/approval/acceptance of the Engineer.						

In kutcha ground by cutting 45.70 cm width x 91.40 cm depth trench with necessary brick or tile protection and mending the damages good by refilling trench with proper compaction.									
In pucca floor through PVC pipe by cutting trench of necessary size and mending the damages good by brick soling, 75 mm (1:2:4) CC work with neat cement finishing etc.									
With cable manufactured by M/S BRB/Paradise/Poly/Citizen/BBS/Supersign cables Ltd.									
1C-2 x 16 sq.mm (N2XY) with 35 sq.mm (BYA) ECC wire through PVC pipe of minimum inner dia 40 mm having wall thickness of 1.9 mm.									
In katcha ground	m	1200							
In pucca floor	m	50							
PVC CONDUIT WORKS									
Supply and installation of water grade PVC pipe (Lira/Aziz brand or equivalent product of other reputed manufacturer) of following sizes in lighting column/pole, RCC cable duct or in underground including other works. The rate should be inclusive of cost of all PVC pipe, necessary accessories, 12 SWG GI pull wire, etc. The work shall be completed as per drawing and direction of the Engineer.									
20mm inner dia and min. wall thickness 1.5mm	m	120							
25mm inner dia and min. wall thickness 1.5mm	m	120							
40mm inner dia and min. wall thickness 1.9mm	m	360							
50mm inner dia and min. wall thickness 2.5mm	m	600							

LIGHT FITTINGS									
Supply & complete installation of IP65 street light fixture of following types complete with LED lamp of approved type, holder electronic control gear, earthing block and all other accessories as per specification, drawing and direction of the Engineer-in-Charge. The light fixture shall be CE,RoHS,UL certified and manufactured by International reputed manufacturer. The rate includes the necessary arms, bracket and other fixing arrangement with the PC pole of 11KV overhead line.									
90W LED street light	Each	18							
LIGHT POLE									
Supply & complete installation of 7500mm long hot dip galvanized G.I light pole having bottom dia 150mm (6") and top dia 75mm (3") complete with welded base plate suitable for bolting with concrete foundation including 50mm (2") dia bracket arm shall be fixed to the light column as per drawing. The length of the bracket shall be such that the end of light fixture will be 1.5meter (approx.) from the light column. A junction box to be installed at bottom level of the pole fabricated from 2.0mm (min.) mild steel sheet and hot deep galvanized complete with cover including termination unit, circuit breaker and earthing terminal etc. The work shall be completed as per drawing and direction of the Engineer.									
Light Pole	Each	18							
DISTRIBUTION BOARD, MCB/MCCB									

Earthing the electrical installation with 38.10 mm (1.5") dia G.I. pipe (earth electrode) having 6.35 mm dia holes across the dia at 305 mm interval securedly bonded with 2 SWG HDBC earth lead with washer, nuts, bolts etc. sunk upto undermentioned depth and protection of earth lead by 20mm mm 3/4") dia G.I. pipe upto plinth level run at a depth of 609.6 mm (2 ft.) below G.L. upto main board to be earthed including necessary connecting copper sockets, bolts, nuts including additional vertical run of 20 mm dia G.I. pipe upto G.L. from 609.6 mm (2') depth with blind socket for water pouring facility etc. complete for maintaining earth resistance less than 1 ohm.									
Depth of bottom of main electrode at 31242 mm. (102.5 ft) from G.L & length of electrode 30480 mm. (100 ft).	Set	2							
Construction of earth inspection pit inside measurement 600mm x600mm with 250mm thick brick in cement mortar (1:4) with 100mm thick RCC top slab (1:2:4) with 1% re-inforcement 450mm dia water sealed CI man hole cover with locking arrangement including necessary earth works,site filling and one brick flat soling 75mm thick (1:3:6) base concrete for making inlet channel & 12mm thick (1:2) cement plaster with neat finishing etc. all complete up to a depth of 0.75 meter.	Set	2							
Providing and drawing No.2 SWG HDBC wire through 20mm (3/4") dia G.I. pipe including fitting, fixing the G.I. pipe in wall or column complete as required.	m	40							
	Sub-Total (A-2) =								

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

Retention Canal (667m)

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
2100	Site improvement by carted earth or dredged sand for filling work						
	Site improvement by carted earth or dredged sand by Dredging including necessary systems, sandy silt (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finish level etc. all complete as per direction and accepted by the engineer-in-charge.	Cu.m	45,243				
2200	Mechanical Compaction of Earth or Sand/Transport						
	Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) up to finished level all complete and accepted by the engineer subject to submission of the method statement. In case of hydraulic filling by sand water pumps, the 2m layers shall be tested by using cone penetration tests to achieve minimum dry density of 90% with optimum moisture content (modified proctor test), final layer having 300mm under Formation Grand Level (FGL) shall be done the mechanical compaction to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) approved by the Engineer.	Cu.m	45,243				
11.2	Bailing out trapped water caused by inundation due to seepage or rain, by pump from foundation trenches.	hr	60				
11.4	Supply, making & laying of CC Block(1:3:6, 250mmx250mmx150mm) as per drawing all complete , accepted and approved by The Engineer.	nos	188,041				

11.5	Supply, making & laying 2 mm thick Geo-textile bags filled with 12.5 cum of sand per bag (size of each bag: perimeter 3.143m x Length 20m as per drawing). Geo-textile is of approved quality and origin/manufacturer as per manufacturer's instructions approved and accepted by the Engineer. Before commencing laying of Geo-textile sand filled bags, the Contractor must submit the method statement for carrying out this work including sample with evidence of origin and compliance certificate from independent testing laboratory for approval.	nos	2,268			
11.6	Supply & laying of 100mm boulder into sloped area and gap will be filled with grout(1:2:4) between two boulder. Boulder shall consist of hard,dense , durable and free of sod,roots,organic materials,debris ,all complete as per drawing , accepted and approved by The Engineer(Riprap).	cum	1,151			
11.7	Supply of clay free from any organic, foreign, environmental hazard substances,sand etc. & to be maintained proper thickness, all complete as per drawing , in/c carrying, placing the clay in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	1,681			
Total of Retention Canal						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

Retention Pond (86,500sqm)

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
2100	Site improvement by carted earth or dredged sand for filling work						
	Site improvement by carted earth or dredged sand by Dredging including necessary systems, sandy silt (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means in/c cost of cutting or by dredging of sand, sandy silt, all in/c local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, leveling and dressing in layers up to finishd level etc. all complete as per direction and accepted by the engineer-in-charge.	Cu.m	88,134				
2200	Mechanical Compaction of Earth or Sand/ Transporation						
	Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) up to finished level all complete and accepted by the engineer subject to submission of the method statement. In case of hydraulic filling by sand water pumps, the 2m layers shall be tested by using cone pnetration tests to achieve minimum dry density of 90% with optimum moisture content (modified proctor test), final layer having 300mm under Formation Grand Level (FGL) shall be done the mechanical compaction to achieve minimum dry density of 90% with optimum moisture content (modified proctor test) aproved by the Engineer.	Cu.m	88,134				
11.2	Bailing out trapped water caused by inundation due to seepage or rain, by pump from foundation trenches.	hr	270				

11.4	Supply, making & laying of CC Block(1:3:6, 250mmx250mmx150mm) as per drawing all complete , accepted and approved by The Engineer.	nos	245,232			
11.5	Supply, making & laying 2 mm thick Geo-textile bags filled with 12.5 cum of sand per bag (size of each bag: perimeter 3.143m x Length 20m as per drawing). Geo-textile is of approved quality and origin/manufacturer as per manufacturer's instructions approved and accepted by the Engineer.Before commencing laying of Geo-textile sand filled bags, the Contractor must submit the method statement for carrying out this work including sample with evidence of origin and compliance certificate from independent testing laboratory for approval.	nos	1,758			
11.6	Supply & laying of 100mm boulder into sloped area and gap will be filled with grout(1:2:4) between two boulder,Boulder shall consist of hard,dense , durable and free of sod,roots,organic materials,debris ,all complete as per drawing , accepted and approved by The Engineer(Riprap).	cum	1,548			
11.7	Supply of clay free from any organic, foreign, environmental hazard substances,sand etc. & to be maintained proper thickness, all complete as per drawing , in/c carrying, placing the clay in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	10,206			
12.0	Drainage work					
12.1	Precast Drain Making & placing of pre cast drain made by C.C (1:3:6) including Excavation, Filling, Curing, Steel shutter, Pouring, Curing ,Labour, Storing, Placing, Jointing,etc. and all other materials as per drawing and accepted by the engineer.	rm	834			
12.2	Key Block:					
	RCC WORKS					
	(f _c = 19 MPa, minimum f _{cr} = 24 MPa in nominal mix 1 : 2 : 4) Brick-Chips using Steel Shutter (Sand of F.M. 1.2 and F.M. 2.2 in equal proportion)					

	Reinforced cement concrete works using wooden shutter, with minimum cement content relates to mix ratio 1:2:4 having minimum $f_{cr} = 24$ Mpa, and satisfying a specified compressive strength $f_c = 19$ Mpa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & cement conforming to BDS EN-197-1- CEM 1 (32.5 to 52.5 N) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming ASTM C-33 including breaking chips and screening, making, placing shutter in position and maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering including excavation, back filling, brick flat soling, local caring, rebar 1%, cost of water, electricity, testing and other charges etc. all complete approved and accepted by the Engineer.	mm	834	
Total of Retention Pond				

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

B-3 Sluice Gate

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
A-1.1: 0.01	Excavation, filling, soling and cement concrete Earth work in excavation in all kinds of soil for foundation trenches including. layout, providing center lines, local bench-mark pillars, leveling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer, subject to submit method statement of carrying out excavation work to the Engineer for approval. However, Engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract.						
	Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in soft clayey soil / loose sand / silt	Cum	43.00				
0.02	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer.	Cum	591.00				

0.03	Mass concrete (1:3:6) in foundation or floor with cement, sand (F.M. 1:2) and picked jhama chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days including the supply of water, electricity and other charges and costs of tools and plants etc. all complete and accepted by the Engineer. (Cement: CEM-II/A-M)	Cum	45.00				
0.04	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150mm layers including leveling, watering and compaction to achieve minimum dry density of 90% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only etc. all complete and accepted by the Engineer.	Cum	12.90				
0.05	LC-CCB: Labour charge for laying single layer CC Block of different sizes for protective wall, including preparation trenches, true to level, maintaining alignment, watering and ramming the base, including carrying and placing CC blocks, filling minimum 65% interstices of CC Block work tightly with cement mortar (1:6), raking out joints, cleaning and soaking Block at least for 24 hours before use, washing of sand, curing for requisite period, etc. all complete in all respect as per approved drawing, specification and direction of the Engineer-in-charge. [Excluding the cost of CC Blocks].	Cum	14.00				
0.06	RCC WORKS (f'c = 25MPa, minimum f'cr = 30 MPa in nominal mix 1 : 1.5 : 3) Stone Chips using Steel Shutter (100% Sand of F.M. 2.2)						

	Reinforced cement concrete works using steel shutter with minimum cement content relates to mix ratio 1:1.5:3 having minimum $f_{cr} = 30$ Mpa, and satisfying a specified compressive strength $f_c = 25$ Mpa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & Cement conforming to BDS EN-197-1-CEM 1 (32.5 to 52.5 N) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making, placing shutter in position and maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing with standard mixer machine with hopper, fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering including cost of water, electricity, testing and other charges etc. all complete approved and accepted by the Engineer. (Rate is excluding the cost of reinforcement and its fabrication, binding, welding and placing)									
a)	(Rate is excluding the cost of reinforcement and its fabrication, placing and binding)									
i)	Footings									
	Concrete	Cum							400.00	
ii)										
	Formwork/shuttering, prop and necessary supports etc. (wooden)	Sqm							139.00	
b)										
i)	Wall, Slab									
	Concrete	Cum							124.00	
ii)										
	Formwork/shuttering, prop and necessary supports etc. (wooden)	Sqm							413.00	
0.07	Supplying, fabrication and fixing Ribbed or deformed bar reinforcement of required size and length in concrete in accordance with BDS ISO 6935-2: 2009 standard, including straightening the bar, removing rusts, cleaning , cutting, bending, binding in position with supply of 22 B.W.G G.I wire including lapping, supporting with precast concrete blocks (1:1), metal chair etc. complete including cost of all materials, labour, local handling, laboratory test, incidental necessary to complete the work in all respects as per specification, drawing and direction of the Engineer.									
	60-grade ribbed or deformed bar	M.Ton							56.03	

0.08	Supplying, fitting and fixing G.I. pipe railing of 900 mm height with 50 x 50 x 6 mm M.S. base plate, 3" dia vertical Pipe @ 1000 mm c/c and 3" dia G.I. pipe hand rail of any design including polishing painting etc. all complete and accepted by the Engineer.	26.00	Sqm			
0.09	Preparation of design & drawing,manufacturing ,supplying of auto system M.S. Vertical Lift Gate/flap shutter of size:1.95mx1.35m., made with 8mm thick M.S. skin plate and stiffener with minimum 75mmx75mmx10mm M.S. angle as frame, horizontal & vertical beam, 75mmx25mmx12mm P-type rubber seal ,fixed with 10mm dia x 63.5 mm M.S. counter shank bolts with nuts and 40mmx10mm M.S. strip as clamp drilled spaces @ 150mm c/c stem attachment with proper thread , cotter pin and washer of proper grade & brand new with a prime coat of redoxide where necessary,Padestal as required,suitable auto lifting device for gate with 63mm dia threaded steel shaft, 146 mm outer dia bronze nut,thrust bearing,steel bevel gear fabricating,rivetting, welding, fixing rubber seal, providing required nuts and bolts,making holes in concrete for hooking arrangements with supply of necessary materials, tools and other accessories required for fitting the same to regulator/sluiice and mending the damages with CC (1:2:4), removing the spoils etc. including the cost of all materials as per approved design, specification and direction of Engineer in charge as well instalation & testing ,commissioning etc.	1.00	LS			

0.10	Brick works with first class bricks with cement sand (F.M. 1:2) mortar (1:6) in foundation and plinth, filling the joints/interstices fully with mortar, racking out the joints, cleaning and soaking the bricks at least for 24 hours before use and curing at least for 7 days etc. all complete including cost of water, electricity and other charges and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M)	Cum	8.95				
0.11	Rule pointing to brick wall with cement sand (F.M. 1:2) mortar (1:2) with fresh cement and raking out the joints, curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	Sqm	17.70				
Total of Sluice Gate (B-3)							

B-4: Pumping Station

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
A-1 :	Sub-structure (Below Ground Level)						
A-1.1	Layout, Excavation, Filling, Site Development etc.						
1	Earth work in excavation in all kinds of soil for foundation work including layout, providing center lines, bench-mark pillars, levelling, ramming and preparing the base, fixing & marking layout, providing necessary tools and plants, protecting and maintaining the bed dry, dewatering, bailing out water during construction period, removing the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete as per drawing, specification and direction of the Engineer (<i>Depth of excavation approximately 10 meter</i>). <i>Excavated earth shall be the property of the Client.</i>						
1.1	Layout and marking for earthwork in excavation in foundation as per specification, drawing and accepted by the Engineer (<i>Plinth area of the structure shall be considered for measurement</i>) .	sqm	159.00				
1.2	Earthwork in excavation in foundation trenches upto 1.5 m depth and storing of excavated materials at a suitable location as per direction of the Engineer for reuse.	cum	33.00				
1.3	Earthwork in excavation in foundation trenches upto 1.5 m depth and storing of excavated materials at a suitable location as per direction of the Engineer for reuse.	cum	11.00				
2	Earth filling (Back filling) in foundation trenches in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 90% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by the Engineer.	Cum	24.00				

	RCC WORKS (f _c = 25MPa, minimum f _{cr} = 30 MPa in nominal mix 1 : 1.25 : 2.5) Stone Chips using Steel Shutter (100% Sand of F.M. 2.2)								
8	Reinforced cement concrete works using steel shutter with minimum cement content relates to mix ratio 1:1.5:3 having minimum f _{cr} = 30 Mpa, and satisfying a specified compressive strength f_c = 25 Mpa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & Cement conforming to BDS EN-197-1- CEM1, 52.5N (52.5MPa) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making, placing shutter in position and maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing with standard mixer machine with hopper, fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, additional testing charges of materials and cylinders required by engineer, other charges etc. all complete approved and accepted by the Engineer. (Rate is excluding the cost of reinforcement and its fabrication, binding, welding and placing)								
8.1	In individual and combined footings								
i)	Concrete	cum	6.00						
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	15.00						
8.2	Floor slab at PL								
i)	Concrete	cum	14.00						
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	6.00						
8.3	Foundation beam / Grade beam								
i)	Concrete	cum	6.00						
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	11.00						
8.4	In Pedestals, column, column capitals, shear wall, below plinth level								
i)	Concrete	cum	3.00						

[illegible][illegible][illegible][illegible][illegible][illegible]

12	38 mm thick artificial patent stone (1:2:4) flooring with cement, best quality coarse sand (50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2 and 50% best local sand of FM 1.2) and 12 mm down well graded stone chips, laying the concrete in alternate panels, compacting and finishing the top with neat cement and curing at least 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer.	sqm	9.00				
		Sub-Total (A-1.4) =					
		Sub-Structure Total (A-1) =					
A-2:	Super-structure (Above Plinth Level)						
A-2.1:	Reinforced Cement Concrete (RCC) Works, Admixture & M.S. Fabrication Works						
	RCC WORKS (f'c = 25MPa, minimum f'cr = 30 MPa in nominal mix 1 : 1.25 : 2.5) Stone Chips using Steel Shutter (100% Sand of F.M. 2.2)						
13	Reinforced cement concrete works using steel shutter with minimum cement content relates to mix ratio 1:1.5:3 having minimum f'cr = 30 Mpa, and satisfying a specified compressive strength f c = 25 Mpa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & Cement conforming to BDS EN-197-1- CEM1, 52.5N (52.5MPa) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making, placing shutter in position and maintaining true to plumb, making shutter water tight properly, placing reinforcement in position; mixing with standard mixer machine with hopper, fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, additional testing charges of materials and cylinders required by engineer, other charges etc. all complete approved and accepted by the Engineer. <i>(Rate is excluding the cost of reinforcement and its fabrication, binding, welding and placing)</i>						
13.1	In column, Shear wall, above plinth level						
a)	In ground floor						
i)	Concrete	cum	17.00				

ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	8.00				
13.2	Tee beams, Ell beams and Rectangular beams etc.						
a)	In ground floor						
i)	Concrete	cum	6.00				
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	55.00				
13.3	Floor /roof slab: Ground Floor						
a)	In ground floor						
i)	Concrete	cum	13.00				
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	109.00				
	RCC WORKS						
	(f'c = 22 MPa, minimum f'cr = 27 MPa in nominal mix 1 : 2 : 4) Stone-Chips using Steel Shutter (100% Sand of F.M. 2.2.)						
14	Reinforced cement concrete works using steel shutter with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa, and satisfying a specified compressive strength f'c = 22 Mpa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM & Cement conforming to BDS EN-197-1 :2003 ; CEM -II/A-M (V-S-L), 42.5N, PCC/ ASTM-C 150 Type – II, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making, placing shutter in position and maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering including cost of water, electricity, testing and other charges etc. all complete approved and accepted by the Engineer.						
14.1	In Tie beam and lintels						
a)	In ground floor						
i)	Concrete	cum	1.00				
ii)	Formwork /shuttering, prop and necessary supports etc. (Steel)	sqm	20.00				

20	Average 100 mm thick finished lime terracing with 20 mm down graded first class brick chips (Khoa), surki from 1st class bricks and min lime content 500kg per 2.83cubic meter (stone lime brought at site, not being powdered in open air and to be slaked in presence of engineer-in-charge and to be measured in volume three days after slaking for using in the mix) in the proportion 7:2:2 (brick chips : surki : lime) including preparation of the mix on the ground by making a suitable platform under proper polythene cover. Cutting the mix twice daily with linewater (1:10) at least for 7 days until the mix attain desirable consistency. Laying the mix in proper slope, beating the same with standard 'koppa' for minimum 7 days to gain maximum consolidation, making ghoondy and neat finishing with lime Surki mortar (1:2) and curing for 21 days providing polythene cover after each day work and cleaning etc. complete in all respect accepted by the Engineer.	cum	11.00					
			Sub-Total (A-2.4) =					
A-2.5:	Wood Work in Door Frame and Shutter, Clamp, Lock etc.							
21	Door Frame: Supplying and making door and other frames (Chowkat) where necessary for all floors with matured natural seasoned wood of required size including painting two coats of coal tar to the surface in contact with wall, fitting and fixing in position and mending good the damages if any etc. all complete as per drawing, specification and direction of the Engineer. (All sizes of wood are finished). For Chittagong Teak Wood	cum	1.00					
22	Supplying, fitting and fixing 38 mm thick well matured, seasoned (min 10" wide plank) solid wood single leaf door shutter having top rail style of sections 100 mm x 38 mm, lock rail 125 x 38 mm and bottom rail 225 x 38 mm. Closed joints with 25 mm x 12 mm size wooden peg and provided with best quality 4 Nos. 100 mm iron hinges 2 (two) Nos. best quality 12 mm dia 300 mm and 200 mm long iron tower and socket bolts, 2 (two) Nos. heavy type nickel plated handle, hinged cleats, buffer blocks and finished by sand papering etc. all complete in all floors and accepted by the Engineer. (All sizes of wood are finished)							
	For Chittagong Teak Wood	sqm	3.00					

28	On exterior surface applying as per manufacturer instructions three (3) coats of weather coat of approved quality and colour delivered from authorized local agent of the manufacturer in a sealed container including cleaning, sand papering, scaffolding, curing, drying, supply and carriage of all materials, labour, tools, plants, incidentals etc. complete in all respect in all floors and accepted by the Engineer.	sqm	67.00			
29	Painting to door and window frames and shutters in 2 (two) coats with approved best quality and colour of synthetic enamel paint delivered from authorized local agent of the manufacturer in a sealed container, having highly water resistant, high bondability, flexible, using specific brand thinner applied by brush / roller / spray over a coat of priming elapsing time for drying including surface cleaning from dust, oil or dirt, smoothening, finishing and polishing with sand paper and necessary tools, scaffolding etc. all complete in all floors approved and accepted by the Engineer.	sqm	13.00			
30	French polishing to door and window frames and shutters three coats over a coat of priming including putty, cleaning finishing and polishing with sand paper etc. all complete in all floors accepted by the Engineer.	sqm	8.00			
		Total (A-3) =				
A-4 :	Aluminium window, sliding door, fixed composite window and glass					
31	Supplying, fitting and fixing of Aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer's Association (AAMA) standard specification having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm, 26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm, 19.90 mm), 1.2 mm thick sliding fixed side (size 31 mm, 26 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm)					

	will be anodized to aluminium bronze/silver colour with a coat not less than 15 micron in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer.	sqm	13.00				
32	Supplying, fitting and fixing in Aluminium door frames, windows, partitions and curtain wall distortion free glass of approved quality and shade including cost of fitting fixing all necessary accessories etc. complete in all respect as per drawing and accepted by the Engineer.						
	5 mm thick clear glass	sqm	13.00				
		Total (A-4) =					
	Grand Total of Pumping Station (B-4)						

THE GOVERNMENT OF THE REPUBLIC OF BANGLADESH
Land Development Works for Bangladesh Special Economic Zone Development under Foreign Direct Investment Promotion Project (FDIPP)

Other Related Facilities

ITEM NO.	PAY ITEM	UNIT	QUANTITY	UNIT PRICE		AMOUNT	
				LOCAL (BDT)	FOREIGN (JPY)	LOCAL (BDT)	FOREIGN (JPY)
Drainage Pump							
1	Providing following capacity 2800 - 2900 RPM single stage Centrifugal water pump manufactured according to DIN/NEMA/IEC/BS/VDE/JIS & ISO 9001 standard complete with steel base plate frame, coupling flange with gaskets, bolts, nuts & standard, accessories etc. or closed coupled as required coupled with 3-phase, 400 volt ± 5 %, 50 Hz 2900 RPM Horizontal motor having six terminals for star-delta or DOL starting & totally enclosed fan cooled & in built thermal protection, Insulation: Class F & Protection: IP44(Minimum) manufactured by CE certified/UL listed countries as per sample accepted/approved by the Engineer.						
	Discharge: 1000 cum/h and Head:15m ,suction & delivery: 400x350.	Nos	3.00				
				Sub-total			
1	11 KV UNDERGROUND CABLE WORKS						
	Providing & laying of following sizes LT PVC insulated sheathed & armoured cable (NYFGbY)/ HT (11KV) PVC insulated, sheathed, screened & armoured cable (NYSEYFGbY)/HT (11KV) armoured XLPE Cable: All electrical contacts shall be of brass/copper connected through connector or soldering (no twisting shall be allowed) and cables shall be manufactured and tested according to relavent IEC/BDS/ BS/ VDE standards . The work shall be carried out as per direction/approval/acceptance of the Engineer.						
(i)	In kutcha ground by cutting 45.70 cm width x 91.40 cm depth trench with necessary brick or tile protection and mending the damages good by refilling trench with proper compaction.						

(ii)	In pucca floor through PVC pipe by cutting trench of necessary size and mending the damages good by brick soling, 75 mm (1:2:4) CC work with neat cement finishing etc.								
(iii)	In pucca ground/road through required size of PVC pipe by cutting 45.70cm width x 91.40 cm depth trench mending good the damages by earth refilling with proper compaction providing 50 mm thick compacted premix bituminous carpeting over one layer of 1st class flat brick soling and 75 mm thick compacted water bound macadam of khoa of brick.								
1.1	3C-185 sq.mm 11KV XLPE cable.								
(i)	In katcha ground	m				750.00			
(ii)	In pucca floor / ground / road through 150 mm PVC/GI pipe.	m				80.00			
	Total:	Sub-total							
	Grand Total of Other Related Facilities (B-5)								