Request for Bids
Works

(Without Prequalification)

Procurement of:

Road and Storm Water Network for Mirsarai-2B EZ

Employer: Bangladesh Economic Zones Authority (BEZA)

Project: Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project, Bangladesh-PRIDE (P170688)

Contract title: Road and Storm Water Network for Mirsarai-2B EZ

Country: Bangladesh

Credit No.: IDA-6676 BD

RFB No: WD2-BSMSN- BEZA

Issued on:

Standard Procurement Document

Table of Contents

PART 1 – Bidding Procedures **3**

Section I - Instructions to Bidders 6

Section II - Bid Data Sheet (BDS) 35

Section III - Evaluation and Qualification Criteria 43

Section IV - Bidding Forms 59

Section V - Eligible Countries 170

Section VI - Fraud and Corruption 171

PART 2 –Works' Requirements **175**

Section VII - Works' Requirements 177

PART 3 – Conditions of Contract and Contract Forms **215**

Section VIII - General Conditions (GC) 216

Section IX - Particular Conditions 217

Section X - Contract Forms 273

PART 1 – Bidding Procedures

Section I - Instructions to Bidders

Contents

A. General 6

1. Scope of Bid 6
2. Source of Funds 7
3. Fraud and Corruption 8
4. Eligible Bidders 8
5. Eligible Materials, Equipment, and Services 11

B. Contents of Bidding Document 11

6. Sections of Bidding Document 11
7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting 12
8. Amendment of Bidding Document 13

C. Preparation of Bids 14

9. Cost of Bidding 14
10. Language of Bid 14
11. Documents Comprising the Bid 14
12. Letter of Bid and Schedules 15
13. Alternative Bids 15
14. Bid Prices and Discounts 16
15. Currencies of Bid and Payment 17
16. Documents Comprising the Technical Proposal 17
17. Documents Establishing the Eligibility and Qualifications of the Bidder 17
18. Period of Validity of Bids 18
19. Bid Security 18
20. Format and Signing of Bid 20

D. Submission and Opening of Bids 21

21. Sealing and Marking of Bids 21
22. Deadline for Submission of Bids 22
23. Late Bids 22
24. Withdrawal, Substitution, and Modification of Bids 22

25. Bid Opening 23

E. Evaluation and Comparison of Bids 24

26. Confidentiality 24
27. Clarification of Bids 25
28. Deviations, Reservations, and Omissions 25
29. Determination of Responsiveness 25
30. Nonmaterial Nonconformities 26
31. Correction of Arithmetical Errors 26
32. Conversion to Single Currency 27
33. Margin of Preference 27
34. Subcontractors 27
35. Evaluation of Bids 28
36. Comparison of Bids 29
37. Abnormally Low Bids 29
38. Unbalanced or Front Loaded Bids 29
39. Qualifications of the Bidder 30
40. Most Advantageous Bid 31
41. Employer's Right to Accept Any Bid, and to Reject Any or All Bids 31
42. Standstill Period 31
43. Notification of Intention to Award 31

F. Award of Contract 32

44. Award Criteria 32
45. Notification of Award 32
46. Debriefing by the Employer 33
47. Signing of Contract 33
48. Performance Security 34
49. Procurement Related Complaint 34

Section I - Instructions to Bidders

A. General

1. Scope of Bid

1.1 In connection with the Specific Procurement Notice – Request for Bids (RFB), specified in the **Bid Data Sheet (BDS)**, the Employer, as specified **in the BDS**, issues this Bidding document for the provision of Works as specified in Section VII, Works' Requirements. The name, identification, and number of lots (contracts) of this RFB are specified **in the BDS.**

1.2 Throughout this bidding document:

the term **"in writing"** means communicated in written form (e.g. by mail, e-mail, fax, including, if specified **in the BDS**, distributed or received through electronic-procurement system used by the Employer) with proof of receipt;

if the context so requires, **"singular"** means **"plural'** and vice versa;

"Day" means calendar day, unless otherwise specified as a **"Business Day."** A **"Business Day"** is any day that is a working day of the Borrower. It excludes the Borrower's official public holidays;

"ES" means environmental and social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH));

"Sexual Exploitation and Abuse" "(SEA)" means the following:

Sexual Exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;

"Sexual Harassment" "(SH)" is defined as unwelcome sexual advances, requests for sexual favors, and other

verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's or Employer's Personnel;

"Contractor's Personnel" is as defined in Sub-Clause 1.1.17 of the General Conditions; and

"Employer's Personnel" is as defined in Sub-Clause 1.1.33 of the General Conditions.

A non-exhaustive list of (i) behaviors which constitute SEA and (ii) behaviors which constitute SH is attached to the Code of Conduct form in Section IV.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called "Borrower") specified **in the BDS** has received or has applied for financing (hereinafter called "funds") from the International Bank for Reconstruction and Development or the International Development Association (hereinafter called "the Bank") in an amount specified **in the BDS**, toward the project named **in the BDS**. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding document is issued.

2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank, and will be subject, in all respects, to the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, equipment, plant, or materials, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Section VI.

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

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, a state-owned enterprise or institution subject to ITB 4.6 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 joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless specified **in the BDS**, there is no limit on the number of members in a JV.

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

(a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or

(b) receives or has received any direct or indirect subsidy from another Bidder; or

(c) has the same legal representative as another Bidder; or

(d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or

influence the decisions of the Employer regarding this Bidding process; or

(e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or

(f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer or Borrower as Engineer for the Contract implementation; or

(g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the Bidding document or specifications of the Contract, and/or the Bid evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Bidding process and execution of the Contract.

4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate in more than one Bid, except for permitted alternative Bids. This includes participation as a subcontractor in other Bids. Such participation shall result in the disqualification of all Bids in which the firm is involved. A firm that is not a Bidder or a JV member may participate as a subcontractor in more than one Bid.

4.4 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion

also shall apply to the determination of the nationality of proposed subcontractors or subconsultants for any part of the Contract including related Services.

4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Anti-Corruption Guidelines, and in accordance with its prevailing sanctions policies and procedures as set forth in the World Bank Group's Sanctions Framework, as described in Section VI paragraph 2.2 d. shall be ineligible to be prequalified for, initially selected for, bid for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified **in the BDS**.

4.6 Bidders that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Employer.

4.7 A Bidder shall not be under suspension from bidding by the Employer as the result of the operation of a Bid–Securing or Proposal-Securing Declaration.

4.8 Firms and individuals may be ineligible if so indicated in Section V and (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country. When the Works are implemented across jurisdictional boundaries (and more than one country is a Borrower, and is involved in the procurement), then exclusion of a firm or individual on the basis of ITB 4.8 (a) above by any country may be applied to that procurement across other countries involved, if the Bank and the Borrowers involved in the procurement agree.

9

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

4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Borrower's request, is satisfied that the debarment; (a) relates to fraud or corruption, and (b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Materials, Equipment, and Services

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

B. Contents of Bidding Document

6. Sections of Bidding Document

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

PART 1 Bidding Procedures

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

PART 2 Works Requirements

- Section VII - Works' Requirements

PART 3 Conditions of Contract and Contract Forms

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

6.2 The Specific Procurement Notice - Request for Bids (RFB) issued by the Employer is not part of the Bidding document.

6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the Bidding document, responses to requests for clarification, the minutes of the pre-Bid meeting (if any), or Addenda to the Bidding document in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding document and to furnish with its Bid all information and documentation as is required by the Bidding document.

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

7.1 A Bidder requiring any clarification of the Bidding document shall contact the Employer in writing at the Employer's address specified **in the BDS** or raise its 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 document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so specified **in the BDS**, the Employer shall also promptly publish its response at the web page identified **in the BDS**. Should the clarification result in changes to the essential elements of the Bidding document, the Employer shall amend the Bidding document following the procedure under ITB 8 and ITB 22.2.

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

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel,

and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 If so specified **in the BDS**, the Bidder's designated representative is invited to attend a pre-Bid meeting and/or a Site of Works visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

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

7.6 Minutes of the pre-Bid meeting, if applicable, including the text of the questions asked by Bidders, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding document in accordance with ITB 6.3. If so specified **in the BDS,** the Employer shall also promptly publish the Minutes of the pre-Bid meeting at the web page identified **in the BDS**. Any modification to the Bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to ITB 8 and not through the minutes of the pre-Bid meeting. Nonattendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

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

8.2 Any addendum issued shall be part of the Bidding document and shall be communicated in writing to all who have obtained the Bidding document from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.

8.3 To give Bidders reasonable time in which to take an addendum into account in preparing their Bids, the

Employer should 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 specified **in the BDS**, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise the following:

(a) Letter of Bid prepared in accordance with ITB 12;

(b) Schedules including priced Bill of Quantities, completed in accordance with ITB 12 and ITB 14;

(c) Bid Security or Bid-Securing Declaration, in accordance with ITB 19.1;

(d) Alternative Bid, if permissible, in accordance with ITB 13;

(e) Authorization: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.3;

(f) Qualifications: documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the Contract if its Bid is accepted;

(g) Conformity: a technical proposal in accordance with ITB 16;

(h) any other document required in the BDS.

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

submitted with the Bid, together with a copy of the proposed Agreement.

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

11.4 The Bidder shall furnish in the Letter of Bid the names of three potential DAAB members and attach their curriculum vitae. The list of potential DAAB members proposed by the Employer (Contract Data 21.1) and by the Bidder (Letter of Bid) shall be subject to Bank's No-objection.

12. Letter of Bid and Schedules

12.1 The Letter of Bid and 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 20.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

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

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

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

13.4 When specified **in the BDS**, Bidders are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified **in the BDS**, as

will the method for their evaluating, and described in Section VII, 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 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 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 Bid, in accordance with ITB 12.1.

14.5 Unless otherwise specified **in the BDS** and the Conditions of 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 Table of Adjustment Data and the Employer may require the Bidder to justify its proposed indices and weightings.

14.6 If, so specified in ITB 1.1, Bids are 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 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. **If, however, rated criteria is used in accordance with ITB 35.2, discounts on condition of award of more than one contract will not be used for Bid evaluation purpose.**

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

15. Currencies of Bid and Payment

15.1 The currency (ies) of the Bid and the currency (ies) of payments shall be the same and shall be as specified **in the BDS**.

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

16. Documents Comprising the Technical Proposal

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

17. Documents Establishing the Eligibility and Qualifications of the Bidder

17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, included in Section IV, Bidding Forms.

17.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract the Bidder shall provide the information requested in the corresponding information sheets included in Section IV, Bidding Forms.

17.3 If a margin of preference applies as specified in accordance with ITB 33.1, domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITB 33.1.

18. Period of Validity of Bids

18.1 Bids shall remain valid until the date specified **in the BDS** or any extended date if amended by the Employer in accordance with ITB 8. A Bid that is not valid until the date specified **in the BDS,** or any extended date if amended by the Employer in accordance with ITB 8, shall be rejected by the Employer as nonresponsive.

18.2 In exceptional circumstances, prior to the date of expiration of the Bid validity, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 19, it shall also be extended for twenty-eight (28) days beyond the extended date for bid validity. 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 date of expiry of the Bid validity specified in accordance with ITB 18.1, the Contract price shall be determined as follows:

(a) in the case of **fixed price** contracts, the Contract price shall be the Bid price adjusted by the factor specified **in the BDS**;

(b) in the case of **adjustable price** contracts, no adjustment shall be made; or

(c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

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

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

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

(a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);

(b) an irrevocable letter of credit;

(c) a cashier's or certified check; or

(d) another security specified **in the BDS**,

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

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

19.5 If a Bid Security is specified pursuant to ITB 19.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the Contract and furnishing the Performance Security and if required **in the BDS**, the Environmental and Social (ES) Performance Security pursuant to ITB 48.

19.6 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security, and if required **in the BDS**, the Environmental and Social (ES) Performance Security.

19.7 The Bid Security may be forfeited:

(a) if a Bidder withdraws its Bid prior to the expiry date of the Bid validity specified by the Bidder on the Letter of Bid, or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 47; or

(ii) furnish a Performance Security and if required **in the BDS**, the Environmental and Social (ES) Performance Security in accordance with ITB 48.

19.8 The Bid Security or the Bid-Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of Bidding, the Bid Security or the Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.2.

19.9 If a Bid Security is not required **in the BDS**, pursuant to ITB 19.1, and:

(a) if a Bidder withdraws its Bid prior to the expiry date of the Bid validity specified by the Bidder on the Letter of Bid or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 47; or

(ii) furnish a Performance Security and, if required **in the BDS**, the Environmental and Social (ES) Performance Security in accordance with ITB 48,

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

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the documents comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE." In addition, the Bidder shall submit copies of the Bid, in the number specified **in the BDS** and clearly mark them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 Bidders shall mark as "CONFIDENTIAL" all information in their Bids which is confidential to their business. This may

include proprietary information, trade secrets, or commercial or financially sensitive information.

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

20.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

20.5 Any 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 deliver the Bid in a single, sealed envelope (one-envelope Bidding process). Within the single envelope the Bidder shall place the following separate, sealed envelopes:

(a) in an envelope marked "ORIGINAL", all documents comprising the Bid, as described in ITB 11; and

(b) in an envelope marked "COPIES", all required copies of the Bid; and

(c) if alternative Bids are permitted in accordance with ITB 13, and if relevant:

(i) in an envelope marked "ORIGINAL –ALTERNATIVE BID", the alternative Bid; and

(ii) in the envelope marked "COPIES- ALTERNATIVE BID", all required copies of the alternative Bid.

21.2 The inner and outer envelopes shall:

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

(b) be addressed to the Employer in accordance with ITB 22.1;

(c) bear the specific identification of this Bidding process specified in accordance with BDS 1.1; and

(d) bear a warning not to open before the time and date for Bid opening.

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

22. Deadline for Submission of Bids

22.1 Bids must be received by the Employer at the address and no later than the date and time specified **in the BDS**. When so specified **in the BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures specified **in the BDS**.

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

23. Late Bids

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

24. Withdrawal, Substitution, and Modification of Bids

24.1 A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that 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 date of expiry of Bid validity specified by the Bidder on the Letter of Bid or any extended date thereof.

25. Bid Opening

25.1 Except in the cases specified in ITB 23 and ITB 24.2, the Employer shall publicly open and read out in accordance with this ITB all Bids received by the deadline, at the date, time and place specified **in the BDS**, in the presence of Bidders` designated representatives and anyone who chooses to attend. Any specific electronic Bid opening procedures required if electronic Bidding is permitted in accordance with ITB 22.1, shall be as specified **in the BDS**.

25.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened but returned to the Bidder. No Bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

25.3 Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.

25.4 Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening.

25.5 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Bidder and whether there is a modification; the total Bid Price, per lot (contract) if applicable, including any discounts and alternative Bids; the presence or absence of a Bid Security or Bid-Securing

Declaration, if required; and any other details as the Employer may consider appropriate.

25.6 Only Bids, alternative Bids and discounts that are opened and read out at Bid opening shall be considered further for evaluation. The Letter of Bid and the Bill of Quantities are to be initialed by representatives of the Employer attending Bid opening in the manner specified **in the BDS**.

25.7 The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).

25.8 The Employer shall prepare a record of the Bid opening that shall include, as a minimum:

(a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;

(b) the Bid Price, per lot (contract) if applicable, including any discounts;

(c) any alternative Bids;

(d) the presence or absence of a Bid Security, if one was required.

25.9 The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the evaluation of Bids and recommendation of contract award shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 43.

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

26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract award, if a Bidder wishes to contact the Employer on any matter related to the Bidding process, it shall do so in writing.

27. Clarification of Bids

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

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

28. Deviations, Reservations, and Omissions

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

(a) "Deviation" is a departure from the requirements specified in the Bidding document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding document.

29. Determination of Responsiveness

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

29.2 A substantially responsive Bid is one that meets the requirements of the Bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the Bidding document, the Employer's

rights or the Bidder's obligations under the proposed Contract; or

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

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

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

30. Nonmaterial Nonconformities

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

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

30.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only to reflect the price of a missing or non-conforming item or component, by adding the average price of the item or component quoted by substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate.

31. Correction of Arithmetical Errors

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

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

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

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

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

32. Conversion to Single Currency

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

33. Margin of Preference

33.1 Unless otherwise specified **in the BDS,** a margin of preference for domestic Bidders[1] shall not apply.

34. Subcontractors

34.1 Unless otherwise stated **in the BDS,** the Employer does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Employer.

34.2 Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified **in the BDS**. Subcontractors proposed by the Bidder shall be fully qualified for their parts of the Works.

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

34.3 The subcontractor's qualifications shall not be used by the Bidder to qualify for the Works unless their specialized parts of the Works were previously designated by the Employer **in the BDS** as can be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Bidder may be added to the qualifications of the Bidder.

35. Evaluation of Bids

Technical Evaluation

35.1 The Employer shall evaluate the Bids using the criteria and methodologies listed in Section III, Evaluation and Qualification Criteria.

35.2 If specified **in the BDS**, the Employer's evaluation will be carried out by applying rated criteria that take into account technical factors, in addition to cost factors. An Evaluated Bid Score will be calculated for each responsive Bid using the formula, specified in Section III, Evaluation and Qualification Criteria. The scores to be given to technical factors and sub factors are specified **in the BDS**. The weight to be assigned for the Technical factors and cost is specified **in the BDS**.

Financial Evaluation

35.3 To evaluate a Bid, the Employer shall consider the following:

(a) the Bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 31.1;

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

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 32;

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 30.3; and

(f) the additional evaluation factors specified **in the BDS** and Section III, Evaluation and Qualification Criteria.

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

35.5 If this Bidding document allows Bidders to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated cost of the lot (contract) combinations, including any discounts offered in the Letter of Bid, is specified in Section III, Evaluation and Qualification Criteria. If, however, rated criteria is used in accordance with ITB 35.2, discounts on condition of award of more than one contract will not be used for Bid evaluation purpose.

36. Comparison of Bids

36.1 The Employer shall compare the evaluated costs of all substantially responsive Bids established in accordance with ITB 35.1 to determine the Bid that has the lowest evaluated cost.

36.2 If ITB 35.2 is applicable, the Employer will determine the Bid with the highest combined technical and financial score in accordance with BDS 35.2.

37. Abnormally Low Bids

37.1 An Abnormally Low Bid is one where the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns as to the capability of the Bidder in regard to the Bidder's ability to perform the Contract for the offered Bid Price.

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

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

38. Unbalanced or Front Loaded Bids

38.1 If the Bid that is evaluated as the lowest evaluated cost is, in the Employer's opinion, seriously unbalanced or front loaded, the Employer may require the Bidder to provide written clarifications. Clarifications may include detailed

price analyses to demonstrate the consistency of the Bid prices with the scope of works, proposed methodology, schedule and any other requirements of the Bidding document.

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

(a) accept the Bid; or

(b) require that the total amount of the Performance Security be increased at the expense of the Bidder to a level not exceeding 20% of the Contract Price; or

(c) reject the Bid.

39. Qualifications of the Bidder

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

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

39.3 Prior to Contract award, the Employer will verify that the successful Bidder (including each member of a JV) is not disqualified by the Bank due to noncompliance with contractual SEA/SH prevention and response obligations. The Employer will conduct the same verification for each subcontractor proposed by the successful Bidder. If any proposed subcontractor does not meet the requirement, the Employer will require the Bidder to propose a replacement subcontractor..

39.4 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 the Employer shall proceed to the Bidder who offers a substantially responsive Bid with the next lowest

evaluated cost to make a similar determination of that Bidder's qualifications to perform satisfactorily.

40. Most Advantageous Bid

40.1 The Employer shall determine the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be substantially responsive to the Bidding document and:

(a) when **rated criteria are used** is the Bid with the highest combined technical and financial score; or

(b) when **rated criteria are not used**, is the Bid with the lowest evaluated cost.

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

41.1 The Employer reserves the right to accept or reject any Bid and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, Bid securities, shall be promptly returned to the Bidders.

42. Standstill Period

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

43. Notification of Intention to Award

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

(a) the name and address of the Bidder submitting the successful Bid;

(b) the Contract price of the successful Bid;

(c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated;

(d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful, unless the price information in c) above already reveals the reason;

(e) the expiry date of the Standstill Period; and

(f) instructions on how to request a debriefing and/or submit a complaint during the standstill period;

F. Award of Contract

44. Award Criteria

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

45. Notification of Award

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

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

(a) name and address of the Employer;

(b) name and reference number of the contract being awarded, and the selection method used;

(c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;

(d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;

(e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope; and

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

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

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

46. Debriefing by the Employer

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

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

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

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

47. Signing of Contract

47.1 The Employer shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and, if specified **in the BDS**, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be

submitted within eight (8) Business Days of receiving this request.

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

48. Performance Security

48.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security and, if required **in the BDS**, the Environmental and Social (ES) Performance Security in accordance with the Conditions of Contract, subject to ITB 38.2 (b), using for that purpose the Performance Security and ES Performance Security Forms included in Section X, Contract Forms, or another form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country, unless the Employer has agreed in writing that a correspondent financial institution is not required.

48.2 Failure of the successful Bidder to submit the above-mentioned Performance Security and, if required **in the BDS**, the Environmental and Social (ES) Performance Security, or 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 Bidder offering the next Most Advantageous Bid.

49. Procurement Related Complaint

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

Section II - Bid Data Sheet (BDS)

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

A. General	
ITB 1.1	The reference number of the Request for Bids (RFB) is: WD2-BSMSN-BEZA The Employer is: Project Director, Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project, Bangladesh-PRIDE (P170688), Bangladesh Economic Zones Authority (BEZA) The name of the RFB is: Road and Storm Water Network for Mirsarai-2B EZ The number and identification of lots (contracts) comprising this RFB is: 01
ITB 2.1	The Borrower is: Government of the Peoples Republic of Bangladesh represented by the Project Director, Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project Bangladesh-PRIDE (P170688) Bangladesh Economic Zones Authority (BEZA) Loan or Financing Agreement amount: US$ 467.50 Million The name of the Project is: Project Director, Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project, Bangladesh-PRIDE (P170688)
ITB 4.1	Maximum number of members in the JV shall be:03 (Three)
ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr.
B. Contents of Bidding Document	
ITB 7.1	For **Clarification of Bid purposes** only, the Employer's address is: Attention: Abdullah Al Mahmud Faruk

	Address: Biniyog Bhaban (9th floor) E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh Floor number: Level-7,8&9 City: Dhaka ZIP Code:1207 Country :Bangladesh Telephone: +880 2-44826009 Electronic mail address: pd.bsmsn.pride@beza.gov.bd Web page: www.beza.gov.bd
ITB 7.4	A Pre-Bid meeting ***shall*** take place at the following date, time and place: Date:13 June 2022 Time: 10:00 am (BST, GMT+6) Place: BEZA Conference Room The pre-bid meeting will also be connected virtually through live video conference, for which the electronic connection link will be sent by the Employer seven (7) calendar days before the meeting through email to all the prospective bidders who purchased the bidding document and who may choose to attend through video conference.
ITB 7.6	Web page: www.beza.gov.bd
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: ***English***. ***Bidders shall have the option to submit their Bid in English language. Bidders shall not submit Bids in more than one language.*** All correspondence exchange shall be in ***English*** _ language. Language for translation of supporting documents and printed literature is ***English***

ITB 11.1 (h)	The Bidder shall submit the following additional documents in its Bid: **Code of Conduct for Contractor's Personnel (ES)** **(i) All bidders shall submit Code of Conduct for Contractor's Personnel (ES): (Details of ES and SEA/SH are available in Section 7, under Works Requirements).** The Bidder shall submit its Code of Conduct that will apply to Contractor's Personnel (as defined in Sub-Clause 1.1.17 of the General Conditions of Contract), to ensure compliance with the Contractor's Environmental and Social (ES) obligations under the Contract. The Bidder shall use for this purpose the Code of Conduct form provided in Section IV. No substantial modifications shall be made to this form, except that the Bidder may introduce additional requirements, including as necessary to take into account specific Contract issues/risks. **Management Strategies and Implementation Plans (MSIP) to manage the (ES) risks** *The Bidder shall submit* Management Strategies and Implementation Plans (MSIPs) to manage the following key Environmental and Social (ES) risks: • *Sexual Exploitation, and Abuse (SEA) prevention and response action plan;* • *Traffic Management Plan to ensure safety of local communities from construction traffic;* • Environmental Pollution (Air, Water, Noise, Soil Quality) management and Monitoring Plan during Pre-Construction and Construction Phases; • Occupational Health and Safety Management Plan; • Grievance Redress Management (GRM) Plan; • Emergency Response Management Plan including man-made disaster.
ITB 13.1	Alternative Bids ***"shall not be"*** considered.
ITB 13.2	Alternative times for completion ***"shall not be"*** permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the Works: None

ITB 14.5	The prices quoted by the Bidder ***shall*** be subject to adjustment during the performance of the Contract.
ITB 15.1	The currency(ies) of the Bid and the payment currency(ies) shall be in accordance with Alternative**A** as described below: **Alternative A (Bidders to quote entirely in local currency):** (a) The unit rates and the prices shall be quoted by the Bidder in the Bill of Quantities, entirely in Bangladesh Taka, and further referred to as "the local currency". A Bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's Country (referred to as "the foreign currency requirements") shall indicate in the Appendix to Bid - Table C, the percentage(s) of the Bid Price (excluding Provisional Sums), needed by the Bidder for the payment of such foreign currency requirements, limited to no more than three foreign currencies. (b) The rates of exchange to be used by the Bidder in arriving at the local currency equivalent and the percentage(s) mentioned in (a) above shall be specified by the Bidder in the Appendix to Bid - Table C and shall apply for all payments under the Contract so that no exchange risk will be borne by the successful Bidder.
ITB 18.1	***The Bid shall be valid until:150 days from the date of opening of bids***
ITB 18.3 (a)	The Bid price shall be adjusted by the following factor(s): Labor, Bitumen, Stone Chips, Bricks, MS Rod and Cement.
ITB 19.1	A Bid Security ***"shall be"*** required. If a Bid Security shall be required, the amount and currency of the Bid Security shall be USD **USD 0.25 Million** (US Dollar Zero point two five million) or BDT **21 Million** (BDT Twenty One Million)
ITB 19.3 (d)	Other types of acceptable securities: ***"None"***
ITB 19.9	Not Applicable
ITB 20.1	In addition to the original of the Bid, the number of copies is: 02 (Two) with 1 USB/CD.

ITB 20.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: Notarized authorization letter ***to demonstrate the authority of the signatory to sign the Bid***
D. Submission and Opening of Bids	
ITB 22.1	For **Bid submission purposes** only, the Employer's address is: Attention: Abdullah Al Mahmud Faruk Street Address: Biniyog Bhaban (9th floor) E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh Floor number: Level-7,8 &9 City: Dhaka ZIP/Postal Code: 1207 Country: Bangladesh The deadline for Bid submission is: Date: 20 July 2022 (Local Time). Time: 14:00 Hours (Local Time). Bidders ***"shall not"*** have the option of submitting their Bids electronically.
ITB 25.1	The Bid opening shall take place at: Street Address: Biniyog Bhaban (9th floor) E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh Floor number: 7,8 &9 City: Dhaka Country: Bangladesh Date & Time: 14:30 Hours of 20 July 2022 (Local Time). The bid opening meeting will also be connected virtually through live video conference, for which the electronic connection link will be sent by the Employer seven (7) calendar days before the meeting through email to all the prospective bidders who purchased the bidding document and who may choose to attend through video conference.
ITB 25.6	The Letter of Bid and priced Bill of Quantities shall be initialed by 3 representatives of the Employer conducting Bid opening.

	Each Bid shall be initialed by all representatives and shall be numbered, any modification to the unit or total price shall be initialed by the Representative of the Employer, etc.
E. Evaluation, and Comparison of Bids	
ITB 32.1	The currency that shall be used for Bid evaluation and comparison purposes to convert at the selling exchange rate all Bid prices expressed in various currencies into a single currency is: Bangladesh Taka (BDT) The source of exchange rate shall be: Bangladesh Bank webpage at "https://www.bb.org.bd/econdata/exchangerate.php" and the rate shall be the BC selling exchange rate. If the exchange rates are not available from the above source on the particular date, the exchange rates published in the Wall Street Journal would be used for currency conversion in US Dollar. The date for the exchange rate shall be*: 23 June 2022* ***Alternative A: Bidders quote entirely in local currency*** For comparison of Bids, the Bid Price, corrected pursuant to ITB 31, shall first be broken down into the respective amounts payable in various currencies by using the selling exchange rates specified by the Bidder in accordance with ITB 15.1. In the second step, the Employer will convert the amounts in various currencies in which the Bid Price 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.
ITB 33.1	A margin of domestic preference ***"shall not"*** apply.
ITB 34.1	At this time the Employer ***"does not intend"*** to execute certain specific parts of the Works by subcontractors selected in advance.

ITB 34.2	Contractor's proposed subcontracting: Maximum percentage of subcontracting permitted is: *15% of the total contract amount* Bidders planning to subcontract more than 10% of total volume of work shall specify, in the Letter of Bid, the activity (ies) or parts of the Works to be subcontracted along with complete details of the subcontractors and their qualification and experience.
ITB 34.3	*Not applicable*
ITB 35.2	**Does not apply**
ITB 35.3 f	*Not applicable*
F. Award of Contract	
ITB 47.1	The successful Bidder *shall* submit the Beneficial Ownership Disclosure Form.
ITB 48.1 and 48.2	The successful Bidder shall be required to submit an Environmental and Social (ES) Performance Security.
ITB 49.1	The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)." If a Bidder wishes to make a Procurement-related Complaint, the Bidder shall submit its complaint following these procedures, In Writing (by the quickest means available, such as by email or fax), to: **For the attention**: Abdullah Al Mahmud Faruk **Title/position**: *Project Director* **Employer**: BEZA **Email address**: *pd.bsmsn.pride@beza.gov.bd* In summary, a Procurement-related Complaint may challenge any of the following: **1.** the terms of the Bidding Documents; and **2.** the Employer's decision to award the contract.

Section III - Evaluation and Qualification Criteria

This section contains all the criteria that the Employer shall use to evaluate Bids and qualify Bidders. No other factors, methods or criteria shall be used other than specified in this Bidding document. The Bidder shall provide all the information requested in the forms included in Section IV, Bidding Forms.

Wherever a Bidder is required to state a monetary amount, Bidders should indicate the USD equivalent using the rate of exchange determined as follows:

- For construction turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year (in which the amounts for that year is to be converted) was originally established.
- 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 the ITB 32.1. Any error in determining the exchange rates in the Bid may be corrected by the Employer.

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A. Qualification

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

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2. Historical Contract Non-Performance							
2.1	**History of Non-Performing Contracts**	Non-performance of a contract[1] did not occur as a result of contractor default since 1st January 2012.	Must meet requirement	Must meet requirements	Must meet requirement[2]	N/A	Form CON-2
2.2	**Suspension Based on Execution of Bid/Proposal Securing Declaration by the Employer**	Not under suspension based on-execution of a Bid/Proposal Securing Declaration pursuant to ITB 4.7 and ITB 19.9	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.3	**Pending Litigation**	Bidder's financial position and prospective long-term profitability still sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement	N/A	Must meet requirement	N/A	Form CON – 2
2.4	**Litigation History**	No consistent history of court/arbitral award decisions against the	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form CON – 2

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

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

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		Bidder[3] since 1st January 2017.					
2.5	**Declaration: Environmental and Social (ES) past performance**	Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons of breach of environmental, or social (including Sexual Exploitation, and Abuse) contractual obligations in the past five years.[4]	Must make the declaration. Where there are Specialized Subcontractor/s, the Specialized Subcontractor/s must also make the declaration.	N/A	Each must make the declaration.	N/A	Form CON-3 ES Performance Declaration
2.6	**Bank's SEA and/or SH Disqualification**	At the time of Contract Award, not subject to disqualification by the Bank for non-compliance with SEA/ SH obligations	Must meet requirement (including each subcontractor proposed by the Bidder)	N/A	Must meet requirement	N/A	Letter of Bid, Form CON-4
3. Financial Situation and Performance							
3.1	**Financial Capabilities**	(i) The Bidder shall demonstrate that it has access to, or has available, financial resources	Must meet requirement	Must meet requirement	N/A	N/A	Form FIN – 3.1, with attachments

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

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

Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		(independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as USD $ 2.5 million (US Dollar Two million Five Hundred Thousand) or **BDT 212.50 Million** for the subject contract(s) net of the Bidder's other commitments. The documentary evidence shall be in the form of supporting letter(s) issued by the Bidder's bank/financial institution confirming that the above-specified minimum amount is available through lines of credit and/or funds in the Bidder's bank account for use specifically in the execution of the subject contract if awarded to the Bidder. (ii) The Bidders shall also demonstrate, to the	Must meet requirement Must meet requirement	Must meet requirement N/A	N/A Must meet requirement	N/A N/A	Supporting letter(s) issued by the Bidder's bank/financial institution confirming that the specified minimum amount is available through lines of credit and/or funds in the Bidder's bank account for use specifically in the execution of the subject contract if awarded to the Bidder.

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		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. (iii) The audited balance sheets or, if not required by the laws of the Bidder's country, other financial statements acceptable to the Employer, for the last 5 (Five) years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability.					
3.2	**Average Annual Construction Turnover**	Minimum average annual construction turnover of US$10,000,000 (US Dollar Ten Million), or **BDT 850 Million,** calculated as total certified payments received for contracts in progress and/or completed within the last *5 (Five)* years	Must meet requirement	Must meet requirement	Must meet 25%, *[Twenty five Percent]* of the requirement	Must meet 40%, *[Forty percent]* of the requirement	Form FIN – 3.2

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		counting backward from the bid submission deadline date, divided by 5 (five) years					
4. Experience							
4.1 (a)	**General Construction Experience**	Experience under construction contracts in the role of prime contractor, JV member, Subcontractor, for at least the last 10 years, starting 1st January 2012.	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP – 4.1
4.2 (a)	**Specific Construction & Contract Management Experience**	(i) A minimum number of similar contracts specified below that have been satisfactorily and substantially[5] completed as a prime contractor, joint venture member[6], or	Must meet requirement	Must meet requirement[7]	N/A	Must meet the following requirements for the key activities (One) contract of Bituminous	Form EXP 4.2(a)

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

[6] For contracts under which the Bidder participated as a joint venture member or Subcontractor, only the Bidder's share, by value, shall be considered to meet this requirement [7] In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

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

Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		Subcontractor between 1st January 2012 and bid submission deadline: (i) 1(One) contract of Bituminous Road Work and Drainage/Hydraulic Structure Work, with a minimum value of **USD 14 Million** (US Dollar Fourteen Million) or **BDT 1200 Million** (wherein at least **USD 7 Million or BDT 600 Million** value includes Bituminous Road Work of the minimum requirement and at least **USD 3.5 Million** or **BDT 300 Million** value includes Drainage/Hydraulic Structure works of the minimum requirement);; OR (ii) 2 (Two) contracts of which One (1) is Bituminous Road Work with a minimum value of **USD 12 Million** (US Dollar Twelve Million) or **BDT**				Road Work/ Drainage/Hydraulic Structure Work or Combination of Bituminous Road Work/ Drainage/Hydraulic Structure Work, minimum value (US $ 7,000,000 (Seven Million US Dollar).	

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		1020 Million and another is Drainage/Hydraulic Structure Work, with a minimum value of **USD 4 Million** (US Dollar Four Million) or **BDT 340 Million**,; but with total value of these Two (2) contracts equal or more than **USD 17 Million** (US Dollar Seventeen Million) or **BDT 1445 Million**. The similarity of the contracts shall be based on the following: Based on Section VII, Scope of Works, specified in terms of physical size, complexity, construction method, technology					
4.2 (b)		For the above and any other contracts [substantially completed and under implementation] as prime contractor, joint venture member, or Subcontractor between 1st January 2012 and Application submission	Must meet requirements	Must meet requirements	N/A	***"N/A"***	Form EXP – 4.2 (b)

Eligibility and Qualification Criteria				Compliance Requirements			Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		deadline, a minimum construction experience in the following key activities successfully completed[8]: [9] (i) At least **38000 Cubic Meter** Aggregate Base Coarse and **600 Cubic Meter** Dense Bituminous Surfacing Road Works under a single contract and (ii) At least **5,000 (Five Thousand)** Cubic meter Reinforced Cement Concrete work of Drain/ Hydraulic Structure Works					

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

[9] The minimum experience requirement for multiple contracts will be the sum of the minimum requirements for respective individual contracts, unless specified otherwise.

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		under a single contract.					
4.2 (c)	**Specific Experience in managing ES aspects**	For the contracts in 4.2 (a) above and/or any other contracts [substantially completed and under implementation] as prime contractor, joint venture member, or Subcontractor between 1st January 2012 and Application submission deadline, experience in managing ES risks and impacts in the following aspects: • Environmental (water, soil, noise, air pollution, etc.), • Health and safety • Social, including SEA prevention, • Traffic and road safety, • GRM • GBV/SEA/SH • Gender/Gender Action Plan. The Minimum requirements	Must meet requirements	Must meet requirement	*N/A*	*N/A*	Form EXP – 4.2 (c)

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
		for managing ES aspects of the similar type activities under a Single contract is **USD 23,530** or Equivalent BDT 20 Lac.					

5. Contractor's Representative and Key Personnel

The Bidder must demonstrate that it will have a suitably qualified Contractor's Representative and suitably qualified (and in adequate numbers) Key Personnel.

The Bidder shall provide details of the Contractor's Representative and Key Personnel and such other Key Personnel that the Bidder considers appropriate to perform the Contract, together with their academic qualification and experience. The Bidder shall complete the relevant Forms in Section IV, Proposal Forms.

For purpose of evaluation, only the Key Personnel listed in the table below will be evaluated. All key personnel proposed by the Bidder are required to meet the qualification requirements specified for each position below. If any of the key personnel proposed by the Bidder is determined by the Employer not meeting the specified requirements, the Employer reserves the right to require the Bidder to replace such key personnel with fully qualified and experienced key personnel prior to contract award, if awarded to the Bidder.

Table: Contractor's Representative and Key Personnel

Sl. No.	Position	Numbers	Total Works Experience (years)	Similar Work Experience (years)
1	Project Manager- B.sc in Civil Engineering	1	Min. 15 years.	Min. 10 years
2	Construction Project Manager- B.sc in Civil Engineering	1	Min. 15 years.	Min. 7 years
3	Structural Engineer- B.sc in Civil Engineering	1	Min. 10 years.	Min. 5 years
4	Pavement Engineer- B.sc in Civil Engineering	1	Min. 10 years.	Min. 5 years
5	Quality Control/ Material Engineer –	1	Min. 10 years.	Min. 5 years

	B.sc in Civil Engineering			
6	Site Engineer – (Diploma in- Civil Engineering	**6**	Min. 10 years.	Min. 5 years
7	Surveyor (Certificated in Surveying)	**2**	Min. 5 years.	Min. 3 years
8	Field Work Supervisor-High School Certificate	**6**	Min. 5 years.	Min. 3 years
9	Accountant-Bachelor in Business Studies	**1**	Min. 5 years.	Min. 3 years
10	Site Manager-Bachelor Degree	**1**	Min. 5 years.	Min. 3 years

6. Equipment

The Bidder must submit documentary evidence to demonstrate that it has access to (owned/leased/rented) the key equipment listed in the table below. The Bidder shall provide further details of proposed items of equipment using Form EQU in Section IV, Bidding Forms.

No.	Equipment Type and Characteristics	Minimum Number required
1	Asphalt Mixing Plant (50-80 Ton)	1 Set
2	Concrete Batching Plant	01 No.
3	Transit Mixture	04 Nos
4	Asphalt Paver	2 Nos.
5	Total Station Survey equipment (600M-1000M)	1 Set
6	Dump Truck	10 Nos.
7	Truck (10 Ton)	5 Nos.
8	Tipper Truck	4 Nos.
9	Road roller (Tyred Roller/Steel Double Wheel) (8-10 ton)	2 Nos.
10	Pneumatic Tyred Rolled	2 Nos.

No.	Equipment Type and Characteristics	Minimum Number required
11	Road roller (Vibrating roller With Soil Compactor) (12-18 ton)	4 Nos.
12	Motor Grader	2 Nos
13	Mobile Soil Stabilizer	2 Nos.
14	Wheel Loader and Pay Loader	4 Nos.
15	Backhoe Loader	2 Nos.
11	Sheep Foot Roller (8-10 Ton)	2 Nos.
16	Crawler Excavator	4 Nos
17	Dozer	2 Nos.
18	Excavator (0.5-0.7 cum)	4 Nos.
19	Water Pump with water tanker (12-16 HP)	2 Nos.
20	Cranes (Minimum 5 Tons)	1 No.
21	Plate Compactor/Rammer	5 Nos.
22	Vibrator with nozzle	15 Nos.
23	Concrete Mixer Machine with hopper	5 Nos.
24	Dewatering Pump	4 Nos.
25	Testing Equipment	1 Set
26	Water Tanker	4 Nos.
27	Generator (50 KVA)	01 No.

Section IV - Bidding Forms

Table of Forms

Letter of Bid **61**
Appendix to Bid **65**
Schedule of Cost Indexation 65
Table A. Local Currency 67
Table B. Foreign Currency (FC) 68
Table C. Summary of Payment Currencies 69
Bill of Quantities **71**
Bill No. 1: Road Work 75
Bill No. 2: Construction of Storm Water RCC Drains 80
Bill No. 3: Environmental, Social, Occupational Health and Safety 88
Bill No. 4: Provisional Sums 107
Grand Summary 108
Technical Proposal **109**
Site Organization 110
Method Statement 111
Mobilization Schedule 112
Construction Schedule 113
ES Management Strategies and Implementation Plans 114
Code of Conduct for Contractor's Personnel (ES) Form 115
The activity wise anticipated environmental and social impacts and corresponding mitigation measures have been outlined from the detailed ESA for the BSMSN Development project for the works carried out under Component 2 in the following table: 119
Form EQU: Equipment 141
Form PER -1 142
Form PER-2: 144
Bidders Qualification without prequalification **146**

Form ELI -1.1 147
Form ELI -1.2 148
Form CON – 2 149
Form CON – 3 151
Form CON – 4 153
Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration 153
Form FIN – 3.1: 155
Form FIN – 3.2: 157
Form FIN – 3.3: 158
Form FIN – 3.4: 159
Form EXP - 4.1 160
Form EXP - 4.2(a) 161
Form EXP - 4.2(b) 163
Form EXP - 4.2(c) 165
Form of Bid Security - Demand Guarantee 167

Letter of Bid

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

The Bidder must prepare this Letter of Bid on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text is to help Bidders in preparing this form.

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

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

Alternative No.: [*insert identification No if this is a Bid for an alternative*]

To: **[*insert complete name of Employer*]**

We, the undersigned, declare that:

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

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

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

(d) **Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH):** [*select the appropriate option from (i) to (v) below and delete the others*].

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

(i) [have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]

(ii) [are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]

(iii) [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor.]

(iv) [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently provided

and demonstrated that we have adequate capacity and commitment to comply with SEA and SH prevention and response obligations.]

(v) [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached documents demonstrating that we have adequate capacity and commitment to comply with SEA and SH prevention and response obligations.]

(e) **Conformity:** We offer to execute in conformity with the Bidding document and in accordance with the implementation and completion specified in the construction schedule, the following Works: *[insert a brief description of the Works]*;

_____;

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

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

Or

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

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

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

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

(h) **Bid Validity**: Our Bid shall be valid until *[insert day, month and year in accordance with ITB 18.1]*, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(i) **Performance Security** If our Bid is accepted, we commit to obtain a Performance Security [*and an Environmental and Social (ES) Performance Security,* ***Delete if not applicable***] in accordance with the Bidding document;

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

(k) **Suspension and Debarment**: We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Employer's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

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

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

Name of Recipient	Address	Reason	Amount
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

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

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

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

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

(q) **Potential DAAB Members:** We hereby propose the following three persons, whose curriculum vitae are attached, as potential DAAB members:

Name	Address
1.	
2.	
3.	

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

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

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

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

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

Date signed _____ day of _____, ____

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

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

Appendix to Bid

Schedule of Cost Indexation

The formulae for price adjustment shall be of the following general type:

Pn= a + b Ln / Lo + c En/ Eo + d Mn/Mo + ...

where:

"Pn" 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;

"Ln", "En", "Mn", ... 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

"Lo", "Eo", "Mo", ... 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.

The cost indices or reference prices stated in the Table of Adjustment Data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table).

If the currency in which the Contract price is expressed is different from the currency of the country of origin of the indices, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall be: Z_0 / Z_1, where,

Z_0 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price on the Base date, and

Z_1 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price on the Date of Adjustment.

Table of Adjustment Data

[In Tables A, B, and C, below, the Bidder shall (a) indicate its amount of local currency payment, (b) indicate its proposed source and base values of indices for the different foreign currency elements of cost, (c) derive its proposed weightings for local and foreign currency payment, and (d) list the exchange rates used in the currency conversion. In the case of very large and/or complex works contracts, it may be necessary to specify several families of price adjustment formulae corresponding to the different works involved.]

Table A. Local Currency

Index code*	Index description*	Source of index*	Base value and date*	Bidder's related currency amount	Bidder's proposed weighting
To be mentioned later	Nonadjustable	Bangladesh Bureau of Statistics	To be mentioned later	—	A: 0.22 B: 0.05 to 0.15 C: 0.20 to 0.30 D: 0.15 to 0.25 E: 0.05 to 0.15 F. 0.02 to 0.012 G. 0.01 to 0.11
			Total		**1.00**

B. Labor
C. Stone Chips
D. Bitumen
E. Bricks
F. MS Rod
G. Cement

[* To be entered by the Employer. Whereas "A" should a fixed percentage, B, C, D, E, F and G should specify a range of values and the Bidder will be required to specify a value within the range such that the total weighting = 1.00]

Table B. Foreign Currency (FC)

Index code	Index description	Source of index	Base value and date	Bidder's related source currency in type/amount	Equivalent in FC1	Bidder's proposed weighting
	Nonadjustable	—	—	—		A: 0.22 B: 0.05 to 0.15 C: 0.20 to 0.30 D: 0.15 to 0.25 E: 0.05 to 0.15 F. 0.02 to 0.012 G. 0.01 to 0.11
				Total		**1.00**

B. Labor
C. Stone Chips
D. Bitumen
E. Bricks
F. MS Rod
G. Cement

[* To be entered by the Employer. Whereas "A" should a fixed percentage, B, C, D and E should specify a range of values and the Bidder will be required to specify a value within the range such that the total weighting = 1.00]

Table C. Summary of Payment Currencies

Table: Alternative A

For ..... [insert name of Section of the Works]

Name of payment currency	A Amount of currency	B Rate of exchange (local currency per unit of foreign)	C Local currency equivalent C = A x B	D Percentage of Total Bid Price (TBP) 100xC / TBP
Local currency _____		1.00		
Foreign currency #1 _____				
Foreign currency #2 _____				
Foreign currency # _____				
Total Bid Price				100.00
Provisional sums expressed in local currency	*[To be entered by the Employer]*		23,00,00,000.00	
TOTAL BID PRICE (including provisional sum)				

4

Bill of Quantities

Notes for Preparing a Bill of Quantities

These Notes for Preparing a Bill of Quantities are intended only as information for the Employer or the person drafting the bidding documents. They should not be included in the final documents.

Objectives

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, Works should be 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 should be as simple and brief as possible.

Content

The Bill of Quantities should be divided generally into the following sections:

(a) Preamble;

(b) Work Items (grouped into parts);

(c) Daywork Schedule; and

(d) Summary.

Preamble

The Preamble should indicate the inclusiveness of the unit prices and should state the methods of measurement that have been adopted in the preparation of the Bill of Quantities and that are to be used for the measurement of any part of the Works.

Rock

Where excavation, boring, or driving is included in the Works, a comprehensive definition of rock (always a contentious topic in contract administration), should be provided in the Technical Specification and this definition should be used for the purposes of measurement and payment.

Work Items

The items in the Bill of Quantities should be grouped into sections 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 may be grouped as a separate section in the Bill of Quantities. When a family of Price Adjustment Formulae are used, they should relate to appropriate sections in the Bill of Quantities.

Quantities

Quantities should be computed net from the Drawings, unless directed otherwise in the Contract, and no allowance should be made for bulking, shrinkage, or waste. Quantities should be rounded up or down where appropriate and spurious accuracy should be avoided.

Units of Measurement

The following units of measurement and abbreviations are recommended for use (unless other national units are mandatory in the country of the Employer).

Unit	Abbreviation	Unit	Abbreviation
cubic meter	m^3 *or* cu m	millimeter	mm
hectare	ha	month	mon
hour	h	number	nr
kilogram	kg	square meter	m^2 *or* sq m
lump sum	sum	square millimeter	mm^2 *or* sq mm
meter	m	week	wk
metric ton (1,000 kg)	t		

Ground and Excavation Levels

The commencing surface should be identified in the description of each item for work involving excavation, boring, or driving, for which the commencing surface is not also the original surface. The excavated surface should be identified in the description of each item for work involving excavation for which the excavated surface is not also the final surface. The depths of work should be measured from the commencing surface to the excavated surface, as defined.

Daywork Schedule

A Daywork Schedule should be included if the probability of unforeseen work, outside the items included in the Bill of Quantities, is relatively high. To facilitate checking by the Employer of the realism of rates quoted by the bidders, the Daywork Schedule should normally comprise:

(a) a list of the various classes of labour, materials, and Contractor's Equipment for which basic Daywork rates or prices are to be inserted by the bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a Daywork basis; and

(b) a percentage to be entered by the bidder against each basic Daywork Subtotal amount for labour, materials, and Plant representing the Contractor's profit, overheads, supervision, and other charges.

Provisional Quantities and Sums

Provision for quantity contingencies in any particular item or class of work with a high expectation of quantity overrun should be made by entering specific "Provisional Quantities" or "Provisional Items" in the Bill of Quantities, and *not* by increasing the quantities for that item or class of work beyond those of the work normally expected to be required. To the extent not covered above, a general provision for physical contingencies (quantity overruns) should be made by including a "Provisional Sum" in the Summary of the Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a "Provisional Sum" in the Summary of the Bill of Quantities. The inclusion of such Provisional Sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises.

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by a Nominated Subcontractor should be specified in the relevant part of the Bill of Quantities as a particular Provisional Sum with an appropriate brief description. A separate bidding procedure is normally carried out by the Employer to select the specialists, who are then nominated as subcontractors to the main or prime contractor. To provide an element of competition among the main bidders (or prime contractors) in respect of any facilities, amenities, attendance, etc., to be provided by the successful bidder as prime contractor for the use and convenience of the specialist or nominated subcontractor, each related Provisional Sum should be following by an item in the Bill of Quantities inviting a percentage (to be quoted by the main bidder) payable on the actual expenditure from the Provisional Sum.

The provisional sums shall also include an estimated amount to cover the Employer's portion (50%) of DAAB's fees and expenses.

Summary

The Summary should contain a tabulation of the separate parts of the Bill of Quantities carried forward, with provisional sums for Daywork, for physical (quantity) contingencies, and for price contingencies (upward price adjustment) where applicable, including DAAB fees and expenses.

9

Bill of Quantities (BOQ)

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Particular Conditions, 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 Contractor and verified by the Engineer 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.
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 Constructional Plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.
4. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
5. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
6. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.
7. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub-Clauses 13.4 and 13.5 of the General Conditions except with respect to DAAB Fees and Expenses for which no instruction will be required from the Engineer.
8. The method of measurement of completed work for payment shall be in accordance with BOQ.

B. Work Items

1. The Bill of Quantities usually contains the following part Bills, which have been grouped according to the nature or timing of the work:

Bill No. 1—Road Work;
Bill No. 2— Construction of Storm Water RCC Drains;
Bill No. 3— Environmental, Social, Occupational Health and Safety
Bill No.4- Provisional Sums
and
Summary Bill of Quantities.

2. If BDS-ITB 15.1 (a) applies, Bidders shall price the Bill of Quantities in local currency only and shall indicate in the Appendix to Bid the percentage expected for payment in foreign currency or currencies. If BDS-ITB 15.1 (b) applies Bidders shall price the Bill of Quantities in the applicable currency or currencies.

Bill of Quantities

Bill No. 1: Road Work

Item no.	*Description*	*Unit*	*Quantity*	*Rate*		*Amount*
				Figure	*Word*	
1	Project Profile Signboard: Providing and maintenance one project profile signboard as per direction of E-I-C, to be placed at a suitable place of the site including submission of proposals for the materials & size of the signboards (recommended size: 1800mm x 1200 mm with 2 nos. 75mm dia. MS post, outer & inner frames of board shall be 50mm x 50mm x 5mm & 20mm x 25mm x 5 mm respectively) and text layout to the engineer for approval which will be positioned as directed by the engineer and removing the same on completion of the works or as instructed by the E-I-C. Sheeting will be made of encapsulated lens with retro-reflective type and messages/ borders will be screen printed. The text shall mention among others the name of the project, name of the implementing agency, cost of the project, completion time, name of the contractor etc.	Sqm	12.960			
2	Bench Mark Pillar: Manufacturing, supplying & fixing in position RCC (1:2:4) Bench Mark Pillars of size 150mm x 150mm x 750mm, with 400mm x 400mm x 100mm base having 3 nos. 10mm dia MS bar each way at base, 4 nos. 10mm dia vertical bar and 8 nos. 6mm dia tie, including cost of form works, concreting, reinforcement, plastering at top, inscribing on exposed surface, finishing surface, curing, earth cutting, embedding 450mm below GL. backfilling, ramming etc. complete as per direction of E-I-C.	Each	12.000			
3	Clearing and Grubbing	Sqm	107,692.500			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
4	Roadway Excavation in Suitable Soil	Cum	89,881.143			
5	Embankment fill from borrow pit in contractor's Arranged land	Cum	119,215.04			
6	Preparation of subgrade 300mm depth	Sqm	138,370.380			
7	Improved Subgrade (Sand F.M >0.80)	Cum	38,530.464			
8	Sub-Base (Sand F.M >1.0 and Brick Khoa <40 mm)	Cum	33,737.595			
9	Aggregate base type-II	Cum	23,376.950			
10	Aggregate base type-I	Cum	32,714.147			
11	Bituminous Prime Coat (Plant Placed)	Sqm	149,344.88			
12	Bituminous Tack Coat (Plant Work)	Sqm	143,772.88			
13	80 mm Dense Bituminous Surfacing-Base Course (Plant Method) Bitumen Grade 60/70 (Coarse Sand F.M >2.5, Crushed boulder/gravel aggregate <25 mm etc.	Cum	11,501.83			
14	40 mm Dense bituminous surfacing wearing course (Plan method) Bitumen Grade 60/70	Cum	5,973.795			
15	125 mm Thick Brick on End Edging (1st Class)	Lin. Metre	9,330.000			
16	Reflecting Road Studs	Number	6,960.000			
17	Road Marking (Thermoplastic Material (indicate if screed or by spray)	Sqm	6,079.500			
18	Creating turf on the side slopes and top of embankment with good quality turf not less than 225 mm square chunk, watering till the grass grown including all leads and lifts etc. complete as per direction of Engineer in charge.	Sqm	66,313.240			
19	Traffic Signs	Number	52.000			
20	Sign Post	Number	52.000			
21	Rumble strips 25mm thick	Cum	4.062			
22	Construction of Sand compaction pile up to required depth and diameter with temporary steel casing in specified type of soil including Derrick/winch machine & Drop hammer (weight minimum 1 ton). The rate shall contribute the full compensation of furnishing all materials like sand (minimum F.M-0.8), driving pile holes, boring casing pipe, placing of materials & other compaction. SPT or any other method & tests for determining the improvement in the bearing capacity (N-value minimum 8), arranging all equipment and machinery, labour, tools and	M	80,000.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	incidentals necessary to complete the work as per requirements described under this item of work as shown on the drawings and direction of the E-I-C. (excluding the cost of SPT) Cost of sand compaction pile (size 300mm dia)					
23	Sub soil Investigation: Sub -soil investigation by 100 mm dia wash boring and or by DCP etc, including collecting disturbed and undisturbed soil samples in numbers as required for classification of soil, conducting SPT, stratification of layers and entering all these data & information in necessary tables & graphs, furnishing them in the form of standard sub - soil investigation report duly signed by competent engineer & exploratory office . (Only after written advice from E-I-C) Bore hole depth from 0 to 20 m	Per bore hole	250.000			
24	Supply, fitting & fixing of Armco-Guard Rail confirming AASHTO M180 as per design and specification with all necessary nut-bolts, cement concrete grounding etc. Specification: the Rail and Post of the Armco-Guard Rail will be of galvanized steel. The post will be @ 2000 mm C/C fixed with rail bar with necessary nut-bolt, post clear height is 0.75m from existing ground level to rail bar bottom; post total length is 2.75m. The rail and Post will be Three Wave in shape with anti-rust- Zinc layer coating confirming of AASHTO M180. Rail bar size of 4120mmX 510mmX 85mm and rail post size 2750mmX 85mm, Thickness 3.43mm. Material: S355, Surface treatment of hot dip galvanized as per ASTM A653, zinc coating thickness 1100g/m2, or customized, Standards AASHTO M180, Material: S355, Base metal nominal thickness is 3.43mm, Surface Treatment is hot dip galvanized as per ASTM A653, AASHTO M180. The post will be grounded of minimum 500mm from existing ground with Cement Concrete (Grade-20 MPa) of 250mm x 250mm x 500mm of base; all complete as per Engineer-in-charge.	M	3,940.000			
25	Excavation & Backfill for Structures	Cum	719.772			
26	Concrete Class as Detailed on Drawings (Class10) (Concrete Mixer)	Cum	35.422			
27	Concrete Class-25 (Foundation) as Detailed on Drawings (Concrete Mixer)	Cum	794.676			
28	Supplying and fabrication of Ribbed or deformed bar reinforcement for all types of RCC work including straightening, removing ruts, cleaning, cutting, hooking, bending, lapping and/or welding wherever required as directed, placing in position, tieing with 22 BWG black annealed binding wire (PVC coated in case of FBEC rebar)					

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	double fold, cost of binding wire and anchoring to the adjoining members wherever necessary, supplying and placing with proper cover blocks (1:1), supports, chairs, spacers, splices or laps etc. including cost of all materials, cost of labour, cost of equipment & machinery, loading and unloading, transportation, all other incidental charges and work at all leads and lifts etc. to complete the work as per design, drawing, specifications and direction of the E-I-C. Measurement relating to nominal mass, dimensions and tolerances of various types of steel shall conform to relevant BDS/ ASTM codes. Reinforcement shall be measured only in lengths of bar as actually placed in position on standard weight i.e. 7850 kg/m3 (BNBC Table 6.2.1) basis. No separate payment shall be allowed for chairs of any shape & profile, spacer bar of any shape & profile, lap/ splice unless otherwise shown in the drawing, wastages, binding wire, concrete cover blocks etc. as the cost of these is included in the unit rate. Test- Unit wt. Elongation & Tensile Strength-1set/ Dia/ 10,000Kg Note: Tests for reinforcing bars shall be conducted at LGED/ BUET/ CUET/ KUET/ RUET.					
	Grade 400 (RB 400/ 400W): Ribbed or Deformed bar produced and marked as per BDS ISO 6935-2:2006 with minimum yield strength, fy (ReH) = 400 MPa, but the tested yield strength shall not exceed fy by more than the 125 MPa and the ratio of tested ultimate strength, fu (Re) to tested yield strength (fy) shall be at least 1.25 and minimum elongation after fracture (A5.65) & minimum total elongation at maximum force (Agt) is 14% and 2.5% respectively. Test- Unit wt. Elongation & Tensile Strength-1set/ Dia/ 10,000Kg	Kg	20,138.220			
29	Supply & Fitting Fixing of 30 watt LED Solar Street Light complete fitting with Solar panel and unique optics and photometric design optimize the light distribution to comply with safety and road lighting standards in terms of luminance, uniformity, glare control etc. **G.I. Pole:** 9.00M (30′) long GI pipe pole, 1st 6.00M (20′) long 150mm (6″) diameter, thickness 3.65mm & 2nd 3.00M (10′) long 100mm (4″) diameter, thickness 3.65mm with base plate 300mm×300mm×10mm size welded and Nut bolt at the bottom, two coat aluminium/desired colour painting. The pole will be installed as per drawing, refilling and RCC 0.3M (1′) Zebra colour above ground. **Solar Panel:** Max Power: 12V/150WP, Cell Type: Polycrystalline/Monocrystalline, Voltage at Maximum Power (Vmpp): 17.8V, Current at	Each	558.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	Maximum Power (Impp): 8.43A, Open Circuit Voltage (Voc):22.5A, Short Circuit Current (Isc): 9.36A, Cell Efficiency: 18.0%, Junction Box Protection Class: IP 65, Power Tolerance: ± 10%, Lifespan: 25years. **Battery:** AH Lithium iron phosphet battery, Battery Type: LifePO4, Capacity: 28Ah, Rated Working Voltage: 12.8V, Efficiency: 95%, Operating Temperature Range: -10°C ~ 70°C, Life Span: >8Years. **Controller:** Type: MPPT, Capacity: 10A, Rated voltage: 11.0V-14.6V, Self-Consumption (Av.): ≤5mA, HVD: 17.0V×2/24V, Efficiency: 92%-95%, Lifespan: >10 Years, Protection: Load short circuit protection, Polarity reverse polarity protection, Reverse discharge protection. **LED Light: (30W)** i) Lamp Efficiency : >125.53Im/Watt ii) LED Type : SMD iii) CRI : >80 iv) Input Voltage : DC 12V v) Beam Angle : 120° vi) LifeSpan : >50000 Hours vii) Color Temperature : 6000-6500K viii) Working Temperature : -10°C~70°C viiii) Lamp Fixture : High Pressure Die casting Aluminum Corrosion resistant alloy heat sink. x) Classification : IP65					
30	Labour charge for Setting/Resetting of single layer Curve Stone of different sizes on road top, including preparation base, true to level, maintaining camber, super elevation, grade, watering and ramming the base, including carrying Curve Stone, supplying and filling the interstices tightly with Flush Pointing etc. all complete in all respect as per approved drawing, specification and direction of the Engineer-in-charge.	Cum	708.515			
				Total for Bill No. 1 (carried forward to Summary, p. __)		_____

Bill No. 2: Construction of Storm Water RCC Drains

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
1	Project Profile Signboard: Providing and maintenance one project profile signboard as per direction of E-I-C, to be placed at a suitable place of the site including submission of proposals for the materials & size of the signboards (recommended size: 1800mm x 1200 mm with 2 nos. 75mm dia. MS post, outer & inner frames of board shall be 50mm x 50mm x 5mm & 20mm x 25mm x 5 mm respectively) and text layout to the engineer for approval which will be positioned as directed by the engineer and removing the same on completion of the works or as instructed by the E-I-C. Sheeting will be made of encapsulated lens with retro-reflective type and messages/ borders will be screen printed. The text shall mention among others the name of the project, name of the implementing agency, cost of the project, completion time, name of the contractor etc.	Sqm	8.640			
2	Bench Mark Pillar: Manufacturing, supplying & fixing in position RCC (1:2:4) Bench Mark Pillars of size 150mm x 150mm x 750mm, with 400mm x 400mm x 100mm base having 3 nos. 10mm dia MS bar each way at base, 4 nos. 10mm dia vertical bar and 8 nos. 6mm dia tie, including cost of form works, concreting, reinforcement, plastering at top, inscribing on exposed surface, finishing surface, curing, earth cutting, embedding 450mm below GL., backfilling, ramming etc. complete as per direction of E-I-C.	Each	13.000			
3	Clearing and Grubbing	Sqm	52,015.690			
4	Earth work in excavation of foundation of structures by mechanical (Hydraulic excavator - Long Boom)/ manual means in all sorts of soil up to specified depth in accordance with requirements of lines, grades, cross sections and elevation as shown in the drawing including setting out, removal of stumps, logs, boulders and other deleterious materials, providing necessary tools and plants, construction of shoring and bracing, cleaning the excavated materials to a safe distance out of the site premises, cut to a firm surface including pumping/ bailing out water, removal of spoils to a safe distance, dressing of sides and bottom and backfilling of trenches up to original level with approved material etc. all complete as per approval of E-I-C. Contractor shall get acquainted with site conditions, nature of soil and adopt suitable adequate dewatering system as deemed fit for the nature of soil and prevailing water table to get the surface	Cum	48,001.845			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	reasonably dry for laying PCC at the time of execution so that execution will not be hampered or delayed. Back-filled materials shall be compacted to a density comparable with the adjacent undisturbed material. For depth 3m to 6m					
5	Polythene sheet : Supplying and laying of single layer polythene sheet weiging one kilogram per 6.5 square metewr in floorf or any where below cement concrete complete in all respect and accepted by Engineer in charge.	Sqm	29,630.050			
6	75mm thick lean cement concrete (1:3:6) in floor and wherever needed with Portland Composite Cement (CEM II/AM, 42.5N), best quality coarse sand (minimum FM1.2) and 20mm down well graded picked brick chips (LAA value not exceeding 38), in/c breaking bricks into chips screening, mixing by concrete mixer machine, laying, compacting, washing of sand, curing for requisite period, etc. all complete as per direction of the E-I-C.	Sqm	29,630.050			
7	RCC-25SCBP: Reinforced cement concrete work with minimum cement content relates to mix ratio 1:1.5:3 and maximum water cement ratio 0.4 having minimum required average strength, f'cr = 33.5 MPa and satisfying a compressive strength f'c = 25 MPa at 28 days on standard cylinders as per standard practice of Code AASHTO/ ASTM and cement conforming to BDS EN 197-1 : 2003 CEM-II/A-L/M/V/W 42.5N, high range water reducing admixture of complying type A or F under ASTM C 494 (Doses of admixture to be fixed by the mix design), sand of minimum FM 2.5 and 20mm down well graded crushed stone chips broken from boulders (Preferably stone chips from Madhyapara, Dinajpur, LAA value not exceeding 30) conforming to ASTM C33 including breaking chips, screening through proper sieves, cleaning, placing shutter in position, making shutter water-tight properly, placing reinforcement in position, mixing in mechanized batch mix plant and pumping using line pump or boom placer, maintaining allowable slump of 75mm to 100mm, casting in forms, compacting by mechanical vibrator machine, curing for 28 days, removing centering-shuttering after approved specified time period, other incidental charges, etc. all complete as per drawing, specification & direction of the E-I-C. The cost of reinforcement and it's fabrication, welding, coupling, placing, binding etc. is not included but the cost of admixture is included in this unit rate. Additional quantity of cement to be added if required to attain the strength at the contractor's own cost.Note: Using Batching	Cum	19,823.250			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	Plant, Transit Mixer & Concrete PumpFor pile caps, abutment base, facing elements of Reinforced/ Mechanically Stabilized Earth Structure, bottom slab of Box Culvert etc. Test- i) FM- one 50cum, ii)W/A (Coarse Aggregate)- one 50cum, iii) LAA/ACV- one 50cum, iv) Gradation of CA- one 50cum, v) Setting Time of Cement-one 50cum, vi) CS of Cement (3,7,28 days)- one 50cum, vii) CS of Concrete-one 50cum					
	RCC-30MPa, Stone Chips (SC), Batching Plant (BP): Reinforced cement concrete work with minimum cement content and maximum water cement ratio as specified by Quality Control Laboratory, LGED or approved laboratory instruction by the Engineer before execution of the work. Having minimum required average compressive strength, f'cr = 40 Mpa and satisfying a specified compressive strength, f'c = 30 Mpa at 28 days on standard cylinder as per standard practice of Code AASHTO/ ASTM and cement conforming to BDS EN 197-1 : 2003 CEM-I 52.5N / ASTM C150 Type-1, high range water reducing admixture of complying type F/ G under ASTM C494 (Doses of admixture to be fixed by the mix design from approved laboratory instruction by the Engineer) for smart dynamic concrete (i.e. Low fines self compacting concrete), sand of minimum FM 2.50 and 20mm down well graded crushed stone chips broken from boulders (Preferably stone chips from Madhyapara, Dinajpur, LAA value not exceeding 30) conforming to ASTM C33 and Aggregate Grading Appendix-3 LGED Schedule of Rates or any other International recognized envelop in/c cost of breaking chips, screening through proper sieves, cleaning and washing thoroughly, centering, shuttering in position with plain 16 BWG steel sheet fitted over 38mmx38mmx5mm MS angle and 25mmx5mm FI bar frame and 38mm/50mm steel or GI pipe props suitably braced and 12 BWG steel sheet plate box of proper size where required i/c cost of nuts, bolts, J-hooks etc, placing of reinforcement in position, mixing in mechanized a batching and mixing plant and pumping using line pump or boom placer, maintaining allowable slump of 100mm to150mm casting in steel forms, compacting by Mechanical vibrators and tapered rods and curing at least for 28 days removing centering-shuttering after approved specified time period i/c cost of additional testing charges of materials and cylinders required (Excluding the cost of reinforcements and its fabrication welding, coupling, placing, binding etc. Additional quantity of cement to be added if required to attain the strength at the contractor's own cost)	Cum	1,111.460			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	etc. all complete as per approval of the Engineer in charge. The Mix Design report shall have to approved by the Central Quality Control Laboratory (CQCL), LGED or approved laboratory instruction by the Engineer before execution of the work. Note: Using Batching Plant, Transit Mixer & Concrete Pump; Test- i) FM- one 50cum, ii)W/A (Coarse Aggregate)- one 50cum, iii) LAA/ACV- one 50cum, iv) Gradation of CA- one 50cum, v) Setting Time of Cement-one 50cum, vi) CS of Cement (3,7,28 days)- one 50cum, vii) CS of Concrete-one 50cum					
8	Manufacturing and supplying C.C blocks (Size:300X300X150 mm) in leanest mix 1:3:6 , with cement, sand (F.M>=1.5) and Stone Chips (40mm down graded), to attain a minimum 28 days cylinder strength of 9.0 N/mm2 including grading, washing stone chips, mixing, laying in forms, consolidation, curing for at least 21 days, including preparation of platform, shuttering and stacking in measurable stacks etc complete including supply of all materials (steel shutter to be used) as per direction of E.I.C	Each	2,133.000			
9	Labour charge for protective works in laying CC blocks of different sizes including preparation of base, watering and ramming of base etc. complete as per direction of Engineer in charge.	Cum	28.796			
10	Reinforced cement concrete work in pre-cast RCC piles and pile heads with Portland Composite Cement (CEM II/A-M, 42.5N), sand (minimum FM 2.50) and 20mm down well graded crushed stone chips (Preferably stone chips from Madhyapara, Dinajpur), (LAA value not exceeding 30), including shuttering, mixing by concrete mixer machine, casting, laying compacting, curing for the requisite period etc. all complete as per design, drawing, specification and direction of the E-I-C but excluding the cost of reinforcement. Strength of concrete should not be less than 25 MPa (suggested mix proportion 1:1.5:3). Additional quantity of cement to be added if required to atta in at his own cost.	Cum	17.520			
11	Labour for driving pre-cast RCC piles in any type of soil, handling and keeping in position and driving with suitable monkey to the required depth including fitting and fixing steel cap, etc. all complete as per direction of E-I-C. Size: 300mm x 300mm From 6m to 12m and above	M	200.000			
12	Labour for breaking head of cast-in-situ bored pile/pre-cast pile up to required length by any means and removing the dismantled materials, such as, concrete to a safe distance including	Cum	0.720			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	scrapping and removing concrete from steel/MS rods, preparation and making of platform where necessary, carrying, all sorts of handling, stacking the same properly after clearing, leveling and dressing the site and clearing the river bed, etc. all complete as per direction of the E-I-C. (Measurement will be given for the actual pile head volume to be broken).					
13	Supplying and fabrication of Ribbed or deformed bar reinforcement for all types of RCC work including straightening, removing ruts, cleaning, cutting, hooking, bending, lapping and/or welding wherever required as directed, placing in position, tieing with 22 BWG black annealed binding wire (PVC coated in case of FBEC rebar) double fold, cost of binding wire and anchoring to the adjoining members wherever necessary, supplying and placing with proper cover blocks (1:1), supports, chairs, spacers, splices or laps etc. including cost of all materials, cost of labour, cost of equipment & machinery, loading and unloading, transportation, all other incidental charges and work at all leads and lifts etc. to complete the work as per design, drawing, specifications and direction of the E-I-C. Measurement relating to nominal mass, dimensions and tolerances of various types of steel shall conform to relevant BDS/ ASTM codes. Reinforcement shall be measured only in lengths of bar as actually placed in position on standard weight i.e. 7850 kg/m3 (BNBC Table 6.2.1) basis. No separate payment shall be allowed for chairs of any shape & profile, spacer bar of any shape & profile, lap/ splice unless otherwise shown in the drawing, wastages, binding wire, concrete cover blocks etc. as the cost of these is included in the unit rate. Test- Unit wt. Elongation & Tensile Strength-1set/ Dia/ 10,000Kg Note: Tests for reinforcing bars shall be conducted at LGED/ BUET/ CUET/ KUET/ RUET.					
	Grade 400 (RB 400/ 400W): Ribbed or Deformed bar produced and marked as per BDS ISO 6935-2:2006 with minimum yield strength, fy (ReH) = 400 MPa, but the tested yield strength shall not exceed fy by more than the 125 MPa and the ratio of tested ultimate strength, fu (Re) to tested yield strength (fy) shall be at least 1.25 and minimum elongation after fracture (A5.65) & minimum total elongation at maximum force (Agt) is 14% and 2.5% respectively.	Kg	2,335,624.473			
	Extra over item code: 5.06.01 for providing Fusion Bonded Epoxy Coating (FBEC) to reinforcement bars as per ASTM A775/ BDS ISO	Kg	1,324,299.076			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	14654: 2013 specification for a coating thickness (after curing) of 175 to 300 microns for 10mm to 16mm and 175 to 400 microns for 20mmm to 50mm re-bars including extra cost on account of careful handling during straightening, cutting, bending & placing, extra cost on account of using PVC coated binding wire instead of G.I. wire, extra cost on account of touch-up material (All cut edges/weld areas and bend locations where coating has been damaged touch up shall be done with same paint, the upper thickness limit shall not apply to repaired areas of damaged coating) supplied by coating agency and repair work, extra cost on account of transportation to and fro from steel yard to plant and plant to work site by trailer (if required), loading, unloading, flexibility & holiday testing, including all taxes, etc. complete to ensure proper resistance of FBE against corrosive environment. [Fusion Bonded Epoxy Coating to be proposed only in Coastal Area/Severe Exposure Condition with prior approval of Design Unit, LGED.] 8mm to 12mm					
	Extra over item code: 5.06.01 for providing Fusion Bonded Epoxy Coating (FBEC) to reinforcement bars as per ASTM A775/ BDS ISO 14654: 2013 specification for a coating thickness (after curing) of 175 to 300 microns for 10mm to 16mm and 175 to 400 microns for 20mmm to 50mm re-bars including extra cost on account of careful handling during straightening, cutting, bending & placing, extra cost on account of using PVC coated binding wire instead of G.I. wire, extra cost on account of touch-up material (All cut edges/weld areas and bend locations where coating has been damaged touch up shall be done with same paint, the upper thickness limit shall not apply to repaired areas of damaged coating) supplied by coating agency and repair work, extra cost on account of transportation to and fro from steel yard to plant and plant to work site by trailer (if required), loading, unloading, flexibility & holiday testing, including all taxes, etc. complete to ensure proper resistance of FBE against corrosive environment. [Fusion Bonded Epoxy Coating to be proposed only in Coastal Area/Severe Exposure Condition with prior approval of Design Unit, LGED.] 16mm to 50mm	Kg	1,011,325.397			
14	Single layer brick flat soling with 1st class or picked kiln burnt bricks in foundation, filling the interstices tightly with sand of minimum FM 0.50, watering, leveling, dressing, etc. all complete as per instruction of the E-I-C.	Sqm	29,636.050			
15	Brick work with 1st class brick in specified cement mortar in foundation with sand of	Cum	30.520			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	minimum FM 1.20 and cement conforming to BDS EN 197-1 : 2003 CEM-II/A-L/M/V/W 42.5N, filling the interstices tightly with mortar, raking out joints, cleaning and soaking bricks at least for 24 hours before use, washing of sand, curing at least for 7 days etc. all complete as per design, specification & direction of the E-I-C. Cement mortar (1:4)					
16	125mm brick work with Kiln 1st class bricks/automatic machine made first class bricks in cement mortar (1:4) with Portland Composite cement (CEM II/AM, 42.5N) and best quality sand (minimum FM1.2) and making bond with connected walls with uniform width and depth joints, true to vertical and horizontal lines in/c necessary scaffolding, raking out joints, cleaning and soaking the bricks at least for 24 hours before use, washing of sand, curing for requisite period, etc. all complete as per direction of the E-I-C. Kiln bricks	Sqm	59.400			
17	Supply of MS work in plates, angles, channels, flat bars, Tees etc. with minimum yield strength, fy (ReH) = 300 MPa, including fabricating, machining, cutting, bending, welding, forging drilling, riveting, embedding anchor bars, staging and fitting, fixing, local handling etc including energy consumption etc. all complete as per design, specification and direction of the Engineer-In-charge.	Kg	4,860.644			
18	Supplying, fitting and fixing in position MS plates , nuts, bolts , MS clamps u-straps etc. (minimum yield strength, fy (ReH) = 300 Mpa) complete as per drawings specifications and directions of the Engineer- in-charge. Size: 100mm x 25mm x 6mm M.S Clamp twisted with four holes for fixing	Each	2,072.000			
19	WH: Providing weep holes in Brick masonry/ Plain/ Reinforced concrete retaining wall, abutment, wing/ return wall, with 50 - 100 mm dia PVC pipe extending through the full width of structure with slope 1V : 20H towards draining face including hand packing of 0.85 cum pervious backfill material (40mm - 63mm sized 1st class/picked brick) wrapped in filter fabric in the back of each weep hole etc. all compete as per direction of the E-I-C. [Cost of PVC pipe is included in this item and shall not be paid separately.]	Each	25,926.000			
20	Construction of Sand compaction pile up to required depth and diameter with temporary steel casing in specified type of soil including Derrick/winch machine & Drop hammer (weight minimum 1 ton). The rate shall contribute the full compensation of furnishing all materials like sand (minimum F.M-0.8),	M	20,000.000			

Item no.	*Description*	*Unit*	*Quantity*	*Rate*		*Amount*
				Figure	*Word*	
	driving pile holes, boring casing pipe, placing of materials & other compaction. SPT or any other method & tests for determining the improvement in the bearing capacity (N-value minimum 8), arranging all equipment and machinery, labour, tools and incidentals necessary to complete the work as per requirements described under this item of work as shown on the drawings and direction of the E-I-C. (excluding the cost of SPT) Cost of sand compaction pile (size 300mm dia)					
					Total for Bill No. 1 (carried forward to Summary, p. __)	_____

Bill No. 3: Environmental, Social, Occupational Health and Safety

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
9.1	Tree Plantation (combination of medicinal, fruit and timber plant)	Nos	7,000.000			
9.2	Air Quality sampling and testing satisfying the provision of the bidding document	Nos	60.000			
9.3	Noise sampling and testing satisfying the provision of the bidding document	Nos	180.000			
9.4	Surface water quality sampling and testing of nearby waterbodies/canals receiving wastewater satisfying the provision of the bidding document	Nos	36.000			
9.5	Groundwater quality sampling and testing satisfying the provision of the bidding document	Nos	12.000			
9.6	Drinking water testing satisfying the provision of the bidding document	Nos	120.000			
9.7	Soil sampling and testing satisfying the provision of the bidding document	Nos	24.000			
9.8	Implementation of Site specific Environment Management Plan, Contractor's Environmental Action Plan (CEAP)					

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	satisfying the provision of the bidding document, obtaining approval of the same from the Engineer and maintenance of such approval.					
9.8A	Drinking Water Facilities: Providing continuous adequate drinking water supply at worksite and site office as well by installing necessary tube-well/s where applicable or any other means depending on local situation, also providing essential arrangement for storing drinking water by supplying portable best quality water tank equivalent to Gazi/Padma of adequate capacity depending on the number of users, including supplying 1 (one) no. best quality water filter of minimum capacity 30 liters with necessary kits, etc. All complete as per satisfaction and direction of the Engineer-in-charge, all relevant goods and equipment under this item shall be property of the contractor and payment will be made after 100% completion of the contract successfully.	Set	5.000			
9.8B	Temporary Toilet Facilities: Providing at least two nos. portable toilets or constructing temporary semi pucca toilets with two pit latrine one for female worker	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	and another for male worker at worksite and workers accommodation site in a safe location, so that no adverse impact will generate on the surrounding environment, including providing requisite arrangement for water supplying etc. All complete as per drawing, specification, direction and satisfaction of the Engineer-in-charge. All relevant accessories and arrangements under this item shall be property of the contractor and payment will be made after 100% completion of the contract successfully.					
9.8 C	Waste Disposal Facilities: Providing, installing and maintaining at least 2 (two) nos. waste collection bins one for organic waste and other for inorganic waste of minimum capacity of 30liters with hinge supported 450mm dia cover plate for opening, made of durable plastic material at worksite, both bins will be kept in a safe and easily accessible place, so that will easy to use and no adverse impact will generate on the surrounding environment, including continuing the full functioning of waste disposal(buried/incineration) in accordance with the full satisfaction of the project manager throughout the	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	contract period, all complete as per drawing, specification and direction of the Engineer-in-charge. Entire relevant accessories and arrangements under this item shall be property of the contractor and payment will be made after 100% completion of the contract successfully.					
9.8 D	Traffic Management: Maintaining traffic management at worksite from time of commencement of contractor's activities to time of completion activities, including ensuring that the road is safe for users, providing a safe working area for those involved in work on trafficked network and minimizing any disruption to smooth flow of traffic (this includes providing necessary barricades, warning signs/lights, guide signs, flagmen, maintaining diversion roads by cutting, filling, constructing, etc. or by any other means) in accordance with the full satisfaction of the Engineering-in-charge, unless specified otherwise, including keeping provision for existing traffic and pedestrian movements in such a way as to assure that a single lane at least 3.0m wide is available for public traffic	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	at all times (including access to properties and local roads) affected by the contractor's activities shall be maintained at all times (day & night), including removal of all temporary constructions on completion of the activities, etc. all complete as per requirement and instruction of Engineer-in-charge. All relevant accessories and arrangements under this item shall be property of the contractor and payment will be made after 100% completion of the contract successfully.					
9.8 E	Control of Air Pollution (Dust Suppression): Maintaining, carrying out proper and efficient measures wherever and as often as necessary to reduce dust nuisance, and to prevent dust which has originated from contractor's activities/ operations at the worksite and site office, including sprinkling water on aggregates/unpaved roads at least three times a day or more depending on the atmospheric conditions, including keeping necessary covering/protection on stockpiled fine aggregates to reduce dust nuisance during natural air blowing, all complete like emission of dust into the atmosphere shall be strictly controlled	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	during manufacture, handling, storage of concrete, road aggregates, and to be used such methods and equipment as are necessary for collection and disposal, or prevention, of dust during these operations means of eliminating atmospheric discharges of dust as per requirement and carrying out air quality test as PM10, PM25, SPM, NOx, Sox including concerned tests to be carried out three times (baseline, monthly/quarterly and end of physical work) from any laboratories approved by PM, all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100% completion of the contract successfully.					
9.8 F	Control of Soil Pollution: Providing appropriate controlling measures to prevent entrance, or accidental spillage, solid matter, contaminants, debris, garbage, cement, concrete, sanitary waste, oil, other petroleum products and wastes into soil to avoid soil pollution at worksite and to evade emission of high concentration of sediments into wetlands, swampy areas and other particular sensitive areas, All complete as per requirement and full satisfaction of Engineer-in-	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	charge. Payment will be made after 100% completion of the contract					
9.8 G	Control of Water Pollution: Providing necessary arrangement to prevent entrance, or accidental spillage, solid matter, contaminants, debris, garbage, cement, concrete, sanitary waste, oil, other petroleum products, pollutants and wastewaters from aggregate processing, concrete batching, or other construction operations into streams, flowing or dry watercourses, lakes, and underground water sources for ensuring water quality, including monitoring pH value, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), turbidity etc, including concerned tests to be carried out three times (baseline, monthly/quarterly and end of physical work) from any laboratories approved by PM, all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100% completion of the contract successfully.	Set	5.000			
9.8 H	Providing and maintaining semi pucca site office (Appendix 5) with necessary furniture, sanitary &	Ls	1.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	electrical/ power facilities with full time Air-Conditioned, water supply arrangement, office and survey equipment for the use of the Engineer and his staff, all complete including removal of structures and restoration of the site on completion of the work. The contractor shall submit the detailed plan and drawing of the site office for approval of the engineer. The site office should be provided with sufficient natural light, heat protecting ceiling, dam proofing etc. as per direction of E-I-C. All materials, equipment and plant, furniture, fittings recovered from dismantling the office and removing access road will be the property of the contractor upon completion of the work. The contractor will responsible for maintaining the facilities of site office in good condition throughout the contract period and payment of this item shall be made only with the final bill. Area of field office: 80 sqm					
9.8 I	First Aid Box: Supplying, equipping and maintaining adequate first-aid box throughout the working period at worksite and site office, and erect conspicuous notice boards directing where these are situated and	Set	5.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	providing all requisite emergency medical first aid kits, including complying with the government medical or labor requirements at all times, and provide, equip and maintain necessary dressing kits throughout the working period for attending minor injuries, etc. all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100% completion of the contract successfully.					
9.8 J	Personal Protection Equipment for Workers: Providing and maintaining appropriate (safe design, fit and comfort) personal protection equipment (PPE) to ensure the highest possible protection for employees in establishing and maintaining a safe and healthful working environment at workplace, including demonstrating, providing training on proper understanding and development of skill in the use of PPE, including supplying (i) best quality safety jacket for construction workers made of 100% polyester waterproof fabric, fluorescent yellow/orange/green/red/blue or pantone color, (ii) suitable hand protection gloves for construction work of Flexible/ durable/	Set	100.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	excellent puncture resistance working gloves with PVC palm and T/C drill back, pasted cuff, palm liner and fit properly and be reasonably comfortable to wear, (iii) appropriate foot protection shoes having impact-resistant toes and heat-resistant soles that will protect the feet against hot working surfaces, (iv) best quality safety helmets of ABS shell, tough, lightweight, durable which will be able to resist penetration by objects, absorb the shock of a blow and water-resistant and slow burning with available four-six-point adjustable suspension for shock-absorbing, slotted sides to accommodate accessories, such as face shields, ear muffs(v) suitable eye protection goggles to protect against specific workplace hazards, fit properly and be reasonably comfortable to wear, provide unrestricted vision and movement, including instructing workers to wear strictly during working time and reviewing periodically, updating, evaluating the effectiveness of PPE and maintaining, replacing worn or damaged PPE etc. all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100%					

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	completion of the contract successfully.					
9.8 K	Site Preparation, Protective Fencing & Safety Measure with Warning Sign: Erecting and maintaining temporary fencing and gates, and if necessary, providing watchmen to ensure that livestock cannot stray at surrounding premises of site office/work site with using of best practice construction techniques to minimize disturbance to fauna and flora, and confining it within defined working areas, utilizing of appropriate techniques to minimize soil erosion, including filling and cutting slopes shall be repaired immediately whenever damaged by surface water, compacting the filled material, using suitable light equipment and confine the effects of vegetation clearance and soil disturbance within defined allocated land boundaries including avoiding environmentally sensitive or valuable areas such as nature reserves, archaeological sites, areas inhabited by sensitive species, areas adjacent to surface water bodies, providing necessary protective fencing and safety measures with warning signboard, including furnishing and placing all	Set	1.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	materials, labor, equipment, tools and incidentals necessary to complete the work and removal, disposal at a safe distance after completion of work etc. all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100% completion of the contract successfully.					
9.8 L	**Site Cleaning, Removal and Disposal Activity:** Cleaning and maintaining at all times, keeping the construction area, storage areas used, free from accumulations of waste materials or rubbish, with necessary arrangement for collecting at a central disposal area, on a daily basis and disposing in a manner approved and satisfaction by the Engineer, especially waste water and sewage from office, residential and mobile camps shall be piped to soak pits or other disposal areas, all used fuels, oils, other plant or vehicle fluids, old tires, tubes, other solid waste from household, office, workshop, construction materials, etc. to be kept at safe places and any spillages shall be cleaned up by either burning in place or collecting the contaminated soils and burning them at the central disposal area, including removing all waste, debris,	Set	1.000			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	rubbish, unused materials, concrete forms and other like material, tools, equipment, machinery and surplus/ unwanted materials buried or cleaned up in a manner acceptable to the Engineer after completion of work etc. all complete as per requirement and full satisfaction of Engineer-in-charge. Payment will be made after 100% completion of the contract successfully					
9.8 M	**Supplying and distribution** of 1) Washable Reusable 3 Layer cotton face mask/KN95 Respiratory face mask 2) Disposable Plastic hand gloves appropriate for Protection glasses (Eye protection safety goggle) with PVC frame and dust Proof transparent lances etc. of approved quality all complete as per sample like in fig 1,2 & 3 and direction of the E-I-C	Set	200.000			
9.8 N	**Supply and installation** of Hand Wash arrangement with soap and water at the location of Site entry gate shall include supplying of appropriate designed fabricated (To be approved by the Engineer-in-charge) iron stand for fitting fixing of a ceramic Hand Wash Basin of standard size along with supply and fitting fixing of C.P Pillar cock, SS soap tray , Towel Rail. Also there shall	Set	100.000			

9

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	be an arrangement for continuous supply of safe water and soap for hand wash purpose etc. of approved quality all complete and direction of the Engineer-in-charge.					
9.8 O	**Supplying of hand sanitizer** like ACI Hexisol hand rub or its equivalent viz. Sepnil Instant Hand Sanitizer among all the workers in the site from commencement of work to completion of work etc. all complete as per sample like in Fig.5 and direction of the Engineer-in-charge.	Set	5,000.000			
9.8 P	**Providing, fitting and fixing 2nos. COVID- 19 awareness display Sign (Digital) Board** as per standard Text of size 500x700mm fitted in 18BWG M.S sheet erected with 38mm dia. and 2.0m long G.I post, fixing M.S sheet by continuous welding including proper foundation etc. of approved quality all complete as per direction of the Engineer-in-charge.	Set	20.000			
9.8 Q	**Supplying, distribution and stick-up 100 nos.Covid-19 awareness leaf let and poster** (Multi color) in A4 size glossy paper etc. all complete as per sample like in Fig.6and direction of the Engineer-in-charge.	Set	5.000			
9.8 R	**Supplying, maintaining and providing services among**					

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	all the workers in the site from commencement to completion of work 1 No. Digital Thermal scanner of K3 Pro Infrared Thermometer or its equivalent having temperature unit in 0Fwith response time 0.5sec.and accuracy level +/-0.2oF etc. of approved quality all complete and direction of the Engineer-in-charge.	Set	5.000			
9.9	**Reports: Environmental**					
	(a). Preparation, Submission and obtaining approval from the Engineer of the Monthly Progress Report satisfying the provision of Particular Condition .	Nos	24.00			
	(b). Preparation, Submission and obtaining approval from the Engineer of the Quarterly Progress Report satisfying the provision of Particular Condition	Nos	8.00			
	(c). Preparation, Submission and obtaining approval from the Engineer of the Yearly/annual report satisfying the provision of Particular Condition.	Nos	2.00			
	(d). Preparation, Submission and obtaining approval from the Engineer of the Completion report satisfying the provision of Particular Condition.	Nos	2.00			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
B	**Social Related Activities**					
	GBV/SEA/SH risk mitigation					
9.10	Design of Grievance Complain Box, Obtaining approval of Engineer, Manufacture, Supply, Erection at Pre-approved location of the Site and Maintenance during the entire period of Construction to the satisfaction of the Engineer.	Nos	5.00			
9.11	Design of billboards for posting of GRM related information, Obtaining approval of Engineer, Manufacture, Supply, Erection at Pre approved public places and Maintenance during the entire period of Construction to the satisfaction of the Engineer.	Nos	5.00			
9.12	Provision for receiving Daily grievance, Proper registration of complain and management, resolution of such grievances, selection, engagement and monitoring of the referral service providers (GO, NGO, Private) satisfying the provision of GBV/SEA/SH risk mitigation guidelines during the period of construction and submission of Report Quarterly satisfying the provision of Particular Condition and obtaining	Nos	8.00			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	approval from the Engineer.					
	Labor Influx Management					
9.13	Daily recording of Labor Inflow and Out Flow satisfying the provision of Labor Influx Management and submission of Report Monthly satisfying the provision of Particular Condition and obtaining approval from the Engineer.	Nos	24.00			
	Grievance Redress Mechanism (GRM)					
9.14	Preparation of Grievance Redress Mechanism (GRM) and obtaining approval, Receiving of grievance, documentation of the same, resolution of such grievance satisfying the provision of GRM and submission of Report Quarterly satisfying the provision of Particular Condition and obtaining approval from the Engineer.	Nos	12.00			
	Communication					
9.16	Preparation of information brochures related to GBV/SEA/SH risk, mitigation measures, Design, Obtaining approval of Engineer, Manufacture, Supply Erection and Maintenance of billboards, dissemination of information to adjacent community through brochures/leaflets	Nos	36.00			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	and community consultation during the period of construction satisfying the provision of Communication guidelines andsubmission of Report Monthly satisfying the provision of Particular Condition and obtaining approval from the Engineer.					
	Occupational Health & Safety (OHS) including Covid-19 issue					
9.16	Supply, Commissioning, Operation & Maintenance of Occupational Health & Safety (OHS) including Covid-19 issues satisfying the provision of Contract, Engineer and covering the following: Case Management comprising of COVID-19 tests, Quarantine/ isolation facilities, Emergency medical transport & Hospitalization/ treatment, etc.; Manpower comprising of Cleaners, Public Health Specialist, etc.; and submission of Monthly Report satisfying the provision of Particular Condition and obtaining approval from the Engineer.	Nos	36.00			
9.17	Reports: Social					
	(a). Preparation, Submission and obtaining approval from the Engineer of the Monthly Progress Report and obtaining	Nos	24.00			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	approval from the Engineer satisfying the provision of Particular Condition .					
	(b). Preparation, Submission and obtaining approval from Engineer of the Yearly /annual report and obtaining approval from the Engineer satisfying the provision of Particular Condition.	Nos	2.00			
	(c). Preparation, Submission and obtaining approval from Engineer of the Completion report and obtaining approval from Engineer satisfying the provision of Particular Condition .	Nos	1.00			
9.18	Manpower for ES-MSIP					
	(a). Environment Health Safety Specialist	MM	36.00			
	(a). Social Specialist	MM	36.00			
	(a). Gender Specialist	MM	36.00			
C	**Awareness training**					
9.18	Preparation of the Awareness Training program for the Contractors personnel, obtaining approval of the Engineer and performance of the training during the period of Construction satisfying the provision of Environment and environmental issue, OHS & COVID 19 issues and Social Issues including submission of Monthly	Nos	36.00			

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
	Report satisfying the provision of Particular Condition and obtaining approval from the Engineer.					
					Total for Bill No. 3 (Carried forward to Summary, p. __)	_____

Bill of Quantities

Bill No. 4: Provisional Sums

Item no.	Description	Unit	Quantity	Rate		Amount
				Figure	Word	
(i) PS1	Quantity Over-run	LS	1	20,000,000.00	Two crore	20,000,000.00
(ii)PS2	Price Adjustment	LS	1	200,000,000.00	Twenty crore	200,000,000.00
(iii)PS3	Unforeseen Work	LS	1	10,000,000.00	One Crore	10,000,000.00
					Total for Bill No. 4 (carried forward to Summary, p. _)	230,000,000.00

Grand Summary

Contract Name: **Road and Storm Water Network for Mirsarai-2B EZ**

Contract No.: W-1/2021-22

General Summary	*Page*	*Amount*
Bill No. 1: Road Work		
Bill No. 2: Drainage Work		
Bill No. 3: Environmental, Social, Occupational Health and Safety		
Sum (Bill no.1 to 3)		
Bill No.4: Provisional Sums		
Bid Price (Carried forward to Letter of Bid)		

i) All Provisional Sums are to be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub-Clauses 13.4 and 13.5 of the General Conditions except with respect to DAAB Fees and Expenses for which Sub-Clause 13.4 of the Particular Conditions – Part B shall apply.

ii) To be entered by the Employer.

* For evaluation purposes, Provisional Sum, other than Daywork will be excluded

Technical Proposal

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

Site Organization

[insert Site Organization information]

Method Statement

[insert Method Statement]

Mobilization Schedule

[insert Mobilization Schedule]

In accordance with the Particular Conditions, Sub-Clause 4.1, the Contractor shall not carry out mobilization to Site unless the Engineer gives consent that appropriate measures are in place to address environmental and social risks and impacts, which as a minimum shall include applying the Management Strategies and Implementation Plans (MSIPs) and Code of Conduct for Contractor's Personnel, submitted as part of the Bid and agreed as part of the Contract.

Construction Schedule

[insert Construction Schedule]

The construction schedule shall include the following key milestones:

- *No-objection to the Contractor's MSIPs, which collectively form the C-ESMP, in accordance with the Particular Conditions – Special provisions Sub-Clause 4.1.*
- *Constitution of the DAAB*

ES Management Strategies and Implementation Plans

(ES-MSIP)

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

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

1. The Works Requirements described in Section VII;
2. Environmental and Social Assessment (ESA);
3. Environmental and Social Management and Monitoring Plan (ESMP);
4. Environmental and Social Commitment Plan (ESCP
5. GBV/SEA/SH Action Plan
6. Consent Conditions (regulatory authority conditions attached to any permits or approvals for the project).

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

Note to the Employer:

The following minimum requirements shall not be modified. *The Employer may add additional requirements to address identified issues, informed by relevant environmental and social assessment.*

The types of issues identified could include risks associated with: labour influx, spread of communicable diseases, Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH) *etc.*

Delete this Box prior to issuance of the bidding documents.

Note to the Bidder:

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

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

CODE OF CONDUCT FOR CONTRACTOR'S PERSONNEL

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

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

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

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

REQUIRED CONDUCT

Contractor's Personnel shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
3. maintain a safe working environment including by:
    a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
    b. wearing required personal protective equipment;
    c. using appropriate measures relating to chemical, physical and biological substances and agents; and
    d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
6. not engage in Sexual Harassment, which means unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;
8. not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH);
11. report violations of this Code of Conduct; and
12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

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

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

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

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

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

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

FOR CONTRACTOR'S PERSONNEL:

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

Name of Contractor's Personnel: [insert name]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date: (day month year): _____

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

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

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

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

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

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

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

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

The activity wise anticipated environmental and social impacts and corresponding mitigation measures have been outlined from the detailed ESA for the BSMSN Development project for the works carried out under Component 2 in the following table:

Table : Environmental and Social Management Plan (ESMP)

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
During Pre-Construction and Construction Phase (ESS 2)				
Labour Management and social conflict management	Labour Management including labour influx mitigation	During construction phases, some workers from outside the project area may be deployed where a conflict may arise among them and local residents, because of any changes to the local customs or when the external workers fail to understand the local customs. In addition, sexual abuse of female workers by the male workers may happen at camp site. Further, due to discrimination of wages, lack of adequate OHS, aggressive behaviour by the migrant labours and manger etc. may create labour unrest in the project site. • Local people should be deployed for the construction works to the maximum extent possible, and the migrated workers from other areas or from other countries should be taught to respect local customs in order to facilitate good relationships with local people. • Ensure construction of the labour shed and stockyard at the designated place and should not be sited nearby any waterbodies and not in the vicinity of local community. • Contractor should follow proper Labour management plan during construction. Within bidding document of contractors, a proper code of conduct should be included. • Proper training for contractors & workers shall be provided. • The lodgings of the project workers should be equipped with sufficient	Contractor	Construction Supervision Consultant (CSC)

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		living facilities to keep workers at the project site as much as possible. • Human resource management should be with proper humanitarian behaviour rather than authorities' attitude. • Identification of factors that might create conflict between worker and management and those probable factors shall be avoided. • Labour should not be under-estimated rather they should be rewarded fairly. • Ensure proper OHS as per industrial rules of GOB and international guidelines; • Providing training facilities among the workers and increment facilities should be same for all, to avoid any discrimination.		
Gender Based Violence (GBV)	During construction, engagement of women labours for different types of construction works	Wage discrimination between men & women workers may occur. Women friendly sitting arrangement and drinking water facilities may not be provided. Women may be a victim of eve teasing and sexual abuse. Consequence Mitigation Measures may be as follows: • Engage competent women Ward member speaking for women and	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		working for them to participate in the implementation of the project. • Impart awareness training for both elected representatives and employees (executives). • Make conditionality in the bid document to ensure equal wage for equal work. • Activate GRC in regards to hearing complaints and resolving them. Intimate the process to all workers • Representative of women groups in GRCs • Beneficiary options reflected in subprojects design and implementation • Ensure woman-friendly sitting arrangements and good drinking water facility in the women designated area. • Workers should sign the Code of Conduct and adequate training on GBV is required.		

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
Occupational Health and Safety Hazard	Handling and disposal of hazardous & non-hazardous waste during implementing various subprojects and from different construction related activities, including management of accidents.	**Health and Hygiene** • Proper training shall be provided for workers and managers about health & hygiene; • Cleanliness at the site premises and workers living places and at the Labour Sheds; • Arrangement of the proper ventilation and temperature at the Labour Sheds; • Protection against dust and furnace by using the nose masks and covering the head and body; • Proper disposal of the solid & liquid wastes; • Provision of the adequate latrines and separate toilets for the women; • Sufficient dustbins for the solid waste management system. **Safety and First Aid Box** • Using the personal protective equipment (helmet, visible jacket, gloves, goggles, nose mask, ear plug, safety boots, etc.); • Precautions during work on or near machineries in motion; • First aid facilities should be provided and maintained; **Compensation for Accidents at Work** Contractors will bear medical treatment costs. If any severe accidents such as loss of hands, legs or loss of working ability or any case of death, compensation will be made by the contractor- (the amount of the compensation should be fixed considering the type of accidents). **Dust and Fumes** For any dust, fumes, or other impurities likely to be injurious to the workers, effective	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		measures shall be taken to prevent their accumulation and its inhalation by the workers. **Overcrowding** No labour room should be overcrowded. **Latrines and Urinals** • Sufficient latrines shall be provided; • Latrines shall be maintained in clean and sanitary condition; • Latrines shall be adequately lighted and ventilated. **Disposal of Wastes and Effluents** • Proper disposal system for the solid waste and effluent is required. • Placement of signboard in front of Hazardous Chemical storing place; • Ensure good housekeeping at the construction site to avoid slips and falls. **Emergency Controller** Contractor should prepare a site Emergency Preparedness and Response Procedure, which should be followed for the subjected project;		
Social Conflict	Management of labour Influx	Due to engagement of a large number of migrant workers in the project site, an extra pressure may impose on the local available resources like housing, water resources etc. In addition, influx of workers to the community may cause impacts to community health and safety, especially an increase in prevalence of disease. Subsequently, main anxiety for the community is food and water borne diseases, faecal elements contamination into water etc. Consequence Mitigation Measures are suggested below: • Orientation and training will be provided to the contractors, supervisors and workers, on health, safety and	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		environment including sexual diseases control (as of BOQ), • Health and safety training on communicable diseases shall be provided for the workers; • Liaison with the communities shall be maintained throughout the construction phase. • Grievance redress mechanism should be established at the project site before starting the subprojects construction works. • Training on resource efficiency management should be provided for the workers and contractors; • Contractors will be responsible for close monitoring of labourers; • No child and/or forced labour will be employed by the contractor; • Contractor will engage both the local and migrant labour with same wage and facilities; • Available treatment for vector borne diseases shall be provided by the contractor; • Creating awareness about local custom and culture among outside migrant and encouraging their respects and honour for same; • Working conditions and terms of employment will be fully compliant to the EPZ/EZ Labour Ordinance 2019.		
Emergency Response Plan & Disaster	Accident from different project	During construction work due to technological failure hazards like; fire, electric power or gas cut, chemical hazard, spills of flammable liquids, accidental release of toxic substances, terrorist	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
Management Plan	activities & natural disaster	activities, threat, hostage incident, loss of water supply etc. may take place at EZ site as well as natural hazards like flood, cyclone and earthquake, etc. also can occur since its located in cyclone prone area. **For Flood** • Evacuate the people from flooded area and place them to a safe area. • Switch of the power supply from effected area. • Remove all types of obstructions from the drainage system. • Coordinate with local Emergency Response Team and take action as per their guidelines. • In case of any accident, ensure presence of first aid team and get medical attention as soon as possible. • Ensure presence of nearby fire brigade team system in case of worst or out of control situation. **For Cyclone** • Switch off the Power Supply of Sub-station. • Close all the wind-entering openings in the houses and sheds. • Open windows and exhaust points to allow the wind go out from the constructed building or labour shades. • Instruct all the associates including workmen not to allow them to go outside till the wind & cyclone effect reduces to the normal level • After the cyclone, inform the Emergency Response Team to		

		investigate the property loss in the project site for further action. **For Earthquake** • Isolate electrical supply wherever it is possible. • Do not use elevators/ hoist • All electric connection of the Economic Zone should be cut off during cyclone. Safe evacuation is important for everybody and measures should be taken accordingly. • Ensure fire and siren alarm system in all floors. During earthquake all the employees will come down to a safe place in a row through stair after hearing the alarm. • Have to evacuate as per evacuation plan • Project should have Rescue Team to help the injured employees. And they will also take the injured employees for treatment. • Isolate all pipelines of steam, gas pipeline, compressed air, fuel and CO_2 when they are not in use. • Check availability of security personnel and have a chat with them in view of likely immediate action to be taken. • Empty the tanks that are installed in vertical and relatively unstable conditions. • Ensure the flammable liquids i.e. Petrol, Diesel and other petroleum products are stored under secondary containment with due precautions **For Fire**		

		• Evacuate the people from Fire hazard area and send them to a safe exit direction. • Remove unwanted combustible material. • Keep cool and do not panic. • Inform the substation and electrician to get the affected area isolated from power supply. • Keep Fire Hydrant accessible. • Keep newest and good conditioned fire hoses and Fire Extinguishers readily available. • Ensure one operator is always present at Hydrant system area when using the fire Hydrant system. • If the fire is very small, use the correct Fire Extinguisher for extinguishing the fire. • Try to isolate the fire by removing the surrounding inflammable material around. • In case of big fire use local Hydrant system for extinguishing the fire. • If the fire is beyond the control, inform the security or higher authority to call local fire Brigade and Inform Emergency Response Team. • On arrival of the fire brigade, help them to reach the site of fire. • In case of any accident of human, ensure immediate medical attention as soon as possible. **Fatal Accidents** • During emergency operation, if there is any injured person, carry out victim/causality to the security room or Conference room or even to OHS room beside the support of		

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		contractor recommended nursing home. • Ensure attendance of First Aid Team and carry out the first aid. • Inform the Emergency Response Team. • If the accident is severe, ensure emergency vehicle for taking the victim to local hospital or recommended nursing home, phone numbers should be available in the site. • Accident report should be prepared with the help of witness and preserve it to the Emergency Response Team. **Utilities Failure** • For emergencies and potential danger, the control room of the respective utilities to be informed. • In a situation where a building needs to be evacuated, please proceed to the building specific evacuation area. • Turn off equipment, machines and computers. • Assist disabled persons, women and children at earlier stage. • Try to avoid elevators • Stay at the designated evacuation area until the fire department or designated representative has given the –all clear to re-enter the project site		
During Pre-Construction and Construction Phase (ESS 3)				
Air Quality	Site preparation, Operation of	Air pollution will occur due to; Site preparation, stack yards and labour shed construction,	Contractor	CSC

	construction vehicles, material storage and different types of construction work etc.	hauling of equipment/Dust generation from earthworks such as levelling, grading, excavation works and movement of vehicles across unpaved roads, especially during windy conditions and the mitigation measures are suggested below: • Ensure that all trucks, vehicles, and electrical devices used in the project area will comply with technical and environmental safety regulations • Schedule the operation times for vehicles, machines working in the construction area to reduce air emissions • Use of adapted Personal Protection Equipment like; ear plugs, goggles, helmets, gloves, masks etc. • Regular watering and sprinkling for dust suppression are to be done properly. • Stockpiles of dusty materials will be covered by polythene or tarpaulin to prevent the escape of dust during loading and transportation. • No stockpiles will be maintained outside, and maximum possible distance between the stockpiles and receptors will be maintained; • Covering and/or watering of all stockpiles of dusty materials such as excavated spoils to avoid fugitive dust emissions; • During construction, the approach road will be kept clean, free from mud and slurry; • Material transport will be totally covered with impervious sheeting; • Speed of vehicles on site and approach road will be limited to 15-20 km/hr which will help in		

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		minimizing fugitive dust emission due to vehicle movement; • All diesel-powered equipment will be regularly maintained to minimize emissions; • Low sulphur diesel will be used in diesel-powered equipment in collaboration with best management practices; • Solid waste burning in the project site is strictly prohibited.		

Water Resources (Surface and Ground Water) and Quality	Construction of labour camp, refuelling of vehicles, washing of equipment and vehicles, at safe distances from water sources	Surface and groundwater can be contaminated by sewage & wastewater from labour camp and effluent disposal from washing of construction vehicles as well as due to improper housekeeping of hazardous waste and the mitigation measures are suggested below: • Labour camp should be constructed at a safer distance from the waterbody; • Arrangement of mobile toilets may be set at work sites • Waste disposal is prohibited to waterbodies. Proper disposal mechanism should be adopted • Proper sanitation facilities should be made available. • Channelize water from labour sheds and work place to nearby drains after passing through settling ditches to segregate sediments and solids • Labour camp shall be set up at safe distance from either any water body or settlement areas, • Camp site sewage disposal will be ensured by constructing septic tanks and soak wells • Periodical training needs to be provided to workers for best utilization of water; • Take permission for installation of deep tube well from Upazila Parishad/ Municipality; • Recycle/reusing of waste to the extent possible; • Fuel, oil and used oil storage areas shall be contained in concrete floor;	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		• Refuelling will be carried out in designated areas using strict protocols; • Project staff will not be permitted to utilize any water sources (stream, river, or other water bodies) for the purposes of bathing or washing; • Construction vehicles and equipment will be serviced regularly at off-site location; • Oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal; • Oil and grease separator shall be used for wastewater generated from cleaning activities; • Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce; • Workers will be trained in the use of designated areas/bins for waste disposal and encouraged to use toilets;		
Soil & Sediment Pollution	Different activities such as handling of construction materials (as stones, sand, gravels, slurry, fuel, lubricants, paints) and disposal of solid waste & sewage from construction and labour camp site.	Project site soil and sediment can be polluted due to disposal of solid and liquid waste of diversified construction works. In addition, due to operation of heavy equipment may impact on soil texture etc. Further, sediment can contaminate due to oil spillage of construction vehicles and waste debris. Consequence Mitigation Measures are given below: • Soil conservation measures will be undertaken during stockpiling,	Contractor	CSC

		preservation of topsoil or gravel for the remediation of disturbed areas; • Construction vehicles will remain on designated and prepared compacted gravel roads; • Earth material should be tested at source prior to fill the land for dike construction; • Fuel, lubricating oil, and used oil storage areas will be in the designated area. • On-site sanitation system shall be adapted for latrines and sewage treatment. • Spill containment and clean up kits will be available in the site and to be cleaned up appropriately. • Construction vehicles and equipment will be under servicing in a regular interval. • The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; • Contractor shall ensure daily collection and disposal of construction waste, debris, metal cutting wastes, used oil etc. • Special care needs to be taken during the road construction to maintain standard slope, and to maintain proper compaction of the road soil; • Covering the road shoulders and slopes by the first growing grass; • Adequate drainage arrangements for storm water management during construction period to		

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		ensure proper drainage pattern and avoid drainage congestion.		
Noise pollution	Operation of various construction vehicles and diesel-based machineries for constructing different type of civil infrastructures	Noise pollution may occur because of: Operation of vehicles and equipment during the site preparation, stack yards and labour shed construction, hauling of equipment/Transportation of construction materials, plant materials, machinery and personnel/Operation of DG sets/Operation of batching plant i.e. concrete, asphalt and mitigation measures are suggested below: • Perform the pre-construction activities within the day time and minimize night time working. • Regulate the speed for traffic in and around the project areas. • Construct the sound walls as feasible in selected areas. • Regularly carry out maintenance and routine inspections on vehicles and construction machineries to ensure the technical standards. • The contractor shall ensure the construction equipment are with proper silencer and muffler. • The contractor shall consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the respective work; • Mobile noise sources such as cranes, earth moving equipment shall be routed in such a way that	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		there is minimum disturbance to receptors (birds and fauna around); • Only limited construction activities shall be carried out during night-time; • Restrict the night time vehicle movement through the access road; • The number of equipment operating simultaneously should be reduced as far as possible; • Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby receptors as far as practicable; • Rubber padding/noise isolators will be used for construction equipment; • Temporary noise barriers shall be provided surrounding the high noise generating construction equipment; • The personnel involved in high noise generating activities shall be provided with personal protective devices like ear plug to minimize their exposure to high noise levels;		

Issues	Project Activity	Probable Impacts & Consequence Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
During Pre-Construction and Construction Phase (ESS 4)				
Traffic & Transportation	Movement of construction vehicles for transporting the material, personnel and	Materials carrying vehicles and construction vehicles (Excavator, pay loader, dump-truck etc.) may damage environment in the construction area and may be a disturbance to nearby physical and social institutions. Without proper traffic management accidents may also occur.	Contractor	CSC

	equipment into the project site	Consequence Mitigation Measures are suggested below: • Inform local people about the subproject's activities; • Inspire local people to use connecting and diversion roads during the construction; • Temporary roads should be developed for transportation of material in place of using the community roads. If village roads are being used, transportation should be carried in non-peak hours and regular maintenance shall be carried out so as to minimize the impact. • Increased traffic should follow the traffic scheduled to avoid traffic congestion. • Place traffic sign/cautionary sign to avoid undue traffic congestion and associated traffic control measures to limit possible disruption; • At the points where traffic is to be deviated from its normal path (whether on temporary diversion or part of the width of the carriageway), the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums, or a similar device to the directions of the vehicles. • At night, the passage shall be delineated with lanterns or other suitable light source. • For regulation of traffic, the flagmen shall be equipped with red and green flags especially near at intersection. • For notification of construction activities, at least two signs shall be put up for each road, one close to the point of where carriageway begins, and		

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
		another will be placed at the end of the carriageway. • Traffic safety is to be ensured as per the traffic management plan.		
Community Health and Safety	Carrying construction materials into the project site by motorized vehicles	Community Health and Safety can hamper due to different construction works & traffic movement and the relevant mitigation measures are suggested below: • Prior to start of the construction activities contractor will inform the local community; • Instruct the drivers and limit the speed (20km/hour) of the vehicles near the settlement area especially in the bazar area; • Ban the use of mobile phones and talking during driving in the approach road; • Regular health check-up of the workers and awareness training about the communicable diseases; • Proper lighting at the project site during the night time; • Avoid unnecessary noise pollution; • Water shall be spread in the dry surface to reduce the dust pollution. • Contractor should develop a traffic management plan • Awareness creation through training on STDs, HIV/AIDS will bring positive result. • Adequate preventive measures are to be taken and regular health check-up is required.	Contractor	CSC

Issues	Project Activity	Probable Impacts corresponding Mitigation Measures	Responsibility	
			Planning and Execution	Supervision & Monitoring
Hazardous and non-hazardous waste	Adding admixture for cocreating work of civil structures. Fuelling and maintenance of construction vehicles and equipment	The Project will generate both solid non-hazardous and hazardous wastes throughout the construction phase. The anticipated non-hazardous waste types include excavated material, construction material, Municipal Solid Waste, wastewater. While hazardous waste may include used oil, empty drums or replaced parts of the construction machinery, used battery, chemical for concreting like admixture etc. There are potentially a number of risks to human health and the environment that may be associated with the handling, storage and disposal of waste, both on and off-site. Consequence Mitigation Measures are given below: • The hazardous waste generated at camp sites is to be collected in steel drums and stored in a segregated roofed area and periodically disposed at approved waste disposal facilitates by BEZA. • The camp site shall have compost pits for treating organic waste and separate bins for collecting the inorganic waste, which shall be disposed at nearest disposal sites. • Waste management and the minimization of potential impacts during construction will depend on the implementation of appropriate procedures, protocols and monitoring of materials being delivered, handled and stored prior to disposal.	Contractor	CSC

During Pre-Construction & Construction Phase (ESS 6)				
Ecosystem and Biodiversity	Operation of different noisy machineries or equipment for executing the construction work of	Negative Impacts on Eco-system and Biodiversity (Aquatic & Terrestrial Ecology) may occur because of spillage or disposal of solid & liquid wastes from onsite development activities and project construction vehicles and equipment will disturb the habitat of fishes. Construction work and its associated machineries and vehicles can adversely affect the biodiversity of adjacent	Contractor	CSC

	different subproject	manmade forest. Consequence Mitigation Measures are given below: • Proper disposal and management of construction waste • No waste should be dumped in water bodies during construction without proper treatment • Wastewater from labour camps and construction sites should not be disposed off in the waterbodies • Site should be kept clean so as no pollutant from site should enter the waterbodies along with run-off • Storage of raw material at construction site should be avoided near waterbodies. • The noise generating activities should be scheduled during daytime • Movement of construction and transport vehicles should be restricted to dedicated paths to minimize any harm to small mammals near to the proposed site. • Construction activities should be planned and undertaken in a phased manner • Damage to the natural topography and landscape should be minimized; • Strict prohibition should be implemented on trapping, hunting or injuring wildlife • Keep present condition of the canals functional in project site for aquatic species • A zone of 30 m is to be left along the canal & periphery of the Zone 2A & Zone 2B zone as if mud crab habitat, as well as migratory birds' habitat are not affected. • Embankments planned to be developed should be provided with grass which can survive in saline water also;		

		• No tree cutting is proposed, even if any tree is to be cut, then plantation should be undertaken in minimum ratio of 1:3. • Plantation of area between Zone 2A and Zone 2B site and sea with mangroves shall be assured; • No untreated solid or liquid waste shall be discharged in waterbodies • Septic tanks/soak pit should be provided to treat sewage to be generated from labour camps and prevent its disposal in waterbody • Toilets should be provided at site to prevent contamination of water due to open defecation in nearby areas. • Vehicle washing/equipment cleaning should not be allowed near canal/drains in Zone 2A and Zone 2B site • Excavation and filling should be carried out in phased manner to minimize exposure of loose earth for longer duration • Before construction work contractor should prepare a proper Biodiversity, Management Plan and that needs to be approved by the BEZA & World Bank • 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 • All the raw material and debris should be stored in covered sheds on paved surfaces to minimize the contamination of rainfall run-off • Diesel, paints, cements etc. should not be stored near the canal/water bodies		

Form EQU: Equipment

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

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 ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Bidder.

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

Form PER -1

Contractor's Representative and Key Personnel Schedule

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

Contractor' Representative and Key Personnel

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

	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
5.	**Title of position: Sexual Exploitation, Abuse and Harassment Expert** *[Where a Project SEA risks are assessed to be substantial or high, Key Personnel shall include an expert with relevant experience in addressing sexual exploitation, sexual abuse and sexual harassment cases]*	
	Name of candidate	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
6.	**Title of position: [insert title]**	
	Name of candidate	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]

9

Form PER-2:
Resume and Declaration
Contractor's Representative and Key Personnel

Name of Bidder

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

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

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

Declaration

I, the undersigned *[insert either "Contractor's Representative" or "Key Personnel" as applicable]*, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

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

Commitment	**Details**
Commitment to duration of contract:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*
Time commitment:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*

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

1. be taken into consideration during Bid evaluation;
2. result in my disqualification from participating in the Bid
3. result in my dismissal from the contract.

Name of Contractor's Representative or **Key Personnel: [*insert name*]**

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Bidder:

Signature: _____

Date: (day month year): _____

Bidders Qualification without prequalification

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

Form ELI -1.1

Bidder Information Form

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

Bidder's name
In case of Joint Venture (JV), name of each member:
Bidder's actual or intended country of registration: *[indicate country of Constitution]*
Bidder's actual or intended year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4 ☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1 ☐ In case of state-owned enterprise or institution, in accordance with ITB 4.6, documents establishing: • Legal and financial autonomy • Operation under commercial law • Establishing that the Bidder is not under the supervision of the Employer 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 47.1, the successful Bidder shall provide additional information on beneficial ownership, using the Beneficial Ownership Disclosure Form.]*

Form ELI -1.2

Bidder's JV Information Form

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

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

Bidder's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Employer, in accordance with ITB 4.6. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 47.1, the successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]*

Form CON – 2

Historical Contract Non-Performance, Pending Litigation and Litigation History

Bidder's Name: _____
Date: _____
JV Member's Name _____
RFB No. and title: _____
Page _____ of _____ pages

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

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

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

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

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

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

Form CON – 3

Environmental and Social Performance Declaration

[The following table shall be filled in for the Bidder, each member of a Joint Venture and each Specialized Subcontractor]

Bidder's Name: *[insert full name]*
Date: *[insert day, month, year]*
Joint Venture Member's or Specialized Subcontractor's Name: *[insert full name]*
RFB No. and title: *[insert RFB number and title]*
Page *[insert page number]* of *[insert total number]* pages

Environmental and Social Performance Declaration in accordance with Section III, Qualification Criteria, and Requirements			
☐ **No suspension or termination of contract**: An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. ☐ **Declaration of suspension or termination of contract**: The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. Details are described below:			
Year	**Suspended or terminated portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and US$ equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s) e.g. gender-based violence; sexual exploitation or sexual abuse breaches]*	*[insert amount]*
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]*	*[insert amount]*

		Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s)]*	
...	...	*[list all applicable contracts]*	...
Performance Security called by an employer(s) for reasons related to ES performance			
Year	Contract Identification		Total Contract Amount (current value, currency, exchange rate and US$ equivalent)
[insert year]	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for calling of performance security: *[indicate main reason(s) e.g. for gender-based violence; sexual exploitation, or sexual abuse breaches]*		*[insert amount]*

Form CON – 4

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

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

Bidder's Name: *[insert full name]*
Date: *[insert day, month, year]*
Joint Venture Member's or Subcontractor's Name: *[insert full name]*
RFB No. and title: *[insert RFB number and title]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration

in accordance with Section III, Qualification Criteria, and Requirements

We:

☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations

☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations

☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor.

☐ (d) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently demonstrated that we have adequate capacity and commitment to comply with SEA/ SH obligations.

☐ (e) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached evidence demonstrating that we have adequate capacity and commitment to comply with SEA/ SH obligations.

[If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]

[If (d) or (e) above are applicable, provide the following information:]

Period of disqualification: From: _____ To: _____

If previously provided on another Bank financed works contract, details of evidence that demonstrated adequate capacity and commitment to comply with SEA/ SH obligations (**as per (d) above)**

Name of Employer: _____

Name of Project: _____

Contract description: _____

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

Form FIN – 3.1:

Financial Situation and Performance

Bidder's Name:_____
Date:_____
JV Member's Name_____
RFB No. and title:_____
Page_____of_____pages

1. Financial data

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

*Refer to ITB 15 for the exchange rate

2. Sources of Finance

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

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

2. Financial documents

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

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

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

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

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

☐ Attached are copies of financial statements[1] for the _____years required above; and complying with the requirements

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

Form FIN – 3.2:

Average Annual Construction Turnover

Bidder's Name:_____
Date:_____
JV Member's Name_____
RFB No. and title:_____
Page_____of_____pages

	Annual turnover data (construction only)		
Year	**Amount Currency**	**Exchange rate**	**USD equivalent**
[indicate year]	*[insert amount and indicate currency]*		
Average Annual Construction Turnover *			

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

Form FIN – 3.3:

Financial Resources

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

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

Form FIN – 3.4:

Current Contract Commitments / Works in Progress

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

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

Form EXP - 4.1

General Construction Experience

Bidder's Name: _____
Date: _____
JV Member's Name _____
RFB No. and title: _____
Page _____ of _____ pages

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

9

Form EXP - 4.2 (a)

Specific Construction and Contract Management Experience

Bidder's Name: _____
Date: _____
JV Member's Name _____
RFB No. and title: _____
Page _____ of _____ pages

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

2

Form EXP - 4.2(a) (cont.)

Specific Construction and Contract Management Experience (cont.)

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

Form EXP - 4.2(b)

Construction Experience in Key Activities

Bidder's Name: _____
Date: _____
Bidder's JV Member Name: _____
Subcontractor's Name[2] (as per ITB 34): _____
RFB No. and title: _____

Page _____ of _____ pages

All Subcontractors for key activities must complete the information in this form as per ITB 34 and Section III, Evaluation and Qualification Criteria, Sub-Factor 4.2.

1. Key Activity No One: _____

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

[2] If applicable

	Information
Address: Telephone/fax number E-mail:	

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

2. Activity No. Two
3. .....

Form EXP - 4.2(c)

Specific Experience in Managing ES aspects

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

Bidder's Name: _____
Date: _____
Bidder's JV Member Name: _____
RFB No. and title: _____
Page _____ of _____ pages

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

Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor ☐	Member in JV ☐	Management Contractor ☐	Subcontractor ☐
Total Contract Amount			US$	
Details of relevant experience				

2. Key Requirement no 2 in accordance with 4.2 (c): _____
3. Key Requirement no 3 in accordance with 4.2 (c): _____
4. ...

Form of Bid Security - Demand Guarantee

Beneficiary: _____

Request for Bids No: _____

Date: _____

BID GUARANTEE No.: _____

Guarantor: _____

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

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

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying 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 prior to the Bid validity expiry date set forth in the Applicant's Letter of Bid, or any extended date provided by the Applicant; or

(b) having been notified of the acceptance of its Bid by the Beneficiary prior to the expiry date of the Bid validity 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 and, if required, the Environmental and Social (ES) Performance Security, in accordance with the Instructions to Bidders ("ITB") of the Beneficiary's Bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, if required, the Environmental and Social (ES) Performance Security, issued to the Beneficiary in relation to such contract agreement; 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 expiry date of the Bid validity.

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)]

Section V - Eligible Countries

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

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

Under ITB 4.8 (a) and 5.1:Israel

Under ITB 4.8 (b) and 5.1:N/A

Section VI - Fraud and Corruption

1. Purpose

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

2. Requirements

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

2.2 To this end, the Bank:

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

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Banks Anti-Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;1 (ii) to be a nominated[2] sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers: and their sub-contractors, sub-consultants, service providers, suppliers, agents, personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process,

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

2 A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

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

selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

PART 2 –Works' Requirements

Section VII - Works' Requirements

Contents

Scope of Works 178
Specification 179
Environmental and Social (ES) requirements 180
Contractor's Representative and Key Personnel 203
Drawings 205
Supplementary Information 206

Scope of Works

Package No.	Lot No.	Brief description	Quantity	Completion Period
WD2-BSMSN-BEZA	Single	Road and Storm Water Network for Mirsarai-2B EZ	Bituminous road work : About 12.10 km Drainage Work : About 12.861 Kilometre	30 months

Specification

Attached.

Environmental and Social (ES) requirements

A. Environment, Health, Safety Code of Conduct/Practices Requirements:

1.0 General

This section specifies the Contractor's environmental, social, health and safety obligations in performing the works to be carried out under Component 2 of the BSMSN Development project. In preparing the construction environment and social management plan (CESMP)

The contractor shall:

a. design the works to minimise adverse environmental impacts;

b. meet all the obligations under the prevailing environmental regulations and the Environmental Management Plan;

c. The Contractor shall at all times operate and maintain the Works in accordance with the approved Environmental Social Management Plan and approved Contractor's Documents including:

   i. the operating and maintenance manuals

   ii. the Emergency Response Plan

   iii. Traffic Management Plan

   iv. the water quality testing plan

   v. the health and safety manual

   vi. GBV plan

   vii. the quality assurance manual

   viii. providing training on OHS and waste management plan

d. The Contractor shall undertake all monitoring, sampling and testing in accordance with:

   i. The minimum frequencies and sampling methods specified in these Employer's Requirements;

   ii. The approved water quality testing plan;

   iii. The Environmental Social Management Plan;

   iv. Any additional requirements specified by the applicable regulatory authorities

2.0 Contractor's Environmental and Social Management Plan (C-ESMP)

Within twenty-eight (28) days from the Commencement Date, the Contractor shall prepare and submit to the Engineer for his approval of a Contractor's Environment Management Plan (C-ESMP) to comply with the environmental protection and mitigation requirements contained in the Specification. The C-ESMP shall in principle be in general compliance with ISO 14001. All potentially affected areas within and in the vicinity of the Site, as agreed with the Engineer, shall be covered by the C-ESMP. The Contractor shall prepare and provide the C-ESMP which will demonstrate the manner in which he will implement, manage and control environmental mitigation measures that are applicable to the Contract. The Engineer will have the final decision over the applicability of a particular measure. The C-ESMP applies to the construction stages and is to be implemented over the time duration of the Contract. The Contractor is advised to refer to the Environmental and Social Assessment (ESA) Report of the BSMSN Development Project which is available in BEZA/World Bank website, while preparing his C-ESMP. The measures mentioned in the Chapter 8 *[Environment and Social Management Plan]* of the ESA report should form the basis of the C-ESMP.

The Contractor shall prepare his C-ESMP considering the following main points as required for the work to be undertaken:

(l) Regulatory and safeguard requirements,
(2) Framework and organization for C-ESMP,
(3) Details of C-ESMP implementation in accordance with ECoP/health safety Code of Conducts/social requirements of the works including but not limited to the followings:
   a. noise and vibration control;
   b. control of dust and air pollution;
   c. traffic management and materials transport;
   d. water pollution control and site drainage;
   e. solid waste and hazardous materials;
   f. community health and safety;
   g. occupational health and safety including the context of COVID 19;
   h. emergency response management and
   h. housing, services and facilities for labour camps,
(4) Grievance Redress Mechanism (GRM),
(5) GBV/SEA/SH prevention and response management
(6) monitoring and reporting.

3.0 Regulatory and Safeguard Requirements:

The Project is categorized as category "Red" according to "DOE Environmental conservation Rules (ECR 1997)" and category "High Risk" in accordance with "WB's Guidelines for Environmental and Social Framework (2018)". An Environmental and Social Assessment (ESA) report was prepared for BSMSN Development Project dated December 2020 addressing the requirements of the ES standards as an updated version of the Environmental Impact Assessment report on the project area approved by Department of Environment (DOE). On the basis of that EIA, an Environmental Clearance Certificate (ECC) was issued (ECC No. 501 dated 03 November 2016 under file No. *DOE/Clearance/5577/2016).* The Contractor should be familiar with the terms of the ECC relevant to the work, note any restrictions and covenants therein, and account for them in its CEMP.

The Contractor shall at all times comply with all existing statutes in Bangladesh and guidelines of World Bank concerning environmental protection, pollution control and abatement that are

applicable to his construction operations. Such statutes and guidelines include, but are not limited to, the following:

- Environmental Conservation Rules (ECR 1997), which provides standards for air, noise and water quality; and also, for emissions and wastewater discharges;
- Environmental and Social Framework (ESF) (that includes ten ES Standards) and Guidance Notes of the World Bank. A copy of the ESF and ESS Guidance Notes may be found at:http://documents.worldbank.org/curated/en/383011492423734099/pdf/114278-WP-REVISED-PUBLIC-Environmental-and-Social-Framework.pdf; https://www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-framework resources#guidancenotes;
- All additional statues, regulations and guidelines referenced in Chapter 2 of the Environmental and Social Assessment Report of BSMSN Development project, BEZA 2020 (available on BEZA and World Bank websites);
- World Bank Group / IFC General Environmental Health and Safety Guidelines, 2007 (see: http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES);
- World Bank Group/IFC EHS Guidelines for Construction Material Extraction. (https://www.ifc.org/wps/wcm/connect/dad17995-66be-4280-86da-b438cf9fbefc/Final%2B-%2BConstruction%2BMaterials%2BExtraction.pdf?MOD=AJPERES&CVID=jkC-EN.&id=1323162191491)

4.0 Framework and Organization for CEMP

The instructions and specifications mentioned in this Clause is included as a binding part of the Bidding Documents and it is obligatory of the Bidder to respond in the bid and in conduct of the work to the requirements herein. Within twenty-eight (28) days from the Commencement Date, the Contractor will prepare their own Contractor's Environmental and Social Management Plan (C-ESMP), to be reviewed and consented by the Engineer prior to the start of actual construction works, and implemented during the course of the work. That C-ESMP should address sufficiently the items contained in this Clause. C-ESMP will be a dynamic document and may be updated if needed. In case the Contractor or his sub-contractor fails to implement the C-ESMP after being informed in writing by the Engineer, the Engineer will take action deemed necessary to ensure that the C-ESMP is properly implemented and to rectify the damages caused by such negligence or both. The Contractor shall appoint an Environmental, Health and Safety (EHS) Officer, Social and Communication Officer and Gender Specialist, with prior approval of the Engineer, as the person who shall be responsible for the environmental and social management and protection of the project. The EHS Officer shall have a minimum bachelor degree related to environmental science / engineering and have experiences of at least 5 years in environmental and OHS management work in construction. The Gender Specialist and Social Officers shall have relevant masters' degrees with minimum 5 years of experience in their relevant fields. The ES team shall directly report to the Contractor's Representative and oversee environmental and social management functions. They will also keep regular communication with the PIU's Environmental and Social unit. The Contractor shall also mobilize necessary staff to carry out the environmental and social works and the organization framework should be mentioned in the CEMP.

5.0 Key ES Impacts and Mitigation Measures Relevant to the ESS:

Key ES risks and impacts with relevance to the ES standards and their associated mitigation measures for implementing the works in zone 2B have been discussed in detail in the relevant section of the ESA for BSMSN Development Project which is already available in the BEZA/World Bank. The ESMP has already been attached in the technical specification section as a requirement to the ES-MSIP preparation.

5.0 The list of Environmental Codes of Practice (ECoPs) applicable to this contract given below:

The Contractor is responsible for implementing mitigation measures listed in this Sub-Clause, and reflected into C-ESMP, related to:

1. Waste Management

(a). General Waste

The Contractor Shall

(i) Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to CSC for approval;
(ii) Contractor shall Remove and manage all wastes and debris from Project area before any construction activity
(iii) Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less environmental impact;
(iv) Segregate and reuse or recycle all the wastes, wherever practical and label the corresponding disposal site for each recyclable waste;
(v) Prohibit burning of solid waste;
(vi) Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route;
(vii) Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.

(b). Hazardous Waste

The Contractor shall

(i) Collect chemical wastes in 200 liters drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot;
(ii) Store, transport and handle all chemicals avoiding potential environmental pollution;
(iii) Store all hazardous wastes appropriately in bunded areas away from water courses;
(iv) Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction;

(v) Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations;
(vi) Construct concrete or other impermeable flooring to prevent seepage in case of spills.
(vii) Construct drainages and water collector around waste storage site to prevent spilling when raining.

2. Water Resources Management

(a). Hazardous Material and Waste

The Contractor Shall Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables.

(b) Discharge from Construction Sites

The Contractor shall

(i) Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials;
(ii) Install temporary sediment basins, where appropriate, to capture sediment- laden run-off from site;
(iii) Divert runoff from undisturbed areas around the construction site; (iv). Stockpile materials away from drainage lines;
(iv) Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot;
(v) Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean.

(c). Soil Erosion and Siltation

The Contractor shall

(i) Ensure that roads used by construction vehicles are swept regularly to remove sediment;
(ii). Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust;
(iii). Increase the watering frequency during periods of high risk (e.g. high winds).

(d). Construction activities in Water Bodies

The Contractor shall
(i). Monitor the water quality before construction and during construction in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary;

(ii). Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables;

(iii). Use environment friendly and nontoxic slurry during construction of piles to discharge into the river;

(iv). Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.

(e). Safe Drinking water

The Contractor Shall pumping of groundwater (if required) shall be from deep aquifers of more than 200 m to supply arsenic free water. Safe and sustainable discharges are to be ascertained prior to selection of pumps.

3. Drainage Management

(a). Excavation and Earth Works, and Construction Yards

The Contractor Shall

(i). Prepare a program for prevent/avoid standing waters, which CSC will verify in advance and confirm during implementation;

(ii). Provide alternative drainage for rainwater if the construction works/earth- fillings cut the established drainage line;

(iii). Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there;

(iv). Rehabilitate road drainage structures immediately if damaged by contractors'road transports;

(v). Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies;

(vi). Protect natural slopes of drainage channels to ensure adequate storm water drains.

(b). Ponding of water

The Contractor Shall not allow ponding of water especially near the waste storage areas and construction camps.

4. Soil Quality Management

(a). Filling of Sites with dredge spoils

The Contractor shall

(i) Ensure that dredged sand used for land filling shall be free of pollutants. Prior to filling, sand quality shall be tested to confirm whether soil is pollution free;
(ii). Slope surface shall be covered by top soils/ cladding materials (0.5m thick) and grass turfing with suitable grass.i.e. Fast-germinating annual and perennial ryegrasses like vetiver grass mixed with deep rooted ipomoea and Bermuda grass. Bermuda grass is known to grow in low quality water but not very good at erosion stabilization. Therefore, the amount mixture of Bermuda grass should be decided after water quality test and slope design.

(b). Storage of hazardous and toxic chemicals

The Contractor shall

(i). Construct appropriate spill contaminant facilities for all fuel storage areas; (ii). Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals.

(c). Construction material stock piles

The Contractor shall protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

5. Erosion and Sediment Control

(a). Clearing of construction sites

The Contractor shall

(i). Reinstate and protect cleared areas as soon as possible;
(ii). Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turfings/tree plantations.

(b). Construction activities and material stockpiles

The Contractor shall

(i). Locate stockpiles away from drainage lines;

(ii). Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds;

(iii). Remove debris from drainage paths and sediment control structures;

(iv). Cover the loose sediments and water them if required;

(v). Divert natural runoff around construction areas prior to any site disturbance;

(vi). Install protective measures on site prior to construction, for example, sediment traps.

6. Air Quality Management

(a).Construction vehicular traffic

The Contractor shall

(i). Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition;

(ii). Operate the vehicles in a fuel-efficient manner;

(iii). Cover haul vehicles carrying dusty materials moving outside the construction site;

(iv). Impose speed limits on all vehicle movement at the worksite to reduce dust emissions;

(v). Service all vehicles regularly to minimize emissions.

(b). Construction machinery

The Contractor shall Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors.

(c). Construction activities The Contractor shall

(i). Water the material stockpiles, access roads and bare soils on twice a day or as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds during winter). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted;

(ii). Open stockpiles of construction materials (e.g. aggregates, sand and fill material) of more than $50m^3$ shall be covered with tarpaulin or similar fabric during rainstorms.

7. Noise

(a). Construction vehicular traffic

The Contractor shall maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures.

(b). Construction machinery The Contractor shall

(i). Use the quietest available plant and equipment;

(ii). Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines);

(iii). Install acoustic enclosures around generators to reduce noise levels; (iv). Fit high efficiency mufflers to appropriate construction equipment.

(c). Construction activity The Contractor shall

(i). Employ best available work practices on-site to minimize occupational noise levels;

(ii). Install temporary noise control barriers where appropriate;

(iii). Notify affected people if major noisy activities will be undertaken, e.g. pile driving;

(iv). Monitor and analyze noise results and adjust construction practices as required;

(v). Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

8. Worker Health and Safety

(a). Construction works

The Contractor shall

(i). Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labour Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national standards of the Government of Bangladesh (e.g. The Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019.);

(ii). Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas;

(iii). Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones;

(iv). Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job;

(v). Appoint an environment Officer and health and Officer to look after the health and safety of the workers;

(vi). Not hire children of less than 18 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the Bangladesh Labour Code, 2006 and Bangladesh Labour (Amendment) Act, 2018.

(b). Accidents

The Contractor shall

(i). Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work;

(ii). Document and report on occupational accidents, diseases, and incidents;

(iii). Identify potential hazards to workers, particularly those that may be life- threatening and provide necessary preventive and protective measures;

(iv). Provide awareness to the construction drivers to strictly follow the driving rules;

(v). Provide adequate lighting in the construction area and along the roads.

(c). Construction Camps

The Contractor shall provide

(i). Adequate ventilation facilities;

(ii). Safe and reliable water supply that meets the national standards;

(iii). Hygienic sanitary facilities and sewerage system with separate latrine for women;

(iv). Treatment facilities for sewerage of toilet and domestic wastes; (v). Storm water drainage facilities;

(vi). Recreational and social facilities;

(vii). Solid waste collection and disposal system;

(viii). Arrangement for trainings;

(ix). Security fence at least 2 m height.

9. Bentonite Slurry Management

Construction sludge by boring from underground is generated during construction. Bentonite is not hazardous matter, but it causes turbidity in the water. So safe dumping in appropriate site is necessary for proper management. Guidelines for contractors on dumping site selection are:

(i). Ensure the selection of appropriate dumping sites which are 500 m (minimum) away from any inhabited areas;

(ii). Ensure that the sites are not located near any Marshy or low lying area;

(iii). Ensure that the Ground Water level sufficiently deep to avoid ground water contamination;

(iv). Ensure that no drinking water sources (surface or ground water) are located within 500 m radius of the facility;

(v). Ensure that the soil is not permeable.

Note: *The mitigation measures provided in the ECoPs will be used as monitoring tool for compliance. It is mandatory for the main contractor procured directly by the project to include these ECoPs in their subcontracts.*

10. Considerations for public health and social measures in the workplace in the context of COVID - 19

According to WHO (2020) this project is under low exposure risk category. Workers in this category have minimal occupational contact with the public and other co-workers. The contractor ensures the following measures for preventing transmission of COVID 19:

(i). Hand hygiene: Ensure regular hand washing with soap or hand washing with alcohol based hand rub before starting works before eating, frequently during the work shift, especially after contact with co-worker and before touching eyes, nose or mouth. Hand hygiene stations, such as hand washing and hand rub dispensers, should be put in prominent places around the work places and be made accessible to all staff.

(ii). Respiratory hygiene: promote respiratory etiquette by all people at the workplace. Ensure that face masks are available at the workplace.

(iii). Physical distancing: Introduce measures to keep a distance of at least 1 meter between people and avoid direct physical contact with other persons (i.e. hugging, touching, shaking hands).

(iv). Reduce and manage work related travels: Cancel or postpone non-essential travel to areas with community transmission of COVID -19. Workers returning from an area where COVID -19 transmission is occurring should monitor themselves for symptoms for 14 days and take their temperature twice a day; if they are feeling unwell, they should stay at home, self-isolate, and contact a medical professional.

(v). Regular environmental cleaning and disinfection: Cleaning, using soap or a neutral detergent, water and mechanical action (brushing, scrubbing) removes dirt, debris, and other materials from surfaces. After the cleaning process is complete, disinfection is used to inactive pathogens and other microorganisms on surfaces. Ensure disinfection the workplace, canteen and other public area: 2 times a day (at 8am and 3pm).

(vi). Risk communication: Provide posters, videos, and electronic message boards to increase awareness of COVID -19 among workers and promote safe individual practices at the workplaces.

(vii). Management of people with COVID -19: Workers who are unwell or develop symptoms consistent with COVID -19 should be urged to stay at home, self- isolate, and contact a medical professional or the local COVID -19 information line for advice on testing and referral. People who were close contact at the work place with persons with labouratory-confirmed COVID -19 should be quarantined for 14 days from the last time of the contact.

11. Monitoring and Reporting Requirements:

A system of monitoring compliance with environmental and social mitigation/management measures will be agreed between the Contractor and the Engineer, and described in the Contractor's C-ESMP. The Contractor will provide in its C-ESMP a plan and schedule, including locations, frequencies and parameters, for monitoring air and water quality, and noise levels, at the boundary of the site, subject to the approval of the Engineer (requirement has been detailed in Table A.1 in the next page). There will be two types of monitoring, namely, external monitoring and internal monitoring. External monitoring will be conducted by a third party or independent monitoring group (IMG) at fixed time frame; while internal or in-house monitoring should be conducted by the Contractor as and when required. IMG should be an Environmental Firm with in-house labouratory facilities and relevant experience. Contractor will nominate the IMG and must get approval from the Engineer for appointment. Before the start of the works, the Contractor will conduct at his own a baseline condition survey of the air and water quality and noise levels at locations specified by ESA's or updated one baseline survey locations and by the Engineer. The types of sampling should align with ESA' s baseline survey parameters and by the Engineer. The processes of the survey will be included in the C-ESMP. Sampling and testing shall also be performed on a quarterly basis by the IMG at same locations as of baseline. The IMG will report results of periodic monitoring directly to the Engineer and the Contractor. The data will be used to assess overall environmental situation due to progress of construction activities. The Contractor should mention in the C-ESMP the method and procedure of regular in-house monitoring of air quality, water quality and noise measurements at the locations required and as specified by the Engineer, which they will arrange at their own cost. The results will be reported in the Monthly Progress Report (MPR). The Contractor has to submit separate monthly/quarterly report on environmental, health, safety and social activities and quality monitoring in accordance with the content as detailed in Part D Section VIII and outlined below in sub-section C.

Table A-1: Environmental and Social Monitoring Plan

Project Stage/ Affected Component	Environmental/ social Issue	Parameters to be Monitored	Location	Measurements	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
Pre-construction and Construction Phase								
Employment	Engaging local labour	Associated project worker	Camp site	Consultation with local labour	World Bank and GoB	Weekly	Contractor	CSC
Women Worker/ Vulnerable/ Disadvantaged	GBV	Wage, increment, working hour etc.	Camp site and work site	Consultation with female labour	World Bank and GoB	Weekly	Contractor	CSC
Community or labour	Social conflict and labour rest	GRM	At project office	Complaint box and discussion with labour	World Bank and GoB	Weekly	Contractor	CSC
Ambient Air Quality	Dust generation	Dust	Project activity areas and construction workers camp	Visual inspection of all active work areas	Government of Bangladesh (GoB) and international standard	Daily	Contractor	CSC
	Ambient Air Pollutant	SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, NOx	2 samples at Project site (one at 2A and other one at 2B site)	24-hour	Air quality standard by DOE, Bangladesh	Quarterly	Contractor by Engaging Environmental Firm with in-house lab and relevant experience	CSC
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night	6 locations Project site at high noise generation location and adjacent	24-hour	Noise Pollution Control Rules (2006)	Quarterly	Contractor by Engaging Environmental Firm with in-house lab and relevant experience	CSC

Project Stage/ Affected Component	Environmental/ social Issue	Parameters to be Monitored	Location	Measurements	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
			sensitive receptor					
Water Quality	Contamination of surface water	Turbidity, pH, DO, Total dissolved solids, oil & grease, BOD_5, COD, NH_3	Two samples from Canal	Monitoring	Surface water quality standard as per Schedule 3 of ECR 1997	Quarterly	Contractor by Engaging Environmental Firm with in-house lab and relevant experience	CSC
	Contamination of Groundwater quality	pH, Alkalinity, Cl, Fe, As, TSS, Salinity, Pb, etc.	2 Locations Project site and Closest borehole of the project site	Monitoring	Drinking water quality standard as per Schedule 3 of ECR 1997	Quarterly	Contractor by Engaging Environmental Firm with in-house lab and relevant experience	CSC
Top Soil	Soil Pollution	• Check liquid waste is carried out by experienced personnel and in proper way • Careful and proper handling of oil and other hazardous liquids	Project Site	Visual inspection of all active work areas	Monitoring	Daily	Contractor	CSC
Sediment of Khal	Sediment Pollution	• Heavy Metal	Project site	Monitoring	International Standard	Quarterly	Contractor	CSC
Waste	Liquid waste, Solid Waste	• Check storage, transportation, disposal,	Project Site	Visual inspection of	Monitoring	Daily	Contractor	CSC

Project Stage/ Affected Component	Environmental/ social Issue	Parameters to be Monitored	Location	Measurements	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
		handling of hazardous waste • Waste and effluents to be collected and disposed safely of camp. • Wastes and garbage from construction sites to be disposed safely		all active work areas				
Ecology	Terrestrial and aquatic flora and fauna	• Tree and Aquatic Species	Canals and Forest	Visual inspection	Monitoring	Once for tree prior to starting construction and yearly aquatic monitoring	Contractor	BEZA
Occupational Health and Safety	Workers Health & Safety	• Check quality of food and accommodation at construction camp; • Check safe water supply, hygienic toilet at camp, construction of	Construction Camp & Construction area	Visual inspection of all active work areas	Monitoring	Daily	Contractor	BEZA

Project Stage/ Affected Component	Environmental/ social Issue	Parameters to be Monitored	Location	Measurements	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
		drain at campsite; • Check toilets are close to construction site with treatment facilities and separate toilet for female workers; • First Aid Box with required tools and medicines; • The heavy construction material to handled and stored safely putting due care on public safety; • Heavy construction materials at construction site to be stored and						

Project Stage/ Affected Component	Environmental/ social Issue	Parameters to be Monitored	Location	Measurements	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
		handled safely; and • Check of personal protective equipment (PPE) for worker at the sites						
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	Monitoring	Based on occurrence	Contractor	BEZA
Drainage Congestion	Waterlogging, Suspension of Community life/activities, ecological impacts.	Construct drainage structures as Per the design; and Control erosion and siltation	Monitoring	At the specific site	Inspection	Weekly	Contractor	CSC
Tree Plantation	Ensure that tree plantation plan isfollowed properly during planting seedlings of the tree	Tree Plantation Plan	Project Site	At the project site	Inspection	During plantation	Contractor	CSC

B. Social Requirements:

The Contractor is responsible for implementing social management measures listed in this Sub-Clause, and reflected into C-ESMP, related to:

1. Issues relevant to the Gender Action Plan:

Specific issues and gender related facilities for the women, elderly and disabled people in the construction site; some of the common issues the contractor shall address are as follows:

a) Separate toilets for male and female workers;

b) Separate toilets with facilities forphysically challenged people;

c) Enough lighting and visible location for female toiletconsidering security and safety;

d) Space for Breast feeding mother and pregnant women;

e) Separate prayer space for femalewith required facilities;

f) Water supply and useable condition must be ensured by proper maintenance of toilets and other facilities;

g) Must give priority to recruit local people including women for construction work;

h) No discrimination of wages for male and female labourers/workers for similar work; and

i) Grievance Redress Mechanism for affected people and construction workers including women.

2. Gender based Violence

Contractors must address the risk of gender-based violence, through:

i. Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;

ii. Informing workers about national laws that make sexual harassment and gender- based violence a punishable offence which is prosecuted;

iii. Introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination).

iv. Adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender- based violence. In this regard, the contractor shall strictly adhere to the provisions of the project's GBv/SEA/SH Action Plan.

v. The contractor also shall manage a grievance mechanism on potential GBV/SEA/SH cases under the guidance of the Project PIU and shall take into account in submitting bid the provisions for service providers in case of potential GBV victims/cases.

3. Labour influx

Where contractors and Labour come from outside the local area, contractors will needto maintain Labour relations with local communities through Labour codes of conduct. Communities will not be engaged in providing any labour from their community and engaged in any activities of construction work by themself.

4. Child Labour and Forced Labour

Contractors must not employ workers below the age of 18 and as well as forced labour. The definition of forced labour shall adhere to ILO Convention No. 29 as following: "all work or service which is exacted from any person under the threat of a penalty and for which the person has not offered himself or herself voluntarily". The contractor shall also ensure that these provisions are equally applied on the sub-contractors and primary suppliers.

5. Vulnerable People

Contractor shall engage Project Affected People as their construction works. According to World Bank ESF requirements vulnerable people (project affected people) must be prioritized the physical/construction work by the contractor.

7. Grievance Mechanism for Workers

Contractors will put in place a Grievance Mechanism for their workers that are proportionate to their workforce, according to the following principles:

(i). **Provision of Information.**

All workers should be informed about the grievance mechanism at the time they are hired, and details about how it operates should be easily available, for example, included in worker documentation or on noticeboards;

(ii).**Transparency of the Process.**

Workers must know to whom they can turn in the event of a grievance and the support and sources of advice that are available to them. All line and senior managers must be familiar with their organization's grievance procedure;

(iii). **Keeping it Up to Date.**

The process should be regularly reviewed and kept up to date, for example, by referencing any new statutory guidelines, changes in contracts or representation.

(iv). **Confidentiality.**

The process should ensure that a complaint is dealt with confidentially. While the procedures may specify that complaints should first be made to the workers' line manager, there should also be the option of raising a grievance first with an alternative manager, for example, a human resource (personnel) manager;

(v). **Non-Retribution.**

Procedures should guarantee that any worker raising a complaint will not be subject to any reprisal;

(vi). **Reasonable Timescales.**

Procedures should allow for time to investigate grievances fully but should aim for swift resolutions.

The longer a grievance is allowed to continue, the harder it can be for both sides to get back to normal afterwards. Time limits should be set for each stage of the process, for example, a maximum time between a grievance being raised and the setting up of a meeting to investigate it;

(vii). **Right of Appeal.**
A worker should have the right to appeal if he or she is not happy with the initial finding;

(viii). **Right to be Accompanied.**
In any meetings or hearings, the worker should have the right to be accompanied bya colleague, friend or union representative;

(ix). **Keeping Records.**
Written records should be kept at all stages. The initial complaint should be in writing, if possible, along with the response, notes of any meetings and the findings and the reasons for the findings;

(x). **Relationship with Collective Agreements.**
Grievance procedures should be consistent with any collective agreements;

(xi). **Relationship with Regulation.**
Grievance processes should be compliant with the national employment code.

C. ES Reporting Requirements:

a. Environmental Reporting Requirements:

1. Baseline Monitoring Report

The contractor should submit a baseline survey report on basic environmental parameters in the area surrounding the proposed project before construction begins. Subsequent monitoring can assess the changes in those parameters over time against the baseline.

2. Impact Monitoring Report (Monthly/Quarterly)

The Contractor should submit impact monitoring report during construction phase on the biophysical and socio-economical (including public health) parameters within the project area. The measurement should be conducted during the project construction phases in order to detect environmental changes, which may have occurred as a result of project implementation, e.g. air emission, dust, noise, water, soil pollution etc.

3. Compliance Monitoring Report

The compliance monitoring report should be prepared by the supervision consultants (CSC) of the project, as may be the case. This report should state how the specific environmental quality indicators or pollution levels comply with the recommended environmental protection standards. The data to be reported in the Impact Monitoring Report should be used after verification, if necessary. The author of the report may ask for additional data from Contractor, if required. The indicative contents of the compliance monitoring report should be as below:

Executive Summary
1.Introduction
  1.1 Purpose of the Report
  1.2 Structure of the Report
2 Project Information

2.1 Background
2.2 Works Undertaken during Reporting Period (generally quarterly)
2.3 Status of Environmental Approval Documents
3 Water Quality Monitoring Requirements
3.1 Monitoring Locations
3.2 Monitoring Parameters and Frequency
3.3 Monitoring Equipment and Methodology
4. Impact Monitoring Results
4.1 Continuous In-situ Data
4.2 Spot Data – intermittent
5. Environmental Non-conformances
5.1 Summary of Environmental Exceedance
5.2 Summary of Environmental Complaint
6. Future Key Issues
6.1 Key Issues for the Coming Monitoring Period
6.2 Monitoring Schedule for the Coming Monitoring Period
7. Conclusions

b. Social Reporting Requirements:

A. Monthly Social report

Minimum Content of the Report shallbe as below:

1. Introduction and Background;
2. Assessing Social Impact;
3. Socio-economic profile;
4. Community and stakeholder's consultation;
5. Labour health and safety issues
   - -Health check-up
   - -Medical Camp
   - -First Aid Box
   - -Sanitation
   - -Labour shade
   - -Toilet Facilities (both male and female)
6. Gender and SEA/SH issues
7. New Grievance Received
8. Grievances resolved
9. Documentation
10. Conclusion.

B. **Labour Influx Report**

Minimum Content of the Report shallbe as below:

1. Project data
2. Initial screening Labour influx requirements and implications
3. Socio-economic considerations
4. Local community
5. Maintenance of other Labour records

6. Labour profile
7. Facilities
8. Supervision by Labour officials
9. Accidents, emergencies and incidents.

C. **Grievance Mechanism Report**

Minimum Content of the Report shall be as below:

1. Introduction;
2. Grievance Redress Mechanism procedure;
3. Number of Grievances logged in the reporting time (both male and female);
4. Type of Grievances;
5. Description of Grievances;
6. Hearing procedure of the Grievances;
7. Grievances resolved in first hearing;
8. Documentation.

D. ENVIRONMENTAL and SOCIAL COMMITMENT PLAN (ESCP)

As per agreed Environmental and Social Commitment Plan of BEZA for BSMSN Development Project, the contractors will ensure following issues;

- REGULAR REPORTING: The contractors will prepare and submit to the PD, regular monitoring reports on environmental, social, health and safety (ESHS) performance of the stakeholder engagement activities, functioning of the grievance mechanism(s), and Labour Management Procedure (LMP) including Occupational Health and Safety Measures (OHS).
- INCIDENTS AND ACCIDENTS: The contractors will promptly notify the PD of any incident or accident related to Project such as cases of GBV/SEA, mismanagement in handling waste, security breach, death/disability etc. The contractors will provide sufficient detail regarding the incident or accident, indicating immediate measures taken or that are planned to be taken to address it.
- Manpower : The contractors would appoint third party firm for implement the day to day activities and monitor the ES activities. The team composition will be Environmental, Social Development Specialist and Gender Specialist . MANAGEMENT TOOLS AND INSTRUMENTS: The contractor will draft, adopt and implement specific Environmental and Social Management Plan (ESMP) including LMP, SEP, GBV risk assessment and action plan in a manner acceptable to the Bank.
- The contractor will ensure healthy work place, accommodation, sanitation facilities, drinking water, COVID-19 health protocol etc.
- The contractor will appoint minimum 40% non-skills worker from the neighbor community
- The contractors will ensure proper security measures within the site.
- The contractors will provide necessary information to the stakeholders as per Stakeholders Management Plan of PRIDE project (https://www.beza.gov.bd/wp-content/uploads/2020/01/Stakeholder-Engagement-Plan-SEP-BEZA.pdf).

- The Contractor will follow the Labour Management Procedures of the PRIDE project (https://www.beza.gov.bd/wp-content/uploads/2020/03/Labour-Management-Procedure-LMP-for-PRIDE-Project-of-BEZA.pdf)

The contractors will implement the ES activities ac per ESMF of PRIDE Project (https://www.beza.gov.bd/wp-content/uploads/2020/01/PRIDE_BEZA_ESMF_revised_Report_February-26-2020_clean.pdf)

Payment for ES Requirements

A separate BoQ for implementation of Environment, Health, Safety and Social requirements has been attached which shall be part of the Bid Document and ES-MSIP of the contractor.

Contractor's Representative and Key Personnel

Contractor's Representative and Key Personnel

Item No.	Position/specialization	Relevant academic qualifications	Minimum years of relevant work experience
1	Contractor's Representative	*Masters in Civil Engineering*	*Minimum 8 years experience*
2	*Environmental, Health and Safety Expert*	Master's degree in Environmental Science or relevant qualification. S/he needsto be familiar with the country's environmental laws as well as ESHS requirements of WB. Ability to clearly communicate in English language (listening speaking and writing) is also a minimum requirement.	Minimum of 5 years of relevant professional experience on road contracts in similar work environment since graduation in environmental field. S/he shall have experience in preparing environmental assessments /Environmental Management Plans for atleast 2 projects funded byWB or ADB.
3	*[Social and Communication Expert]*	*Master's degree in Social Science and or other related disciplines. Ability to clearly communicate in English language (listening speaking and writing) is also a minimum requirement. Minimum Masters in Social Science*	*Minimum of 5 years of relevant professional experience in social assessment and resettlement in comparable works funded by the WB. Minimum 5 years working experience in similar work*

4	Gender Expert (Sexual Exploitation, Abuse and Harassment)	*Master's degree in Social Science and or other related disciplines. Ability to clearly communicate in English language (listening speaking and writing) is also a minimum requirement.* *Minimum Masters in Social Science*	*Minimum of 5 years of relevant professional experience for monitoring and managing risks related to gender-based violence, out of which 3 years of relevant experience in addressing issues related to sexual exploitation, sexual abuse and sexual harassment]*

Drawings

Attached.

Supplementary Information

ENGINEER'S REQUIREMENTS

The Contractor shall be responsible for construct and maintenance of site office for the employer and engineers including all necessary facilities during execution of the work.

The Contractor shall be responsible for construct and maintenance of site office and other facilities for the employer and engineers including all necessary facilities during execution of the work.

Notwithstanding any provision made in this Clause or elsewhere in the Tender Document, the Contractor shall provide suitable one vehicle **(1 no. 5 doors 4WD Vehicle and 1 no. 5 doors Double Cabin Pickup (Engine CC at least 2400-2500)** with all facilities as according to instruction provided by the Engineer) for exclusive and full time use of the Project officials through the duration of contract. The Contractor shall provide, maintain the driver, maintain, clean and fuel the vehicle. All costs for providing and maintaining the vehicle to the Project Officials are deemed to be covered by the rates and prices of the overall items of works entered in the BoQ under the contract. No extra cost will be paid or no separate items of works for these works/ services are provided in the BoQ.

The Contractor shall be responsible for arranging and ensuring that adequate supplies of High Speed Diesel (HSD), motor spirits, kerosene, lubricants and other petroleum produces are available at all times to meet his requirements for the purposes of or in connection with the contract; the Contractor's particular attention is drawn to this requirements as from time to time shortages and interruptions in the supply of fuel oils, etc occur in the region.

All costs including Contractor's margin, overhead, taxes etc, incurred by the Contractor to provide, construct, supply, fabricate, erect, install in accordance with the specifications mentioned elsewhere, shall be deemed to be included in the rates/price quoted in the Bill of Quantities of the respective items. All facilities shall be ready for occupation by the Engineer within one month after receiving the instruction.

If the Contractor fails to provide this service the Engineer shall be entitled to withhold the issue of Payment Certificate until the service is resumed.

ASSISTANCE TO ENGINEER'S STAFF

The Contractor shall render all necessary assistance to the Engineer's staff and shall provide for checking the Contractor's setting-out and the measurement of the Works.

The Contractor shall provide such full time or part time surveyors as may be required. The cost of all laborers, surveyors, survey equipment and tools, for checking the setting-out and the measurement of the Works shall be covered by the Contractor's expense and no separate payment shall be made thereof.

CONTRACTOR'S OFFICES, WORKSHOPS, ACCOMMODATIONS, LABORATORY ETC.

The Contractor shall be responsible for the land he deems necessary for his offices, stores, warehouse, motor pool, laboratory, workshops, pre-cast concrete factory, staff quarters and labour camp. Separate accommodation and toilet facilities to be kept for male and female workers. The Contractor shall be also responsible for construction, maintenance, operation of such temporary facilities as his office, stores, warehouse, motor pool, laboratory, workshops, pre-cast concrete factory, staff quarters and labourer camps including feeding and accommodation. These facilities shall be equipped with adequate electricity and potable water supplies. Bangladesh labour law would be strictly followed in administering the workers (labours). The Contractor shall also keep sufficient fast aid kit and preventive medicines of viral and water borne diseases.

The Contractor shall submit for approval of the Engineer within fourteen (14) days from the date of the Notice to Commence his detailed plan and/or construction drawings of his offices, stores, warehouse, motor pool, workshops, pre-cast concrete factory, staff quarters, labourer camps and field laboratory that he proposes to construct or rent, including his proposals for water and power supply and sewage facilities and Inspection Sheds. All buildings and facilities shall conform to the Employer's standards.

Beyond the space as mentioned above, arranging of land that deemed necessary in fulfilment the obligations under this Clause shall be the full responsibilities of the Contractor.

All costs including Contractor's margin, overhead, taxes, etc, incurred by the Contractor in complying with requirements of this Clause shall be deemed to be included in the lump sum price of Contractor's facilities of the Bill of Quantities (Item No.1.02). Payment for this item shall be made on pro-rata basis depending upon the total progress accomplished.

STANDARDS AND SUPPLEMENTAL SPECIFICATIONS

Unless otherwise stated in the Contract, all workmanship, materials, and equipment shall comply with the relevant American, British and Bangladesh Standard viz.

AASHTO, ACI, AISC, ASTM, AWSAWWA, BSI, DIN, DNA, ISO, and SSPC, U.S. Fed. Specand USBR

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 of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the contract.

SANITATION

The Contractor is to arrange for a high standard of sanitation to be maintained through out the Camp and the Work sites. He shall construct and maintain at his own cost a system of surface drainage and waste disposal. Sanitary conveniences for the use of persons employed in the works shall be provided and maintained by the Contractor in accordance with the appropriate laws and regulations in force in Bangladesh to the extent and in such a manner and at such places as may be approved by the Engineer, and all persons connected with the works shall be obliged to use them.

MEDICAL ARRANGEMENTS AND FIRST-AID FACILITIES

The Contractor shall make arrangements according to the regulations in force in Bangladesh for treatment on the site of casualties and sick persons. The Contractor shall make his own arrangements for treatment of casualties on the Site in such first-aid units as may be thought necessary.

In addition, the Contractor shall manage and operate appropriate ambulances for the transportation of injured or sick employees to nearby hospitals. This facility shall be available for the Employer's, Engineer's, Subcontractors' and Contractor's personnel and workmen.

o separate payment shall be made for this provision.

CONSTRUCTION AND MAINTENANCE OF TEMPORARY ACCESS ROAD

The Contractor shall construct and maintain the temporary access roads including temporary access bridges necessary for construction of the Works and transportation of the materials. The Contractor shall also pay compensation to the owner(s) if he constructs the temporary access roads on a privately owned land.

The public and village roads may also be used as temporary access road. The Contractor shall maintain and repair them to the satisfaction of the authorities concerned.

The Contractor shall facilitate the use of such roads for other contractors of the Project and public in a friendly co-operative manner without maintenance of the roads required by them.

PERMITS, LICENSES OR APPROVALS:

The Contractor shall, in performing the Contract, comply with the applicable Laws of Bangladesh. The Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licenses and approvals, as required by the applicable Laws in relation to the execution and completion of the Works and the remedying of any defects.

Contractor shall be allowed to re-export, out of Bangladesh, his equipment, including essential spare parts therefore, and any material imported by the Contractor for the sole purpose of executing the Contract, on completion of the contract. If the Contractor wishes to dispose them of locally, subject to the local laws, BEZA shall be given first preference to purchase at the negotiated price. Import and re-export of equipment, including essential spare parts will be subject to applicable laws of National Board of Revenue (NBR).

ENGINEER'S SITE FACILITIES

The Contractor shall be responsible for the provision, maintenance and operation of the following facilities and services for Engineer.

In addition to the office space required for his own use, the Contractor shall provide and maintain Field Office with toilet facilities, furniture and office equipment for the use of the Engineer and his staff.

Field Office for the Engineer shall mean a building having a minimum 15 square meter net clear internal floor area exclusive of walls and partitions, staircase and toilet and have number of rooms as required by the Engineer. It shall be constructed in 250mm thick brick wall in appropriate cement mortar with C.I. sheet roofing and a protective ceiling made of hard board and timber to the satisfaction of the Engineer. The floor shall be 75mm thick lean concrete with 30mm thick mortar on the top with a neat cement finish to give a smooth look. The foundation of this building shall be sound to the satisfaction of the Engineer. The building shall have required number of doors and windows. Uninterrupted power supply facility, if necessary, shall be made available by means of arranging a stand-by generator.

Access road to the Field Office, sufficient parking accommodation and hard standing sheds for vehicles along with boundary fencing shall be constructed by the Contractor.

The Contractor shall provide, for each office, one office table and four chairs of standard, approved by the Engineer. Safety helmets in adequate numbers be always made available for use of the staff and the visitors.

Offices shall be maintained watertight and shall be provided with ventilation. All doors shall be fitted with approved locks. Windows shall be provided with separate screens and blinds and shall have interior locking devices too.

All offices, complete with furnishings, fittings, access roads and hard standings, shall be ready, for occupation by the Engineer within four weeks of the date when the Contractor first occupies the Site.

All offices shall be regularly and properly cleaned as long as they are in use.

All access roads and hard standings shall be maintained in a convenient trafficable condition throughout the Contract period.

The general location of the Field Office shall be decided by the Engineer in consideration of the Contractor's Work Plans. The Field Office shall be situated at locations that shall be free from flooding.

The Contractor shall submit for the approval of the Engineer, along with the Tender, Plans and Drawings showing the details for the building including plans and designs for foundations, access roads, sheds, etc. Plans shall also be submitted showing architectural and structural details and the proposed layout of electrical and running water supply, roads and hard standings thereto. The Engineer may require revision of the said plan prior to the approval for construction.

Prior to the occupation of the office, the Engineer may specify to the Contractor the defects in the work whereupon he may occupy the office and withhold payment for the work in this item until the Contractor remedies and makes good the said defects to the satisfaction of the Engineer.

On completion of the Contract the Field Office including furnishings shall become the property of the Employer.

Office equipment and stationary articles

The Contractor shall require to purchase and supply the following Office equipment and consumables to the Engineer:

(i) One Computer (English) of approved brand with printer and Auto CAD facilities

(ii) One Photocopy Machine (A3 size)

(iii) Minor items of field office equipment such as file trays, punches, staplers etc. in reasonable number/quantities as requested by the Engineer.

(iv) Consumables such as papers, pens, files etc. in reasonable number/quantities as requested from time to time by the Engineer.

Upon completion of the Contract, the office equipment listed above shall remain the property of the Employer.

Survey equipment

As per requirement of the program, survey equipment shall be provided on each contract Site for use by the staff of the Contractor and the Engineer. A tentative list of such survey equipment is given below:

Optical square	1 no.
RTK Machine	1 no.
Spirit level (metal 1m long)	1 no.
Steel measuring tape 25m long	1 no.
Steel measuring tape 5m long	1 no.
Leveling staff 3m long	1 no.
Ranging poles	5 nos.
Surveyor's plumb bob	1 no.
Wild T-1A Theodolite with tripod (or equivalent)	1 no.
Wild NA-2 Automatic level with tripod (or equivalent)	1 no.
Traversing targets with tripods	1 no.
Magnetic Compass	1 no.

Miscellaneous tools and minor items of survey equipment such as umbrellas, hammers, knives etc. shall be made available at Site in reasonable numbers at all times for use by the staff of the Contractor and the Engineer.

Consumables such as pegs, stakes, string lines, paint, marking crayons, etc., shall be made available at Site in reasonable numbers and quantities at all times for use by the staff of the Contractor and the Engineer.

Upon completion of the Contract, the survey equipment listed above shall remain the property of the Contractor.

Offices and equipment

The Contractor shall provide and maintain an inventory of all furnishings and equipment and shall replace any equipment, which is lost or irreparably damaged subject to the condition that the Engineer shall ensure his staff to take all reasonable precautions in the handling, operation and transportation of such equipment.
The Contractor shall pay all expenses in respect of water, electricity (where available), garbage cleaning etc. necessary for running the Office and maintaining conducive environment.

The Contractor shall place all necessary support staff such as office boys, cleaners, messengers, road-men, chain-men etc. in required number to the Engineer and his personnel in smooth performing of his responsibilities.

Signboards

The Contractor shall supply, erect and maintain in good condition at least two Identification Signboards of sizes to be specified by the Engineer to be fixed one at each end of the Work at a place clearly visible to the public. The Signboards shall be mounted on steel pipe frames with the required sizes at a height 2m above the ground and shall be sufficiently strong to withstand the wind forces. The board shall be fabricated from steel angle and plates and painted with suitable colours and written in English and/or Bengali as per direction of the Engineer.

Each board shall display:

- The name of the Project
- The name of the Work
- The name of the Employer
- Contract value
- Date of commencement of work
- Date of completion of work
- Other particulars, which will be asked by the Engineer.

Progress in photographs and videos

Photographs and videos showing the progress of works and special photographs showing particular features or other matters of interest in connection with the Work or their surroundings shall be taken every month by an approved qualified photographer/cameraman to the choice of the Engineer. Number of photographs/video clips will not exceed 10 (ten) per month.

Four colour un-mounted prints of a size 250mm on approved photographic paper of every such photograph inscribed with its serial number, date of shooting and a short title shall be furnished to the Engineer every month.

All negatives and video clips shall be numbered, filed and retained at the Site. On completion of the Contract, those shall become the properties of the Employer and shall be handed over to the Employer by the Contractor.

6 (six) complete sets of colour prints of the finished permanent Work, not exceeding 20 (twenty) photographs in number, shall be taken when and as directed by the Engineer prior to finally granting the Contractor the Certificate of Completion and shall be suitably mounted, titled and supplied to the Engineer.

Measurement and payment

Provisions for Office space and facilities for the Engineer shall not be measured.

Payment for all the items as stated below shall be for the full period of the Contract including any extension, if allowed.
Payment for all equipment, signboards, photographs, video clips, services etc. of the Field Office detailed in this Sub-section shall be made as described below, where price and payment shall be the full compensation for complying with this Section of the Specification and the Conditions of the Contract.

Payment of rates for the pay items shall be the full compensation for supplying, erecting and maintaining the Field Office for the Engineer including all furniture, fixtures and fittings, access roads, office equipment, signboards, photographs, video clips etc. all in full compliance with the requirements of this Section.

No separate payment shall be made to the Contractor for providing the requisite tools, minor items and the consumables. Compensation for these items shall be deemed to be included in the other pay items of the BOQ.

Pay Items shall be as Ls.

CONTRACTOR'S SITE FACILITIES

The Contractor shall be responsible for the provision, maintenance and operation facilities and services on site at his own expenses.

CONTRACTOR'S RESPONSIBILITY FOR TESTING

Contractor shall bear all Contingency and Laboratory testing charge as may be required for materials from BUET/CUET or any other recognized Laboratory as will be selected by the Engineer.

The Contractor when requested by the Engineer or his Representative to carry out any test in the presence of the Engineer or his Representative, shall provide all necessary assistances in carrying out the tests providing concerned Material Engineer, Laboratory Assistants and labors required to the Engineer free of charge. The Contractor shall ensure that the Engineer and his staff have unrestricted access to these facilities free of charge

Testing equipment and apparatus as are needed for the performance of the above tests as specified in the Technical Specifications for the materials and construction of earthworks, concrete, gravels etc. are to be supplied by the Contractor.

All costs including Contractor's margin, overhead, taxes, etc, incurred by the Contractor in complying with requirements of this sub-clause shall be deemed to be included in the lump sum price of Contractor's site facilities of the Bill of Quantities. Payment for this item shall be made on pro-rata basis depending upon the total progress accomplished. Prior approval from the Engineer will be required for utilization of this sum.

PART 3 – Conditions of Contract and Contract Forms

Section VIII - General Conditions (GC)

Red Book:

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The Conditions of Contract are the "General Conditions" which form part of the "Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer ("Red book") Second edition 2017" published by the Federation Internationale Des Ingenieurs – Conseils (FIDIC) and the following "Particular Conditions" which comprise of the Bank's COPA and the amendments and additions to such General Conditions.

An original copy of the above FIDIC publication i.e. "*Conditions of Contract for Building and Engineering Works Designed by the Employer*" must be obtained from FIDIC.

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Section IX - Particular Conditions

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

Particular Conditions

Part A – Contract Data

Conditions	Sub-Clause	Data
Where the Contract allows for Cost Plus Profit, percentage profit to be added to the Cost	1.1.20	None
Employer's name and address	1.1.31	Abdullah Al Mahmud Faruk Project Director Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project Bangladesh-PRIDE (P170688) Bangladesh Economic Zones Authority (BEZA) Biniyog Bhaban (9th floor) E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh
Engineer's name and address	1.1.35	Design and Supervision Consultant to be appointed by the Employer
Bank's name	1.1.89	The World Bank/IDA
Borrower's name	1.1.90	Government of the Peoples Republic of Bangladesh represented by the Project Director, Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project Bangladesh-PRIDE (P170688) Bangladesh Economic Zones Authority (BEZA)
Time for Completion	1.1.84	900 (Nine hundred) days
Defects Notification Period	1.1.27	365 days.
Sections	1.1.73	
Electronic transmission system	1.3 (a) (ii)	Not Applicable
Address of Employer for communications:	1.3(d)	Abdullah Al Mahmud Faruk Project Director Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project Bangladesh-PRIDE (P170688) Bangladesh Economic Zones Authority (BEZA) Biniyog Bhaban (9th floor), E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh Tel: +880 2-44826050 E-mail: pd.bsmsn.pride@beza.gov.bd

Conditions	Sub-Clause	Data
		https://www.beza.gov.bd
Address of Engineer for communications:	1.3(d)	To be mentioned later
Address of Contractor for communications:	1.3(d)	
Governing Law	1.4	Law of the Country (People's Republic of Bangladesh
Ruling language	1.4	English
Language for communications	1.4	English
Time for the Parties to sign a Contract Agreement	1.6	28 days after receipt of the Letter of Acceptance
Number of additional paper copies of Contractor's Documents	1.8	*2 (Two)*
Total liability of the Contractor to the Employer under or in connection with the Contract	1.15	100% of Contract Price
Site	1.1 74	Mirsarai-2B EZ, Bangabandhu Sheikh Mujib Shilpa Nagar, Mirsarai, Chattogram.
Time for access to the Site	2.1	*No later than the Commencement Day.*
Engineer's Duties and Authority	3.2	Variations resulting in an increase of the Accepted Contract Amount in excess of 0% shall require written consent of the Employer.
Performance Security	4.2	The Performance Security will be in the form of a *"demand guarantee"* in the amount(s) of *5% (Five)* percent of the Accepted Contract Amount and in the same currency (ies) of the Accepted Contract Amount.
Environmental and Social (ES) Performance Security	4.2	The ES Performance Security will be in the form of a "demand guarantee" in the amount(s) of *1%* (one) of the Accepted Contract Amount and in the same currency (ies) of the Accepted Contract Amount.
Period for notification of errors in the items of reference	4.7.2 (a)	*28* Days
Period of payment for temporary utilities	4.19	None

Conditions	Sub-Clause	Data
Number of additional paper copies of progress reports	4.20	5
Maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	5.1(a)	15 (Fifteen) percent
Parts of the Works for which subcontracting is not permitted	5.1(b)	All works except Earth Works
Normal working hours	6.5	8 hours
Number of additional paper copies of program	8.3	5
Delay damages payable for each day of delay	8.8	0.05% of the Accepted Contract Amount, less provisional sum, for DAAB.
Maximum amount of delay damages	8.8	10% of the Accepted Contract Amount less provisional sum for DAAB.
Method of measurement	12.2	As per specification of bidding document.
Percentage profit	12.3	*As stated under 1.1.20 above None*
Percentage rate to be applied to Provisional Sums for overhead charges and profit	13.4 (b)(ii)	20 (Twenty) percent including Taxes
Total advance payment	14.2	10% (Ten Percentage) of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable
Repayment of Advance payment	14.2.3	(a) exceeds 20% of the portion of the Accepted Contract Amount payable in that currency less Provisional Sums (b) deductions shall be made at the amortisation rate of 20%
Number of additional paper copies of Statements	14.3(b)	5
Percentage of retention	14.3(iii)	5%
Limit of Retention Money (as a percentage of Accepted Contract Amount)	14.3(iii)	5%

Conditions	Sub-Clause	Data
Plant and Materials	14.5(b)(i)	If Sub-Clause 14.5 applies: Plant and Materials for payment when shipped :None
	14.5(c)(i)	Plant and Materials for payment when delivered to the Site :None
Minimum Amount of Interim Payment Certificates	14.6.2	Three (3) percent of the Accepted Contract Amount.
Period of payment of Advance Payment to the Contractor	14.7(a)	*28* days
Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.6 (interim Payment)	14.7b(i)	56 days
Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 (Final Payment)	14.7b(ii)	28 days
Period for the Employer to make final payment to the Contractor	14.7(c)	56 days
financing charges for delayed payment (percentage points above the average bank short-term lending rate as referred to under sub-paragraph (a))	14.8	Euribor (6th months) plus 1% fixed rate
Number of additional paper copies of draft Final Statement	14.11.1(b)	*5*
Forces of nature, the risks of which are allocated to the Contractor	17.2(d)	

Conditions	Sub-Clause	Data
Permitted deductible limits	19.1	insurance required for the Works: : 110% of value of works. insurance required for Goods:110% of value of works. insurance required for liability for breach of professional duty:Contract Price. insurance required against liability for fitness for purpose (if any is required): 10 (Ten) percent of Contract Amount. insurance required for injury to persons and damage to property: 10 (Ten) percent of Contract Amount. insurance required for injury to employees: 10 (Ten) percent of Contract Amount. other insurances required by Laws and by local practice: Bangladesh Law.
Additional amount to be insured (as a percentage of the replacement value, if less or more than 15%)	19.2.1(b)	10 (Ten) percent
List of Exceptional Risks which shall not be excluded from the insurance cover for the Works	19.2.1(iv)	Damaged by unpredicted events.
Extent of insurance required for Goods	19.2.2	
Amount of insurance required for Goods		
amount of insurance required for liability for breach of professional duty	19.2.3(a)	Contract Price

Conditions	Sub-Clause	Data
Insurance required against liability for fitness for purpose	19.2.3(b)	Yes
Period of insurance required for liability for breach of professional duty	19.2.3	Contract Price
Amount of insurance required for injury to persons and damage to property	19.2.4	10 (Ten) percent of Contract Price.
Other insurances required by Laws and by local practice (give details)		
Time for appointment of DAAB member (s)	21.1	42 days after signature by both parties of the Contract Agreement
The DAAB shall be comprised of	21.1	Three (3) members
List of proposed members of DAAB	21.1	Not Applicable
Appointment (if not agreed) to be made by	21.2	The President, Institution of Engineers Bangladesh (IEB), Dhaka, Bangladesh
Rules of arbitration	21.6(a)	Sub-Clause 21.6(a) of PART B – Special Provisions *"shall"* apply. **For Foreign Contractor:** Any dispute, controversy or claim arising out of or relating to this Contract, or breach, termination or invalidity thereof, shall be settled by arbitration in accordance with the **United Nations Commission on International Trade Law (UNCITRAL) Arbitration Rules of 1976** as at present in force **For Domestic Contractor:** The arbitration shall be conducted in accordance with the **Arbitration Act (Act No 1 of 2001) of Bangladesh** as at present in force and in the place mentioned.
	21.6 (b)	Sub-Clause 21.6(b) of PART B – Special Provisions ***"shall"*** apply.

Conditions	Sub-Clause	Data
Place of arbitration	21.6(a)	Biniyog Bhaban, E-6/B, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh Bangladesh Economic Zones Authority (BEZA)

Part B - Special Provisions

Sub-Clause 1.1.10 Contract	"the Contractor's Proposal" is deleted.
Sub-Clause 1.1.49 Laws	The Sub-Clause is replaced with: "**Laws**" means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority."
Sub-Clause 1.1.74 Site	The Sub-Clause is replaced with: "**Site**" means the places where the Permanent Works are to be executed, including storage and working area, and to which Plant and Materials are to be delivered, and any other places specified in the Contract as forming part of the Site."
Sub-Clause 1.1.77 Statement	On the second line after "Payment Certificate under...", add "Sub-Clause 14.2.1 [Advance Payment Guarantee] (if applicable),".
Sub-Clause 1.1.81 Tender	"the Contractor's Proposal" is deleted.

Sub-Clause 1.1.89 to 1.1.92 are added after Sub-Clause 1.1.88

Sub-Clause 1.1 89 Bank	"**Bank**" means the financing institution (if any) named in the Contract Data.
Sub-Clause 1.1.90 Borrower	"**Borrower**" means the person (if any) named as the borrower in the Contract Data.
Sub-Clause 1.1.91 ES	"**ES**" means Environmental and Social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)).
Sub-Clause 1.1.92 Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)	"**Sexual Exploitation and Abuse**" "**(SEA)**" means the following: **Sexual Exploitation** is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting

monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions; and

"Sexual Harassment" "(SH)" is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's or Employer's Personnel.

Sub-Clause 1.2

Interpretation

Sub-paragraph (a) is replaced with the following:

(a) "Words indicating one gender include all genders;

"he/she" is replaced with:" it";

"him/her" is replaced with "it";

"his" and "his/her" are replaced with: "its";

"himself/herself" are replaced with: "itself"."

Further, "and" is deleted from the end of sub-paragraph (i) and added at the end of sub-paragraph (j).

sub-paragraph (k) is added:

(k) "The word "tender" is synonymous with "bid" or "proposal", the word tenderer with "bidder" or "proposer" and the words "tender documents" with "request for bids documents" or "request for proposal documents", as applicable."

Sub-Clause 1.5

Priority of Documents

The following documents are added in the list of Priority Documents after (e):

"(f) the Particular Conditions Part C- Fraud and Corruption;

(g) the Particular Conditions Part D- Environmental and Social (ES) Metrics for Progress Reports;

(h) Particular Conditions- Part E- Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration for Subcontractors;"

and the list renumbered accordingly.

Sub-Clause 1.6 **Contract Agreement**	The last paragraph is replaced with: "If the Contractor comprises a JV, *the authorised representative of the JV shall sign* the Contract Agreement in accordance with sub –clauses 1.14 (Joint and Several Liability)."
Sub-Clause 1.12 **Confidentiality**	The following is added at the end of the second paragraph: "The Contractor shall be permitted to disclose information required to establish its qualifications to compete for other projects." "or" at the end of (b) is deleted. "or" at the end of (c) is added. The following is then added as (d): "is being provided to the Bank ."
Sub-Clause 1.17 **Inspections & Audit by the Bank**	The following Sub-Clause is added after Sub-Clause 1.16: "Pursuant to paragraph 2.2 e. of Particular Conditions - Part C- Fraud and Corruption, the Contractor shall permit and shall cause its agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and personnel, to permit, the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank. The Contractor's and its Subcontractors' and subconsultants' attention is drawn to Sub-Clause 15.8 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures)."
Sub-Clause 2.4 **Employer's Financial Arrangements**	The first paragraph is replaced with: "The Employer shall submit, before the Commencement Date, reasonable evidence that financial arrangements have been made for financing the Employer's obligations under the Contract." The following sub-paragraph is added at the end of Sub-Clause 2.4:

"In addition, if the Bank has notified to the Borrower that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Borrower having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in its notice of the extent to which such funds will be available."

Sub-Clause 2.6

Employer-Supplied Materials and Employer's Equipment

[If Employer- Supplied Materials are listed in the Works' Requirements for the Contractor's use in the execution of Works, the following provisions may be added]:

The following is added after the last paragraph of Sub-Clause 2.6:

"The Employer shall supply to the Contractor the Employer-Supplied Materials listed in the Specification, at the time(s) stated in the Specification (if not stated, within the times that shall be required to enable the Contractor to proceed with execution of the Works in accordance with the Programme).

When made available by the Employer, the Contractor shall visually inspect the Employer-Supplied Materials and shall promptly give a Notice to the Engineer of any shortage, defect or default in them. Thereafter, the Contractor shall rectify such shortage, defect or default to the extent instructed by the Engineer. Such instruction shall be deemed to have been given under Sub-Clause 13.3.1 [*Variation by Instruction*].

After this visual inspection, the Employer-Supplied Materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody, and control shall not relieve the Employer of liability of any shortage, defect or default not apparent from a visual inspection."

[*If Employer's Equipment are listed in the Specification for the Contractor's use in the execution of Works, the following provisions may be added*]:

The following is added after the last paragraph of Sub-Clause 2.6:

"The Employer shall make the Employer's Equipment listed in the Specification available to the Contractor at the time(s) stated in the Specification (if not stated, within the times that shall be required to enable the Contractor to proceed with execution of the Works in accordance with the Programme).

Unless expressly stated otherwise in the Specification, the Employer's Equipment shall be provided for the exclusive use of the Contractor.

When made available by the Employer, the Contractor shall visually inspect the Employer's Equipment and shall promptly give a Notice to the Engineer of any shortage, defect or default in them. Thereafter, the Contractor shall rectify such shortage, defect or default to the extent instructed by the Engineer. Such instruction shall be deemed to have been given under Sub-Clause 13.3.1 [*Variation by Instruction*].

The Contractor shall be responsible for the Employer's Equipment while it is under the Contractor's control and/or any of the Contractor's Personnel is operating it, driving it, directing it, using it, or in control of it.

The Contractor shall not remove from the Site any items of the Employer's Equipment without the consent of the Employer. However, consent shall not be required for vehicles transporting Goods or Contractor's personnel to or from the Site."

Sub-Clause 3.1

The Engineer

The following is added at the end of the first sub-paragraph:

"The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties."

Sub-Clause 3.2

Engineer's Duties and Authority

The Engineer shall obtain the consent in writing of the Employer before taking action under the following Sub-Clauses of these Conditions:

(a) Sub-Clause 13.1: Right to vary - instructing a variation, except;

(i) in an emergency situation as determined by the Engineer; or

(ii) (if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data.

(b) Sub-Clause 13.2 (Value Engineering): stating consent or otherwise to a value engineering proposal submitted by the Contractor in accordance with Sub-Clause 13.2.

Notwithstanding the obligation, as set out above, to obtain consent in writing, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, it may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of consent of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, and EOT if any, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Employer.

Sub-Clause 3.3

Engineer's Representative

The following is added at the end of Sub-Clause 3.3:

"The Engineer shall obtain the consent of the Employer before appointing or replacing an Engineer's Representative."

Sub-Clause 3.4

Delegation by the Engineer

The following is added at the end of the second paragraph:

"If any assistants are not fluent in this language, the Engineer shall make competent interpreters available during all working hours, in a number sufficient for those assistants to properly perform their assigned duties and/or exercise their delegated authority."

Sub-Clause 3.6

Replacement of the Engineer

In the first paragraph, "42 days" is replaced with: "21 days";

In the third para, "shall" is replaced with: "should".

Sub-Clause 4.1

The following is inserted after the paragraph "The Contractor shall provide the Plant (and spare parts, if any) ...":

Contractor's General Obligations

"All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by the Bank."

The following is inserted after the paragraph "The Contractor shall, whenever required by the Engineer...":

"The Contractor shall not carry out mobilization to Site (e.g. limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits) unless the Engineer gives a Notice of No-objection to the Contractor, a Notice that shall not be unreasonably delayed, to the measures the Contractor proposes to manage the environmental and social risks and impacts, which at a minimum shall include applying the Management Strategies and Implementation Plans (MSIPs) and Code of Conduct for Contractor's Personnel submitted as part of the Bid and agreed as part of the Contract.

The Contractor shall submit, to the Engineer for Review any additional MSIPs as are necessary to manage the ES risks and impacts of ongoing Works (e.g. excavation, earth works, bridge and structure works, stream and road diversions, quarrying or extraction of materials, concrete batching and asphalt manufacture). These MSIPs collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP). The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to ensure that it contains measures appropriate to the Works. The updated C-ESMP shall be submitted to the Engineer for Review.

The C-ESMP shall be part of the Contractor's Documents. The procedures for Review of the C-ESMP and its updates shall be as described in Sub-Clause 4.4.1 *[Preparation and Review]."*

The following is added as (g); (g) and (h) of the Sub-Clause are then renumbered as (h) and (i) respectively.(g) "if so stated in the Specification, the Contractor shall:

(i) design structural elements of the Works taking into account climate change considerations;

(ii) apply the concept of universal access (the concept of universal access means unimpeded access for people of all ages and abilities in different situations and under various circumstances;

(iii) consider the incremental risks of the public's potential exposure to operational accidents or natural hazards, including extreme weather events; and

(iv) any other requirement stated in the Specification."

The following is added at the end of the Sub-Clause:

"The Contractor shall provide relevant contract-related information, as the Employer and/or Engineer may reasonably request to conduct Stakeholder engagements. "Stakeholder" refers to individuals or groups who:

(i) are affected or likely to be affected by the Contract; and

(ii) may have an interest in the Contract.

The Contractor shall also directly participate in Stakeholder engagements, as the Employer and/or Engineer may reasonably request."

Sub-Clause 4.2

Performance Security and ES Performance Security

The first paragraph is replaced with:

"The Contractor shall obtain (at its cost) a Performance Security for proper performance and, if applicable, an Environmental and Social (ES) Performance Security for compliance with the Contractor's ES obligations, in the amounts stated in the Contract Data and denominated in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer. If amounts are not stated in the Contract Data, this Sub-Clause shall not apply."

In the following Sub-Clauses of the General Conditions, the term "Performance Security" is replaced with: "Performance Security and, if applicable, an Environmental and Social (ES) Performance Security":

2.1- Right of Access to the Site;

14.2- Advance Payment;

14.6- Issue of IPC;

14.12- Discharge;

14.13- Issue of FPC;

14.14 Cessation of Employer's Liability;

15.2- Termination for Contractor's Default;

15.5- Termination for Employer's Convenience.

Sub-Clause 4.2.1

Contractor's obligations

The first paragraph is replaced with:

"The Contractor shall deliver the Performance Security and, if applicable, an ES Performance Security to the Employer within 28 days after receiving the Letter of Acceptance and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable bank or financial institution selected by the Contractor and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer. The ES Performance Security shall be issued by a reputable bank selected by the Contractor and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer."

Thereafter, throughout Sub-Clause 4.2 "Performance Security" is replaced with: "Performance Security and, if applicable, ES Performance Security."

Sub-Clause 4.2.2

Claims under the Performance Security

The first paragraph is replaced in its entirety with: "The Employer shall not make a claim under the Performance Security, except for amounts for which the Employer is entitled under the Contract."

Sub-Clause 4.2.3

Return of Performance Security

In sub-paragraph (a) "21 days" is replaced with: "28 days".

Sub-Clause 4.3

Contractor's Representative

The following is added at the end of the last paragraph: "If any of these persons is not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer."

Sub-Clause 4.6

Co-operation

On the second-last line of the first paragraph before "Contractor's", "of the" is added.

The following is added after the first paragraph:

"The Contractor shall also, as stated in the Specification or as instructed by the Engineer, cooperate with and allow appropriate opportunities for the Employer's Personnel to conduct any environmental and social assessment."

Sub-Clause 4.7

Setting out

In the second bullet-point of sub-paragraph (b) of Sub-Clause 4.7.3:

before "if the items of reference", the following is add: "when examining the items of reference within the period stated in sub-paragraph (a) of Sub-Clause 4.7.2,".

On the second and third lines, the following is deleted "and the contractor's Notice is given after the period stated in sub-paragraph (a) of Sub-Clause 4.7.2".

Sub-Clause 4.8

Health and Safety Obligations

The following are included after deleting "and" at the end of (f) and replacing "." with ";" at the end of (g):

"

(h) provide health and safety training of Contractor's Personnel as appropriate and maintain training records;

(i) actively engage the Contractor's Personnel in promoting understanding, and methods for, implementation of health and safety requirements, as well as in providing information to Contractor's Personnel, and provision of personal protective equipment without expense to the Contractor's Personnel;

(j) put in place workplace processes for Contractor's Personnel to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health;

(k) Contractor's Personnel who remove themselves from such work situations shall not be required to return to work until necessary remedial action to correct the situation has been taken.

Contractor's Personnel shall not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal;

(l) subject to Sub-Clause 4.6, collaborate with the entities and Personnel under paragraph (a) , (b) and (c) of Sub-Clause 4.6, in applying the health and safety requirements. This is without prejudice to the responsibility of the relevant entities for the health and safety of their own personnel; and

(m) establish and implement a system for regular (not less than six-monthly) review of health and safety performance and the working environment."

The second and third paragraphs are replaced with the following:

"Subject to Sub-Clause 4.1, the Contractor shall submit to the Engineer for Review a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works. The procedures for Review of the health and safety manual and its updates shall be as described in Sub-Clause 4.4.1 *[Preparation and Review]*.

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

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

(a) which shall include at a minimum:

(i) the procedures to establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the Contractor, including control measures for chemical, physical and biological substances and agents;

(ii) details of the training to be provided, records to be kept;

(iii) the procedures for prevention, preparedness and response activities to

be implemented in the case of an emergency event (i.e. an unanticipated incident, arising from both natural and man-made hazards, typically in the form of fire, explosions, leaks or spills, which may occur for a variety of different reasons including failure to implement operating procedures that are designed to prevent their occurrence, extreme weather or lack of early warning);

(iv) the measures to be taken to avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases,

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

(vi) the policies and procedures on the management and quality of accommodation and welfare facilities if such accommodation and welfare facilities are provided by the Contractor in accordance with Sub-Clause 6.6; and

(b) any other requirements stated in the Specification.

The paragraph starting with: "In addition to the reporting requirement of..." is deleted and replaced with the addition to GC Sub-Clause 4.20 in Sub-Clause 4.20 of the Special Provisions.

Sub-Clause 4.15

Access Route

The following is added at the end of Sub-Clause 4.15:

"The Contractor shall take all necessary safety measures to avoid the occurrence of incidents and injuries to any third party, associated with the use of, if any, Contractor's Equipment on public roads or other public infrastructure.

The Contractor shall monitor road safety incidents and accidents to identify negative safety issues, and establish and implement necessary measures to resolve them."

Sub-Clause 4.18

Protection of the Environment

Sub-Clause 4.18 Protection of the Environment is replaced with:

"The Contractor shall take all necessary measures to:

(a) protect the environment (both on and off the Site); and

(b) limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities.

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

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

Sub-Clause 4.20

Progress Reports

Replace "4.20 (g) with: "the Environmental and Social (ES) metrics set out in Particular Conditions - Part D"

The following is added at the end of the Sub-Clause:

"In addition to the reporting requirement of this sub-paragraph (g) of Sub-Clause 4.20 [*Progress Reports*] the Contractor shall inform the Engineer immediately of any allegation, incident or accident, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's Personnel. This includes, but is not limited to, any incident or accident causing fatality or

serious injury; significant adverse effects or damage to private property; or any allegation of SEA and/or SH. In case of SEA and/or SH, while maintaining confidentiality as appropriate, the type of allegation (sexual exploitation, sexual abuse or sexual harassment), gender and age of the person who experienced the alleged incident should be included in the information.

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

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

Sub-Clause 4.21

Security of the Site

Sub-Clause 4.21 Security of the Site is replaced with:

"**Sub-Clause 4.21 Security of the Site**

The Contractor shall be responsible for the security of the Site, and:

(a) for keeping unauthorised persons off the Site;

(b) authorised persons shall be limited to the Contractor's Personnel, the Employer's Personnel, and to any other personnel identified as authorised personnel (including the Employer's other contractors on the Site), by a Notice from the Employer or the Engineer to the Contractor.

Subject to Sub-Clause 4.1, the Contractor shall submit for the Engineer's No-objection a security management plan that sets out the security arrangements for the Site.

The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine

that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct towards Contractor's Personnel, Employer's Personnel and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Specification.

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

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

Sub-Clause 4.22

Contractor's Operations on Site

On the third line of the second paragraph before "4.17", "Sub- Clause" is added.

Sub-Clause 4.23

Archaeological and Geological Findings

The first paragraph is replaced with the following:

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

(a) take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's Personnel or other persons from removing or damaging any of these findings;

(b) train relevant Contractor's Personnel on appropriate actions to be taken in the event of such findings; and

(c) implement any other action consistent with the requirements of the Specification and relevant Laws."

Sub-Clause 4.24

Suppliers (other than Subcontractors)

4.24.1 Forced Labour

The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage forced labour including trafficked persons as described in Sub-Clause 6.21. If forced labour/trafficking cases are identified, the Contractor shall take measures

to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

4.24.2 Child labour

The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage child labour as described in Sub-Clause 6.22. If child labour cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

4.24.3 Serious Safety Issues

The Contractor, including its Subcontractors, shall comply with all applicable safety obligations, including as stated in Sub-Clauses 4.8, 5.1 and 6.7. The Contractor shall also take measures to require its suppliers (other than Subcontractors) to adopt procedures and mitigation measures adequate to address safety issues related to their personnel. If serious safety issues are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

4.24.4 Obtaining natural resource materials in relation to supplier

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

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

that is able to demonstrate that they are not significantly adversely impacting the habitats.

Sub-Clause 4.25

Code of Conduct

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

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

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

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

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

Sub-Clause 5.1

Subcontractors

The following is added at the beginning of the second paragraph.

"The Contractor shall require that its Subcontractors execute the Works in accordance with the Contract, including complying with the relevant ES requirements and the obligations set out in Sub-Clause 4.25 above."

The following is added after the first sentence of the fourth paragraph: "The Contractor's submission to the Engineer shall also include the Subcontractor's declaration in accordance with the Particular Conditions- Part E- Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration for Subcontractors."

The following is added at the end of the last paragraph of Sub-Clause 5.1:

"All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under sub-paragraph (a) of Sub-Clause 15.2.3 [*After Termination*].

Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors."

Sub-Clause 5.2.2

Objection to Nomination

In sub-paragraph (a), on the first line before "Subcontractor", "nominated" is added.

In sub-paragraph (c):

"and" is deleted from the end of (i);

"." at the end of (ii) is replaced with: ", and".

The following is then added as (iii):

"(iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.2.3 [*Payment to nominated Subcontractors*]."

Sub-Clause 6.1

Engagement of Staff and Labour

The following paragraphs are added at the end of the Sub-Clause:

"The Contractor shall provide the Contractor's Personnel information and documentation that are clear and understandable regarding their terms and conditions of employment. The information and documentation shall set out their rights under relevant labour Laws applicable to the Contractor's Personnel (which will include any applicable collective agreements), including their rights related to hours of work, wages, overtime, compensation and benefits, as well as those arising from any requirements in the Specification. The Contractor's Personnel shall be informed when any material changes to their terms or conditions of employment occur.

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within the Country."

Sub-Clause 6.2

The following paragraphs are added at the end of the Sub-Clause:

Rates of Wages and Conditions of Labour

"The Contractor shall inform the Contractor's Personnel about:

(a) any deduction to their payment and the conditions of such deductions in accordance with the applicable Laws or as stated in the Specification; and

(b) their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force.

The Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

Where required by applicable Laws or as stated in the Specification, the Contractor shall provide the Contractor's Personnel written notice of termination of employment and details of severance payments in a timely manner. The Contractor shall have paid the Contractor's Personnel (either directly or where appropriate for their benefit) all due wages and entitlements including, as applicable, social security benefits and pension contributions, on or before the end of their engagement/ employment."

Sub-Clause 6.5 Working Hours

The following is inserted at the end of the Sub-Clause:

"The Contractor shall provide the Contractor's Personnel annual holiday and sick, maternity and family leave, as required by applicable Laws or as stated in the Specification."

Sub-Clause 6.6

Facilities for Staff and Labour

The following is added as the last paragraph:

"If stated in the Specification, the Contractor shall give access to or provide services that accommodate the physical, social and cultural needs of the Contractor's Personnel. The Contractor shall also provide similar facilities for the Employer's Personnel as stated in the Specification."

Sub-Clause 6.7

Health and Safety of Personnel

In the second paragraph, "The Contractor" is replaced with:

"Except as otherwise stated in the Specification, the Contractor..."

Sub-Clause 6.9

Contractor's Personnel

The Sub-Clause is replaced with:

"The Contractor's Personnel (including Key Personnel, if any) shall be appropriately qualified, skilled, experienced and competent in their respective trades or occupations.

The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative and Key Personnel (if any), who:

(a) persists in any misconduct or lack of care;

(b) carries out duties incompetently or negligently;

(c) fails to comply with any provision of the Contract;

(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment;

(e) based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution of the Works;

(f) has been recruited from the Employer's Personnel in breach of Sub-Clause 6.3 [Recruitment of Persons];

(g) undertakes behaviour which breaches the Code of Conduct for Contractor's Personnel (ES).

If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience. In the case of replacement of the Contractor's Representative, Sub-Clause 4.3 [*Contractor's Representative*] shall apply. In the case of replacement of Key Personnel (if any), Sub-Clause 6.12 [*Key Personnel*] shall apply.

Subject to the requirements in Sub-Clause 4.3 [*Contractor's Representative*] and 6.12 [*Key Personnel*], and notwithstanding any requirement from the Engineer to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Works are being carried out, any Contractor's Personnel who engages in (a), (b), (c), (d), (e) or (g) above or has been recruited as stated in (f) above."

Sub-Clause 6.12

The following is inserted at the end of the last paragraph:

Key Personnel

"If any of the Key Personnel are not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer."

The following Sub-Clauses 6.13 to 6.27 are added after sub-clause 6.12

Sub-Clause 6.13
Foreign Personnel

The Contractor may bring into the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use its best endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

Sub-Clause 6.14
Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

Sub-Clause 6.15
Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

Sub-Clause 6.16
Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

Sub-Clause 6.17
Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or

permit or allow importation, sale, gift, barter or disposal thereto by Contractor's Personnel.

Sub-Clause 6.18

Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

Sub-Clause 6.19

Festivals and Religious Customs

The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.

Sub-Clause 6.20

Funeral Arrangements

The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of its local employees who may die while engaged upon the Works.

Sub-Clause 6.21

Forced Labour

The Contractor, including its Subcontractors, shall not employ or engage forced labour. Forced labour consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

Sub-Clause 6.22

Child Labour

The Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age).

The Contractor, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

The Contractor including its Subcontractors, shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment

has been conducted by the Contractor with the Engineer's consent. The Contractor shall be subject to regular monitoring by the Engineer that includes monitoring of health, working conditions and hours of work.

Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

(a) with exposure to physical, psychological or sexual abuse;

(b) underground, underwater, working at heights or in confined spaces;

(c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads;

(d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise or vibration damaging to health; or

(e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.

Sub-Clause 6.23

Employment Records of Workers

The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked, and wages paid to all workers. These records shall be summarised on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

Sub-Clause 6.24

Workers' Organisations

In countries where the relevant labour laws recognise workers' rights to form and to join workers' organisations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labour laws substantially restrict workers' organisations,

the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organisations and collective bargaining or alternative mechanisms. Workers' organisations are expected to fairly represent the workers in the workforce.

Sub-Clause 6.25

Non-Discrimination and Equal Opportunity

The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices.

Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-discrimination and equal opportunity, including for specific groups such as women, people with disabilities, migrant workers and children (of working age in accordance with Sub-Clause 6.22).

Sub-Clause 6.26

Contractor's Personnel Grievance Mechanism

The Contractor shall have a grievance mechanism for Contractor's Personnel, and where relevant the workers' organizations stated in Sub-Clause 6.24, to raise workplace concerns. The grievance mechanism shall be proportionate to the nature, scale, risks and impacts of the Contract. The mechanism shall address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a language they understand, without any retribution, and shall operate in an independent and objective manner.

	The Contractor's Personnel shall be informed of the grievance mechanism at the time of engagement for the Contract, and the measures put in place to protect them against any reprisal for its use. Measures will be put in place to make the grievance mechanism easily accessible to all Contractor's Personnel. The grievance mechanism shall not impede access to other judicial or administrative remedies that might be available, or substitute for grievance mechanisms provided through collective agreements. The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to Contractor's Personnel. Existing grievance mechanisms may be supplemented as needed with Contract-specific arrangements.
Sub-Clause 6.27 **Training of Contractor's Personnel**	The Contractor shall provide appropriate training to relevant Contractor's Personnel on ES aspects of the Contract, including appropriate sensitization on prohibition of SEA and SH, and health and safety training referred to in Sub-Clause 4.8 As stated in the Specification or as instructed by the Engineer, the Contractor shall also allow appropriate opportunities for the relevant Contractor's Personnel to be trained on ES aspects of the Contract by the Employer's Personnel. The Contractor shall provide training on SEA and SH, including its prevention, to any of its personnel who has a role to supervise other Contractor's Personnel.
Sub-Clause 7.3 Inspection	The following is added in the first paragraph after "Employer's Personnel" "(including the Bank staff or consultants acting on the Bank's behalf, stakeholders and third parties, such as independent experts, local communities, or non-governmental organizations)" The following is added as (b) (iv): "(iv) carryout environmental and social audit, and"
Sub-Clause 7.7 **Ownership of Plant and Materials**	The following is added before the first paragraph: "Except as otherwise provided in the Contract,"

Sub-Clause 8.1

Commencement of Work

The Sub- Clause is replaced in its entirety with the following:

"The Engineer shall give a Notice to the Contractor stating the Commencement Date, not less than 14 days before the Commencement Date.

The Notice shall be issued promptly after the Engineer determines the fulfilment of the following conditions:

(a) signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of the Country;

(b) delivery to the Contractor of reasonable evidence of the Employer's financial arrangements (under Sub-Clause 2.4 [Employer's Financial Arrangements]);

(c) except if otherwise specified in the Contract Data, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works;

(d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor;

(e) constitution of the DAAB in accordance with Sub-Clause 21.1 and Sub-Clause 21.2 as applicable.

Subject to Sub-Clause 4.1 on the Management Strategies and Implementation Plans and the C-ESMP and Sub-Clause 4.8 on the health and safety manual, the Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date, and shall then proceed with the Works with due expedition and without delay."

Sub-Clause 11.7

Right of Access after Taking Over

In the second paragraph, "Whenever the Contractor intends to access any part of the Works during the relevant DNP:" is replaced with:

"Whenever, until the date 28 days after issue of the Performance Certificate, the Contractor intends to access any part of the Works:"

Sub-Clause 13.3.1
Variation by Instruction

Subparagraph 13.3.1 (a) is replaced with: "a description of the varied work performed or to be performed, including details of the resources and methods adopted or to be adopted by the Contractor, and sufficient ES information to enable an evaluation of ES risks and impacts;"

Sub-Clause 13.4
Provisional Sums

The following is inserted as the penultimate paragraph:

"The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB. The Contractor shall submit the DAAB members' 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."

Sub-Clause 13.6
Adjustments for Changes in Laws

The following paragraph is added at the end of the Sub-Clause:

"Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the Table of Adjustment Data in accordance with the provisions of Sub-Clause 13.7 [Adjustments for Changes in Cost]."

Sub-Clause 14.1
The Contract Price

The following is added at the end of the Sub-Clause:

"Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts therefore, imported by the Contractor for the sole purpose of executing the Contract shall be temporarily exempt from the payment of import duties and taxes upon initial importation, provided the Contractor shall post with the customs authorities at the port of entry an approved export bond or bank guarantee, valid until the Time for Completion plus six months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment

and spare parts, and callable in the event the Contractor's Equipment is not exported from the Country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer upon the importation of individual items of Contractor's Equipment and spare parts. Upon export of individual items of Contractor's Equipment or spare parts, or upon the completion of the Contract, the Contractor shall prepare, for approval by the customs authorities, an assessment of the residual value of the Contractor's Equipment and spare part to be exported, based on the depreciation scale (s and other criteria used by the customs authorities for such purposes under the provisions of the applicable Laws. Import duties and taxes shall be due and payable to the customs authorities by the Contractor on (a) the difference between the initial imported value and the residual value of the Contractor's Equipment and spare parts to exported; and (b) on the initial imported value of the Contractor's Equipment and spare parts remaining in the Country after completion of the Contract. Upon payment of such dues within 28 days of being invoiced, the bond or bank guarantee shall be reduced or released accordingly; otherwise the security shall be called in the full amount remaining."

Sub-Clause 14.2.1

Advance Payment Guarantee

The first paragraph is replaced with:

"The Contractor shall obtain (at the Contractor's cost) an Advance Payment Guarantee in amounts and currencies equal to the advance payment, and shall submit it to the Employer with a copy to the Engineer. This guarantee shall be issued by reputable bank or financial institution selected by the Contractor and shall be based on the sample form annexed to the Particular Conditions or in another form agreed by the Employer (but such agreement shall not relieve the Contractor from any obligation under this Sub-Clause)."

Sub-Clause 14.3

Application for Interim Payment

The following is inserted at the end of (vi) after: *[Agreement or Determination]*: "any reimbursement due to the Contractor under the Dispute Avoidance/ Adjudication Agreement. (Appendix General Conditions of Dispute Avoidance/ Adjudication Agreement)."

Sub-Clause 14.6.2

"and/or" from subparagraph (b) is deleted.

Withholding (amounts in) an IPC

The following is then added as subparagraph (c) and sub-paragraph (c) of the Sub-Clause is renumbered as (d):

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

(i) failure to comply with any ES obligations or work described in the Works' Requirements which may include: working outside site boundaries, excessive dust, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archaeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion;

(ii) failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ES issues, or anticipated risks or impacts;

(iii) failure to implement the C-ESMP e.g. failure to provide required training or sensitization;

(iv) failing to have appropriate consents/permits prior to undertaking Works or related activities;

(v) failure to submit ES report/s (as described in Particular Conditions - Part D), or failure to submit such reports in a timely manner;

(vi) failure to implement remediation as instructed by the Engineer within the specified timeframe (e.g. remediation addressing non-compliance/s)."

Sub-Clause 14.7 Payment

At the end of sub-paragraph (b): "and" is replaced with "or" and the following inserted as (iii):

"(iii) at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor within 14 days after such statement is submitted, any discrepancy being rectified in the next payment to the Contractor; and"

At the end of sub-paragraph (c): "." is replaced with ";" and the following inserted:

"or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended the undisputed amount shown in the Final Statement within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2 [Termination by Contractor]."

Sub-Clause 14.9

Release of Retention Money

The following is added at the end of Sub-Clause 14.9:

"Unless otherwise stated in the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and issued by a reputable bank or financial institution selected by the Contractor, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security and, if applicable, an ES Performance Security in Sub-Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release after the latest of the expiry dates of the Defects Notification Periods. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.

If the Performance Security and, if applicable, an ES Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount

guaranteed under them when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security and, if applicable, an ES Performance Security, when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security and, if applicable, an ES Performance Security."

Sub-Clause 14.12 Discharge

On the seventh line of the first paragraph, "Sub-Clause 21.6 *[Arbitration]*" is replaced with: "Clause 21 *[Disputes and Arbitration]'.*

Sub-Clause 14.15 Currencies of Payment

Throughout Sub-Clause 14.15, "Contract Data" is replaced with: "Schedule of Payment Currencies".

Sub-Clause 15.1 Notice to Correct

"and" is deleted from (b) and

"." is replaced by: "; and" in (c).

The following is then added as (d)

"(d) specify the time within which the Contractor shall respond to the Notice to Correct."

In the third para., "shall immediately respond" is replaced with: "shall respond within the time specified in (d)". Further, in the third para., "to comply with the time specified in the Notice to Correct." is replaced with: "to comply with the time specified in (c)."

Sub-Clause 15.2.1 Notice

Sub-paragraph (h) is replaced with: "based on reasonable evidence, has engaged in Fraud and Corruption as defined in paragraph 2.2 of the Particular Conditions - Part C- Fraud and Corruption, in competing for or in executing the Contract."

Sub-Clause 15.8 Fraud and Corruption

The following new Sub-Clause is added:

" 15.8.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the Bank's Sanctions Framework, as set forth in Particular Conditions - Part C- Fraud and Corruption.

15.8.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee."

Sub-Clause 16.1

Suspension by Contractor

The following paragraph is inserted after the first paragraph:

"Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank."

Sub-Clause 16.2.1

Notice

Sub-paragraph (j) is deleted in its entirety.

At the end of sub-paragraph (i): "; or" is replaced with: "."

sub-paragraph (f) is replaced with:

"(f) the Contractor does not receive a Notice of the Commencement Date under Sub-Clause 8.1 [*Commencement of Works*] within 180 days after receiving the Letter of Acceptance, for reasons not attributable to the Contractor."

Sub-Clause 16.2.2

Termination

The following is added at the end of Sub-Clause 16.2.2:

"In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by

giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice."

Sub-Clause 16.3

Contractor's Obligations After Termination

[If the Employer has made available any Employer-Supplied Materials and/or Employer's Equipment in accordance with Sub-Clause 2.6, include the following:]

"and" is deleted from the end of sub-paragraph (b), sub-paragraph (c) deleted and the following added:

"

(c) deliver to the Engineer all Employer- Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 *[Employer-Supplied materials and Employer's Equipment]; and*

(d) remove all other Goods from the Site, except as necessary for safety, and leave the Site."

Sub-Clause 17.1

Responsibility for Care of the Works

On the fourth and fifth lines of the first paragraph, replace "Date of Completion of the Works" with "issue of the Taking-Over Certificate for the Works".

[If Employer- Supplied Materials are listed in the Specification for the Contractor's use in the execution of Works, include the following provision. See also Sub-Clause 2.6 [Employer-Supplied Materials and Employer's Equipment]]

After the two instances of "Goods" in the last paragraph, the following is added: "Employer- Supplied Materials".

[If Employer's Equipment are listed in the Works' Requirements for the Contractor's use in the execution of Works, include the following provision. See also Sub-Clause 2.6 [Employer-Supplied Materials and Employer's Equipment]]

After the two instances of "Goods" in the last paragraph, the following is added: ", Employer's Equipment,".

Sub-Clause 17.3

Intellectual and Industrial Property Rights

On the first line of the second paragraph, replace "notice" is replaced with "a Notice".

Sub-Clause 17.7

The following Sub-Clause is added as 17.7:

Use of Employer's Accommodation/Facilities

"The Contractor shall take full responsibility for the care of the Employer-provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works)

If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at its own cost, rectify the loss or damage to the satisfaction of the Engineer."

Sub-Clause 18.1

Exceptional Events

Sub-paragraph (c) is substituted with:

"(c) riot, commotion, disorder or sabotage by persons other than the Contractor's Personnel and other employees of the Contractor and Subcontractors;"

Sub-Clause 18.4

Consequences of an Exceptional Event

The following is added at the end of sub-paragraph (b) after deleting the ".":

", including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Exceptional Events, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 19.2 [Insurance to be provided by the Contractor]."

Sub-Clause 18.5

Optional Termination

In sub-paragraph (c), "and necessarily" is inserted after ""was reasonably".

Sub-Clause 19.1

General Requirements

The following paragraphs are added after the first:

"Wherever the Employer is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with terms (if any) agreed by both Parties before the date of the Letter of Acceptance.

This agreement of terms shall take precedence over the provisions of this Clause."

Sub-Clause 19.2

insurance to be provided by the Contractor

The following is inserted as the first sentence in Sub-Clause 19.2:

"The Contractor shall be entitled to place all insurances relating to the Contract (including, but not limited to the

	insurance referred to Clause 19) with insurers from any eligible source country."
Sub-Clause 19.2.1 **The Works**	On the last line of the second paragraph, "Clause 12 *[Tests after completion]*" is deleted.
Sub-Clause 19.2.5 **Injury to employees**	The second paragraph is replaced with: "The Employer and the Engineer shall also be indemnified under the policy of insurance, against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel."
Sub-Clause 20.1 **Claims**	In a): "any additional payment" is replaced with "payment".
Sub-Clause 20.2 **Claims for Payment and/or EOT**	The first paragraph is replaced with: "If either Party considers that it is entitled to claim under 20.1 (a) or (b), the following claim procedure shall apply:"
Sub-Clause 21.1 **Constitution of the DAAB**	In the second paragraph, at the end of the first sentence after deleting: ".", the following is added: ", each of whom shall meet the criteria set forth in Sub-Clause 3.3 of Appendix- General Conditions of Dispute Avoidance/ Adjudication Agreement." After the second paragraph insert the following paragraph: "If the Contract is with a foreign Contractor, the DAAB members shall not have the same nationality as the Employer or the Contractor."
Sub-Clause 21.2 **Failure to Appoint DAAB Member (s)**	For both (a) and (b): "by the date stated in the first paragraph of Sub-Clause 21.1 [*Constitution of the DAAB*]" is replaced with: "within 42 days from the date the Contract is signed by both Parties"
Sub-Clause 21.6 **Arbitration**	In the first paragraph, delete starting from: "international arbitration" up to the end of (c), and replace with the following: "arbitration. Arbitration shall be conducted as follows:

(a) if the contract is with foreign contractors, unless otherwise specified in the Contract Data; the dispute shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce; by one or three arbitrators appointed in accordance with these Rules. The place of arbitration shall be the neutral location specified in the Contract Data; and the arbitration shall be conducted in the ruling language defined in Sub-Clause 1.4 [Law and Language].

(b) If the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country."

Appendix- General Conditions of Dispute Avoidance/Adjudication Agreement

Title

"General Conditions of Dispute Avoidance/Adjudication Agreement" is replaced with "General Conditions of DAAB Agreement".

1. Definitions

Sub-Clause 1.2: In both the first and third lines, "DAA Agreement" is replaced with "DAAB Agreement".

Sub-Clause 1.3:

-In the first line, "Dispute Avoidance/Adjudication Agreement" or "DAA Agreement" means" is replaced with:

"DAAB Agreement" is as defined under the Contract and is".

- In the first line of sub-paragraph (c), "DAA Agreement" is replaced with "DAAB Agreement".

- In sub-paragraph (c)(ii), "chairman" is replaced with "chairperson".

Sub-Clause 1.3 "DAAB Activities" is replaced with Sub-Clause 1.4 "DAAB Activities" and the subsequent Sub-Clauses under Clause 1 "Definitions" renumbered:

Sub-Clause 1.7 to 12: Replace all instances of "DAA Agreement" with "DAAB Agreement".

In Sub-Clause 1.8 a(i):" authorised representative of the contractor or of the Employer" is replaced with:

"Contractor's Representative or authorised representative of the Employer".

2. General Provisions

Sub-Clause 2.2 is deleted in its entirety.

3. Warranties

Sub-Clause 3.3 is deleted and replaced with the following:

"When appointing the DAAB Member, each Party relies on the DAAB Member's representations, that he/she:

a) has at least a bachelor's degree in relevant disciplines such as law, engineering, construction management or contract management;

b) has at least ten years of experience in contract administration/management and dispute resolution, out of which at least five years of experience as an arbitrator or adjudicator in construction-related disputes;

c) has received formal training as an adjudicator from an internationally recognized organization;

d) has experience and/or is knowledgeable in the type of work which the Contractor is to carry out under the Contract;

e) has experience in the interpretation of construction and/or engineering contract documents;

f) has familiarity with the forms of contract published by FIDIC since 1999, and an understanding of the dispute resolution procedures contained therein; and

g) is fluent in the language for communications stated in the Contract Data (or the language as agreed between the Parties and the DAAB)."

7. Confidentiality

In Sub-Clause 7.3: "or" is deleted after sub-paragraph (b), and the following added:

"or (d) is being provided to the Bank."

9. Fees and Expenses

In Sub-Clause 9.1 (c): "business class or equivalent" is replaced with: "in less than first class".

In Sub-Clause 9.4: "and air fares" and "other" are deleted from the first and second sentences respectively.

10. Resignation and Termination	In Sub-Clause 10.3: "the DAA Agreement" is replaced with: "a DAAB member's DAAB Agreement".

Annex- DAAB Procedural Rules

Rule 4.2 On the fourth line, "chairman" is replaced with "chairperson".

Rule 8.3 On the sixth line, "chairman" is replaced with "chairperson".

Form of Dispute Avoidance/Adjudication Agreement

All instances of "DAA Agreement" are replaced with: "DAAB Agreement".

In C (b): "chairman" is replaced with "chairperson".

Particular Conditions

Part C- Fraud and Corruption

(Text in this Particular Conditions - Part C shall not be modified)

1. **Purpose**

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

2. **Requirements**

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

2.2 To this end, the Bank:

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

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harass or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner[1]; (ii) to be a nominated [2] sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a

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

[2] A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders, consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect [3] all accounts, records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by the Bank.

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

Particular Conditions

Part D- Environmental and Social (ES)

Metrics for Progress Reports

[Note to Employer: the following metrics may be amended to reflect the specifics of the Contract. *The Employer shall ensure that the metrics provided are appropriate for the Works and impacts/key issues identified in the environmental and social assessment.]*

Metrics for regular reporting:

a. *environmental incidents or non-compliances with contract requirements, including contamination, pollution or damage to ground or water supplies;*
b. *health and safety incidents, accidents, injuries that require treatment and all fatalities;*
c. *interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);*
d. *status of all permits and agreements:*
   (i) work permits: number required, number received, actions taken for those not received;
   (ii) status of permits and consents:
   - list areas/facilities with permits required (quarries, asphalt & batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, etc.);
   - list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent);
   - identify major activities undertaken in each area in the reporting period and highlights of environmental and social protection (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation);
   - for quarries: status of relocation and compensation (completed, or details of activities and current status in the reporting period).
e. *health and safety supervision:*
   (i) safety officer: number days worked, number of full inspections & partial inspections, reports to construction/project management;

(ii) number of workers, work hours, metric of PPE use (percentage of workers with full personal protection equipment (PPE), partial, etc.), worker violations observed (by type of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any);

f. worker accommodations:

(i) number of expats housed in accommodations, number of locals;

(ii) date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, etc.;

(iii) actions taken to recommend/require improved conditions, or to improve conditions.

g. Health services: provider of health services, information and/or training, location of clinic, number of non-safety disease or illness treatments and diagnoses (no names to be provided);

h. gender (for expats and locals separately): number of female workers, percentage of workforce, gender issues raised and dealt with (cross-reference grievances or other sections as needed);

i. training:

(i) number of new workers, number receiving induction training, dates of induction training;

(ii) number and dates of toolbox talks, number of workers receiving Occupational Health and Safety (OHS), environmental and social training;

(iii) number and dates of communicable diseases (including STDs) sensitization and/or training, no. workers receiving training (in the reporting period and in the past); same questions for gender sensitization, flag person training.

(iv) number and date of SEA and SH prevention sensitization and/or training events, including number of workers receiving training on Code of Conduct for Contractor's Personnel (in the reporting period and in the past), etc.

j. environmental and social supervision:

(i) environmentalist: days worked, areas inspected and numbers of inspections of each (road section, work camp, accommodations, quarries, borrow areas, spoil areas, swamps, forest crossings, etc.), highlights of activities/findings (including violations of environmental and/or social best practices, actions taken), reports to environmental and/or social specialist/construction/site management;

(ii) sociologist: days worked, number of partial and full site inspections (by area: road section, work camp, accommodations, quarries, borrow areas, spoil areas, clinic, HIV/AIDS center, community centers, etc.), highlights of activities (including violations of environmental and/or social requirements

observed, actions taken), reports to environmental and/or social specialist/construction/site management; and

(iii) community liaison person(s): days worked (hours community center open), number of people met, highlights of activities (issues raised, etc.), reports to environmental and/or social specialist /construction/site management.

k. *Grievances: list new grievances (e.g. number of allegations of SEA and SH) received in the reporting period and number of unresolved past grievances by date received, complainant's age and sex, how received, to whom referred to for action, resolution and date (if completed), data resolution reported to complainant, any required follow-up (Cross-reference other sections as needed):*

(i) Worker grievances;

(ii) Community grievances

l. *Traffic, road safety and vehicles/equipment:*

(i) traffic and road safety incidents and accidents involving project vehicles & equipment: provide date, location, damage, cause, follow-up;

(ii) traffic and road safety incidents and accidents involving non-project vehicles or property (also reported under immediate metrics): provide date, location, damage, cause, follow-up;

(iii) overall condition of vehicles/equipment (subjective judgment by environmentalist); non-routine repairs and maintenance needed to improve safety and/or environmental performance (to control smoke, etc.).

m. *Environmental mitigations and issues (what has been done):*

(i) dust: number of working bowsers, number of waterings/day, number of complaints, warnings given by environmentalist, actions taken to resolve; highlights of quarry dust control (covers, sprays, operational status); % of rock/ spoil lorries with covers, actions taken for uncovered vehicles;

(ii) erosion control: controls implemented by location, status of water crossings, environmentalist inspections and results, actions taken to resolve issues, emergency repairs needed to control erosion/sedimentation;

(iii) quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken in the reporting period at each, and highlights of environmental and social protection: land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation;

(iv) blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, etc.), incidents of off-site damage or complaints (cross-reference other sections as needed);

(v) spill clean-ups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination;

(vi) waste management: types and quantities generated and managed, including amount taken offsite (and by whom) or reused/recycled/disposed on-site;

(vii) details of tree plantings and other mitigations required undertaken in the reporting period;

(viii) details of water and swamp protection mitigations required undertaken in the reporting period.

n. compliance:

(i) compliance status for conditions of all relevant consents/permits, for the Work, including quarries, etc.): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;

(ii) compliance status of C-ESMP/ESIP requirements: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

(iii) compliance status of SEA and SH prevention and response action plan: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

(iv) compliance status of Health and Safety Management Plan re: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

(v) other unresolved issues from previous reporting periods related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

Particular Conditions

Part E- Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration for Subcontractors

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

Subcontractor's Name: *[insert full name]*
Date: *[insert day, month, year]*

Contract reference *[insert contract reference]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration
We: ☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. An arbitral award on the disqualification case has been made in our favor. ☐ (d) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have subsequently demonstrated that we have adequate capacity and commitment to comply with SEA /SH obligations. ☐ (e) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations for a period of two years. We have attached specific evidence demonstrating that we have adequate capacity and commitment to comply with SEA and SH obligations.
[If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]
[If (d) or (e) above are applicable, provide the following information:]
Period of disqualification: From: _____ To: _____
If previously provided on another Bank financed works contract, details of evidence that demonstrated adequate capacity and commitment to comply with SEA/SH obligations **(as per (d) above)**

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

Name of the Subcontractor_____

Name of the person duly authorized to sign on behalf of the Subcontractor_____

Title of the person signing on behalf of the Subcontractor_____

Signature of the person named above_____

Date signed _____ day of _____, ____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date signed _____ day of _____, ____

Section X - Contract Forms

Table of Forms

Notification of Intention to Award 274
Contract Agreement 281
Performance Security 283
Performance Security 285
Environmental and Social (ES) Performance Security 287
Advance Payment Security 289
Demand Guarantee 289
Retention Money Security 291

Notification of Intention to Award

[*This Notification of Intention to Award shall be sent to each Bidder that submitted a Bid.*]

[*Send this Notification to the Bidder's Authorized Representative named in the Bidder Information Form*]

For the attention of Bidder's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert the date that this Notification is transmitted to Bidders. The Notification must be sent to all Bidders simultaneously. This means on the same date and as close to the same time as possible.]

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

Notification of Intention to Award

Employer: *[insert the name of the Employer]*
Project: *[insert name of project]*
Contract title: *[insert the name of the contract]*
Country: *[insert country where RFB is issued]*
Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*
RFB No: *[insert RFB reference number from Procurement Plan]*

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

a) request a debriefing in relation to the evaluation of your Bid, and/or

b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	[*insert name of successful Bidder*]
Address:	[*insert address of the successful Bidder*]
Contract price:	[*insert contract price of the successful Bid*]

2. Other Bidders ***[INSTRUCTIONS: insert names of all Bidders that submitted a Bid. If the Bid's price was evaluated include the evaluated price as well as the Bid price as read out.]***

Name of Bidder	Bid price	Evaluated Bid price (if applicable)
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]

3. Reason/s why your Bid was unsuccessful

[INSTRUCTIONS: State the reason/s why <u>this</u> Bidder's Bid was unsuccessful. Do NOT include: (a) a point by point comparison with another Bidder's Bid or (b) information that is marked confidential by the Bidder in its Bid.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (local time).

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

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

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

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

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

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

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

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

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

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

Further information:

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

In summary, there are four essential requirements:

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

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

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

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

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

On behalf of the Employer:

Signature: _____

Name: _____

Title/position:

_____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

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

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

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

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

RFB No.: [*insert number of RFB process*]
Request for Bid No.: [*insert identification*]

To: **[*insert complete name of Employer*]**

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

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

Details of beneficial ownership

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

OR

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

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

OR

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

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

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

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

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

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

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

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

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

LETTER OF ACCEPTANCE

[letterhead paper of the Employer]

[date]

To: *[name and address of the Contractor]*

This is to notify you that your Bid dated *[date]* for execution of the *[name of the Contract and identification number, as given in the Contract Data]* for the Accepted Contract Amount *[amount in numbers and words] [name of currency]*, as corrected and modified in accordance with the Instructions to Bidders, is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security and an Environmental and Social Performance Security ***[Delete ES Performance Security if it is not required under the contract]*** within 28 days in accordance with the Conditions of Contract, using, for that purpose, one of the Performance Security Forms and the ES Performance Security Form, ***[Delete reference to the ES Performance Security Form if it is not required under the contract]*** and (ii) the additional information on beneficial ownership in accordance with BDS ITB 47.1, within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, Contract Forms, of the bidding document.

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Agency: _____

Attachment: Contract Agreement

9

Contract Agreement

THIS AGREEMENT made the _____ day of _____, ____, between _____of _____ (hereinafter "the Employer"), of the one part, and _____ of _____ (hereinafter "the Contractor"), of the other part:

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

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

(a) the Letter of Acceptance;

(b) the Letter of Bid;

(c) the addenda Nos _____ (if any);

(d) the Particular Conditions;

(e) the General Conditions;

(f) the Specification;

(g) the Drawings; and

(h) the completed Schedules and any other documents forming part of the contract, including, but not limited to:

i. the ES Management Strategies and Implementation Plans; and

ii. Code of Conduct for Contractor's Personnel (ES).

3. In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

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

Signed by _____ (for the Employer)

Signed by _____ (for the Contractor)

Performance Security

Option 1: Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

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

Date: _____*[Insert date of issue]*

PERFORMANCE GUARANTEE No.: _____

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

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____),[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the .... Day of ....., 2...[2], and any demand for payment under it must be received by us at this office indicated above on or before that date.

---

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

2 *Insert the date twenty-eight days after the expected completion date as described in 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."*

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.

Performance Security

Option 2: Performance Bond

By this Bond_____ as Principal (hereinafter called "the Contractor") and_____] as Surety (hereinafter called "the Surety"), are held and firmly bound unto_____] as Obligee (hereinafter called "the Employer") in the amount of _____, for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

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

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

(1) complete the Contract in accordance with its terms and conditions; or

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

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

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

Any suit under this Bond must be instituted before the expiration of one year from the date of the issuing of the Taking-Over Certificate.

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

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

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

Environmental and Social (ES) Performance Security

ES Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

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

Date: _ *[Insert date of issue]*

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

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

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____),[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its Environmental and/or Social (ES) obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the .... Day of ....., 2... [2], and any demand for payment under it must be received by us at this office indicated above on or before that date.

---

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

2 *Insert the date twenty-eight days after the expected completion date as described in 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."*

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.

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

[Guarantor letterhead or SWIFT identifier code]

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

Date: _____ *[Insert date of issue]*

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

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

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum _____ (_____) 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 _____ (_____) [1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

(a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

---

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.*

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

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 __ day of ____, 2__,[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

_____ *[Guarantor letterhead or SWIFT identifier code]*

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

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 _____ 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 and, if required, the ES 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]* (_____) *[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 that the Applicant is in

---

[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 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.*

breach of its obligation(s) under the Contract, without your needing to prove or show grounds for your 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 _____ at _____ *[insert name and address of Applicant's bank].*

This guarantee shall expire no later than the .... Day of ....., 2...[2], and any demand for payment under it must be received by us at 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.

---

[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."*

SECTION 7 – GENERAL SPECIFICATIONS

CONTENTS

ABBREVIATIONS

DIVISION 1 GENERAL AND SITE FACILITIES

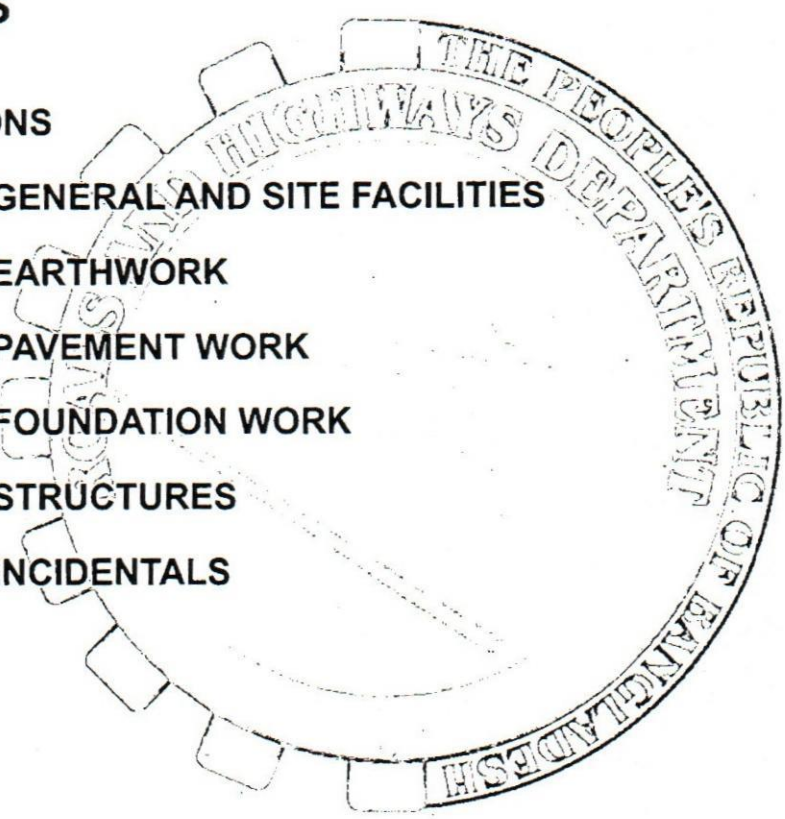
DIVISION 2 EARTHWORK

DIVISION 3 PAVEMENT WORK

DIVISION 4 FOUNDATION WORK

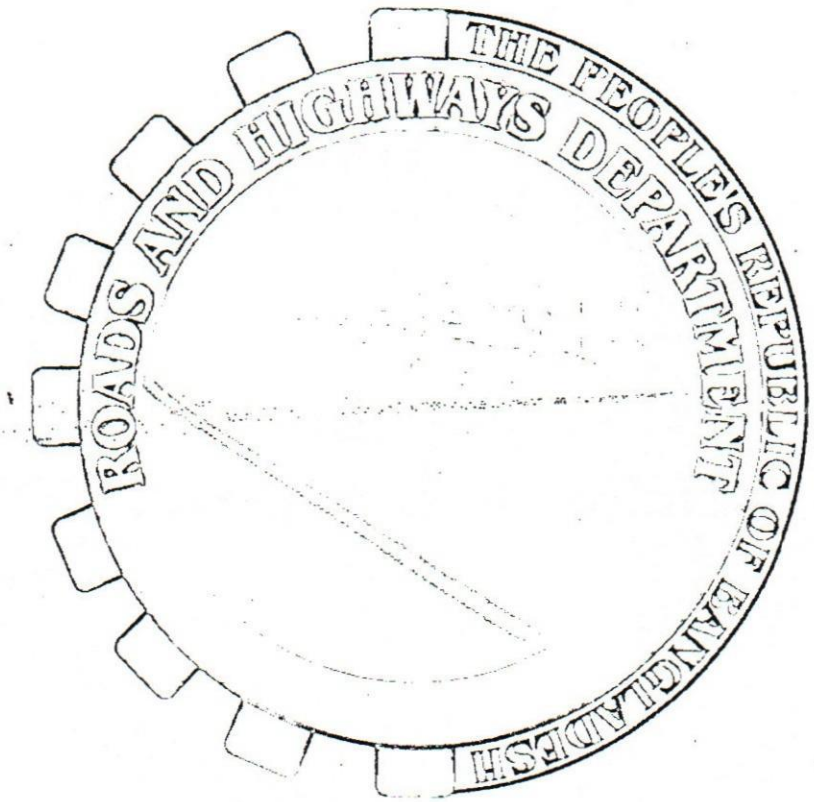
DIVISION 5 STRUCTURES

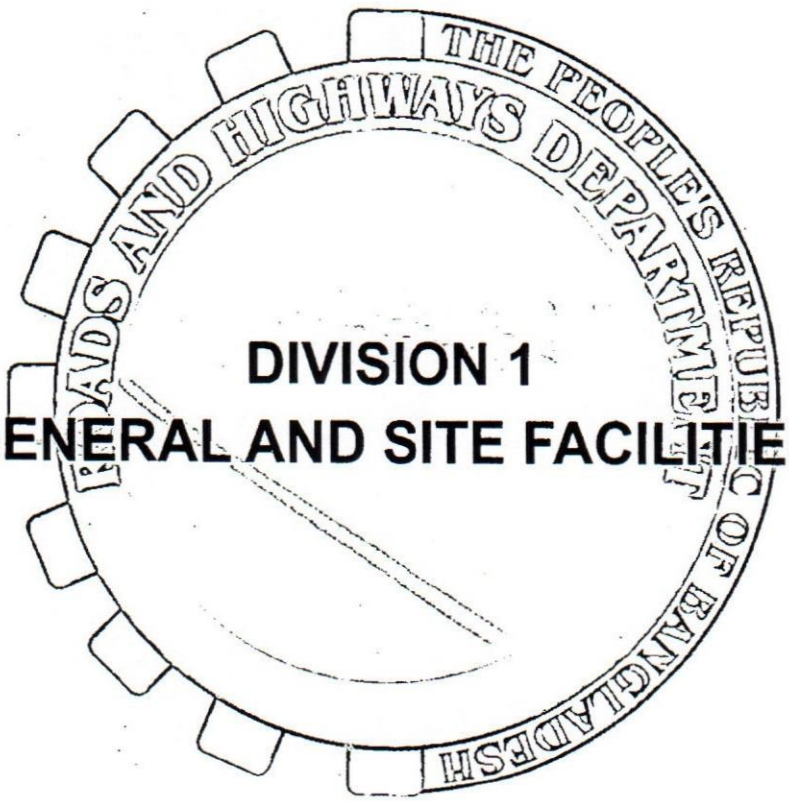
DIVISION 6 INCIDENTALS



ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society of Testing and Materials
BSTI	Bangladesh Standards Testing Institute
BR	Bangladesh Railways
REB	Rural Electrification Board
BRRL	Bangladesh Road Research Laboratory
BS	British Standard
CBR	California Bearing Ratio
HWL	High Water Level
IP	International Petroleum Society
JIS	Japan Industrial Standard
LWL	Low Water Level
MSL	Mean Sea Level
PVC	Polyvinyl Chloride
RHD	Roads and Highways Department
ROW	Right of Way
STP	Standard Laboratory Test Procedures for Quality Control Laboratories, BRRL


THE PEOPLE'S REPUBLIC OF BANGLADESH
ROADS AND HIGHWAYS DEPARTMENT



DIVISION 1
GENERAL AND SITE FACILITIES

DIVISION 1 - GENERAL AND SITE FACILITIES

Page

1.1 MAINTENANCE AND PROTECTION OF TRAFFIC ---- 1
1.1.1 General ---- 1
1.1.2 Measurement and Payment ---- 2

1.2 FIELD OFFICE FOR THE ENGINEER AND OTHER FACILITIES TO BE PROVIDED BY THE CONTRACTOR ---- 3
1.2.1 Field Office for the Engineer and his Staff ---- 3
1.2.2 Sanitation ---- 3
1.2.3 Office Equipment and Consumables ---- 4
1.2.4 Sign Boards ---- 4
1.2.5 Survey Equipment ---- 4
1.2.5.1 Levels and Levelling Staffs ---- 5
1.2.5.2 Theodolites ---- 5
1.2.5.3 Electronic Distance Measurer (EDM) ---- 5
1.2.6 Insurance of Engineer's Field Office, Furniture and Equipment ---- 5
1.2.7 Progress Photographs ---- 5
1.2.8 Measurement and Payment ---- 6

1.3 TESTING OF MATERIALS ---- 7
1.3.1 Contractor's Site Laboratory ---- 7
1.3.2 Materials Testing by Independent Laboratories ---- 7
1.3.3 Special and Additional Testing ---- 8
1.3.4 Staff for Materials Testing ---- 8
1.3.5 Test Results and Records ---- 9
1.3.6 Measurement and Payment ---- 9

1.4 TRANSPORT FOR THE ENGINEER ---- 10
1.4.1 General ---- 10
1.4.2 Items of Transport ---- 10
1.4.3 Measurement and Payment ---- 10

1.5 RELOCATION OF PUBLIC UTILITIES ---- 11
1.5.1 Description ---- 11
1.5.2 Measurement and Payment ---- 11

1.6 GENERAL CONTRACTOR'S OBLIGATIONS ---- 12
1.6.1 Site Establishment, Maintenance and Demobilisation ---- 12
1.6.2 Provision of Performance Bond ---- 12
1.6.3 Provision of Insurances ---- 12
1.6.4 As-Built Drawings ---- 12
1.6.5 Measurement and Payment ---- 12

1.1 MAINTENANCE AND PROTECTION OF TRAFFIC

1.1.1 General

The Contractor shall at all times maintain the traffic flow along 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, warning lights and signs as well as other equipment at all hours during the day or night.

The Engineer's approval of plan and section drawings of proposed detours, temporary roads and temporary bridges shall be obtained by the Contractor before any work is commenced. Where the work site takes up part of the road only, and the full width of the road can be restored for night time traffic, the Engineer may give permission for control of the traffic through the works area by use of flagmen or electronically controlled mobile traffic lights, without the need for construction of bypass roads, but the Engineer's approval will only be given if, and while, the Contractor demonstrates that sufficient resources are applied and maintained for this purpose.

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 minimise delays and inconvenience to road users during the course of the works.

Notwithstanding the above any diversion of the National and Regional Highways shall comply to at least the minimum standard stated as following:

- Minimum carriageway width of 7.3 metres.
- Minimum horizontal radius of 150 metres.
- Maximum gradient of 1 in 33.
- The construction shall be sufficient for the smooth uninterrupted passage of all traffic and have a bituminous surface.

Notwithstanding the above any diversion of Feeder Roads shall comply to at least the minimum standard stated as following:

- Minimum carriageway width of 5.50 metres.
- Minimum horizontal radius of 100 metres.
- Maximum gradient of 1 in 33.
- All weather surfaces.

The Contractor shall supply all temporary signs, lights and other equipment, to the approval of the Engineer, to ensure smooth and safe flows of traffic. Also the Contractor shall take all reasonable precautions to prevent damage to vehicles from construction equipment or materials and shall be responsible for any claims arising from such damage.

The Contractor shall in due time and at least seven days before any diversion, interruption or impediment to traffic takes place, submit a detailed stage programme for the Engineer's approval. The programme shall show all arrangements necessary to ensure a smooth traffic flow. Upon completion of the Works, all temporary roads, temporary bridges, barricades, signs and other equipment shall be completely removed, unless otherwise approved in writing by the Engineer. From the date of Commencement of the Contract to the date of the Completion or Partial

Completion Certificate the Contractor shall also be responsible for maintenance of, and repair of damage, to all existing features, constructions, structures, pavements etc. which come within the limits of the site irrespective of the cause of the damage, unless that cause is determined to be an accepted risk and the repairs are determined to be a compensation event.

If in the opinion of the Engineer the Contractor has failed to properly repair or maintain existing or temporary construction, or provide sufficient or appropriate warning signs, lights, barricades etc. he shall instruct the Contractor, in writing, to provide such signs as he considers appropriate for protection of traffic, pedestrians, employees and the works. If the Contractor fails to respond within the time given by the Engineer, the Engineer may suspend works which interfere with traffic until such time as the Contractor provides sufficient signs etc. as the Engineer has directed, or the Engineer may arrange to provide the required signs etc. at cost to the Contractor, these costs being deducted from monies due to the Contractor under the Contract. These costs will include any costs for missing or stolen items not returned to the Engineer at the completion of works or when replaced by the Contractor.

1.1.2 Measurement and Payment

The construction and ultimate removal of all temporary constructions as well as the provision of barricades, signs and other equipment shall be paid for at a lump sum price. This sum shall cover all earthworks, temporary bridging and culverts, pavement and surfacing materials, warning signs, lights, control of traffic including single lane working, by day and by night, and all other items to ensure the smooth and safe flow of traffic.

Where temporary bridging materials, such as Bailey Bridge components are supplied to the Contractor, these will be delivered to the Site. The Contractor shall be responsible for the care of all materials supplied to him and shall bear all costs associated with repair and replacement due to damage and loss.

The maintenance and repair of existing and temporary constructions, and equipment provided for the maintenance and protection of traffic flows shall be paid for at a daily rate. When the Engineer issues an instruction requiring the Contractor to provide; repairs, maintenance, or additional temporary signs, lights, barricades or any other such feature, every day the Contractor fails to comply with the instruction to the satisfaction of the Engineer, the day shall not be included for payment and a corresponding pro rata deduction shall be made to the Lump Sum for establishment of temporary construction and provision of signs etc. noted above. This means that for every day the Contractor fails to comply with the Engineer's instruction there will be no payment made for establishment and maintenance of temporary works and signs for the whole of the site.

Additional fill material used for temporary diversions outside the lines shown on the cross sections and plans for the permanent works may be allowed to remain in place on completion of the Works, provided it is trimmed to levels and slopes approved in writing by the Engineer and all additional costs such as extending drainage and for additional grassing to shoulders and side slopes are at the cost of the Contractor.

Pay items shall be:

1/1/1	Provision, Construction and Removal, as applicable, of Temporary Roads, Structures etc. and Equipment for the Maintenance and Protection of Traffic. (Applicable deduction for days of non-compliance with an Engineer's direction for additional traffic control requirements equals the Lump Sum tendered divided by the construction period in days)	Lump Sum
1/1/2	Maintain Temporary Structures and Equipment for the Maintenance and Protection of Traffic	Day

1.2 FIELD OFFICE FOR THE ENGINEER AND OTHER FACILITIES TO BE PROVIDED BY THE CONTRACTOR

1.2.1 Field Office for the Engineer and his Staff

In addition to the office space required for his own use, the Contractor shall provide and maintain a furnished field office for the use of the Engineer and his staff. Requirements for the office, including overall size, number and size of individual rooms, construction and furniture are stated in Particular Specifications Clause 1.2.1 in Section 6 of Volume 1 - The Tender.

The field office shall be maintained in a secure and watertight condition by the Contractor until completion of the Works or as otherwise instructed by the Engineer and shall be provided with electricity, running water and sewerage. All doors shall be fitted with approved locks, and windows shall be provided with mosquito screens and blinds and shall have interior locking devices.

The Contractor shall submit for the approval of the Engineer before construction, plans and drawings showing proposed details and location for the field office, including foundations, access roads, shades, layout of electrical and water supplies and hard standings thereto. The Engineer may require revision of the plans prior to giving approval for construction. The Contractor shall also submit details of proposed furniture and fittings to the Engineer for approval. These items shall generally be of the best quality obtainable locally.

The office, complete with furnishings, fittings, access roads and hard standings shall be ready for occupation by the Engineer within four weeks of the date when the Contractor first occupies the site.

The Contractor will provide all necessary MLSS (Members of Lower Service Staff) for the field office, including day and night security guards and a tea boy. The Contractor will also provide a competent computer operator. Staff considered unsuitable by the Engineer shall be replaced.

The Contractor shall arrange for the field office to be regularly and properly cleaned and for access roads and hard standings to be maintained in a well drained and trafficable condition. All furnishings and fittings in the field office shall also be maintained by the Contractor in working condition and to the approval of the Engineer.

All materials recovered from dismantling the office and removing access roads, hard standings etc., should be stockpiled on site as approved by the Engineer and along with all furniture and fittings will be the property of the Employer.

Where suitable buildings are available within the general limits of the site of the works the Contractor may propose to the Engineer that the buildings be rented. The buildings must conform with all the criteria above and if deemed to be satisfactory, the Engineer may accept their use as offices.

1.2.2 Sanitation

The Contractor shall provide adequate water-borne sanitation and refuse collection and disposal, complying with the Laws of Bangladesh and all local By-Laws, and to the satisfaction of the Engineer, for all offices, laboratories, workshops, houses etc. erected on the Site.

1.2.3 Office Equipment and Consumables

The Contractor shall provide and maintain the office equipment such as photocopy machines and computers for the Engineer's field office as listed in Particular Specifications Clause 1.2.3 in Section 6 of Volume 1-The Tender. Equipment supplied will be subject to the approval by the Engineer. The Contractor shall supply all consumables related to the equipment and arrange for the equipment to be maintained, including servicing at intervals recommended by the respective manufacturers. Upon completion of the Works or as otherwise instructed by the Engineer, the equipment shall become the property of the Contractor.

The Contractor shall provide and maintain in working order/good condition, as applicable, the items of kitchen equipment listed in Particular Specifications Clause 1.2.3 in Section 6 of Volume 1-The Tender.

The Contractor shall provide all standard stationery items to the Engineer's field office, along with kitchen and bathroom supplies as may be required by the Engineer throughout the duration of the contract.

1.2.4 Sign Boards

The Contractor shall provide identification sign boards, of the number and size stated in Particular Specifications Clause 1.2.4 in Section 6 of Volume 1-The Tender, and maintain them in good condition. All information on the signboards will be written in English and Bengali. The signboards will be positioned as directed by the Engineer. The Contractor shall submit proposals for the materials of the signboards, the text layout and installation of the signboards on Site to the Engineer for approval. Each sign shall show:

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

The Contractor shall remove the sign boards on completion of the Works or when instructed by the Engineer

1.2.5 Survey Equipment

The Contractor will be required to provide survey equipment for the use of the Contractor's and Engineer's staff. The description of the main items required is given in Sections 1.2.5.1 to 1.2.5.3. The numbers of each item to be provided are stated in Particular Specifications Clause 1.2.5 in Section 6 of Volume 1-The Tender. The Contractor shall provide manufacturers published specifications of proposed survey equipment for the approval of the Engineer and shall ensure that equipment supplied to Site is maintained in good working order.

In addition to the survey equipment specified in Sections 1.2.5.1 to 1.2.5.3, the Contractor shall supply miscellaneous tools and minor items of survey equipment such as 30 m and 3 m long steel tapes, ranging rods, spirit levels, plumb bobs, umbrellas, hammers, knives, wooden stakes, steel pins, string lines, paint, marking crayons etc. to the Site. These shall be available in reasonable quantities at all times for use by the Contractor's and Engineer's staff. Ranging rods shall be 1.8 m long with alternate red and white painting. They shall be true and straight with a steel pointed tip to one end.

The Contractor shall supply the required manpower to the Engineer to assist with survey and setting out works, as and when required.

On completion of the Works or as otherwise instructed by the Engineer, all survey equipment shall remain the property of the Contractor.

1.2.5.1 Levels and Levelling Staffs

Levels shall be autoset in carrying cases, complete with centering tripods with extension legs, and to the following minimum specifications:

Magnification 32 times	Stadia 1:100
Aperture 40 mm minimum	Resolving power 3"(sec)
Angular field of view 1° 20'	Range of sensitivity ±15 minutes or less
Short Focusing Distance 1 m	Horizontal circle diameter 75 mm
Addition constant 0	Graduation 10 minutes
Accuracy ± 1mm for 1km double run	

Staffs shall be telescopic, aluminium with graduations in Metric units.

1.2.5.2 Theodolites

Theodolites shall be double circle Triangulation Theodolites with optical Micrometers. The instruments shall be in airtight metal/wooden carrying cases with tool compartments and eyepiece filters complete with centering tripods and extension legs, to the following minimum specifications. One or more theodolites suitable for the attachment of an EDM may be required.

Objective aperture 45 mm	Addition constant 0
Shortest focusing distance 1.7 m	Sensitivity of collimation level 20"/2 mm
Multiplication constant 100	Graduations 360°

1.2.5.3 Electronic Distance Measurer (EDM)

EDM's shall be supplied with full accessories including legs, reflectors and stands, rechargeable batteries and charger and shall be to the following minimum specification.

Distance measurement:	Range not less than 1500 m Accuracy + (5 mm = 5 pmm) mse
Telescope:	Image/Mag: Erect 30 X Min focus 1.5 m
Angle Measurement:	Method: Electronic or Optical Direct Reading to 5"
Automatic Vertical Index:	Range + 5' Setting Accuracy + 0.25"
Weight including case:	Less than 15 kg

1.2.6 Insurance of Engineer's Field Office, Furniture and Equipment

The Contractor shall insure the Engineer's field office, furniture, office equipment and survey equipment against loss or damage by accident, fire or theft for the duration of the Contract.

1.2.7 Progress Photographs

Each month on a date to be agreed with the Engineer, the Contractor shall arrange to take a series of not less than 20 and not more than 40 colour photographs which record the progress of the Works.

Two complete sets of prints of approximate size 175 mm x 125 mm plus the negatives shall be supplied to the Engineer by the Contractor within one week of each series of photographs being taken. A list shall accompany the photographs, indicating the date when the photographs were taken and a short description of the photographs, against the negative numbers.

The photographs shall be taken by an approved professional photographer, accompanied by representatives of the Engineer and the Contractor. If, for any reason, the Engineer is not satisfied with any of the photographs, the Contractor shall arrange at his cost for further photographs to be taken.

1.2.8 Measurement and Payment

Supplying materials for and constructing the field office for the Engineer, including all furniture and fittings, access roads, car parking shades etc., and the provision of water, electricity and sewerage facilities, and the removal of the field office at the end of the Contract, as described in Specifications Sections 1.2.1 and 1.2.2 and Particular Specifications Clause 1.2.1 in Section 6 of Volume 1-The Tender shall be paid for at a lump sum price.

The maintenance, cleaning and security of the field office for the Engineer, the provision of MLSS (chowkhidars and a tea boy), the provision of a typist / computer operator and the cost of water, electricity and sewerage shall be paid for at a monthly rate.

The provision of office equipment, consumables and insurance as described in Specifications Sections 1.2.3 and 1.2.6 and Particular Specifications Clause 1.2.3 shall be paid for at a monthly rate.

Payment for the provision, maintenance and removal of sign boards as described in Specifications Section 1.2.4 and Particular Specifications Clause 1.2.4 in Section 6 of Volume 1-The Tender shall be on a Lump Sum basis.

Payment for the provision, maintenance and insurance of survey equipment and the provision of approval personnel as described in Specifications Sections 1.2.5 and 1.2.6 and Particular Specifications Clause 1.2.5 in Section 6 of Volume 1-The Tender shall be at a monthly rate.

Payment for the provision of progress photographs as described in Specifications Section 1.2.7 shall be at a monthly rate.

Pay items shall be :

1/2/1	Supply, Erect and Remove Field Office for the Engineer	Lump Sum
1/2/2	Maintenance, Staffing, Security and Cleaning of the Field Office for the Engineer	Month
1/2/3	Provision of Office Equipment and Consumables	Month
1/2/4	Provision, Maintenance and Removal of Sign Boards	Lump Sum
1/2/5	Provision and Maintenance of Survey Equipment	Month
1/2/6	Provision of Insurance for the Engineer's Office, Furniture and Equipment.	Month
1/2/7	Progress Photographs	Month

1.3 TESTING OF MATERIALS

1.3.1 Contractor's Site Laboratory

The Contractor shall provide and maintain a site laboratory for the use of the Contractor and the Engineer including furniture, testing equipment and consumable stores necessary to carry out the tests listed in Particular Specifications Clause 1.3.1 in Section 6 of Volume 1-The Tender. The laboratory shall be constructed with a reinforced concrete floor (minimum thickness 150mm) and brick walls. The building shall be watertight and provided with electricity, potable running water and sewerage connections. The location of septic tank(s) and soak-away(s) is to be approved by the Engineer. Doors shall be fitted with approved locks, and windows shall be provided with mosquito screens and blinds and shall have interior locking devices.

The Contractor shall submit for the approval of the Engineer before construction, plans and drawings of the proposed laboratory indicating location, overall size, construction details and layout of benches, washing facilities, furniture, testing equipment, sample storage etc. The Engineer may require revision of the plans prior to giving approval for construction. The Contractor shall also submit details of proposed testing equipment, furniture and fittings to the Engineer for approval.

It will be contractor's responsibility to ensure that all the laboratory equipments are duly calibrated as per required frequency from an authorized agency and the current calibration charts are available for Engineers inspection at all times within the laboratory.

The Contractor shall maintain the laboratory, furniture, fittings and testing equipment for the duration of the Contract and replace any part or item that is irreparably damaged or lost. The Contractor shall pay all expenses in respect of water, electricity and other consumables necessary for the running of the laboratory and shall arrange for the laboratory to be regularly cleaned.

The Contractor shall not be permitted to commence permanent works requiring on-Site testing until the Site laboratory is complete in all respects, unless temporary testing procedures proposed by the Contractor have been approved by the Engineer.

At the end of the Contract, all materials recovered from dismantling the laboratory, together with all furniture, fittings and testing equipment will remain the property of the Contractor.

1.3.2 Materials Testing by Independent Laboratories

In addition to the Site testing facilities described in Specifications Section 1.3.1 and Particular Specifications Clause 1.3.1, in Section 6 of Volume 1-The Tender, the Contractor shall be responsible for arranging for the field and off-Site laboratory tests listed in Particular Specifications Clause 1.3.2, in Section 6 of Volume 1-The Tender, and all other tests indicated as the responsibility of the Contractor in Sections of Divisions 2 to 6 of the Specifications. These should be performed by testing laboratories, for example BRRL, or others as approved by the Engineer. The Contractor shall be responsible for all attendance on staff from these approved testing laboratories, including if necessary the provision of transport for personnel, equipment and test specimens.

1.3.3 Special and Additional Testing

In addition to the testing described in Specifications Sections 1.3.1 and 1.3.2, the Engineer may require further testing to be carried out. Such special and additional testing shall be arranged by the Contractor under the direction of the Engineer.

1.3.4 Staff for Materials Testing

The Contractor shall provide qualified laboratory engineers, technicians, assistants, labourers, etc. to carry out sampling and testing of materials in accordance with Specifications Sections 1.3.1, 1.3.2 and 1.3.3. Laboratory staff shall be subject to the approval of the Engineer and be available to assist the Engineer with materials testing, as and when required.

1.3.5 Sampling and Testing

The frequency of test requirements for pavement layers, bitumen and concrete mixes should comply to those in Table 1.3-1.

Table 1.3-1 Frequency of Tests

	Washed Grading (STP 3.3 / 7.2)	Atterberg Limits (STP 3.2)	Max Dry / CBR (STP 4.3 / 4.5, 5.1)	DensityIn-situ Density (STP 6.2)	ACV, 10% Fines and LAA (STP 7.7.1, 7.7.2, AASHTO T96)
Earthworks		1/2000 m^3	1/2000 m^3	1/1000 m^2	
Improved Sub-Grade	1/1000 m^3	1/1000 m^3	1/1000 m^3	3/1000 m^2	
Sub-Base	1/750 m^3	1/750 m^3	1/750 m^3	3/1000 m^2	1/2000 m^3
Base	1/500 m^3	1/500 m^3	1/500 m^3	3/1000 m^2	1/1000 m^3

For Bituminous and Concrete Mixes 1 set of tests per 100 cum of aggregate for shape (STP 7.3), grading (STP 7.2), ACV , 10% Fines and Los Angeles Abrasion Value (STP 7.7.1, 7.7.2 and AASTO T96) should be carried out. If crushed gravel is used as coarse aggregate, percentage of fractured faces shall be checked 1 test per 100 cum.

Water absorption, Soundness and Coating & Stripping Test should be carried out 1 test for each source/type of aggregate at the start of work and subsequently on every change in quality of aggregate. Sand Equivalent Value for the fine aggregate for bituminous mixes shall be determined minimum 1 test / 100 cum.

Grading of filler (STP 7.2) for bituminous mixes should be checked 1 test / 20 tons of filler. Water Sensitivity Test should be carried out on the bituminous mixes as per AASHTO-T283 at the time of mix design and subsequently as and when required by the Engineer.

Dynamic cone Penetrometer (DCP) should be carried out in addition to the density test for each layer of Embankment and Subgrade 1 test / 500 sqm.

The Contractor shall maintain complete records of test results, which may be inspected by the Engineer at any time. All test results shall be recorded on standard forms approved by the Engineer and shall be signed by the Contractor's engineer or technician in charge of the laboratory. Completed forms shall clearly show the locations of samples, sampling dates and testing dates. Samples shall be numbered serially at the time of sampling. A copy of all test results should be submitted to the Engineer immediately after completion of the test.

The Engineer will be informed prior to any sampling or testing carried out in the laboratory and will have the right to use the facilities and equipment to make his own tests. The Contractor shall have the right to witness any sampling or testing carried out by the Engineer. On completion of the Contract the original copies of all test results shall be handed over to the Employer, via the Engineer.

1.3.6 Measurement and Payment

The provision of the laboratory, furniture, equipment and services detailed in Specifications Section 1.3.1 and Particular Specifications Clause 1.3.1, in Section 6 of Volume 1-The Tender, and the removal from Site of the laboratory, furniture and equipment at the end of the Contract shall be paid for at a lump sum price. Maintenance of the site laboratory, furniture and equipment shall be paid for at a monthly rate.

The sampling and testing carried out by the Contractor in accordance with Specifications Sections 1.3.1, 1.3.2, 1.3.4 and 1.3.5 is included in the pay items for the respective work in Divisions 2 to 6 of the Specifications.

Payment for special or additional tests described in Specifications Section 1.3.3, shall be under a provisional sum, unless the costs of such tests are to be borne by the Contractor in accordance with Clause 35.4 of Volume 2 - Conditions of Contract.

Pay items shall be:

1/3/1	Provide and Remove Site Laboratory and Equipment	Lump Sum
1/3/2	Maintain Site Laboratory	Month
1/3/3	Special or Additional Tests	Provisional Sum

1.4 TRANSPORT FOR THE ENGINEER

1.4.1 General

The Contractor shall provide and maintain road and river transport for the exclusive use of the Engineer, his representatives and representatives of the Employer.

1.4.2 Items of Transport

Road transport, which shall be used both on and off the Site, shall include saloon cars of 1200 cc capacity, double cab pick-ups, four wheel drive vehicles with a minimum of 6 seats and motor cycles of 125 cc capacity.

River transport shall be motor boats of minimum length 5 m suitable for carrying out survey and inspection work and shall have covered deck areas to give protection from the sun and rain. No persons of either the Engineer's or Contractor's staff other than authorised boatmen shall be allowed to operate the boats.

The Bill of Quantities indicates the requirements for road and river transport. When items of transport are out of use for repairs, servicing etc., equivalent substitutes shall be provided by the contractor.

Items of transport and drivers or boatmen considered unsuitable by the Engineer shall be replaced.

1.4.3 Measurement and Payment

The Contractor's monthly rate for the provision and maintenance of vehicles and motor cycles shall include fuel, servicing, maintenance, drivers wages, taxes, duties, registration, insurance etc., as applicable.

The Contractor's monthly rate for the provision of motor boats shall include fuel, servicing, maintenance, experienced boatmen's wages, taxes, duties, registration, insurance, etc. All boats shall be provided with life belts, life jackets and navigation and warning lights.

Pay items shall be :

1/4/1	Saloon Car 1200 cc Capacity	Month
1/4/2	Pick-up (Double Cab)	Month
1/4/3	Four Wheel Drive Vehicle minimum 6 seats	Month
1/4/4	Motor Cycle 125 cc	Month
1/4/5	Motor Boat minimum 5 metre length	Month

1.5 RELOCATION OF PUBLIC UTILITIES

1.5.1 Description

The Contractor shall be responsible for establishing the locations of all public utilities within the Site of the Works, and for their protection.

Where the necessity for the permanent relocation of public utilities has been identified, details will be indicated on the Drawings.

Should the Contractor consider that the temporary diversion of public utilities is necessary in order to carry out Contract works, he shall submit details of his proposals to the Engineer.

Relocation works will normally be undertaken by the concerned authorities, with which the Contractor will be expected to liaise. The Contractor shall indicate relocation works in his Contract Programme.

1.5.2 Measurement and Payment

The Contractor should include for costs associated with the location and protection of public utilities and the temporary diversion of public utilities in his pricing.

Payment for the necessary permanent relocation of public utilities will be under a provisional sum.

Pay items shall be:

1/5/1	Relocation of Public Utilities	Provisional Sum

1.6 GENERAL CONTRACTOR'S OBLIGATIONS

1.6.1 Site Establishment, Maintenance and Demobilisation

The Contractor is to allow for the provision, maintenance and removal at the end of the Contract of all offices, stores, covered workshops, canteens, toilet facilities etc. for his own use, required to execute the Works in accordance with the Contract Documents. In addition, the Contractor is to allow for complying with his obligations for safety, security and protection of the environment described in the Contract Documents including in Sub-Clauses 17.1 and 18.1 of Volume 2 - Conditions of Contract.

1.6.2 Provision of Performance Security

This item is for the provision by the Contractor of the Performance Security, the requirements of which are stated in Clause 43 of Volume 2 – Conditions of Contract.

1.6.3 Provision of Insurances

This item is for the provision of insurances as required in accordance with Clauses 11, 13 and 53 of Volume 2 - Conditions of Contract. The minimum amount of third party insurance shall be as stated in the Contract Data in Section 4 of Volume 1-The Tender. Failure to provide insurance will result in no interim payments.

1.6.4 As-Built Drawings

The Contractor shall furnish sets of as-built Drawings of the Works to the Engineer, 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. For specific requirements for the As-built Drawings refer to Particular Specifications Clause 1.6.4 in Section 6 of Volume 1 – The Tender.

1.6.5 Measurement and Payment

Payment for these items will be deemed to be included for by the contractor in his rates for the Works unless otherwise provided for in Clause 25 of the Contract Data in Section 4 of Volume 1 – The Tender.

DIVISION 2
EARTHWORK

CONTENTS

DIVISION 2 - EARTHWORK

Page

2.1 CLEARING AND GRUBBING ---- 1
2.1.1 Description ---- 1
2.1.2 Preservation of Property ---- 1
2.1.3 Construction Methods ---- 1
2.1.3.1 Clearing ---- 1
2.1.3.2 Grubbing ---- 1
2.1.3.3 Ownership of Cleared Material ---- 2
2.1.3.4 Existing Drainage ---- 2
2.1.4 Measurement ---- 2
2.1.5 Payment ---- 2

2.2 ROADWAY EXCAVATION ---- 3
2.2.1 Description ---- 3
2.2.2 Materials ---- 3
2.2.3 Construction Methods ---- 4
2.2.3.1 General ---- 4
2.2.3.2 Excavated Material Used in the Works ---- 4
2.2.3.3 Unsuitable Material from Roadway Excavation ---- 4
2.2.3.4 Excess Suitable Excavated Material ---- 4
2.2.3.5 Excavation of Unsuitable Soil ---- 4
2.2.3.6 Slopes ---- 4
2.2.3.7 Drainage ---- 4
2.2.3.8 Preparation of Excavated Areas ---- 4
2.2.4 Measurement ---- 5
2.2.5 Payment ---- 5

2.3 BORROW 6
2.3.1 Description ---- 6
2.3.2 Acquisition and Use of Borrow Pits ---- 6
2.3.2.1 Borrow Pits within the Right-of-Way ---- 6
2.3.2.2 Borrow Pits Outside the Right-of-Way ---- 6
2.3.3 Construction Methods ---- 6
2.3.4 Measurement and Payment ---- 6

2.4 CHANNEL EXCAVATION ---- 7
2.4.1 Description ---- 7
2.4.2 Materials ---- 7
2.4.3 Construction Methods ---- 7
2.4.3.1 Alignment and Levels ---- 7
2.4.3.2 Excavation ---- 7
2.4.3.3 Filling of Obsolete Channels ---- 7
2.4.3.4 Unsuitable Excavated Material ---- 7
2.4.3.5 Excess Suitable Excavated Material ---- 7
2.4.4 Measurement ---- 8
2.4.5 Payment ---- 9

DIVISION 2 - EARTHWORK

2.5 EXCAVATION AND BACKFILL FOR STRUCTURES ---- 10
2.5.1 Description ---- 10
2.5.2 Materials ---- 10
2.5.2.1 Foundation Fill Material ---- 10
2.5.2.2 Backfill Material ---- 10
2.5.3 Construction Methods ---- 10
2.5.3.1 Clearing ---- 10
2.5.3.2 Excavation ---- 10
2.5.3.3 Disposal of Excavated Material ---- 11
2.5.3.4 Cofferdams ---- 11
2.5.3.5 Pumping and Bailing ---- 13
2.5.3.6 Backfilling ---- 13
2.5.4 Measurement ---- 14
2.5.5 Payment ---- 14

2.6 EMBANKMENT ---- 16
2.6.1 Description ---- 16
2.6.2 Materials ---- 16
2.6.3 Construction Methods ---- 16
2.6.3.1 Preparation of Foundations for Embankment ---- 16
2.6.3.2 Placing Embankment ---- 16
2.6.3.3 Compaction of Embankment ---- 17
2.6.4 Measurement ---- 18
2.6.5 Payment ---- 18

2.7 PREPARATION OF SUBGRADE ---- 19
2.7.1 Description ---- 19
2.7.2 Materials ---- 19
2.7.3 Construction Methods ---- 19
2.7.4 Measurement ---- 20
2.7.5 Payment ---- 20

2.8 IMPROVED SUBGRADE ---- 21
2.8.1 Description ---- 21
2.8.2 Materials ---- 21
2.8.3 Construction Methods ---- 22
2.8.3.1 Preparation of Subgrade ---- 22
2.8.3.2 Spreading ---- 22
2.8.3.3 Sprinkling, Rolling and Compacting ---- 22
2.8.4 Measurement ---- 23
2.8.5 Payment ---- 23

2.9 REMOVAL OF EXISTING STRUCTURES ---- 24
2.9.1 Description ---- 24
2.9.2 Materials Obtained from Dismantling ---- 24
2.9.3 Backfilling after Distmantling of Structures ---- 24
2.9.4 Measurement ---- 25
2.9.5 Payment ---- 25

DIVISION 2 - EARTHWORK

2.10 CONSTRUCTION OF EARTHEN SHOULDERS ---- 26
2.10.1 Description ---- 26
2.10.2 Materials ---- 26
2.10.3 Construction Methods ---- 26
2.10.3.1 Preparation ---- 26
2.10.3.2 Placing ---- 26
2.10.3.3 Compaction of Shoulders ---- 26
2.10.4 Measurement ---- 27
2.10.5 Payment ---- 27

2.11 CONSTRUCTION OF HARD SHOULDERS ---- 28
2.11.1 Description ---- 28
2.11.2 Materials ---- 28
2.11.3 Construction Methods ---- 28
2.11.3.1 Preparation of Sub-base ---- 28
2.11.3.2 Spreading Hard Shoulder ---- 28
2.11.3.3 Sprinkling, Rolling and Compacting ---- 28
2.11.3.4 Surface Tolerance ---- 29
2.11.4 Measurement ---- 29
2.11.5 Payment ---- 29

2.12 SUBGRADE DRAINS ---- 30
2.12.1 Description ---- 30
2.12.2 Materials ---- 30
2.12.3 Construction Methods ---- 30
2.12.4 Measurement ---- 31
2.12.5 Payment ---- 31

2.1 CLEARING AND GRUBBING

2.1.1 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 Specifications.

The clearing and grubbing shall in more detail consist of clearing the designated areas of all trees, down timber, vegetation, rubbish and any other objectionable materials and shall include grubbing roots and stumps and disposing of all material resulting from the clearing and grubbing. It shall also include the demolition, removal and disposal of structures that obtrude the Works except where provided for in Section 2.9.

Clearing shall be confined to the areas enclosed by the right-of-way limits. Grubbing shall be confined to areas covered by the Works.

2.1.2 Preservation of Property

Attention is directed to the Contractor's obligations under the Contract with regard to damage, particularly with regard to protection of property, gardens and landscape and to responsibility for damage claims. Existing roads, improvements, facilities, adjacent property, utilities, services and trees and plants designated for preservation shall be protected from injury or damage which could result from the Contractor's operations.

2.1.3 Construction Methods

2.1.3.1 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, brush, undergrowth, grass, crops, loose vegetable matter and structures unless provided for elsewhere. Trees and stumps shall be cut to ground level.

Clearing shall also include the removal of existing fences, remnants of buildings and courtyard pavements etc.

The roadway and adjacent areas shall be left with a neat and finished appearance. No accumulation of inflammable material shall remain on or adjacent to the right-of-way.

2.1.3.2 Grubbing

The original ground surface shall be disturbed as little as possible. Grubbing shall, therefore, be confined to major roots beneath the embankment, ditches, canal diversions and footing excavations. In these areas grubbing shall consist of the removal of all major stumps, embedded logs, tree roots and other material, except as otherwise directed by the Engineer. Holes left shall be filled with suitable material compacted to comply with Section 2.6 of the Specification with the cost of this being deemed to be included in the rate for grubbing. Topsoil shall be removed as agreed with the Engineer and will be measured as roadway excavation. Grubbing beneath the embankment shall be at the direction of the Engineer.

In agricultural areas where the ground has been formed into ridges or dikes, the ground shall be roughly levelled or graded to form a surface suitable for embankment foundation to the satisfaction of the Engineer.

2.1.3.3 Ownership of Cleared Material

All cleared material shall, unless otherwise provided for in the Contract, be the property of the Employer. Materials shall be stockpiled, or placed, by the contractor on site in a location agreed by the Engineer.

2.1.3.4 Existing Drainage

Existing ditches, drainage channels etc., shall be closed at the embankment foundation boundary except where pipes or other structures are prescribed. Disused drains below embankments shall be removed and trenches filled in accordance with Section 2.4.

The Contractor is responsible for undertaking any provisional drainage measures, including temporary watercourses and ditches, which may be necessary.

2.1.4 Measurement

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.

2.1.5 Payment

Clearing and grubbing will be paid by area. The payment shall be full compensation for furnishing all labour, materials, tools, equipment and incidentals necessary for the clearing and grubbing the designated areas as specified in these Specifications or as directed by the Engineer including the removal and disposal of all resulting material.

Pay item shall be:

2/1/1 Clearing and Grubbing Square Metre

2.2 ROADWAY EXCAVATION

2.2.1 Description

The work shall consist of all the required excavation within the limits of the right of way unless covered by other Sections of these Specifications. This shall include excavation of side ditches, where required, the removal, hauling and proper utilisation 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 sections shown on the Drawings or as required by the Engineer. The works specified shall also include operations in part widths and small areas of roadway where directed by the Engineer without any extra cost to the Employer.

Roadway excavation shall include the following:

a) All excavation indicated on the Drawings within the limits of the cross sections and excavation of all materials for side roads and intersections.

b) The removal of existing pavement, sidewalks, kerbs and gutters within the limits of construction.

c) Excavation for stream and channel changes where not covered under Section 2.4, Channel Excavation.

d) Excavation required in cuts under embankments below the lowest normal limit of excavation indicated on the Drawings or below ground line and for the removal of unsuitable material.

Where the existing pavement and/or shoulders are ordered to be scarified and recompacted, this work shall be carried out and paid for in accordance with the provisions of Section 3.1.3.

2.2.2 Materials

Materials from roadway excavations shall be classified as suitable or unsuitable as fill material, or as road pavement material, by the Engineer. To be suitable as fill material, soil must not contain roots, sods or other deleterious materials and must conform to the requirements of Section 2.6.2.

Material excavated from existing road pavements which are to be reconstructed may be used in the new road pavement provided the material after suitable breaking and mixing satisfies all requirements of these Specifications.

The existing pavement materials which will include, but not be restricted to bituminous surfacing, bricks and brick materials, stone, concrete and concrete materials, need not in themselves comply fully with the Specifications for the intended use but should be of such quality to allow the Specifications to be met after breaking, processing and if necessary mixing with better quality materials. Existing pavement materials containing an excess of clay, soil or organic material will not normally be considered suitable for reuse in the new pavement. Fine sands which may be found under some pavements shall not be considered as part of the road pavement but shall be classed as material suitable for use as fill.

Deduction of the value of excavated pavement material under Pay item No. 2/2/6 shall not qualify it as suitable for reuse in the Works. Acceptability of the material (after processing as the case may be) shall be determined by the Engineer and only such material shall be permitted for incorporation in the permanent works that fully satisfies these Specifications in all respect.

2.2.3 Construction Methods

2.2.3.1 General

All roadway excavation and embankment construction shall be performed as specified here and in Section 2.6 (Embankment), and the excavation as well as the completed roadway shall conform to the required alignments, levels, grades and cross sections. Prior to the commencement of any work, cross sections and measurements should be taken of the undisturbed roadway. Excavated material shall be deposited so as not to cause damage to services or property and so as to cause no impediment to the drainage of the site or surrounding area.

2.2.3.2 Excavated Material Used in the Works

Suitable soil from the roadway excavation shall be used so far, as is practicable as fill or top soil material.

Suitable excavated material, if it is to be reused for the Works, shall be temporarily stockpiled in suitable and safe areas approved by the Engineer and properly protected from any damage or loss.

2.2.3.3 Unsuitable Material from Roadway Excavation

Excavated material classified as unsuitable as fill material and excavated road pavement material not approved by the Engineer for use in the new road pavement shall be known as waste. It shall be the property of the Employer. The Contractor shall stockpile, or place the material in a location approved by the Engineer.

2.2.3.4 Excess Suitable Excavated Material

Suitable material from approved roadway excavation which is in excess of that required for construction of any part of the Works shall be the property of the Contractor, and it may be shifted/disposed of by the contractor with prior intimation to the Engineer.

2.2.3.5 Excavation of Unsuitable Soil

Unsuitable soil shall be excavated below subgrade level in cut and below embankment foundation level to the depth shown on the Drawings or as directed by the Engineer. The excavation shall be backfilled in accordance with Section 2.6 of the Specifications where unsuitable soil is excavated below the normal subgrade level or below embankment foundations or for benching under embankments.

2.2.3.6 Slopes

All slopes shall be finished in a neat and workmanlike manner as shown in the drawings or as directed by the Engineer and to an accuracy appropriate to the material, and care shall be taken that no material is loosened below the required slopes.

2.2.3.7 Drainage

During construction, the roadbed and ditches shall be maintained in such condition as to ensure proper drainage at all times.

Any ditches and channels temporarily required shall be constructed and maintained as to avoid damage to the roadway section.

2.2.3.8 Preparation of Excavated Areas

The surfaces of all excavated areas shall be neat and workmanlike and shall have the required forms, superelevations, levels, grades and cross sections. The surfaces shall be constructed to the required accuracy to permit the construction of subsequent layers of material as specified in Section 2.6 and other Sections of these Specifications. The surface tolerance shall be ±25 mm from the specified levels at any point.

2.2.4 Measurement

All required and accepted roadway excavation including excavation of suitable soil, unsuitable soil and existing road pavement shall be measured separately in cubic metres by the average end area method as computed from the initial (prior to excavation) and final (post excavation) roadway cross sections. For the purpose of measurement all the material except structures and pavement materials shall be considered as soil.

Preparation of excavated areas will not be measured and paid for separately as this is deemed to be included in the excavation work. Measured roadway excavation shall include removal of slides, breakages and cave-ins except where caused by carelessness or improper methods of the Contractor.

2.2.5 Payment

The quantities of roadway excavation in pavement, suitable soil and unsuitable soil measured as specified above will be paid for at the respective unit price per cubic metre under the Contract. The price shall include all labour, materials, tools, equipment and incidentals to complete the work of excavation and stockpiling or disposal at locations approved by the Engineer, including shaping and preparation of all excavated surfaces and working in small areas if necessary.

The value of suitable soil recovered from Roadway excavation shall be deducted from payments due to the Contractor. It shall be determined by multiplying the total quantity of suitable soil measured in accordance with Section 2.2.4 by the rate inserted by the Contractor against pay item 2/2/5. No consideration shall be given to weather the whole quantity of recovered suitable soil could be reused or not in the Works.

The value of the recovered pavement material shall also be deducted from payments due to the Contractor. It shall be determined from the total quantity of pavement material measured in accordance with Section 2.2.4, multiplied by the rate inserted by the Contractor against pay item 2/2/6. No consideration shall be given to weather the whole quantity of excavated pavement material was determined suitable or not by the Engineer, and also to weather it could be reused in the works or not.

The measured quantity of recovered pavement material or suitable soil shall include no allowance for losses during excavating, transporting, mixing, stockpiling, processing and compaction or for pilferage for the purpose valuation of respective deduction amount.

The pay items in this section of the specifications for roadway excavation shall be full compensation for all work involved in performing the roadway excavation as shown on the drawings and as directed by the engineer, including the cost of temporary stockpiling, selecting and protecting the materials to be reused and the cost of disposal of unsuitable/excess suitable material.

Pay items shall be:

2/2/1	Roadway Excavation in Unsuitable Soil including stockpiling or disposal in a location agreed by Engineer.	Cubic Metre
2/2/2	Roadway Excavation in Suitable Soil including stockpiling on Site	Cubic Metre
2/2/3	Roadway Excavation in Existing Pavement (Bituminous, Brick, Stone, Unreinforced Concrete and other Materials Except Reinforced Concrete).	Cubic Metre
2/2/4	Roadway Excavation in Existing Reinforced Concrete Pavement	Cubic Metre
2/2/5	Deduction for Value[1] of Suitable Soil Recovered from Existing Road.	Cubic Metre
2/2/6	Deduction for Value[2] of Pavement Materials Recovered from Existing Road.	Cubic Metre

Note:

1. Quantity for item no. 2/2/5 shall be taken equal to that of item no. 2/2/2.
2. Quantity for item no. 2/2/6 shall be taken equal to that of item no. 2/2/3.

2.3 BORROW

2.3.1 Description

This work shall consist of the clearing and stripping of borrow pits, the excavation and hauling of materials obtained from approved sources using the material from borrow pits for constructing embankment, backfill, subgrade, shoulders and other parts of the work as required under the Contract or by the Engineer.

This Section applies to borrow whether from borrow pits within or outside the right-of-way.

2.3.2 Acquisition and Use of Borrow Pits

2.3.2.1 Borrow Pits within the Right-of-Way

The use, depth, location, and dimensions of borrow pits within the right-of-way shall be subject to the approval of the Engineer. The Contractor will be deemed to have satisfied himself before entering into the Contract as to the use of borrow pits within the right-of-way and to have allowed in the rates for the risk of borrow pits not being permitted in areas of uncertainty. Notwithstanding any general advice given by the Employer or the Engineer before the submission of tenders, borrow pits may be prohibited, or restricted in dimensions and depth by the Engineer where:

a) They might affect the stability or safety of the highway, the railway or structures.

b) They might interfere with natural or artificial drainage or irrigation.

c) They might interfere with adjoining property or future expansion plans for the highway.

2.3.2.2 Borrow Pits Outside the Right-of-Way

The Contractor may open borrow pits outside the right-of-way and in such cases the Contractor shall be fully and solely responsible for the expenses incurred and any legal consequences.

2.3.3 Construction Methods

All suitable materials removed from borrow sources shall be used as indicated on the Drawings or as directed by the Engineer. During construction the borrow pits shall be kept drained as far as practicable and the work shall be carried out in a neat and workmanlike manner.

Sites of the borrow operations shall be left in a suitable and sightly condition such as to provide proper drainage where practicable.

2.3.4 Measurement and Payment

No payment will be made to the Contractor for borrow and as such it shall not be measured. Payment under the items of the work in which the borrow material is placed shall be full compensation for all the necessary tasks and activities to acquire, to provide and place the material.

2.4 CHANNEL EXCAVATION

2.4.1 Description

This work shall consist of excavation for channels for discharging water from side ditches where shown on the Drawings, required in the Specifications or as directed by the Engineer. The work shall include the proper utilisation and hauling or disposal of all excavated materials, and constructing, shaping and finishing of all earthworks.

2.4.2 Materials

Excavated materials shall be classified as unsuitable and suitable soil. To be suitable as fill material the soil must not contain muck, roots, sods or other deleterious materials and must conform to the requirements of Section 2.6.2.

2.4.3 Construction Methods

2.4.3.1 Alignment and Levels

Channel work shall be constructed in a neat and workmanlike manner correct to alignments, levels, grades and cross sections required on the Drawings, in the Specifications or by the Engineer.

2.4.3.2 Excavation

Deepening and realignment of existing canals and channels shall be carried out in a way to allow free flow of the water.

During excavation of new channels these shall as far as possible be kept drained.

All suitable materials removed from the excavation shall be used as far as practicable in constructing the roadway.

2.4.3.3 Filling of Obsolete Channels

Any obsolete canals and channels within the embankment area shall be cleaned up and back filled with sand to obtain sufficient stability. When sand fill is at a level of 500 mm above water level, compaction shall be carried out as specified in Section 2.6.

2.4.3.4 Unsuitable Excavated Material

Excavated material from channel excavations classified as unsuitable as fill material by the Engineer shall be known as waste. The Contractor, shall stockpile, or place the material in a location approved by the Engineer.

2.4.3.5 Excess Suitable Excavated Material

Suitable material from channel excavation, which is in excess of that, required for construction of any part of the Works shall be the property of the Employer and shall be stockpiled on Site as instructed by the Engineer.

2.4.4 Measurement

Payment for backfilling existing channels shall be in accordance with Section 2.6.

Quantities of channel excavation in unsuitable material shall be measured in cubic metres determined by average end area methods computed from the original and final geometric cross sections of the authorised and completed excavation.

Excavation of channel in suitable material shall not be measured for direct payment. The cost shall be deemed to be included in the rates for the items of the Works in which the excavated material is placed. The exception to this is excess suitable material which is stockpiled on Site.

Measured channel excavation shall include for the removal of any slides and cave-ins which occur in channels except where these have been caused by carelessness or the use of improper methods by the Contractor.

2.4.5 Payment

This work measured as provided above shall be paid for at the Contract unit price per cubic metre. The payment shall be full compensation for all excavation, for maintaining free flow in the channel where necessary and for all labour materials, tools, equipment and incidentals necessary to complete the work, including stockpiling or disposal off Site.

Channel excavation of material which is suitable for embankment fill shall not be paid for separately but shall be paid for at the rate for fill from land as provided for in Section 2.6.

Pay items shall be:

2/4/1	Channel Excavation in Unsuitable Material	Cubic Metre
2/4/2	Channel Excavation in Suitable Material including stockpiling on Site (applies to Excess Suitable Excavated Material only)	Cubic Metre

2.5 EXCAVATION AND BACKFILL FOR STRUCTURES

2.5.1 Description

This work shall consist of excavation in any material for the foundation of structures, other than for pipe culverts, not otherwise provided for in the Specifications; constructing and removing cofferdams, sheeting; pumping, dewatering and bailing; backfilling of completed structures with suitable material and disposal of excavated material. Pipes and manholes shall be excavated and backfilled in accordance with Sections 6.2 and 6.3.

Filling of areas above the natural ground level or above the limits of road excavation or channel excavation is described in Section 2.6.

2.5.2 Materials

2.5.2.1 Foundation Fill Material

Material for foundation fill shall consist of suitably graded sand to one of the grading envelopes A to C of Section 2.8.2, gravel or stone as shown on the Drawings or as required by the Engineer, or concrete. Concrete for foundation fill shall conform to the general requirements of Section 5.1. Concrete to be placed under water shall conform to the requirements of Section 5.1.3.14. Concrete used as foundation fill in dry excavation shall be class 15.

2.5.2.2 Backfill Material

Backfill materials below top level of pile caps shall consist of sand with not more than 10% of material passing the 75 micron sieve, if not otherwise directed by the Engineer or stated on the Drawings.

Backfill above top level of pile caps but outside embankment and road areas shall be excavated material if suitable and approved by the Engineer.

2.5.3 Construction Methods

2.5.3.1 Clearing

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

2.5.3.2 Excavation

A) General

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

Trenches and foundation pits for structures and structure footings shall be excavated to the lines, grades and elevations shown on the Drawings or as directed by the Engineer. The elevations of the bottoms of footings shown on the Drawings 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.

Boulders, logs and other objectionable material encountered in excavation shall be removed. After each excavation is complete the Contractor shall notify the Engineer to that effect and no footings, bedding material or structure shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

The foundation material shall be cleared of all loose material and cut to a firm surface, either level or stepped or serrated, as specified or shown on the Drawings or directed by the Engineer.

B) Foundation Directly on the Ground

When the footing is to rest on the ground and not on piles, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall be deferred until just before the footing is to be placed. When, in the opinion of the Engineer, the foundation material is soft or otherwise unsuitable, the Contractor shall remove the unsuitable material and insert foundation fill material or concrete as specified or shown on the Drawings or directed by the Engineer. If foundation fill material is required, it shall be placed and compacted in layers not more than 150 mm thick to the degree of compaction as specified in Section 2.6.

C) Foundation on Piles

When the ground between piles is too soft to support green foundation concrete, the Contractor shall submit his proposals for a bottom form to the Engineer for his approval. Extra excavation and foundation fill or concrete fill in such cases will not be paid for separately.

If the bottom form is achieved by such strengthening of the ground, the Contractor shall, if requested, submit calculations showing that the pile cap will not be harmed during hardening due to differential settlements between the piles and the strengthened ground.

2.5.3.3 Disposal of Excavated Material

Excavated material classified as suitable by the Engineer shall generally be utilised as backfill or embankment fill. Surplus suitable material shall be stockpiled on Site as described in Section 2.2.3.4 of these Specifications. Excavated suitable material for use as backfill shall be deposited by the Contractor in spoil heaps at points convenient for re-handling of the material during the backfilling operation and approved by the Engineer.

Excavated material classified as unsuitable as backfill by the Engineer shall be carried to waste as described in Section 2.2.3.3 of these Specifications.

Excavated material shall be deposited in such places and in such a manner as not to cause damage to roads, services or property either within or outside the right-of-way and so as to cause no impediment to the drainage of the site or surrounding area. The location of spoil heaps shall be subject to the approval of the Engineer who may require that the reference lines and the traverse lines of any part of the structure be kept free of obstruction.

2.5.3.4 Cofferdams

A) The term "cofferdam" denotes any temporary or removable structure, constructed to hold the surrounding earth, water or both, out of the excavation, whether such structure is constructed of earth, timber, steel, concrete or any combination of these. The term includes earth dikes, timber cribs, sheet piling, removable steel shells and all bracing; and it shall be understood to include excavation enclosed by pumping wells and well points.

The cost of cofferdams is always to be included in the tender rates/prices for the permanent work.

B) The term "caisson" denotes a permanent part of the substructure so constructed as to sink gradually into place as material is excavated within the area protected by its side walls. Where the term "well" is used it shall be taken to have the same meaning as "caisson".

C) When no provision for caissons is shown on the Drawings, it shall be the intent of the Contract that suitable cofferdams shall be provided for all excavations where cofferdams may be necessary in order to control water to preclude sliding and caving of the walls of the excavation.

D) The Contractor shall submit upon request, drawings showing his proposed method of cofferdam and caisson construction. Approval of the drawings by the Engineer will not in any way relieve the Contractor of the responsibility for the adequacy of the design for strength and stability or for the safety of the people working therein.

E) The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction and removal of any required forms and the inspection of the interior and to permit pumping.

F) If possible, cofferdams shall be so designed that no cross bracing shall be left in place. If this is not possible, bracings left in place shall be of structural steel. The end of such structural members that would be exposed when the structure is completed shall be boxed back at least 50 mm behind the concrete face. The resulting holes shall be completely filled with concrete.

G) In general, sheet piling cofferdams shall extend well below the bottom of the footing and shall be well braced and as watertight as possible.

H) When foundation piles are to be driven inside a cofferdam and it is judged impossible to de-water the cofferdam before placing a concrete seal, the excavation may be extended below the designed level to a depth sufficient to allow for swell of the material during pile driving operations. Any material that rises to a level above the design level shall be removed.

I) Where it is possible to de-water the cofferdam, the foundation material shall be removed to exact grade after the foundation piles are driven.

J) Backfilling in a foundation to compensate for excavation, which has been extended below the required grade, shall be at the expense of the Contractor. Backfilling shall be with concrete or foundation fill material as indicated on the Drawings, or as directed by the Engineer.

If no material is indicated, backfilling shall be concrete of the same kind as required for the structure to be constructed in the excavation. Unless otherwise permitted no excavation shall be made outside of caissons or cribs or cofferdams or sheet piling and the natural streambed adjacent to the structure shall not be disturbed without permission from the Engineer.
If any excavation or dredging is made at the site of the structure before caissons, cribs, or cofferdams are in place, the Contractor shall after the foundation is in place, backfill all such excavation to the original ground surface or stream bed with material satisfactory to the Engineer.

Material deposited within the stream area from foundations or other excavations or from the filling of cofferdams shall be removed and the stream area freed from obstruction.

K) Caissons and cofferdams, which have tilted or moved laterally during construction, shall be corrected as necessary at the expense of the Contractor.

L) Unless otherwise provided cofferdams shall be removed after the completion of the sub-structure. The removal shall be effected in such a manner as not to disturb or mar the finished work. The Engineer may order the Contractor to leave any part or the whole of the cofferdam in place.

M) When conditions which, in the opinion of the Engineer, render it impossible to de-water the foundation before placing the footing are encountered, the Engineer may require the construction of a concrete foundation or seal of such dimensions as he may consider necessary, and of such thickness as to resist any possible uplift. The concrete for such seal shall be placed as shown on the Drawings or required by the Engineer. The foundation shall then be de-watered and the footing placed. When weighted cribs are used and the weight is used to overcome partially the hydrostatic pressure acting against the bottom of the foundation seal, special anchorages such as dowels or keys shall be provided to transfer the entire weight of the crib to the foundation seal. When a foundation seal is placed under water the cofferdam shall be vented at low water as directed.

Cofferdams shall be constructed so as to protect newly cast concrete from sudden rising of the water and to prevent damage to the foundation by erosion.

2.5.3.5 Pumping and Bailing

Pumping and bailing 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 or alongside any concrete being placed. No pumping or bailing will be permitted during the placing of concrete and for a period of a least 24 hours thereafter unless it is done from a suitable pump separated from the concrete work by a watertight wall or from well points.

Excavations shall be as dry as possible prior to and during placing concrete. Placing concrete under water will only be permitted if indicated on the Drawings or approved by the Engineer.

2.5.3.6 Backfilling

All spaces excavated under these Specifications and not occupied by the permanent structure shall be backfilled. Backfilled material shall fully comply with this Specification and adequate provision shall be made for drainage. No backfilling shall commence until permission has been given by the Engineer.

Backfill under top level of pile caps shall always be made with compacted sand fill free from chemical contamination. Over top level of the pile cap but outside embankment and road areas, the backfill shall be excavated material if suitable and free from chemical contamination, and approved by the Engineer. If the excavated material is not suitable, the Engineer may order sand filling.

Backfill within the embankment and road areas shall be made in accordance with Section 2.6 of these Specifications.

Special care shall be taken to prevent any unduly high pressure against the structures. In placing backfill and embankment, the material shall be placed insofar as possible to approximately the same height on both sides of the structure at the same time. If conditions require backfilling appreciably higher on one side, the additional material on the higher side shall not be placed until permission is given by the Engineer that the structure has enough strength to withstand any pressure created.

Jetting of fill or other hydraulic methods involving, or likely to involve, liquid or semi-liquid pressure is prohibited. Backfill and embankment fill shall not be placed behind the walls of bridges or box culverts until the top slab has been placed for at least three days.

The placing of embankment and the benching of slopes shall continue in such a manner that at all times there will be a horizontal berm of thoroughly compacted material for a distance at least equal to the height of the abutment or wall to be backfilled.

2.5.4 Measurement

The volume of excavation and backfill shall be measured in cubic metres of excavated undisturbed material.

The quantity of excavation for structures to be measured for payment shall include excavation for all structures except pipe culverts, which will be in accordance with Section 6.2. The measured volume shall be the excavation plan outline, bounded on the bottom by the plane of the underside of the brick flat soling to the blinding concrete under the reinforced concrete footing and on the top by the surface of the existing ground and on the sides by vertical planes of the footings.

Backfilling with previously excavated material shall not be measured or paid for separately but shall be deemed included in the rate for excavation.

Backfill with concrete or sand where directed by the Engineer including concrete seals shall be measured separately as the volume within the plan outline and top and bottom surfaces. Concrete or sand placed to backfill excavation beyond the excavation required will not be measured for payment. The plan outline referred to is the excavation plan outline as defined above.

If sand fill is ordered over top level of pile cap, the fill shall be the specified filling volume measured on the Drawings up to profiles agreed upon in writing by the Engineer.

In the case of structures for which a lump sum price is called for, the volume of excavation as stated above for the work as shown on the Contract Drawings, shall be subtracted from the volume measured as above, and the price to be paid or deducted shall be based on the measured increase or reduction of the excavation shown on the Drawings.

Removal of slides, cave-ins, silting or filling shall not be measured nor paid for.

2.5.5 Payment

This work measured as provided in Section 2.5.4 shall be paid for at the Contract unit prices per cubic metre for each particular item. The payment shall be full compensation for all excavation, stockpiling, backfilling and disposal including compaction; constructing and removing all cofferdams; all dewatering, pumping and bailing; and for furnishing all materials, labour, equipment, tools, sheeting, bracing, cofferdams, pumps, and incidentals necessary to complete the work.

Should it be necessary, in the opinion of the Engineer, to lower the footings to an elevation below the level shown on the Drawings, payment for the "Excavation and Backfill for Structures" required below plan level down to and including an elevation 1.5 metres below plan level for any individual footing will be made at a unit price equal to 115% of the Contract unit tender price. Payment for the excavation from an elevation greater than 1.5 metres below plan level down to and including an elevation 3 metres below plan level will be made at a unit price equal to 125% of the Contract unit tender price for "Excavation and Backfill for Structures". No additional extra compensation will

be allowed for any required cofferdam adjustments made necessary by such lowering of footings.

In case where the extra depth required for any footing or footings exceeds 3 metres, a supplementary agreement shall be made covering the quantities removed from depths in excess of 3 metres below plan grade.

Payment for backfilling shall be included in the pay item for "Excavation and Backfill for Structures" except for sand backfill and concrete backfill. These backfill types shall be measured as provided in Section 2.5.4 and paid for at the concerned Contract unit prices, but no compensation in the pay item "Excavation and Backfill for Structures" shall be made for less backfilling with excavated material or more surplus to waste.

All payment for the backfilling and compaction of those areas which were removed, as structural excavation shall be included in the appropriate unit rates below. Filling or backfilling of areas above the natural ground level or above the limits of road excavation or channel excavation section shall be paid for under Section 2.6.

Cofferdams for structures without excavation, for example for pile caps over water shall be deemed to be included in the unit prices for the concerned pile cap.

Pay items shall be:

2/5/1	Excavation and Backfill for Structures	Cubic Metre
2/5/2	Concrete Backfill for Structures	Cubic Metre
2/5/3	Sand Backfill for Structures	Cubic Metre

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2.6 EMBANKMENT

2.6.1 Description

This work shall consist of the construction of embankment and fill by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from approved sources in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

2.6.2 Materials

All fill materials shall be free from roots, sods or other deleterious material.

Materials for embankments shall be from sources which the Contractor shall propose and which shall be approved by the Engineer. Approval shall normally be given to the use of material which, when compacted to 98% of maximum dry density determined in accordance with STP 4.3 has a 4 day soaked CBR value of not less than 4%.

- Liquid limit of soil fraction passing 0.425 mm sieve not to exceed 50% (STP 3.2)
- Plasticity index of soil fraction passing 0.425 mm sieve not to exceed 25% (STP 3.2)

2.6.3 Construction Methods

2.6.3.1 Preparation of Foundations for Embankment

Prior to placing any embankment upon any area, all clearing and grubbing operations shall have been completed in accordance with Section 2.1 and excavation under carriageways shall be carried out in accordance with Section 2.2.

The original ground surface shall be disturbed as little as possible except for levelling of dikes, terraces and obsolete ditches.

Existing ditches etc., shall be closed at the embankment as described in Section 2.1.3.5. Embankments in swamps or water shall be constructed as indicated on the Drawings and as described in these Specifications. The Contractor shall, when ordered by the Engineer, excavate or displace swamp ground (Section 2.2.3.5) and backfill with river or beach sand unless otherwise directed by the Engineer.

2.6.3.2 Placing Embankment

A) General

Except as otherwise required by the Drawings, all embankments shall be constructed in layers approximately parallel to the finished grade of the roadbed. During construction of embankment, a smooth grade having an adequate crown shall be maintained at all times to provide drainage.

The placing of fill shall be carried out in successive layers for the full width of fill as shown on the Drawings with allowance being made for the placement of topsoil if applicable and in such lengths as are suited to the watering and compaction methods utilised. Each layer shall not exceed 150 mm in thickness on completion of compaction. The completed embankment shall have the required form, cross-section, grade and levels as detailed on the drawings or as directed by the Engineer with a surface tolerance of ±25mm from the specified levels.

Embankment fill placed adjacent to structures shall be in accordance with Section 2.5.3.6.

B) Placing Embankment over Swampy Ground

Where new embankment will overlay existing canals, ditches, ponds or other waterways, these shall be filled in exclusively with sand in accordance with Section 2.4.3.3. Prior to filling, cofferdams shall be made to allow pumping, and the bed shall be left to dry until approved by the Engineer for filling.

The Works shall be performed in such a manner and at such times as to avoid interruption of or interference with the free flow of water in the canals.

Full compensation for conforming to these requirements shall be considered included in other rates within the Contract items, and no additional payment will be made.

C) Widening of Existing Embankment

Where embankment fill is being carried out to widen an existing embankment the new fill material shall be fully keyed into the old embankment by means of benching which shall be in steps each not less than 300 mm high and 600 mm wide. Steps shall be cut in advance of the filling. Material cut in benches may be used as fill if found to be suitable.

2.6.3.3 Compaction of Embankment.

The moisture content of the fill materials before compaction shall be within ±2% of the optimum moisture content as determined in accordance with STP 4.3(Standard Compaction). The achieved dry density of the embankment after compaction shall not be less than 98% of maximum dry density determined earlier in accordance with STP 4.3.

One density test for each 1,000 square metres of a completed layer will be carried out according to STP 6.2, unless otherwise directed by the Engineer. If test results show that the density is less than the required density, the Contractor shall carry out further compaction to obtain at least the required density. The compacted layer shall be approved by the Engineer before the Contractor can commence a new layer.

In addition to the density test, one Dynamic Cone Penetrometer (DCP) test shall be carried out for each 500 sqm of a completed layer; the rate of penetration from the test should not exceed 38 mm/ blow.

When necessary, each layer, before being compacted, shall be mixed with dry material or otherwise processed to bring the moisture content sufficiently close to optimum to make possible its compaction to the required density. The material shall be so worked as to have a uniform moisture content through the entire layer.

Each layer of material shall be compacted uniformly by use of adequate and appropriate compaction equipment. The compaction shall be done in a longitudinal direction along the embankment and shall generally begin at the outer edges and progress toward the centre in such a manner that each section receives equal compactive effort.

Hauling equipment shall be operated over the full width of each layer in so far as practicable.

2.6.4 Measurement

Embankment shall be measured in cubic metres based on cross sections of accepted embankment constructed and completed in accordance with the Specifications, to the lines, levels and grades required or as directed by the Engineer.

The cross section to be used will be the area bound by the subgrade (below improved subgrade or sub-base) the side slopes or edge limits and the original ground line or the level after excavation of unsuitable material with the net volume being calculated by the End area method. A deduction of volume will occur when topsoil is placed in accordance with Section 6.6 of this Specification.

No allowance will be made for material cut in benching operations.

The final volume of embankment fill shall not include the voids for bridges and box-culverts, but the voids for pipes, manholes, catch basins and the like will however not be deducted.

Sand backfill to swampy ground shall be measured in cubic metres based on the net volumes backfilled as directed by the Engineer.

2.6.5 Payment

This work measured as provided above shall be paid for at the Contract unit prices per cubic metre. Payment shall be full compensation for performing the work, furnishing the materials and providing all labour, equipment, tools and incidentals necessary to complete the work.

Partial payment may be made on measured volumes of required embankment fill actually executed. The Engineer will set terms for deduction in this quantity to compensate for work not fully completed.

Pay items shall be:

2/6/1(a)	Embankment Fill from Excavation on Site	Cubic Metre
2/6/1(b)	Embankment Fill from Excavation in Borrow Pit within the Right-of-Way	Cubic Metre
2/6/2	Embankment Fill from Borrow Pit in Contractor's Arranged Land	Cubic Metre
2/6/3	Sand Backfill to Swamp	Cubic Metre

2.7 PREPARATION OF SUBGRADE

2.7.1 Description

This work shall consist of the preparation of subgrade in embankment, or in cut by removing, scarifying, watering, compacting and shaping existing or previously placed material in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

2.7.2 Materials

All subgrade material shall be from sources, which the contractor shall propose and which shall be approved by the Engineer. The material shall be free from roots, sods or other deleterious material and when compacted to 95% of maximum dry density determined in accordance with STP 4.4 shall have a 4 day soaked CBR value of not less than 6%.

Subgrade material shall satisfy the following criteria:

- Liquid limit of soil fraction passing 0.425 mm sieve not to exceed 50% (STP 3.2)
- Plasticity index of soil fraction passing 0.425 mm sieve not to exceed 15% (STP 3.2)

Any subgrade material in cut or existing old embankment, which is found to be unsuitable, shall be removed and replaced as directed by the Engineer.

2.7.3 Construction Methods

The subgrade shall be prepared over the full width of the embankment including shoulders. Part width working may be allowed with the prior written approval of the Engineer.

The subgrade shall be prepared in lengths of not less than 100 metres at any one time, unless otherwise approved by the Engineer.

Where the subgrade is in embankment, the subgrade layers to the required depth shall be compacted to achieve dry density not be less than 95% of maximum dry density (MDD) determined earlier in accordance with Modified Proctor Test (STP 4.4).

In the case of road sections in cut or in case of full reconstruction of pavements, where the existing subgrade does not meet the above compaction criteria upto a depth of 300 mm, the material in the upper layer will be first removed and stacked separately. The bottom layer shall be scarified until the soil is fully loosened; any lumps or clods shall be removed or broken to pass 50 mm sieve. The layer shall be brought to optimum moisture content (OMC) and then compacted so as to achieve the minimum compaction level as given above, and minimum CBR of 6%. Any unsuitable material occurring within the layers shall be removed and replaced by approved materials. The second layer of subgrade shall be laid after testing and approval the first layer and compacted to similar specifications.

The moisture content of the sub-grade material before compaction shall be within ±2% of the predetermined optimum moisture content established in accordance with STP 4.3 (Standard Compaction). The achieved dry density after compaction of the subgrade layer shall not be less than 98% of maximum dry density as determined in accordance with STP 4.3.

When necessary, each layer, before being compacted, shall be allowed to dry or be watered to bring the moisture content to within ±2% of optimum to make possible its compaction to the required dry density. The material shall be so worked as to have a uniform moisture content through the entire layer.

The subgrade material shall be compacted uniformly by use of adequate and appropriate compaction equipment. The compaction shall be done in a longitudinal direction along the embankment and shall generally begin at the outer edges and progress toward the centre in such a manner that each section receives equal compactive effort.

Samples to determine the compaction shall be taken regularly with a set of three samples for each 1,000 square metres of finished layer or as decided by the Engineer will be carried out according to STP 6.2. If the test results show that the density is less than the required dry density, the Contractor shall carry out further compaction to obtain at least the required dry density. In addition to the density test, one Dynamic Cone Penetrometer (DCP) test shall be carried out for each 500 sqm of a completed layer; the rate of penetration from the test should not exceed 28 mm/ blow. The compacted subgrade layer shall be approved by the Engineer before the Contractor can commence a new layer.

The surface of the finished subgrade shall be neat and workmanlike and have the required form, super elevation, levels, grades and cross section. The finished surface shall be constructed with a tolerance of 20 mm above or below the specified levels at any point.

2.7.4 Measurement

Subgrade preparation shall be measured in square metres based on the surface area of compacted and accepted subgrade actually completed in accordance with the Specifications, to the lines, levels, grades and cross sections required as directed by the Engineer. No allowance will be made for overlapping of areas due to half width working.

No differentiation will be made between subgrade compaction in cut or in fill.

2.7.5 Payment

This work measured as provided above shall be paid for at the Contract unit prices per square metre. Payment shall be full compensation for performing the work and providing all labour, equipment, tools and incidentals necessary to complete the work.

The rates shall not include the cost of furnishing the subgrade materials which, if not existing, shall be included in the quantity for fill material as provided for in Section 2.6.

Pay item shall be:

2/7/1	Preparation of subgrade 300 mm Depth	Square Metre
2/7/2	Preparation of subgrade 450 mm Depth Metre	Square Metre 2.8

2.8 IMPROVED SUBGRADE

2.8.1 Description

This work shall consist of furnishing, placing and compacting improved subgrade material on a prepared and accepted subgrade in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections shown on the Drawings, or as required by the Engineer.

2.8.2 Materials

Material shall be a natural or artificial mixture of sand or other mineral aggregates, free from vegetable matter, soft particles, clay and excess quantities of silt.

Grading: The grading (washed method) shall conform to one of the grading envelopes A to C in Table 2.8-1. If the material meeting these grading is not locally available then grading-D may be used with the permission of Engineer. Material with the grading-E shall not be allowed to be used under this item.

Table 2.8-1

	A	B	C	D	E
Nominal fineness modulus	Not less than 2.8	1.5 - 2.8	1.0 - 1.5	0.8 - 1.0	0.5 - 0.8
Sieve size (mm)	% passing by weight				
10	100	100	100	100	100
5.0	90 – 95	95 - 100	100	100	100
2.4	70 – 90	90 - 100	100	100	100
1.2	45 – 70	70 - 95	95 - 100	100	100
0.6	25 – 45	40 - 80	85 - 100	95 - 100	100
0.3	10 – 20	10 - 50	50 - 80	70 - 90	80 - 95
0.15	0 – 2	0 - 20	5 - 25	15 - 40	30 - 60

Gradings outside the above limits may in certain circumstances be approved by the Engineer. Such permission shall be in writing.

b) Plasticity. The portion of material passing the 0.425 mm sieve shall be non-plastic, when tested in accordance with test procedure STP 3.2."

c) CBR. The material shall have a soaked CBR value not less than 8% when compacted to 95% of maximum dry density as determined by STP 4.5 (Vibrating Hammer compaction).

d) The material shall be free draining. Suitable measures shall be taken for protecting the material from erosion, with necessary arrangement to drain out the water from subgrade.

2.8.3 Construction Methods

2.8.3.1 Preparation of Subgrade

The subgrade shall be shaped and compacted in conformity with the provisions of Section 2.7 and completed along with all subgrade drainage ahead of the placing of the improved subgrade material. Notwithstanding any earlier approval of subgrade, any damage to or deterioration of subgrade shall be made good before the improved subgrade is laid.

Preparation of the subgrade shall be carried out, unless otherwise agreed by the Engineer, immediately prior to laying the improved subgrade.

2.8.3.2 Spreading

Improved subgrade shall be spread in layers, with uncompacted thickness up to 200 mm, subject to the approval of the Engineer, and the layers shall be as nearly equal in thickness as possible.

Where the material for shoulders is the same as that used for the improved subgrade course, the material shall be placed for the full width of the roadbed and the shoulders simultaneously.

Where the shoulders are not of the same material as the improved subgrade course, then the improved subgrade shall be spread to give the required compacted depth and the edge detail shown on the Drawings.

When the improved subgrade 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 gutters at the Contractor's sole expense.

2.8.3.3 Sprinkling, Rolling and Compacting

Each layer shall be compacted to at least 95% of the maximum dry density as determined by STP 4.5 (Vibrating Hammer). 3 No. in situ density tests in accordance with STP 6.2 shall be taken from each 1,000 square metres of compacted improved subgrade, or as directed by the Engineer. If the achieved density is less than the minimum required, the Contractor shall carry out further compaction.

When commencing work on the improved subgrade the Contractor shall carry out a field compaction trial to determine the optimum moisture content and the required number of passes of his particular compaction equipment to comply with the Specification. This method will be approved by the Engineer and shall be used for all subsequent compaction of improved subgrade material. Such agreement will not however relieve the Contractor of his responsibility and in the event that test results later show that the specified compaction is not being achieved all improved subgrade work shall cease and not be resumed until a fresh trial has been undertaken and a revised compaction method approved by the Engineer.

In order to ensure uniform bearing capacity at the finished improved subgrade level, CBR tests shall be carried out as directed by the Engineer. The CBR shall be such that the laboratory value obtained in accordance with STP 5.1, at the specified compaction and after 4 days soaking, shall exceed 8%. In areas where these requirements are not met, correction shall be made by such measures as the Engineer deems necessary.

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. 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.

Improved subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of this Section shall be watered by methods approved by the Engineer at the Contractor's own expense. Improved subgrade material containing excess moisture shall be dried prior to or during compaction by methods approved by the Engineer, at the expense of the Contractor.

The finished improved subgrade shall follow the required grades and cross sections and at any point shall not vary more than 20 mm above or below the specified level. The thickness of the finished improved subgrade shall be:

-not thinner than 20 mm less than the required thickness at any point

-overall not less than the required thickness when five thickness measurements are averaged in any 100 metres of road.

Improved subgrade which does not conform to the above requirements shall be reworked, watered and thoroughly re-compacted to conform.

2.8.4 Measurement

Improved subgrade as described in this section shall be measured by the cubic metres of material compacted in place and accepted. Measurement shall be based on the average width and thickness of the improved subgrade shown on the Drawings and actual length measured horizontally along the centreline of the surface of the road.

2.8.5 Payment

This work measured as provided above shall be paid for at the Contract unit rate per cubic metre for improved subgrade. 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.

Pay item shall be:

2/8/1	Improved Subgrade	Cubic Metre

2.9 REMOVAL OF EXISTING STRUCTURES

2.9.1 Description

This work shall consist of the satisfactory removal and salvage or disposal, wholly or in part, of existing bridges, structures, substructures, buildings, culverts etc., within the right-of-way as indicated in the Contract Documents or as required by the Engineer.

The Employer will generally arrange for all structures within the right-of-way, which are not the property of the Employer to be removed by the respective owners prior to the Contractor commencing work on site.

Existing structures which are the property of the Employer and which are in the vicinity of a proposed roadway shall be dismantled or demolished by the Contractor to a level one metre lower than the proposed road surface elevation. For areas of the Site that will be used for purposes other than roadways, existing structures shall be dismantled or demolished to a level lower than the lowest elevation of the finished ground level; as indicated on the Drawings or directed by the Engineer.

2.9.2 Materials Obtained from Dismantling

The materials in the existing structures may include but are not restricted to structural steel, reinforced concrete materials, or stone/brick masonry materials, in any combination. The concrete materials, stone/brick masonry materials obtainable from dismantling of structure shall be taken to stock-piles by the Contractor for their possible use in the works when so approved by the Engineer.

The materials salvaged from dismantling may not in itself comply fully with specifications for intended use in the permanent works. The salvaged material shall be first sorted out as directed. The materials, which may be used directly in permanent works, shall be stockpiled separately from those that require processing for reuse. The materials selected for processing should be of such quality as will meet the specifications after breaking, screening and / or mixing with better quality materials if necessary.

Acceptability of the materials (after processing as the case may be) shall be determined by the Engineer and only such materials that fully satisfy the specifications in all respects shall be permitted for incorporation in the permanent works.

Structural/reinforcing steel obtained from dismantling of the existing structures is not considered suitable for use in the permanent works. This will be the property of the Contractor; it will not be reused for the permanent Works, and shifted/disposed of from the site with intimation to the Engineer. Structures or portions thereof which are specified in the contract for re-erection shall be stored in separate piles in a location agreed by the Engineer.

The Contractor shall comply with all laws, ordinances, building regulations etc as prevailing in Bangladesh.

2.9.3 Backfilling after Dismantling of Structures

As directed by the Engineer, holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved materials and thoroughly compacted in line with surrounding areas. The backfilling required for restoring the ground after dismantling of structures shall not be paid separately as the cost shall be deemed to be included in the rate for dismantling structures.

2.9.4 Measurement

The dismantling or rehabilitation, disposal of the material and the backfilling after dismantling of structures shall be measured as a Lump Sum per structure.

2.9.5 Payment

The Lump Sum (LS) amounts rates for the various items of dismantling or rehabilitation shall be the full compensation for carrying out the required operations including excavation backfilling and shaping and providing all labour, materials, tools, equipment, safeguards and incidentals necessary to complete the work for each individual structure. These will also include for handling, sorting out, salvaging, and stock piling usable materials.

All materials from existing structures, which are suitable for use in the road pavement, shall be stockpiled in a manner approved by the Engineer. The rate per cubic metre inserted by the Contractor against pay item 2/9/3 shall be deducted from payments due to the Contractor.

Pay item shall be:

2/9/1	Dismantling existing structure (Box Culvert/Pipe Culvert/Bridge) including disposal of spoil and backfilling (Individual Structure to be stated in Bill of Quantities).	Lump Sum
2/9/2	Dismantling portions of existing structure including Stockpiling of materials (Individual Structure to be stated in Bill of Quantities)	Lump Sum
2/9/3(a)	Deduction of the Value of Recovered Materials (Except Reinforcing steel) from Structures	Cubic Metre
2/9/3(b)	Deduction of the Value of Recovered Materials (reinforcing Steel) from Structures	Tonnes

2.10 CONSTRUCTION OF EARTHEN SHOULDERS

2.10.1 Description

This work shall consist of the construction of shoulders to the road pavement by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from approved sources in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

2.10.2 Materials

All shoulder materials shall be free from roots, sods or other deleterious material.

Materials for shoulders shall be from sources, which the Contractor shall propose and which shall be approved by the Engineer. Approval shall not normally be given to the use of material from borrow areas which, when compacted to 98% of maximum dry density in accordance with STP 4.3, has a 4 day soaked CBR value of less than 8%. Shoulder materials shall conform to the following requirements.

- Liquid limit of soil fraction passing 0.425 mm sieve not to exceed 40% (STP 3.2)
- Plasticity index of soil fraction passing 0.425 mm sieve to be greater than 7% but not to exceed 15% (STP 3.2)

2.10.3 Construction Methods

2.10.3.1 Preparation

Prior to placing any shoulder fill, all subgrade preparation and subgrade drainage work shall be complete.

2.10.3.2 Placing

Except as otherwise required by the Drawings, all shoulders shall be constructed in layers approximately parallel to the finished grade of the roadbed. The layers shall not exceed 150 mm in thickness on completion of compaction.

Attention is drawn to the requirements for shoulders to be constructed in stages with the road pavement layers. The finished surface of the soft shoulder shall have a tolerance of ±20mm from the specified level for the full width, except that where it adjoins a hard shoulder then the level at this point must be equal or lower than the finished level of the approved hard shoulder.

2.10.3.3 Compaction of Shoulders

Each layer being compacted, shall be within ±2% of the optimum moisture content to ensure its compaction to the required density and shall be worked to have a uniform moisture content through the entire layer. The achieved dry density after compaction shall not be less than 98% of the maximum dry density as determined in accordance with STP 4.3.

Samples to determine the compaction shall be taken regularly, with one sample for each 500 square metres of finished layer, or as directed by the Engineer. Such density tests will be carried out according to STP 6.2. If test results show that the achieved dry density is less than the minimum required, the Contractor shall carry out further compaction. Each compacted layer shall be approved by the Engineer before the Contractor can commence a new layer.

2.10.4 Measurement

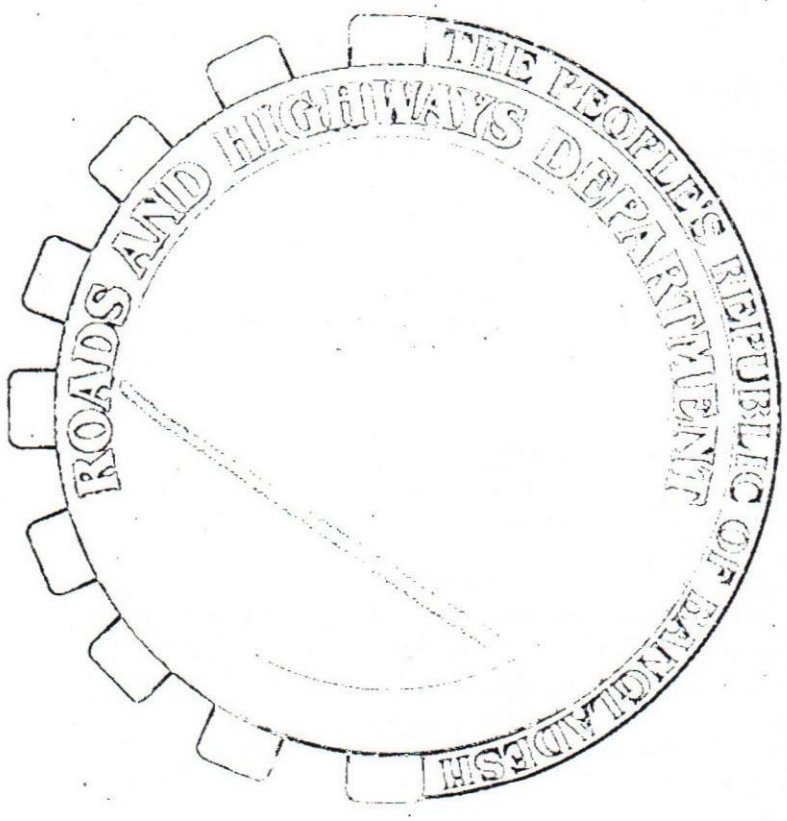
Shoulders shall be measured in cubic metres based on cross sections compacted and accepted in place. The volume to be measured will be the net volume of required and accepted shoulder, constructed and completed in accordance with the Specifications, to the lines, levels, grades and cross sections required or as directed by the Engineer.

2.10.5 Payment

This work measured as provided above shall be paid for at the Contract unit prices per cubic metre. Payment shall be full compensation for performing the work, furnishing the materials and providing all labour, equipment, tools and incidentals necessary to complete the work.

Pay item shall be:

2/10/1	Construction of Soil Earthen Shoulders	Cubic Metre



2.11 CONSTRUCTION OF HARD SHOULDERS

2.11.1 Description

This work shall consist of the construction of hard shoulders to the road pavement by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from approved sources in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

2.11.2 Materials

The materials for hard shoulder shall meet the requirements for aggregate base type II provided for in Section 3.3.2

2.11.3 Construction Methods

2.11.3.1 Preparation of Sub-base

The sub-base shall be shaped and compacted in conformity with the provisions of Section 3.2 to the correct moisture content, and be completed for at least 100 metres ahead of the placing of the hard shoulder material, unless otherwise approved by the Engineer.

2.11.3.2 Spreading Hard Shoulder

The aggregate and sand shall be mixed thoroughly to obtain a homogenous mix complying with either grading A or B of Section 3.3.2. Water shall be added during mixing to keep the mixed material moist so as to prevent segregation during transportation.

The mixed hard-shoulder material, which should be at or near optimum moisture content shall be spread in two layers of nearly equal thickness so that the compacted thickness shall conform to that shown on the Drawings or as directed by the Engineer. All areas of segregation shall be corrected, or removed and replaced with well graded material.

Where the material for hard 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 roadbed and the base course and the shoulders should be constructed simultaneously.

At the edge of the hard shoulders the hard shoulder material shall be spread to give the required compacted depth and the edge detail shown on the Drawings.

2.11.3.3 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.

Hard shoulder material, which does not contain sufficient moisture to be compacted in accordance with the requirements of this Section, shall be sprinkled with water. The Contractor shall supply the necessary water at his own expense.

Hard shoulder material containing excess 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.

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 hard shoulder shall be determined in accordance with STP 6.2 (150 mm or 200 mm diameter), with at least one test being made for each 200 linear metres of hard shoulder.

The final shaping and rolling of the soft shoulder to the full width shall be made after the hard shoulder is completed.

2.11.3.4 Surface Tolerance

The finished surface of the hard shoulder shall follow the required grades, levels and cross-sections and shall not vary from the specified level by more than ±10mm. The finished surface shall also not deviate by more than 10mm from a 3m long straight edge laid perpendicular and parallel to the road centre-line. Any areas having irregularities greater than 10 mm, shall be corrected by loosening, adding or removing material, reshaping and re-compacting.

The minimum thickness at any single point shall be not less than the required thickness less 10 mm. The hard shoulder shall also have an average thickness not less than the required thickness when five thickness measurements are averaged in any 100m length of completed shoulder.

The Contractor shall carry out at his own expense, the reconstruction of areas of hard shoulder, which are too thin or too variable in thickness to meet this requirement.

2.11.4 Measurement

This item shall be measured as the number of cubic metres of material complete in place and accepted. Measurements shall be based on the cross section of the hard shoulder shown on the Drawings and the actual length measured on the surface of the road.

2.11.5 Payment

This work measured as provided above shall be paid for at the Contract unit rates per cubic metre for hard shoulder. 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.

Hard shoulder shall be paid for at the Contract unit rates irrespective of the sources of material used. All costs of excavating existing pavement or savings to the Contractor from re-using materials excavated from existing pavements in section 2.2 should be included under this item.

Pay items shall be:

2/11/1	Construction of Hard Shoulder	Cubic Metre

2.12 SUBGRADE DRAINS

2.12.1 Description

This work shall consist of excavating, furnishing material, backfilling and finishing drains to the prepared and accepted subgrade in accordance with these specifications and the dimensions and cross sections shown on the drawings, or as required by the Engineer.

2.12.2 Materials

The material for backfilling of subgrade drains shall be clean free draining sand and gravel, free from any vegetable matter, soft particles, silt or clay.

The grading requirement of the drain backfill material shall conform to that shown in Table 2.12-1 below:

Table 2.12-1

Sieve size	% passing by weight Min - Max
10 mm	100
5 mm	80-100
2.4 mm	65-95
1.2 mm	50-80
0.6 mm	25-50
0.3 mm	10-20
0.15 mm	0-10
0.075 mm	0-2

The separator material shall consist of suitable woven rot proof fabric, geotextile membrane or perforated heavy duty polythene sheeting. The separator shall be of adequate strength to protect the drainage material from contamination during construction of the pavement and shoulder and shall allow the free passage of water whilst preventing the contamination of drainage backfilling material with fine soil particles. Samples of proposed materials shall be submitted by the contractor not less than one month prior to commencement of drainage works. The Engineer shall order the contractor to carry out tests and field trials necessary to ensure the adequacy of the material prior to approval.

2.12.3 Construction Methods

Subgrade drains shall be excavated neatly by hand in the prepared subgrade to dimensions and grades and intervals shown on the drawings or directed by the Engineer. Drains on opposite sides of the road shall be staggered.

The excavation shall be backfilled with material in accordance with Table 2.12-1. The backfill shall be compacted by hand ramming and struck off level with, or slightly above, the finished subgrade level.

The finished backfill shall be immediately covered with approved separator material, which shall extend 150 mm beyond the edges of the drain on all exposed faces. Any joints in the fabric shall be overlapped by at least 150 mm. Fabric shall be held in place by suitable means to prevent movement of the separator during construction operations.

Shoulder and pavement materials over the drain and separator shall be carefully placed by hand for a depth of not less than 100 mm prior to placing and rolling of the general shoulder pavement materials.

2.12.4 Measurement

Subgrade drains shall be measured in linear metres of drain completed and accepted.

Drains shall extend from a point vertically below the outer edge of the carriageway, or paved shoulder, to the finished face of the embankment, or side ditch. In the event that the contractor constructs the embankment to dimensions in excess as those shown on the plans and sections additional length of subgrade drains shall be at the Contractor's expense.

2.12.5 Payment

The work measured as provided above shall be paid at the contract unit rate per linear metre. Payment shall be full compensation for performing the work and providing all labour, equipment, materials, tools and incidentals necessary to complete the works.

Pay item shall be:

2/12/1	Subgrade drains	Linear Metre

ROADS AND HIGHWAYS DEPARTMENT
THE PEOPLE'S REPUBLIC OF BANGLADESH

DIVISION 3
PAVEMENT WORK

CONTENTS

DIVISION 3 - PAVEMENT WORK

Page

3.1 PAVEMENT (MINOR WORKS & PRELIMINARIES) 1
3.1.1 General 1
3.1.2 Preparation and Stockpiling of Materials 1
3.1.3 Scarification and Preparation of Existing Pavement and/or Hard Shoulders 1
3.1.4 Repair of Potholes and Damaged Areas of the Existing Bituminous Surfaced Roads 2
3.1.5 Levelling Course 2
3.1.6 Payment 2

3.2 SUB-BASE 3
3.2.1 Description 3
3.2.2 Materials 3
3.2.3 Construction Methods 4
3.2.3.1 Preparation of Subgrade 4
3.2.3.2 Spreading Sub-base 4
3.2.3.3 Sprinkling, Rolling and Compacting 4
3.2.4 Measurement 6
3.2.5 Payment 6

3.3 AGGREGATE BASE 7
3.3.1 Description 7
3.3.2 Materials 7
3.3.3 Construction Methods 8
3.3.3.1 Preparation of Sub-base 8
3.3.3.2 Spreading Base 8
3.3.3.3 Sprinkling, Rolling and Compacting 9
3.3.3.4 Surface Tolerance 9
3.3.4 Measurement 9
3.3.5 Payment 10

3.4 BITUMINOUS MATERIALS 11
3.4.1 Description 11
3.4.2 Material 11
3.4.2.1 Bitumen 11
3.4.2.2 Cut back Bitumen 11
3.4.2.3 Bitumen Emulsion 13
3.4.3 Methods of Storage, Handling and Application 14
3.4.4 Measurement 15
3.4.5 Payment 15

3.5 GENERAL REQUIREMENTS FOR BITUMEN BOUND SURFACING (PLANT METHOD) 16
3.5.1 Description 16
3.5.1.1 General 16
3.5.1.2 General Composition of Mixtures 16
3.5.1.3 Formula for Job-Mix 16
3.5.1.4 Applications of Job-Mix Formula and Allowable Tolerances 17

CONTENTS

DIVISION 3 - PAVEMENT WORK

3.5.2 **Materials** 17
3.5.2.1 Coarse Mineral Aggregate 17
3.5.2.2 Fine Mineral Aggregate 18
3.5.2.3 Mineral Filler 18
3.5.2.4 Bituminous Materials 19
3.5.3 **Construction** 19
3.5.3.1 Weather Limitation 19
3.5.3.2 Progress of Work 19
3.5.3.3 Plant and Equipment 19
3.5.3.4 Preparation and Placing 23
3.5.3.5 Surface Test of the Pavement 27
3.5.3.6 Control and Testing 27
3.5.4 **Measurement** 28
3.5.5 **Payment** 28

3.6 **BITUMINOUS PRIME COAT** 29
3.6.1 **Description** 29
3.6.2 **Materials** 29
3.6.2.1 Bituminous Materials 29
3.6.2.2 Blotting Material 29
3.6.3 **Construction Methods** 29
3.6.3.1 Weather Limitations 29
3.6.3.2 Equipment 29
3.6.3.3 Cleaning Surface 30
3.6.3.4 Application of Bituminous Material 30
3.6.3.5 Maintenance and Opening to Traffic 30
3.6.4 **Measurement** 31
3.6.5 **Payment** 31

3.7 **BITUMINOUS TACK COAT** 32
3.7.1 **Description** 32
3.7.2 **Materials** 32
3.7.3 **Construction Methods** 32
3.7.3.1 Equipment 32
3.7.3.2 Cleaning Surface 32
3.7.3.3 Application of Bituminous Material 32
3.7.4 **Measurement** 33
3.7.5 **Payment** 33
3.8 **PRIMER SEAL** 34
3.8.1 **Description** 34
3.8.2 **Materials** 34
3.8.2.1 Bituminous Materials 34
3.8.2.2 Cover Coat Materials 34
3.8.3 **Construction Methods** 34
3.8.3.1 Cleaning Surface 34
3.8.3.2 Applying Bituminous Materials 34
3.8.3.3 Spreading and Rolling 35
3.8.4 **Measurement** ..... 35.
3.8.5 **Payment** 35

CONTENTS

DIVISION 3 - PAVEMENT WORK

3.9 BITUMINOUS SURFACE TREATMENT (PLANT METHOD) 36
3.9.1 Description 36
3.9.2 Materials 36
3.9.2.1 Bituminous Materials 36
3.9.2.2 Bitumen Additive 36
3.9.2.3 Aggregates 36
3.9.2.4 Pre-coated Aggregate 37
3.9.2.5 Stockpiling of Aggregates 37
3.9.3 Construction Methods 38
3.9.3.1 Equipment 38
3.9.3.2 Weather Limitations and Control of Work 39
3.9.3.3 Cleaning and Preparation of Surface 39
3.9.3.4 Application of Bituminous Material 39
3.9.3.5 Application of Cover Aggregate 41
3.9.3.6 Rolling and Brushing 41
3.9.3.7 Control of Traffic 42
3.9.4 Measurement 42
3.9.5 Payment 42

3.10 DENSE BITUMINOUS SURFACING (PLANT METHOD) 43
3.10.1 Description 43
3.10.1.1 General 43
3.10.1.2 General Composition of the Mixture 43
3.10.2 Materials 44
3.10.2.1 General 44
3.10.2.2 Bituminous Materials 44
3.10.2.3 Bitumen Additive 44
3.10.2.4 Coarse Mineral Aggregates 45
3.10.2.5 Fine Mineral Aggregate 45
3.10.2.6 Mineral Filler 45
3.10.2.7 Mixture 45
3.10.3 Construction Methods 45
3.10.3.1 General 45
3.10.3.2 Preparation of Bituminous Material 45
3.10.3.3 Preparation of Mineral Aggregate 45
3.10.3.4 Preparation of Mixture 46
3.10.3.5 Spreading and Compaction 46
3.10.3.6 Joints 46
3.10.3.7 Protection of the Pavement 46
3.10.3.8 Pavement Samples 47
3.10.3.9 Surfacing Texture 47
3.10.4 Measurement 47
3.10.5 Payment 47

3.11 PREMIX BITUMINOUS CARPETING (MANUAL METHOD) 48
3.11.1 Description 48
3.11.1.1 General 48
3.11.1.2 General Composition of the Mixture 48
3.11.2 Materials 49
3.11.2.1 General 49
3.11.2.2 Bituminous Materials 49
3.11.2.3 Coarse Mineral Aggregate 49
3.11.2.4 Fine Mineral Aggregate and Mineral Filler 49
3.11.2.5 Mixture 49

CONTENTS

DIVISION 3 - PAVEMENT WORK

3.11.3 Construction Methods 49
3.11.3.1 General 49
3.11.3.2 Preparation of Bituminous Material 50
3.11.3.3 Preparation of Mineral Aggregate 50
3.11.3.4 Preparation of Mixture 50
3.11.3.5 Spreading and Compaction 50
3.11.3.6 Joints 51
3.11.3.7 Edge Treatment 51
3.11.3.8 Protection of the Pavement 51
3.11.3.9 Pavement Samples 52
3.11.3.10 Surface Texture 52
3.11.4 Measurement 52
3.11.5 Payment 52

3.12 PREMIX BITUMINOUS SEAL COAT (MANUAL METHOD) 53
3.12.1 Description 53
3.12.1.1 General 53
3.12.1.2 Composition of the Mixture 53
3.12.2 Materials 53
3.12.2.1 General 53
3.12.2.2 Bituminous Materials 54
3.12.2.3 Mineral Aggregate 54
3.12.2.4 Mixture 54
3.12.3 Construction Methods 54
3.12.3.1 General 54
3.12.3.2 Preparation of Bituminous Material 55
3.12.3.3 Preparation of Mineral Aggregate 55
3.12.3.4 Preparation of Premix Seal Coat 55
3.12.3.5 Spreading and Compaction 55
3.12.3.6 Joints 56
3.12.3.7 Protection of the Pavement 56
3.12.3.8 Pavement Samples 56
3.12.3.9 Surface Texture 56
3.12.4 Measurement 57
3.12.5 Payment 57

3.13 BRICK PAVEMENT 58
3.13.1 Description 58
3.13.2 Subgrade and Improved Subgrade 58
3.13.3 Materials 58
3.13.4 Brick on End Edging 58
3.13.4.1 Description 58
3.13.4.2 Construction Methods 58
3.13.5 Single Layer Brick Flat Soling 58
3.13.5.1 Description 58
3.13.5.2 Construction Methods. 58
3.13.6 Brick on Edge Pavement in Herringbone Bond 59
3.13.6.1 Description 59
3.13.6.2 Construction Methods 59
3.13.6.3 Surface Tolerance 59
3.13.7 Measurement 59
3.13.8 Payment 59

CONTENTS

3.14. DRY LEAN CEMENT CONCRETE

3.14.1. Scope 3.60
3.14.2. Materials 3.60
3.14.3. Proportioning of Materials for the Mix 3.60
3.14.4. Construction 3.60
3.14.5. Trial Mixes : 3.62
3.14.6. Curing: 3.62
3.14.7 Removal of Scaffolding and Formwork : 3.63
3.14.8 Repair of Concrete: 3.63
3.14.9. Traffic 3.63
3.14.10 Tolerances for Surface Regularity, Level, Thickness and Strength 3.63
3.14.11. Measurements 3.63
3.14.12. Payment 3.63

3.15. CEMENT CONCRETE PAVEMENT 3.64
3.15.1. Scope 3.64
3.15.2. Materials 3.64
3.15.3. Proportioning of Concrete 3.66
3.15.4 Separation Membrane 3.66
3.15.5. Joints 3.66
3.15.6 Dowel bars 3.68
3.15.7. Weather and Seasonal Limitations 3.70
3.15.8. Side Forms, Rails 3.71
3.15.9. Construction 3.71
3.15.10. Preparation and Sealing of Joint Grooves 3.77
3.15.11 Removal of Scaffolding and Formwork : 3.79
3.15.12 Repair of Concrete : 3.79
3.15.13 Measurement of Texture Depth 3.79
3.15.14. Opening to Traffic 3.80
3.15.15. Tolerances for Surface Regularity, Level, Thickness and Strength 3.80
3.15.16. Measurements for Payment 3.80
3.15.17. Payment 3.81

3.1 PAVEMENT (MINOR WORKS & PRELIMINARIES)

3.1.1 General

Division 3 of the Specifications covers all requirements for road pavements that will be incorporated in the Works.

3.1.2 Preparation and Stockpiling of Materials

Materials to be used in pavement works shall be processed and stockpiled only in designated areas as approved by the Engineer. The Contractor shall make all arrangements and bear all costs associated with the provision of these storage areas. Preparation and storage of materials along the alignment will not be allowed.

The designated areas shall be cleared of all vegetation and topsoil prior to commencing work and the arrival of any materials. The area will be graded with proper slopes, drained, and well compacted to provide a plane and hard surface for the stockpiling of materials. The area to be used for stockpiling of concrete/bituminous works aggregates shall be a surfaced platform with a well compacted 150 mm thick layer of stone/gravel/brick aggregate or with brick flat soling over a compacted sand bed. The area of surfaced platform will be sufficient enough to allow stockpiling and handling operations of aggregates without intermixing of different types of aggregates or spilling of aggregates outside the surfaced platform at any stage. All necessary measures shall be taken to prevent contamination of aggregates with silt and clay and other deleterious materials during the stockpiling and handling operations. If any aggregate has been stockpiled outside the surfaced platform, the bottom 300 mm of material shall not be used in the concrete/bituminous works; however it can be used in other un-important works with the permission of the Engineer. Similar kinds of precautions shall be taken during stockpiling and handling of stone boulders to be crushed at the plant site to prevent contamination of their products. In any case, any contaminated aggregate shall not be used in the works.

Bricks of different frog marks, different materials and size fractions shall be kept in separate stockpiles divided as necessary to prevent contamination.

Unless otherwise approved by the Engineer, each stockpile shall be built at least 2 metres high. The Contractor shall supply any planking or other material required in connection with movement of vehicles over and about the stockpiles.

3.1.3 Scarification and Preparation of Existing Pavement and/or Hard Shoulders

This work shall consist of scarifying the existing pavement and shoulders to a depth up to 200 mm, or as ordered by the Engineer, and over a width as indicated on the Drawings or as instructed by the Engineer. The material shall be thoroughly mixed by means of a motor grader and homogenised with a pulvimixer or similar approved plant or by labour intensive methods. It shall then be spread and compacted, with the addition of water as may be required, in such manner as to obtain a profile conforming with the lines, grades and cross-sections shown on the Drawings, or as directed by the Engineer.

If there is any suitable surplus material this shall be temporarily stockpiled for subsequent reuse in the Works, as directed by the Engineer.

Any shortage of materials shall be supplied by the addition of material having engineering characteristics not inferior to those required for sub-base or base, as appropriate. The additional material shall be thoroughly mixed with the scarified and homogenised material, by means of a motor grader, before compacting.

3.1.4 Repair of Potholes and Damaged Areas of the Existing Bituminous Surfaced Roads

The Engineer may instruct the Contractor to repair potholes or damaged areas on existing bituminous surfaced roads including depressions and broken edges.

The Contractor shall remove the bitumen surface as directed. All damaged and unstable parts of the existing base and sub-base shall be excavated until sound material is reached on all sides and at the base of the excavation. Unsuitable excavated materials shall either be disposed of or stockpiled in locations as directed by the Engineer. The shape of the excavation shall then be made rectangular with vertical sides.

The excavated material, depending on its nature, shall be:

1) stocked adjacent to the Works for reuse, if so directed, or
2) disposed of to spoil, if so instructed in writing by the Engineer.

The bottom of the excavation shall then be shaped, trimmed, watered if necessary, and compacted to the density required for the appropriate pavement layer. The excavation shall then be filled with base material of the type directed by the Engineer in layers after compaction of not thicker than 100 mm. Each layer shall be properly levelled and watered and carefully rammed or compacted with an approved hand vibratory roller, in order to achieve the density required in Section 3.3 for Aggregate Base. A bituminous leveling course or bituminous surfacing will then be placed after applying tack coat to the bottom layer and outer vertical sides, as directed by the Engineer in accordance with the procedure as described in Sections 3.7.3.2, 3.7.3.3 and 3.5.3.4.

3.1.5 Levelling Course

Where shown on the Drawings, or as ordered by the Engineer a levelling course will be constructed on the existing pavement with the materials required in the Drawings or as otherwise ordered by the Engineer. The execution, measurement and payment of the levelling course works shall be in accordance with the relevant provisions of these Specifications, for the material that will be ordered by the Engineer to be used.

3.1.6 Payment

The scarification and preparation of Existing Pavement and/or shoulders will be paid for at the Contract unit price for each square metre actually scarified in accordance with the instructions of the Engineer. The price shall be full compensation for all labour, equipment, tools, plant, etc. for scarifying, mixing, homogenising, spreading, watering and compacting, or temporary stockpiling for reuse, and all other incidentals necessary to complete the work specified.

The repair of Potholes and damaged areas of Existing Bituminous Surfaced roads shall be paid for at the Contract unit rate, on the basis of the volume of excavation filled as ordered by the Engineer. The rate shall include for all excavation, for disposal or stockpiling of resulting material, where ordered, for the compaction of the bottom of the excavation to the specified density, for the supply and placing of sub-base or base material to the specified density along with the supply and placing of the bituminous material, and for all charges related to the proper execution of the work prescribed. The cost of tack coat shall be considered to be included within the rates of this item.

Pay items shall be:

3/1/1	Scarify, Mix and Recompact Existing Pavement and/or Shoulder	Square Metre
3/1/2	Repair of Potholes on the Existing Pavement	Cubic Metre

3.2 SUB-BASE

3.2.1 Description

This work shall consist of furnishing, placing and compacting sub-base material on a prepared and accepted subgrade or improved subgrade in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

3.2.2 Materials

The Contractor shall submit results of material tests on the proposed subbase 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.

Material shall be natural or artificial aggregate material, free from vegetable matter, soft particles, clay and excess silt. Natural and artificial materials may be mixed together provided they fully conform to all requirements of the Specification and the proportions are approved by the Engineer in writing. If gravel is used as coarse aggregate, it shall contain at least 50% particles (by weight) having broken faces. Natural sand with Fineness Modulus less than 1.0 shall not be allowed to be used in the sub-base material.

The material for sub-base shall conform to the requirements given below:

a) Grading: The grading (washed method) shall conform to grading envelopes A, or B in Table 3.2-1, as specified in the contract; in case the type of grading is not specified in the contract, it shall be as instructed by the Engineer.

The grading shall not be allowed to vary from coarser side on one sieve to finer side on another sieve within the grading envelope; and the fraction passing the 0.075 sieve shall be not greater than two-thirds 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 STP 3.2.

c) CBR. The material shall have a 4 day soaked CBR value not less than 25% when compacted to 98% of maximum dry density as determined by STP 4.5 (Vibrating Hammer).

d) Aggregate Crushing Value/Ten Percent Fines Value. Any material retained on the 10 mm sieve when sampled and tested in accordance with STP 7.7.1 and 7.7.2 shall have an Aggregate Crushing Value of not greater than 38% and the ten percent fines value shall not be less than 75 kN.

Table 3.2-1

Grading Requirements for Sub-base Material		
Sieve Size (mm)	Percentage by Weight Passing Sieves	
	Grading A	Grading B
50	100	--
38	85 – 100	--
20	55 – 95	100
10	35 – 75	70 – 100
5	25 – 60	45 - 85
2.4	15 – 50	30 – 70
0.600	7 – 35	10 – 45
0.300	6 – 27	7 – 30
0.075	3 – 15	4 - 20

3.2.3 Construction Methods

3.2.3.1 Preparation of Subgrade or Improved Subgrade

The subgrade or improved subgrade shall be shaped and compacted in conformity with the provisions of Specifications Sections 2.7 and 2.8 and completed ahead of the placing of the sub-base material. Notwithstanding any earlier approval, any damage to or deterioration of the subgrade or improved subgrade, including any increase in moisture content above that permitted to achieve the specified compaction, shall be corrected at the Contractors expense before sub-base is laid.

Preparation and surface treatment of the subgrade or improved subgrade shall be carried out only after completion of any specified subgrade drainage and unless otherwise agreed by the Engineer immediately prior to laying the sub-base. The sequence of operations shall be as follows:

a) The subgrade or improved subgrade shall be regulated and trimmed so that its finished profile shall not vary by more than 20 mm above or below the specified formation level at any point.

b) The trimmed formation shall be rolled by 1 pass of a smooth-wheeled roller having a load per 100 mm width of roll not less than 214 kg or a vibratory roller having a static load per 100 mm width of vibratory roll of not less than 71 kg or a vibratory plate compactor having a static pressure under the base plate of not less than 1,400 kg/m^2.

3.2.3.2 Spreading Sub-base

Sub-base shall be spread in layers of nearly equal thickness either by hand or by using a grader or paving machine, with an uncompacted thickness up to 150 mm, subject to the approval of the Engineer. Where sand and aggregates are combined together to meet the specified grading, care shall be taken to prevent segregation of the material into fine and coarse parts. 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 sub-base course, the material shall be evenly spread in layers, as herein specified, for the full width of the sub-base course and the shoulders simultaneously.

Where the shoulders are not of the same material as the sub-base course, then the sub base shall be spread to give the required compacted depth and the edge detail shown on the Drawings.

When the sub base is spread contiguous to concrete kerbs or gutters, extreme care shall be exercised not to damage them. Any damage of kerbs or gutters resulting from carelessness or negligent construction methods by the Contractor shall warrant their removal and replacement at the Contractor's sole expense.

3.2.3.3 Sprinkling, Rolling and Compacting

Immediately after each layer has been spread and shaped to the cross section required each layer shall be compacted with suitable and adequate 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.

If water is required, to bring the sub base to the correct moisture content, it shall be sprinkled on the surface. The contractor shall supply and sprinkle the necessary water at his own expense.

Sub-base material containing excess 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.

Each layer shall be compacted to at least 98% of the maximum dry density as determined in accordance with STP T4.5 (Vibrating Hammer). Moisture content at the time of compaction shall be the optimum moisture content ± 3%.

The Contractor shall carry out a field compaction trial at the start of constructing the sub-base to determine the optimum moisture content and the required number of passes of his particular compaction equipment to comply with the Specification. This trial will also determine the relationship between the loose and compacted thickness in controlling the loose thickness at the time of spreading the mix. The method will require to be approved by the Engineer and shall then be used for all subsequent compaction of sub-base material. Such agreement will not, however, relieve the Contractor of his responsibility and in the event that test results later show that the specified compaction is not being achieved all sub base work shall cease and not be resumed until a fresh trial has been undertaken and a revised compaction method approved by the Engineer.

3 No. in situ density tests in accordance with STP 6.2 (150 or 200 mm diameter) shall be taken for each 1,000 square metres of compacted sub-base, or as directed by the Engineer. If the test results show that the achieved dry density is less than that required, the Contractor shall carry out further compaction to obtain the minimum required dry density.

In order to ensure uniform bearing capacity at the finished sub-base level, CBR measurements may be ordered by the Engineer. The CBR shall be such that the laboratory value obtained from testing in accordance with STP 5.1 on samples compacted to the specified dry density and soaked for 4 days shall exceed 25%. In areas where these requirements are not met, correction shall be made by such measures, as the Engineer deems necessary.

The finished sub-base shall be checked for level and crossfall and at any point shall not vary more than 15 mm above or below the planned grade or adjusted grade. The thickness of the finished sub-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 10 mm less than the required thickness at any point

Sub-base which does not conform to the above requirements shall be corrected by scarifying the full depth of the affected areas, adding or removing materials and re-rolling, watering if necessary, until the entire surface conforms to the correct levels and cross-falls.

The prepared sub-base layer shall be protected against damage until covered by the base course.

3.2.4 Measurement

Sub-base as described in this Section shall be measured by the cubic metres of compacted material in place and accepted. Measurement shall be based on the thickness/cross-section of the sub-base shown on the Drawings and area/length measured on the surface of the road.

3.2.5 Payment

This work measured as provided above shall be paid for at the Contract unit rate per cubic metre for aggregate sub-base, as detailed below. 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.

Sub-base shall be paid for at the Contract unit rate irrespective of the sources of materials used for constructing the sub-base. All costs for excavating existing pavement, or removing existing structures, or savings to the Contractor from re-using materials excavated from existing pavements or structures shall be deemed already covered under pay items 2/2/3, 2/2/4, 2/2/5, 2/9/1 and 2/9/2.

Pay item shall be:

3/2/1	Sub-base	Cubic Metre

3.3 AGGREGATE BASE

3.3.1 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.

3.3.2 Materials

Crushed aggregate shall consist of hard durable particles or fragments of rocks or gravel crushed to the required size, and a filler of coarse sand (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 particles having 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.

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 3.3-1. 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 3.3-1 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 sieve 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 STP 3.2.

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 STP 4.5 (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 AASHTO T96 shall have Aggregate Crushing Values (ACV) and Los Angeles Abrasion Value (LAA).

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%

Table 3.3-1

Grading Requirements for 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
2.4	15 – 38	35 – 65
0.600	8 – 22	15 – 40
0.300	6 – 16	10 – 30
0.075	2 – 8	5 - 10

3.3.3 Construction Methods

3.3.3.1 Preparation of Sub-base

The sub-base or lower base shall be shaped and compacted in conformity with the provisions of Section 3.2, to the correct moisture content and be completed for at least 100 metres ahead of the placing of the base material, unless otherwise approved by the Engineer.

3.3.3.2 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 gutters at the Contractor's sole expense.

3.3.3.3 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.

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 begin 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 (150 mm or 200 mm diameter depending on the layer thickness); with at least three tests being made for each 1,000 square metres.

The final shaping and rolling of the shoulders to the full width shall be made after the base course is completed.

3.3.3.4 Surface Tolerance

The finished surface of the aggregate base shall be checked for level and crossfall and at any point shall not vary more than ±10mm 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 centreline at intervals not exceeding 20m. The deviation from the straight edge shall not exceed 10mm. Any areas 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 10 mm 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.

3.3.4 Measurement

This item shall be measured as the number of cubic metres 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.

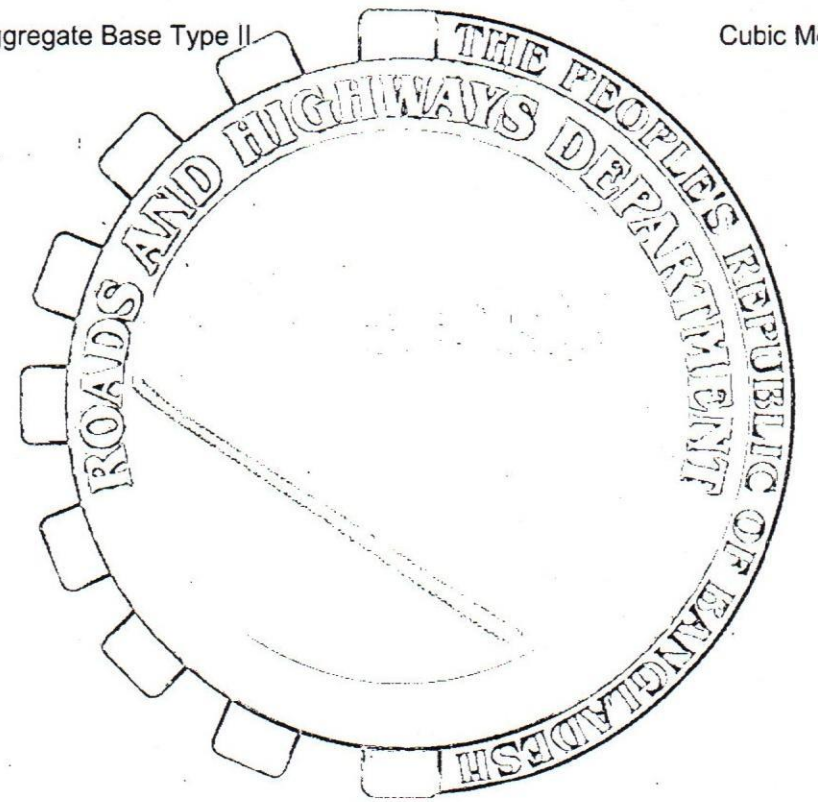
3.3.5 Payment

This work measured as provided above shall be paid for at the Contract unit rates per cubic metre 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.

All costs of excavating existing pavement, or removing existing structures, or savings to the Contractor from re-using materials excavated from existing pavements, or structures shall be deemed already covered under pay items 2/2/3, 2/2/4, 2/2/5, 2/9/1 and 2/9/2.

Pay items shall be:

3/3/1	Aggregate Base Type I	Cubic Metre
3/3/2	Aggregate Base Type II	Cubic Metre



3.4 BITUMINOUS MATERIALS

3.4.1 Description

This Section specifies the bituminous materials to be used in the work.

3.4.2 Material

The materials shall be as indicated in the Contract Documents. If materials are not completely described, materials suitable for the purpose and in accordance with generally recognised good practice should be used. Material shall meet the requirements for one of the following types.

3.4.2.1 Bitumen

Bitumen shall conform to the requirements (for the appropriate grade) given in Table 3.4-1 below. Bitumen shall be intended when material is referred to as "asphalt cement", "straight run bitumen", "penetration grade bitumen" or by its penetration value (as for example 60/70).

Table 3.4-1

Requirements for Penetration Grade Bitumen												
Requirement	STP (ASTM)	Unit	Penetration Grade									
			40/50		60/70		80/100		180/200			
			Min	Max	Min	Max	Min	Max	Min	Max		
Penetration at 25°C, 100 g,, 5 Sec	10.1	0.1 mm	40	50	60	70	80	100	180	200		
Softening Point R&B	10.2	°C	52	60	48	56	45	52	37	43		
Flash Point (Cleveland Open Cup)	10.5	°C	250	-	250	-	250	-	200	-		
Ductility at 25°C	(D113)	cm	100	-	100	-	100	-	100	-		
Loss on heating to 163°C for 5 hr	-	% wt	-	0.2	-	0.2	-	0.5	-	0.5		
Penetration of residue from loss on heating test at 25°C, 100 g, 5 Sec, as compared to penetration before heating	-	%	80	-	80	-	80	-	80	-		
Specific Gravity					1.01	1.05	0.99	1.04				
Solubility in carbon tetrachloride	(D4)	% wt	99.0	-	99.0	-	99.0	-	99.0	-		

3.4.2.2 Cut back Bitumen

Cut back bitumen shall be of either rapid curing or medium curing type and shall conform to the requirements (for the appropriate grade of cut back bitumen) given in Tables 3.4-2 and 3.4-3.

Cut back bitumen shall be intended when material is referred to as "cut back bitumen" or described by one of the grades given in the standard specifications (as for example RC-2 which is approximately RC-250).

Table 3.4-2

Requirements for Cutback Bitumen - Rapid Curing Type												
Requirement	Method STP (ASTM)	Unit	Cutback Grade									
			RC - 70		RC - 250		RC - 800		RC - 3000			
			Min	Max	Min	Max	Min	Max	Min	Max		
Water	(D95)	%	-	0.2	-	0.2	-	0.2	-	0.2		
Flash point (Tag Open Cup)	(D1310)	°C	-	-	26.7	-	26.7	-	26.7	-		
Viscosity, kinematic at 60°C	10.6	ST	70	140	250	500	800	1600	3000	6000		
Distillation test:	10.7											
Distillation to 90°C		% volume	10	-	-	-	-	-	-	-		
225°C		of total	50	-	35	-	15	-	-	-		
260°C		distillate	70	-	60	-	45	-	25	-		
316°C		to 360°C	85	-	80	-	75	-	70	-		
Residue from distillation to 360°C		% volume	55	-	65	-	75	-	80	-		
Test on residue from distillation:												
Penetration, 100 g, 5 sec, at 25°C	10.1	0.1 mm	80	120	80	120	80	120	80	120		
Ductility, 5 cm/min 25°C	(D113)	cm	100	-	100	-	100	-	100	-		
Solubility in carbon tetrachloride	(D4)	% wt	99.5	-	99.5	-	99.5	-	99.5	-		

Table 3.4-3

Requirements for Cutback Bitumen - Medium Curing Type																
Requirement	Method STP (ASTM)	Unit	Cutback Grade													
			MC - 30		MC - 70		MC - 250		MC - 800		MC - 3000					
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max				
Water	(D95)	%	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2				
Flash point (Tag Open Cup)	(D1310)	°C	37.8	-	37.8	-	65.5	-	65.5	-	65.5	-				
Viscosity, kinematic at 60°C	10.6	ST	30	60	70	140	250	500	800	1600	3000	6000				
Distillation test:	10.7															
Distillation to225°C		% vol. of	-	25	-	20	-	10	-	-	-	-				
260°C		total dist.	40	70	20	60	15	55	-	35	-	15				
316°C		to 360°C	75	93	65	90	60	87	45	80	15	75				
Residue from distillation to 360°C		% volume	50	-	55	-	67	-	75	-	80	-				
Test on residue from distillation:																
Penetration, 100 g, 5 sec, at 25°C	10.1	0.1 mm	120	250	120	250	120	250	120	250	120	250				
Ductility, 5 cm/min 25°C	(D113)	cm	100	-	100	-	100	-	100	-	100	-				
Solubility in carbon tetrachloride	(D4)	% wt	99.5	-	99.5	-	99.5	-	99.5	-	99.5	-				

When cutback bitumen of the specified grade is not available from commercial suppliers the Contractor shall give full details of his proposed methods of producing cutback bitumen and the Engineer shall order all necessary tests to ensure the material so produced is satisfactory for the intended use.

3.4.2.3 Bitumen Emulsion

Anionic bitumen emulsion shall conform to the requirements for the appropriate grade, given in Table 3.4-4.

Cationic bitumen emulsion, shall conform to the requirements for the appropriate grade, given in Table 3.4-5.

Bitumen emulsion shall be intended when material is referred to as "emulsified asphalt".

Bitumen emulsion shall conform in all respects to Bangladesh Standard Specification BDS 867, 1978.

Table 3.4-4

Specification for Anionic Emulsified Asphalts							
Property	Class of Anionic Road Emulsion						
	Labile			Semi-stable		Stable	Slurry Seal
	AI - 60	AI - 55	AI - 40	A2 - 57	A2 - 50	A3	A4
Residue on 710 µm BS sieve (% by mass maximum)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Residue on 150 µm BS sieve (% by mass maximum)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Stability to mixing with coarse aggregate (% coagulation)	20 - 80	20 - 80	20 - 80	< 40	< 40	< 5	< 5
Stability to mixing with cement (% coagulation)	-	-	-	> 2	> 2	> 2	-
Binder content (minimum % by mass)	58	53	38	55	48	55	56
Viscosity (°Engler 20°C)	6 - 9	5 - 8	4 max	8 max	5 max	9 max	8 max
Coagulation of emulsion at low temperature	nil	nil	nil	nil	nil	nil	nil
Storage stability (short period test)							
(inversions to clear sediment, maximum)	60	60	60	60	60	60	60
Storage stability (long period test)							
(water content difference % maximum)	2	2	2	2	2	2	2
Particle charge	negative	negative	negative	negative	negative	negative	negative

Table 3.4-5

Specification for Cationic Bitumen Emulsion					
Property	Class of Cationic Road Emulsion				
	Rapid Acting			Medium Acting	Slow Acting
	KI - 70	KI - 60	KI - 40	K2	K3
Residue on 710 µm BS sieve (% by mass maximum)	-	0.05	0.05	0.05	0.05
Residue on 150 µm BS sieve (% by mass maximum)	-	0.15	0.15	0.15	0.15
Binder contents (minimum % by mass)	67	57	38	57	56
Viscosity (°Engler 20°C)	-	6 - 9	4 max	10 max	10 max
Viscosity Redwood No. II (s at 85°C)	25.35	-	-	-	-
Coagulation of emulsion at low temperature	-	nil	nil	nil	nil
Storage stability (short period test) (inversions to clear sediment)	-	60	60	60	60
Storage stability (long period test) (water content difference % maximum)	-	2	-	2	2
Particle charge	positive	positive	positive	positive	positive

3.4.3 Methods of Storage, Handling and Application.

Bituminous materials shall be handled and stored with due regard for safety and in such a way that at the time of use in the work the materials conform to the Specifications. In particular, bitumen emulsion shall be handled with care and not subjected to mechanical shocks or extremes of temperature likely to cause separation of the bitumen. Bitumen emulsion showing signs of separation shall not be used.

The bitumen shall be applied at the temperature range called for in Table 3.4-6 for the particular material being used.

Spraying Temperatures For Bitumen		
Type	Grade	Temperature (°C)
Cut-Backs R.C. or M.C.	30	38 - 57
	70	57 - 71
	250	77 - 94
	800	99 - 113
	3,000	118 - 132
Penetration Grade Bitumen	60 - 70	151 - 161
	80 - 100	151 - 161
	200 - 300	138 - 151
Emulsion: As necessary for uniform spraying and satisfactory penetration		

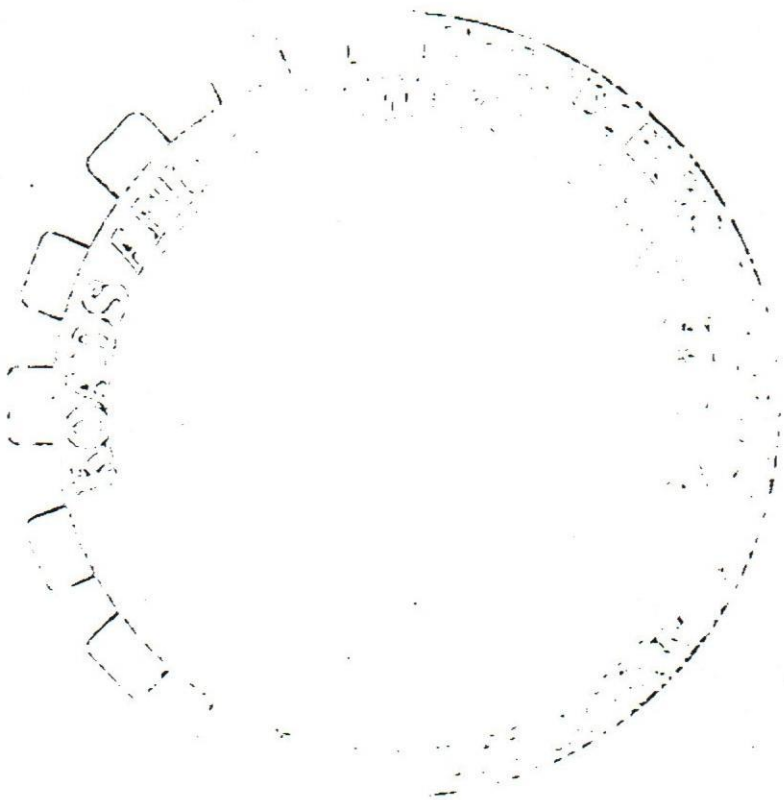
3.4.4 Measurement

Measurement of bituminous material shall be either in metric tons or in litres as indicated in the Contract Documents.

The measured quantity shall be the quantity theoretically required to comply with the Contract, or shall be the quantity used and accepted, whichever is the less.

3.4.5 Payment

This work shall be paid for as provided in the Section of the Specifications dealing with the work incorporating the bituminous material and shall be full compensation for complying with that Section of the Specifications as well as this Section.



3.5 GENERAL REQUIREMENTS FOR BITUMEN BOUND SURFACING (PLANT METHOD)

3.5.1 Description

3.5.1.1 General

This work shall cover the general requirements that are applicable to all types of bituminous bound surfacing irrespective of gradation of mineral aggregate, kind and amount of bituminous material, or use. Deviations from these general requirements are indicated in the specific requirements as set forth in the respective Sections of the Specifications.

Section 3.6 is for Prime Coats
Section 3.7 is for Tack Coats
Section 3.8 is for Primer Seal
Section 3.9 is for Bituminous Surface Treatment (Plant Method).
Section 3.10 is for Dense Bituminous Surfacing (Plant Method).
Section 3.11 is for Pre Mix Bituminous Surfacing (Manual Method).
Section 3.12 is for Premix Bituminous Seal Coat (Manual Method).

The work shall consist of one or more courses of pre-mixed bituminous mixtures constructed on a prepared and accepted base course or other roadbed in accordance with Sections of these Specifications and in conformity with the required lines, levels, grades, dimensions and typical cross sections.

3.5.1.2 General Composition of Mixtures

The bituminous mix shall be composed basically of coarse mineral aggregate, fine mineral aggregate, filler, and bituminous material. 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.

3.5.1.3 Formula for Job-Mix

Before starting work, the Contractor shall submit in writing to the Engineer a job-mix formula for each type of proposed asphaltic mixture. This shall state the sources and types of the various materials to be used, the mixing proportions of the various constituents, the method of mixing, the methods of heating bitumen and aggregates (including means of temperature control) and the means of transportation, laying and compaction. The formula so submitted shall stipulate a single definite temperature for the emptying of the mixture from the mixer, and, for mixtures to be laid hot, a single definite temperature at which the mixture is to be delivered on the road, all of which shall fall within the ranges of the general composition and temperature limits. The job-mix formula for the mixture shall indicate the percentage of aggregate passing each required sieve size and the percentage of bitumen to be added to the aggregate.

The contractor shall not commence bituminous surfacing work until the job mix formula has been approved in writing by the Engineer, including any adjustments to the job mix formula which the Engineer considers are necessary.

Following approval of the mix formulae the Contractor shall produce trial mixes and lay trial sections of surfacing for each formula. As many samples of the materials shall be taken and tested as the Engineer considers necessary for checking the required uniformity of the mixture and ensuring compliance with the Specification. Following approval of the trial sections

by the Engineer in writing the actual surfacing works may be carried out strictly in accordance with the approved mix formulae and trial sections.

Should a change in a material be encountered or should a change in a source of material be made, a new mix formula shall be submitted and approved before the mixture containing the new material is delivered for trials and approval on the surfacing works.

3.5.1.4 Applications of Job-Mix Formula and Allowable Tolerances

All mixture furnished shall conform to the job-mix formula, within the ranges of tolerance given below and subject to the maximum temperatures as given in clauses 3.10.3.2 and 3.10.3.4 :-

Passing sieves 10 mm and larger	± 8%
Passing sieves between 10 mm and 0.075 mm	± 5%
Passing 0.075 mm sieve	± 1%
Bitumen content (single test result)	± 0.50%
Bitumen content (three consecutive test results)	± 0.40%
Temperature of mixture when emptied from mixer	± 15° C
Temperature of mixture at delivery on road	± 15° C

These tolerances are applicable to individual test results. The mean value for a series of test results should be as close as possible to the approved job mix formula. The grading shall not be allowed to vary from coarser side on one sieve to finer side on another sieve within the approved job mix grading envelope.

Each day as many samples of the materials and mixture shall be taken and tested as the Engineer considers necessary for checking the required uniformity of the mixture. When unsatisfactory results are obtained the Contractor should take immediate corrective action. If the Engineer is not satisfied with the actions taken he may halt production, which will not be allowed to resume until the Contractor demonstrates that the problem has been corrected.

Job materials will be rejected if they are found not to conform to the requirements of the Specification.

3.5.2 Materials

3.5.2.1 Coarse Mineral Aggregate

The portion of the aggregate retained on the 5 mm sieve shall be known as coarse aggregate and shall be crushed stone, or crushed gravel. Only one source of coarse aggregate shall be used except by written permission from the Engineer. Approval of sources of supply of aggregate shall be obtained from the Engineer prior to delivery of the material. Samples and test results shall be submitted for approval of the Engineer at least 14 days in advance of its use.

Crushed stone and crushed gravel shall consist of clean, tough, durable material free from coherent coatings, decomposed stone, soft particles, organic matter, shale, clay and any other substances, which in the opinion of the Engineer may be deleterious to the mixture. Coarse aggregate shall meet the following requirements.

S.No.	Name of Test	Testing Procedure	Wearing Course	Base Course
1	Aggregate Crushing Value (ACV) (%)	STP 7.7.1	Less than 25%	Less than 30%
2	Los Angeles Abrasion (LAA) (%)	AASHTO T96	Less than 30%	Less than 35%
3	Water absorption	STP 7.5.4	Not more than 2%	Not more than 2%
4	Soundness	AASHTO T104	Loss in weight (after 5 cycles) with Sodium Sulphate solution- not more than 10%	
5	Coating & Stripping Test	AASHTO T182	Min. 95% retained coating	

When crushed gravel is used, not less than 90% by weight of the particles retained on a 5 mm sieve shall have at least two fractured faces.

The flakiness index as determined in accordance with STP 7.3.1 shall not exceed 30%.

3.5.2.2 Fine Mineral Aggregate

The portion of the aggregate passing a 5 mm sieve shall be known as fine mineral aggregate, and shall consist of natural sand, stone screenings, or a combination of both. Stone screenings shall be produced from stone meeting the requirements for coarse mineral aggregate in Section 3.5.2.1. 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.

The PI for material passing the 0.425 mm sieve shall be less than 4. Sand Equivalent of material passing 4.75 mm sieve, when tested in accordance with AASHTO T176, shall be minimum 50.

When the fine aggregate is tested for soundness as per AASHTO T104, the loss in weight after 5 cycles with sodium sulphate shall not exceed 15%.

Approval of sources of supply of aggregate shall be obtained from the Engineer prior to delivery of the material. Samples and test results shall be submitted for approval of the Engineer at least 14 days in advance of its use.

3.5.2.3 Mineral Filler

Mineral filler where required shall consist of limestone dust, dolomite dust, or similar rock dust, Portland cement, hydrated lime, silica cement or other mineral matter from sources approved by the Engineer. It shall be non plastic and free from foreign or other objectionable material. It shall be dry and free from lumps and when tested by means of laboratory sieves shall meet the following grading requirements:

Sieve Designation	Percentage by Weight (STP 3.3)
0.600 mm	100
0.150 mm	95 - 100
0.075 mm	65 - 100

Mineral filler shall be considered to include any mineral dust naturally present in the bitumen.

Approval of sources of supply of mineral filler shall be obtained from the Engineer prior to delivery of the material. Samples and test results shall be submitted for approval of the Engineer at least 14 days in advance of its use.

3.5.2.4 Bituminous Materials

Details as to the source and type of bitumen must be submitted for approval at least 14 days before the proposed use of the material and should conform to the requirements of Section 3.4. The Engineer may instruct for samples of the bitumen to be taken from the consignment before leaving the place of manufacture and that these should be forwarded to a laboratory nominated by the Engineer for analysis and testing. The material from which these samples for testing are taken must be segregated at the place of manufacture until the satisfactory completion of the aforesaid tests permit release.

Each consignment of bituminous material delivered to the site must be accompanied by a certificate showing the place of manufacture and the results of standard tests carried out on the bulk supply from which the material was extracted. No bituminous material other than that represented by the sample submitted shall be used by the Contractor except with the written consent of the Engineer. The contractor shall, in accordance with Specification Clause 1.3.2 and when so directed by the Engineer, arrange for sampling and testing, at an approved testing laboratory, of all bituminous materials delivered to and stored at site. Blending of bituminous materials from different refineries shall not be permitted.

3.5.3 Construction

3.5.3.1 Weather Limitation

Bituminous mixtures shall be placed only when the surface is dry, when rain does not appear imminent and when the prepared roadbed is in a satisfactory condition. However, the Engineer may permit, in case of sudden rain, the placing of mixture then in transit from the plant, if laid at proper temperature and if the roadbed is free from pools of water. Such permission shall in no way relax the requirements for quality and smoothness of surface.

3.5.3.2 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 not less than 60% of the capacity of the mixing plant.

3.5.3.3 Plant and Equipment

A) Requirements for all Mixing Plants

All plant used by the Contractor for the preparation of bituminous mixtures shall conform to all of the requirements below, except that scale requirements shall apply only where weight proportioning is used; and in addition, any batch mixing plants shall conform only to the relevant special requirements herein and any continuous mixing plants shall conform only to the relevant special requirements herein.

The mixing plant, which can be a batching plant or a continuous mixing plant, shall have a capacity sufficient to supply the paver on the road continuously when spreading the bituminous mix at normal speed and required thickness.

1) Uniformity. The plants shall be so designed, co-ordinated and operated as to produce a mixture within the job - mix tolerances.

2) Plant scales and weigh house. Scales for any weigh box or hopper may be either of the beam or spring less dial type and shall be of a standard make and design accurate to within one-half of 1 percent of the maximum load required.

Scales shall be approved by the Engineer and shall be checked as often as the Engineer may deem necessary to ensure their continued accuracy.

The Contractor shall provide and have at hand not less than ten 25 kilogram weights for frequent testing of all scales.

3) Equipment for preparation of bituminous material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control at all times, to a temperature within the range specified. The circulating system for the bituminous material shall be of adequate size to ensure proper and continuous circulation during the entire operating period. Suitable means shall be provided for maintaining the specified temperature of the bituminous material in the pipe lines, meters, weigh buckets, spray bars, and other containers or flow lines. The storage tank capacity shall be sufficient for at least 1 day's run. Bituminous material may be partially heated in the tanks and brought to the specified temperature by means of booster heating equipment between the tanks and the mixer.

4) Feeder for drier. The plant shall be provided with an accurate mechanical means for uniformly feeding the mineral aggregate into the drier so that uniform production and uniform temperatures are obtainable.

5) Drier. A rotary drier of approved design for drying and heating the mineral aggregate shall be provided. The drier shall be capable of drying and heating the mineral aggregate to the specified temperature.

6) Screens. Plant screens, capable of screening all aggregate to the specified sizes and proportions and having normal capacities slightly in excess of the full capacity of the mixer, shall be provided. The screens shall be readily exposed for inspection by the Engineer.

7) Bins. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be divided into at least three compartments and shall be arranged to ensure separate and adequate storage of appropriate fractions of the aggregate. For a mineral filler admixture a separate feeder bin and/or weighing hopper arrangement may be required. Bins shall be so constructed that representative samples can readily be obtained, and the aggregate level observed.

8) Bituminous control unit. Satisfactory means either by weighing or metering shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified for the job-mix.

For use with batching plants, it shall provide the designated quantity of bituminous material for each batch. For continuous mixing plants, the operating speed of the pump shall be synchronised with the flow of aggregate in the mixer by an automatic locking control, and the device shall be easily and accurately adjustable. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer. An accuracy within 1% of the specified amount is required.

9) Thermometric equipment. An armoured thermometer reading from 50°C to 200°C shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit.

The plant shall be further equipped with a thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.

10) Dust collector. The plant shall be equipped with a dust collector constructed to waste or return uniformly to the elevator all or any part of the material collected. The material to be returned from the dust collector shall be weighed over the filler scale.

11) Control of mixing time. The plant shall be equipped with accurate positive means to govern the time of mixing and to maintain it constant unless changed at the direction of the Engineer. The time of mixing shall be considered as the interval between the time the bituminous material is spread on the aggregate and the time the same aggregate leaves the mixing unit.

When bituminous is applied by a spray system, the mixing time shall begin with the start of the bitumen spray. When the bitumen is not applied by a spray system, a minimum dry mixing period of five seconds shall precede the addition of the bitumen to the mix.

12) Safety requirements. Adequate and safe stairways to the mixer platform and guarded ladders to other plant units shall be placed at all points required for accessibility to all plant operations. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected. Ample and unobstructed space shall be provided on the mixing platform. A clear and unobstructed passage shall be maintained at all times in and around the truck loading space. This space shall be kept free from drippings from the mixing platform. Flexible pipe connections carrying hot bitumen shall be shielded.

B) Special Requirements for Batch Mix Plants

1) Weigh box or hopper. The equipment shall include a means for accurately weighing each bin size of aggregate in a weigh box or hopper, suspended on scales, ample in size to hold a full batch without hand raking or running over. The weigh box or hopper shall be supported on fulcrums and knife edges so constructed that they will not easily be thrown out of alignment or adjustment. All edges, ends, and sides of weighing hoppers shall be free from contact with any supporting rods, columns or other equipment that will in any way affect the proper functioning of the hopper. There shall also be sufficient clearance between hoppers and supporting devices to prevent accumulations of foreign materials. The discharge gate of the weigh box shall be so hung that the aggregates will not be segregated when dumped into the mixer and shall close tightly when the hopper is empty so that no material is allowed to leak into the batch in the mixer during the process of weighing the next batch.

2) Mixer. The batch mixer shall be capable of producing a continuous uniform mixture within the job - mix tolerances. It shall be of such design as to permit visual inspection of the mix.

The mixer shall be equipped with a sufficient number of paddles or blades with proper arrangement to produce a properly and uniformly mixed batch. The clearance of blades from all fixed and moving parts shall not exceed 20 mm unless the maximum diameter of the aggregate particle in the mix exceeds 25 mm.

C) Special Requirements for Continuous Plants

1) Gradation control unit. The plant shall include a means for proportioning accurately each bin size of aggregate either by weighing or by volumetric measurement.

When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the materials drawn from each respective bin compartment. Indicators shall be provided for each gate to show the respective gate opening in centimetres.

2) Weight calibration of aggregate feed. The plant shall include provision for a calibration of the gate openings by means of weight test samples so that each of the materials fed out of the bins through individual orifices may be by-passed satisfactorily to suitable test boxes, each bin material being confined separately.

The plant shall be equipped to handle conveniently such test samples weighing not less than 150 kilograms combined weight of samples from all bins, and not less than 50 kilograms for any one bin sample.

3) Synchronisation of aggregate and bitumen feed. Satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bitumen from the meter or other proportioning source. This control shall be accomplished by interlocking mechanical means or by a positive method satisfactory to the Engineer.

4) Mixer. The plant shall include a continuous mixer of an approved type capable of producing a continuous uniform mixture within the job - mix tolerances.

Determination of the mixing time shall be by a weight method, using the following formula (the weights shall be determined for the job): -

$$\text{Mixing time in seconds} = \frac{\text{Pugmill dead capacity in kilograms}}{\text{Pugmill output in kilograms per second}}$$

5) Hopper. The mixer shall be equipped with a hopper at the discharge end, of such size and design that no segregation of mix occurs. Any elevator used for loading mixture into vehicles shall have an equally satisfactory hopper.

D) Equipment for Hauling and Placing

1) Trucks. Trucks for hauling bituminous mixtures shall have tight, clean and smooth metal beds 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. Each load shall be covered with canvas or other suitable material of such size as to protect the mixture from the weather. Any truck causing excessive segregation of material by its spring suspension or other contributing factors, or that shows oil leaks in detrimental amounts, or that causes undue delays, shall upon direction of the Engineer be removed from the Works until such conditions are corrected. When necessary, in order that the mixture shall be delivered on the road at the specified temperature, truck beds shall be insulated to maintain workable temperature of the mixture and all covers shall be securely fastened.

Trucks or any other equipment leaking petroleum products will not be allowed admittance to paved areas or areas where paving is under construction.

2) Spreading and finishing equipment. The equipment for spreading and finishing shall be approved mechanical, self powered pavers, capable of spreading and finishing the mixture true to the lines, grades, levels dimensions and cross sections.

The pavers shall be equipped with hoppers and distributing screws of the reversing type to place the mixture evenly in front of adjustable screeding devices and shall have reverse as well as forward travelling speeds.

The pavers shall maintain the grade and confine the edges of the pavement to true lines without the use of stationary side forms. The equipment shall include blending or joint levelling devices for smoothing and adjusting longitudinal joints between lanes. The assembly shall be adjustable to give the cross-section shape prescribed and shall be so designed and operated as to place the thickness or weight per square metre of material required.

Pavers shall be equipped with activated screeds and devices for heating the screeds to the temperature required for the laying of the mixture without pulling or marring.

The term "screed" includes any cutting, crowding, or other practical action that is effective in producing a finished surface of the evenness and texture specified, without tearing, shoving, or gouging.

If, during construction, it is found that the spreading and finishing equipment in operation leaves in the pavement surface tracks or indented areas of other objectionable irregularities that are not satisfactorily corrected by scheduled operations, the use of such equipment shall be discontinued and other satisfactory spreading and finishing equipment shall be provided by the Contractor forthwith.
Rollers shall be pneumatic typed rollers and smooth wheel rollers with or without vibration. The rolling procedure is described in Section 3.5.3.4.

3) Small tools. 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.

3.5.3.4 Preparation and Placing

A) Preparation of Existing Surface

Where local irregularities in an existing surface would otherwise result in a course more than 75 mm thick after compaction, the surface shall be brought to uniform contour by patching with a bituminous mixture to be approved by the Engineer, and thoroughly tamping or rolling until it conforms with the surrounding surface. The mixture used shall be the same as that specified for the next course, unless the size of the largest aggregate in the mixture precludes this when the Engineer will decide the mixture to be used.

Where the existing roadbed is broken or shows instability, the unstable material shall be removed and disposed of 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 mixture.

B) Preparation of Bituminous Material

The bituminous material shall be heated to the specified temperature in kettles or tanks so designed as to avoid local overheating and to provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.

C) Preparation of Mineral Aggregate

The mineral aggregates for the mixture shall be dried and heated before being placed in the mixer. Flames used for drying and heating shall be adjusted properly to avoid adversely affecting the aggregate and to avoid forming a heavy coating of soot on the aggregate. The aggregates shall be heated to the temperature specified in the applicable Section.

The aggregates, immediately after heating, shall be screened into three or more fractions and conveyed into separate bins ready for combining and mixing with bituminous material. The fraction of aggregate deposited in any bin shall not contain more than 10% of material outside the specified size limits for that bin.

D) Preparation of Mixture

The dried mineral aggregates prepared as prescribed above, shall be combined in the amount of each fraction of aggregate required to meet the job-mix formula for the particular mixture. The bituminous material shall be measured or gauged and introduced into the mix in the amount determined in the job mix formula. The proper amount of bituminous material shall be distributed over the mineral aggregate and the whole thoroughly mixed for a period of at least 30 seconds, or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregate are coated uniformly. For a continuous mixing plant, the mixing time shall be determined from the formula in Section 3.5.3.3(C)(4) and may be regulated by fixing a minimum gauge in the mixer unit and/or by other mixing unit adjustment.

E) Transportation and Delivery of Mixture

The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 3.5.3.3(D)(1). 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. Bituminous mixture pavers conforming to the requirements of Section 3.5.3.3(D)(2) shall be used for this purpose. The mixture shall be laid upon an approved surface and only when weather conditions are considered suitable by the Engineer.

In narrow base widening, deep or irregular sections, turn outs or driveways where it is impractical to spread and finish the mixture by use of a paver, the Contractor shall use approved spreading equipment or acceptable hand methods as directed by the Engineer.

On areas where in the opinion of the Engineer, the use of spreading equipment is considered impractical, the mixture shall be dumped on steel boards then spread, raked and luted by hand to provide the correct weight or uniform thickness of material without segregation. Mixture shall not be applied faster than can be properly handled and spread.

G) Compaction of Mixture

1) 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.

2) Roller Requirements. With each paver, two steel wheeled tandem rollers and one pneumatic tyred roller will be required.

All rollers shall be self propelled, capable of being reversed without backlash and equipped with power steering, dual controls allowing operation from either the right or left side, water tanks, sprinkler systems and coco-mats to ensure even wetting of rolls or tyres. The Contractor shall supply to the Engineer for each type of roller a calibration chart showing the relation between depth of ballast and weight and giving the tare weight of the roller. Each roller shall be in good condition and worked by a competent and experienced operative.

Steel wheeled tandem rollers shall weigh not less than 8 metric tons and each tandem roller used for final compaction (finish rolling) shall have at least one roll capable of applying a minimum rolling pressure of 35 kilograms per centimetre of roll width.

Pneumatic tyred rollers shall be of an approved type having not less than seven wheels with smooth treat compactor tyres of equal size and construction capable of operating at inflation pressures up to 8.5 kg/cm². Wheels shall be equally spaced along both axle lines and arranged so that tyres on one axle line track midway between those on the other with an overlap. Each tyre shall be kept inflated to the specified operating pressure such that the pressure difference between any two tyres shall not exceed 0.35 kg/cm². Means shall be provided for checking and adjusting the tyre pressures on the job at all times. Each roller shall be so equipped that its total weight is adjustable by ballasting allowing the load per wheel to be varied from 1,500 to 2,500 kilograms. In operation, the tyre inflation pressure and the wheel load shall be adjusted, as required by the Engineer, to meet the requirements of each particular application. In general the compaction of any course with a pneumatic tyred roller shall be accomplished with contact pressures as high as the material will support.

3) Procedure. Rolling of the mix shall consist of six separate operations as follows:
- transverse joint
- longitudinal joint
- edges
- initial or breakdown rolling
- second or intermediate rolling
- finish rolling

The first rolling of all joints and edges, the initial or breakdown rolling and the final or finish rolling shall all be done with the steel wheeled tandem rollers.

The second or intermediate rolling shall be done with the pneumatic tyred roller except on small operations.

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 shall overlap by at least one half of the width of the roller and alternative trips shall not terminate at the same point. For initial rolling, the drive roll should be nearest the paver.

The speed of the rollers shall not exceed 4 kilometres per hour for steel wheeled rollers and 6 kilometre per hour for pneumatic tyred 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. Heavy equipment or rollers shall not be permitted to stand on the newly laid surface until it has thoroughly cooled.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excess water will not be permitted.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is cause for the removal and replacement of the contaminated pavement by the Contractor.

Along kerbs, headers, manholes, and similar structures and at all places not accessible to the roller, thorough compaction shall be secured by means of hot hand tampers or with mechanical tampers giving equivalent compaction. Each hand tamper shall weigh not less than 10 kilograms and shall have a tamping face area of not more than 250 square centimetres.

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 with the surrounding area. Any area of 1,000 square centimetres 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 staggered a minimum of 20cm and so arranged 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 100cm centimetres and shall be straight.

Spreading shall be as nearly continuous as possible and rollers shall pass over the unprotected end of freshly laid mixture only when authorised by the Engineer. In all such cases provision shall be made for a properly bonded and sealed joint with the new surface for the full depth of the course as specified above.

Before placing mixtures against them, all contact surfaces of kerbs, gutters, headers, manholes etc. shall be given a thin uniform coating of hot bitumen and the joints between these structures and the surface mixture shall be effectively sealed by the subsequent spreading, finishing and compaction operations.

When the wearing course is placed adjacent to kerbs to form a bitumen gutter it shall be sealed with bitumen for a distance of 30 centimetres from the kerb. The seal shall be evenly applied to the surface by means of hot irons or squeegees so that the surface voids are completely filled and no excess bitumen remains on the surface. The desired drainage pattern shall be maintained.

3.5.3.5 Surface Test of the Pavement

The finished surface of the pavement for both base (binder) and wearing courses shall not vary from the specified levels and grades by more than ±5mm. The surface shall be also tested by a crown template and 3 metre straight edge, furnished by the Contractor, applied respectively at right angles and parallel, to the centreline of the road. The Contractor shall designate some employees to use the template and straight edge under the direction of the Engineer in checking all surfaces. The crown template shall conform to the typical cross section shown on the Drawings.

The variation of the surface from the testing edge of the crown template and the straight edge between any two contacts with the surface shall not exceed 5 millimetres for both binder and wearing courses.

Tests for conformity with the specified crown and grade shall, when agreed by the Engineer, be made immediately after initial compaction and variations shall be corrected by removing or adding materials as may be necessary. Rolling shall then be continued as specified. After final rolling, the smoothness of the course shall be checked again and any irregularity of the surface exceeding the above limits and any areas defective in texture, compaction, or composition, shall be corrected as directed by the Engineer, including removal and replacement at the Contractor's expense if so directed by the Engineer.

The average thickness of the compacted bituminous layer, as computed from 5No successive determinations for every 400 to 800 m^2 of pavement area, shall not be less than the specified thickness nor shall any particular point be thinner than 5mm less than the specified thickness. Any section of paving having thickness measurements outside these limits shall be rectified at the contractor's expense as directed by the Engineer, including where necessary removal and replacement. In case of removal and relaying of the pavement layer a minimum length of 50m shall be removed for its full width.

The edges of the pavement shall follow a smooth alignment and, where not bound by kerbs or other edgings, shall not deviate from the specified alignment by more than ±20mm. Any material laid out of alignment is to be corrected as directed by the Engineer. Excess material shall be cut off square after final rolling, and disposed of by the Contractor.

3.5.3.6 Control and Testing

The Contractor shall supply qualified personnel to be in charge of the tests and controls required to ensure correct operation of the plant and the manufacture of a satisfactory product.

The Contractor shall keep a diary and maintain records of times, batch numbers, areas paved and other observations, and he shall follow such instructions as may be given by the Engineer in order to obtain the required quality of the bituminous bound material.

3.5.4 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.

3.5.5 Payment

The work shall be paid for as provided in the respective Section for each type of bituminous layer.

3.6 BITUMINOUS PRIME COAT

3.6.1 Description

This work shall consist of the careful cleaning of the surface to be primed and furnishing and applying bituminous material in accordance with these Specifications to the area shown on the Drawings or as directed by the Engineer.

3.6.2 Materials

3.6.2.1 Bituminous Materials

Bituminous material shall be a MC 30 or MC 70 cut back bitumen and shall conform to the requirements of Section 3.4. The bituminous material shall be approved by the Engineer and may be prepared by cutting back 80/100 penetration bitumen with kerosene 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.

3.6.2.2 Blotting Material

Blotting material shall be approved clean dry sand or stone screenings free from any cohesive materials or organic matter. Not more than 10 per cent of the sand shall be finer than the 75 micron sieve.

3.6.3 Construction Methods

3.6.3.1 Weather Limitations

Prime coat shall be applied at a time when the surface to be treated is dry or slightly damp, when the ambient temperature is above 13°C and rising, or above 16°C if falling, and when the weather is dry.

3.6.3.2 Equipment

The Engineer may approve Construction equipment and methods (including labour intensive methods) other than those specified hereinafter provided that the contractor can demonstrate his ability to carry out the work to a satisfactory standard using his proposed equipment and methods to the complete satisfaction of the Engineer. Such approval shall be in writing and may be withdrawn at any time if the work is found to be unsatisfactory in any respect.

The equipment used by the Contractor shall include, unless otherwise approved by the Engineer, a power brush, a pressure bituminous distributor, and, when necessary, equipment for heating bituminous material.

The distributor shall have pneumatic tyres and shall be so designed, equipped, maintained and operated that bituminous material at constant temperature may be applied uniformly on variable widths of surface up to 4 metres at readily determined and controlled rates of from 0.2 to 2.0 litres per square metre with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.1 litre per square metre. Distribution equipment shall include an instrument for measuring the speed of travel accurately at low speeds, and the temperature of the contents of the tank.

The spray bar on the distributor shall be controlled by a man riding at the rear of the distributor in such a position that operation of all sprays is in his full view.

The tanks of distributors shall be fitted with accurately calibrated dipsticks or contents gauges.

All measuring equipment on the distributor shall have been recently calibrated and an accurate and satisfactory record of such calibration shall be supplied to the Engineer. If, after beginning the work, the distribution of bituminous material is found to be in error, the distributor shall be withdrawn from the work and calibrated to the satisfaction of the Engineer before any further work is undertaken.

The Engineer may require such tests, as he considers necessary to check the performance of the distributor. As and when directed by the Engineer, the Contractor, at his own expense, shall make the distributor and its equipment available for field testing and shall supply any assistance required for this purpose. Any distributor, which does not operate satisfactorily or conform to the requirements of the Specifications in all respects, may be rejected by the Engineer for further use on the Works.

3.6.3.3 Cleaning Surface

Immediately before applying the bituminous material, all loose dirt and other objectionable material shall be removed from the surface with a power brush. When so ordered by the Engineer, a light application of water shall be made just before the application of bituminous material.

3.6.3.4 Application of Bituminous Material

Bituminous material shall be applied at the rate, or rates, either shown in the Contract Documents or as directed by the Engineer. The rate sprayed can be verified using STP 10.12. This will usually be from 1.0 to 2.5 litres per square metre, and at a temperature within the range called for in Table 3.4-6 for the particular material being used. Any prescribed application shall be divided into two applications when necessary to prevent bitumen flowing off the surface, and additional bituminous material shall be applied where surface conditions indicate it to be necessary, if the Engineer so directs. No further courses shall be applied until the prime coat has dried and the solvent evaporated.

When so directed, the prime coat shall be applied in lanes of approximately one-half or less of the width of the completed surface. A lane of prime coat shall be applied, allowed to penetrate for not less than 48 hours, then covered with blotting material if required, and opened to traffic before bituminous material is applied to the adjacent lane. In covering the first primed lane, a strip at least 200 mm wide shall be left uncovered where it joins the second traffic lane to permit an overlap of the bituminous material.

The surface of structures and trees adjacent to the areas being treated shall be protected in such manner as to prevent their being splashed or damaged. No bituminous material shall be discharged into a borrow pit or gutter.

3.6.3.5 Maintenance and Opening to Traffic

Traffic shall not be permitted on the primed surface until the material has penetrated and dried and, in the opinion of the Engineer, will not be picked up by traffic. Where the Engineer deems it impracticable to detour traffic, the Contractor shall spread the minimum quantity as determined by the Engineer, of blotting material necessary to avoid picking up, and traffic shall be allowed to use areas so treated. Any areas containing an excess or deficiency of priming material shall be corrected by the addition of sand or bitumen as directed by the Engineer. Such corrections of faulty work shall be carried out at the Contractor's expense.

3.6.4 Measurement

The quantity of bituminous material shall be measured for payment in square metres; however, in the case of plant placed materials a record of the number of Litres of bituminous material placed will also be kept.

The measured quantity shall be the theoretical required to comply with the Contract, or shall be the quantity used and accepted. This should be within ± 5% of the theoretical quantity unless there is a change in the area of coverage.

3.6.5 Payment

This work measured as provided above, 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 surface and furnishing and placing the materials and application of blotting materials including all labour, equipment, tools and incidentals necessary to complete the work prescribed in this Section.

Pay item shall be:

3/6/1(a)	Bituminous Prime Coat (plant placed)	Square Metre
	or	
3/6/1(b)	Bituminous Prime Coat (hand placed)	Square Metre

3.7 BITUMINOUS TACK COAT

3.7.1 Description

This work shall consist of furnishing and applying bituminous material to a previously prepared roadbed, in accordance with the Specifications and to the width and area required by the Engineer.

3.7.2 Materials

Bituminous material shall be either 60/70 or 80/100 penetration grade bitumen, cut back bitumen RC 30, RC 70 cut back bitumen RC 30, RC 70, or rapid setting emulsion conforming to the requirements of Section 3.4 of these Specifications. The bituminous material shall be approved by the Engineer.

3.7.3 Construction Methods

3.7.3.1 Equipment

The Engineer may approve Construction equipment and methods (including labour intensive methods) other than those specified hereinafter provided that the contractor can demonstrate his ability to carry out the work to a satisfactory standard using his proposed equipment and methods to the complete satisfaction of the Engineer. Such approval shall be in writing and may be withdrawn at any time if the work is found to be unsatisfactory in any respect. The equipment shall be as specified in Section 3.6, Bituminous Prime Coat.

3.7.3.2 Cleaning Surface

The full width of surface to be treated shall be cleaned with a power brush to remove loose dirt, sand, dust and other objectionable material. The surface to be treated shall be dry.

3.7.3.3 Application of Bituminous Material

Immediately after cleaning the surface, bituminous material shall be applied at the rate directed by the Engineer, but not to exceed 0.45 litres per square metre and at the temperature within the range included in Table 3.4-6 for the particular material being used. The tack coat shall be applied only when the surface is dry.

The tack coat material shall be uniformly distributed over the surface without streaking. Quantities shall not deviate more than 10% from the quantity prescribed by the Engineer. Quantities outside the specified tolerances shall be adjusted by the Contractor at his own expense, to the satisfaction of the Engineer.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such manner as to prevent their being splashed or damaged. No bituminous material shall be discharged into a borrow pit or gutter. The Engineer may direct that emulsions shall be diluted with clean water in order to control the rate of spread. This shall be done at the Contractor's expense.

After the tack coat is applied the Contractor shall protect it from damage until the surface course is placed. No surfacing layer will be permitted to be placed unless the tack coat is in a satisfactory condition to receive it and as such the tack coat shall be applied only so far in advance of surface course placement as is necessary for this to occur.

3.7.4 Measurement

The quantity of bituminous material shall be measured for payment in square metres; however, in the case of plant placed materials a record of the number of Litres of bituminous material placed will also be kept.

or

The measured quantity shall be the theoretical required to comply with the Contract, or shall be the quantity used and accepted. This should be within ± 5% of the theoretical quantity unless there is a change in the area of coverage.

3.7.5 Payment

This work measured as provided above, shall be paid for at the Contract price per unit of measurement. The prices and payment shall be full compensation for furnishing and placing the materials, including all labour, equipment, tools and incidental necessary to complete the work.

Pay item shall be:

3/7/1(a)	Bituminous Tack Coat (plant work)	Square Metre
	or	
3/7/1(b)	Bituminous Tack Coat (labour intensive work)	Square Metre

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3.8 PRIMER SEAL

3.8.1 Description

The work shall consist of an application of bituminous material followed by spreading of pea-gravel, a cover coat material, in accordance with these Specifications to the area shown on the Drawings or as directed by the Engineer.

3.8.2 Materials

3.8.2.1 Bituminous Material

Cutback bitumen conforming to the requirements of section 3.4 as appropriate, shall be used for the purpose. The 80-100 penetration grade bitumen may be converted into cutback by fluxing and thoroughly mixing 4% diesel with the bitumen after it is heated. The method of mixing or fluxing for cutback from 80-100 penetration grade bitumen shall be approved by the Engineer.

3.8.2.2 Cover Coat Material

Cover coat material used for this work shall be screened Pea gravel conforming to the Specification and graded so that 100% of the materials falls within the size range of 2.4 mm to 6.3 mm. Pea-gravel shall be washed by water, dried and be free from any organic matter, clay or any other objectionable matter and completely dust free. Samples of the Pea gravel proposed for use shall be submitted for approval of the Engineer.

3.8.3 Construction Methods

3.8.3.1 Cleaning Surface

The contractor shall furnish all labour and equipment required for thoroughly cleaning the surface to be primed. The cleaning shall be done in such a manner as to thorough remove all mud, dust and other foreign materials. The sweeping on a water bound surface shall be just sufficient to expose the pattern of the coarse aggregate. Any surplus bituminous materials shall be removed from the surface.

Special care shall be taken to clean the edges of the road to be primed in order to ensure uniform application of the bituminous materials, directly on the existing base of pavement material.

3.8.3.2 Applying Bituminous Materials

Primer seal work shall be carried out only when the surfaces and aggregates are dry and shall only be commenced in areas which can be completed in dry conditions. Any work which becomes wet by rain or other causes before rolling is completed may be rejected.

Fluxed bitumen, at a temperature as given in table 3.4-6 , shall be applied uniformly to the prepared surface at a rate of 1.0 L/m^2 or as directed by the Engineer.

Application may be approved by labour intensive methods in which case the following procedure will be adopted.

- The surface to be sprayed will be marked into 1 metre wide strips for the full width of the pavement.

- Using a container constructed to hold the quantity of bituminous materials required for the area of 1 strip, apply the fluxed bitumen using a rubber squeegee.
- The contractor shall furnish a thermometer at each mixing unit to ensure that temperature of cutback bitumen is always within specified range.

3.8.3.3 Spreading and Rolling

Screened pea gravel aggregate, shall be spread uniformly to the required density over the bitumen prime as soon as possible after application of the bitumen to provide a dense uniform cover one stone thick. Brooming or other methods shall be used if necessary to achieve a uniform spread rate. The aggregate application rate will be approximately 10kg/m², or as directed by the Engineer. Rollers shall comply with section 3.5.3 of this Specification.

The time between application of the bitumen at any location and the completion of spreading the aggregate over it at that location shall ensure that the bitumen is still within the specified temperature range and shall not exceed 3 minutes. The aggregate shall be rolled into the bitumen immediately using a rubber tyred roller for at least 4 passes and the road shall not be opened to traffic if this will cause any damage to the works.

3.8.4 Measurement

Surface dressing work shall be measured under this item by the number of square metres of acceptable work completed.

3.8.5 Payment

The quantity measured as provided above shall be paid for at the contract unit price per unit of measurement as shown in the Bill of Quantities, or on the drawings. The prices and payments shall be full compensation for cleaning, application of bitumen, compaction, furnishing the materials, testing, site trials and for all labour, tools, equipment and incidentals necessary to complete this item.

Pay item shall be:

3/8/1 Primer Seal	Square Metre

3.9 BITUMINOUS SURFACE TREATMENT (PLANT METHOD)

3.9.1 Description

Bituminous Surface Treatment shall consist of one or more applications of bituminous material and cover aggregate to a primed non-bituminous surface, or to a previously constructed bituminous surface, in accordance with these Specifications and to the area shown on the Drawings and as directed by the Engineer.

3.9.2 Materials

3.9.2.1 Bituminous Materials

Bituminous material shall be either RC 800 or RC 3000 cut back bitumen, rapid setting emulsion or, with the agreement of the Engineer 80/100 penetration grade bitumen conforming to the requirements of Section 3.4 of these Specifications. The bituminous material shall be approved by the Engineer.

3.9.2.2 Bitumen Additive

An Adhesion and Anti-stripping Agent shall be added to the bituminous material where so specified or when the Engineer so directs or approves. The additive shall be of a type approved by the Engineer and the required percentage of additive shall be thoroughly mixed with the bituminous material in accordance with the manufacturer's instructions, or as directed by the Engineer, for such time as is necessary to produce a homogeneous mixture.

3.9.2.3 Aggregates

Aggregates shall consist of clean, hard, dry, sound, crushed stone or crushed gravel of uniform quality, free from dust, clay, dirt and other deleterious matter and from excess of flat or laminated pieces. When crushed gravel is used, not less than 90% by weight of the particles retained on a 5 mm sieve shall have at least Two fractured faces.

Aggregate shall be of such a nature that when thoroughly coated with the bituminous material proposed for the work, the coating will not be removed upon contact with water.

The aggregate when tested in accorded with STP 7.7.1 and 7.7.2 shall have an Aggregate Crushing Value less than 25 and a ten per cent fines value greater than175 kN. The flakiness index as determined in accordance with STP 7.3.1 shall not exceed 25%.

Test results should be submitted to the Engineer for approval. The Engineer may require that other tests shall be carried out to determine its acceptability for surface treatment.

The grading of the aggregates shall fall within the limits specified in Table 3.9-1 for the appropriate specified nominal size.

Table 3.9-1

Grading Requirements for Cover Aggregate for Bituminous Surface Treatment			
Nominal Sieve Size	Aggregate Nominal Size		
	20 mm	14 mm	10 mm
	Percentage by weight passing square mesh sieves		
20	100	100	100
14	0 - 45	85 - 100	100
10	0 - 7	0 - 45	85 - 100
6.3	0 - 2	0 - 7	0 - 45
2.4	-	0 - 2	0 - 7
0.075	0 - 1	0 – 1.5	0 - 2

Notes on Table 3.9-1

1) For Single Surface Treatment either 20, 14 or 10 mm nominal size may be specified.

2) For Double Surface Treatment the first course may be either 20 mm or 14 mm followed by a second course of 10 mm nominal size.

Aggregate shall not contain sufficient moisture to cause uneven distribution of the pre-coating material and shall not be used in the work until the moisture has evaporated and the pre-coating material has adhered effectively to the aggregate.

3.9.2.4 Pre-Coated Aggregate

Aggregates shall be pre-coated with approved pre-coating material to improve the adhesion to the bitumen. Pre-coating material shall be thinly and evenly applied by means of a fine pressure spray to a moving stream of aggregate in an approved mixing plant so that all particles are fully coated but do not contain excess material. The coating shall be such that no material will drip from a particle of aggregate suspended between the fingers.

Pre-coating of aggregate shall not be carried out when rain is imminent unless the aggregate is adequately covered or unless the mixing of an adhesion agent in the pre-coating material has been authorised by the Engineer.

3.9.2.5 Stockpiling of Aggregates

Stockpiling of aggregates will be permitted only in designated areas approved by the Engineer. A separate stockpile shall be made for each nominal size of aggregate at each location.

In areas subject to dusty conditions, pre-coated aggregate shall not be stockpiled for any period longer than is necessary for moisture to dry out. When there is a visible coating of dust on the particles, the Engineer may direct that portions of the stockpiles be pre-coated again.

The site of the stockpile shall be cleared of all vegetation and debris, graded and drained, and, where the Engineer deems it necessary, the area shall be surfaced with a 100 mm layer of approved stone or with brick flat soling. In any case, the bottom 50 mm layer of aggregate or any contaminated aggregate shall not be used in the work.

Unless otherwise approved by the Engineer, each stockpile shall be built at least 2 metres high. The Contractor shall supply any planking or other material required in connection with movement of vehicles over and about the stockpiles.

3.9.3 Construction Methods

3.9.3.1 Equipment

Equipment described in this Section will be used for bituminous surface treatments unless the Engineer approves alternative construction methods proposed by the Contractor. Alternative construction methods would be particularly applicable to small areas and to the surfacing of footpaths and hard shoulders.

The Contractor shall supply all the plant and equipment necessary for carrying out the work in accordance with these Specifications and shall supply details of the make, model, capacity, weight and such other details of the plant and equipment as may be required by the Engineer.

For seal coats without cover aggregate, the equipment shall include a power brush, a self-powered bituminous material pressure distributor and, when necessary, equipment for heating bituminous material.

For seal coats with aggregate, and surface treatments, the equipment shall include a power brush, a drag brush, a bituminous material pressure distributor, a self-propelled pneumatic tyred roller, aggregate spreading equipment, an adequate number of trucks and, when necessary, equipment for heating bituminous material. A steel wheeled roller may be used only when so authorised by the Engineer.

In addition, when coated aggregates, bitumen additive or rubberised bituminous materials are specified, approved mixing plant shall be provided for the particular application.

Plant and equipment shall comply with the following requirements:

a) The Bituminous Material Distributor shall conform to the requirements of Section 3.6.3.2

b) The Power Brush shall be a rotary brush, towed or self-propelled, designed for sweeping road surfaces.

c) The Drag Brush shall be capable of distributing unevenly spread aggregate without disturbing the particles freshly bedded in the binder.

d) The Pneumatic Tyred Roller shall conform to the requirements of Section 3.5.3.4(G)(2).

e) The Steel Wheeled Roller, where this type is permitted, shall have a load per 10 mm width of roll between 25 and 45 kg.

f) The Aggregate Spreader shall be approved mechanical equipment capable of spreading a uniform layer of cover aggregate of the specified size.

g) Motor Trucks shall be suitable in number and performance for the application of aggregate in accordance with Section 3.9.3.5.

h) Heating Equipment shall be capable of producing uniform heating to the required temperature without damage to the bituminous material. An approved instrument for temperature measurement with an accuracy of 3% shall be provided. Means shall be provided to drain completely the heating tank or tanks. Suitable fire-fighting equipment and material shall be conveniently available to the heating equipment at all times when heating is in progress.

3.9.3.2 Weather Limitations and Control of Work

No spraying shall be carried out on a wet pavement, while rain appears imminent or during high winds. The Engineer may order work to cease temporarily on account of adverse weather. The Engineer may also order work to cease if the condition of materials is unsatisfactory, or conditions exist which he considers may affect the work adversely, for example the equipment or pavement is in unsatisfactory condition. The work will not be allowed to restart until the contractor has taken the necessary corrective action.

3.9.3.3 Cleaning and Preparation of Surface

No application of bituminous material shall be undertaken until the pavement has been cleaned to the satisfaction of the Engineer. Loose dirt and other objectionable material shall be removed from the surface by means of the power brush. If this does not provide a uniformly clean surface, additional sweeping shall be done by hand, using stiff bass or similar brushes. Sweeping shall extend at least 200 mm beyond each edge of the area to be sprayed.

Adherent patches of objectionable material shall be removed from the surface by steel scraper or other approved method, and where the Engineer so directs, the scraped area shall be washed down with water and hand brushes.

Where a prime coat has been applied to the surface, any area in which the prime coat has been insufficiently applied or is defective in any way shall be re-primed as directed by the Engineer. A period of at least 48 hours or such longer period as may be necessary for the primer to become completely dry shall elapse before any further bituminous material is applied.

Before application of the bituminous material, any necessary preliminary patching of the surface of the road shall have been completed to the satisfaction of the Engineer.

3.9.3.4 Application of Bituminous Material

The uniform application of bituminous material at the rate specified or ordered, reference is made to Table 3.9-2, shall be made by means of the distributor. For small areas, the Engineer may approve the application by means of hand spray equipment attached to the distributor.

For the particular bituminous material being used the application temperature shall be within the range included in Table 3.4-6. When an adhesion agent has been added to the bituminous material, the whole of the material in the distributor shall be circulated for at least fifteen minutes, or such greater time as may be necessary, to achieve a homogeneous mixture at uniform temperature.

Quantities of bituminous materials in excess of requirements shall not be heated, nor shall such materials be held within the range of the application temperatures for periods in excess of ten hours. Any bituminous material which has been heated for an excessive period of time, or which has been overheated, shall be rejected.

The area to be sprayed with bituminous material at any time shall be limited to that which can be covered with aggregate at the specified rate within 15 minutes of the time of spraying in the case of liquid asphalts, or such smaller duration of time as the Engineer shall direct.

When so directed, the bituminous material shall be applied in lanes of approximately one-half or less of the width of the completed surface and when so applied, there shall be a slight overlap of bituminous material along the adjoining edges of lanes. In the case of multiple surface treatments, succeeding courses shall have the bitumen joint offset by approximately 200 mm from the joint of the preceding application.

Table 3.9-2

Approximate Quantities of Materials for Surface Treatment per Square Metre		
Nominal Size of Aggregate (mm)	Rate of Application	
	Kilograms Aggregate	Litres Bituminous Material
20	20 - 32	1.2 - 2.2
14	12 - 20	0.8 - 1.5
10	8 - 15	0.7 - 1.2

Notes on Table 3.9-2

1. The quantities shown above are a guide only and will vary considerably according to the type and condition of the surface, the grading, type, shape and absorbency of the aggregate, the weather conditions and the traffic.

2. The bituminous material may be bitumen, cut back bitumen or bitumen emulsion as specified elsewhere in the Contract Documents. For seal coats, the Engineer may direct that emulsions shall be diluted with clean water in order to control the rate of application. This shall be done at the Contractor's expense.

3. In the case of multiple surface treatments a considerable variation of the quantities shown above for bituminous materials may be found necessary or desirable. The first application of bitumen may be reduced and subsequent applications increased if this provides a better result.

4. The rates may be specified by the Engineer, but normally the Contractor will be required to carry out trials at the Contractor's expense. These should use materials in the range indicated in Table 3.9-2, and be on areas other than the Project road surface, in order to allow the necessary rates to be established. These rates should be agreed with the Engineer and utilised for the bituminous surface treatment on the Project road surface and these will produce the actual quantities for the works.

A minimum of two tests for each days work shall be carried out by the Contractor, under the supervision of the Engineer, in order to verify that the actual rate of application of aggregates and bituminous material complies with the specified rate or those established by the trials and agreed by the Engineer.
If the measured application rates vary within ±10% of the established rates, the work will be accepted.

Should the measured application rates for bituminous surface treatment be greater than ±10% of the rates ordered, the Engineer shall decide if the concerned work shall be condemned. Such condemned defective bituminous surface treatment shall be completely removed, and the work will be carried out again with all abortive and additional work being at the Contractor's expense.

When surface treatment is being applied to the shoulders of the carriageway, the Contractor shall take suitable precautions to prevent contamination of the finished carriageway surface with bituminous material. However, the bituminous material shall slightly overlap the adjoining bituminous concrete surface to prevent the ingress of water along the joint.

During all applications, iron work in the road shall be covered with heavy oil or grease and the surfaces of adjacent structures and trees shall be protected in such manner as to prevent their being splashed or damaged.

Suitable paper or metal sheets shall be spread on the ground for a sufficient distance back from the ends of each application so that flow through the nozzles may be started and stopped on the paper or metal sheets and so that all nozzles will operate properly over the entire length being treated. The distributor shall commence moving at a sufficient distance in advance of the start of the application to ensure that the road speed for the correct application rate is attained at the commencement of spraying and this speed shall be maintained until past the finishing point of the application.

After each application, the quantity of material sprayed shall be checked against the area covered, and any necessary adjustments shall be made to ensure that the specified or ordered rate of application is maintained in subsequent runs.

Spraying shall cease immediately if any defect develops in the spraying equipment and it shall not re-commence until the fault has been rectified.

3.9.3.5 Application of Cover Aggregate

Before the bituminous material is applied, sufficient cover aggregate shall be in trucks at the site of the work to fully cover the area to be sprayed. The application of the aggregate shall proceed immediately after spraying of the bituminous material and shall be completed within 15 minutes of the completion of spraying or such smaller period of time, as the Engineer shall direct.

The aggregate shall be spread uniformly over the bituminous material by means of the approved aggregate spreader at either the rate specified or as determined by trials. Any bare or insufficiently covered areas shall be re-run by the mechanical spreader or covered by hand as necessary to give uniform and complete coverage. Any aggregate spread in excess of the rate specified or ordered shall be scattered and evenly distributed on the road or otherwise removed and stockpiled as directed by the Engineer.

3.9.3.6 Rolling and Brushing

Immediately after spreading to the satisfaction of the Engineer, the aggregate shall be rolled with one or more pneumatic tyred rollers or, if permitted by the Engineer, by approved steel wheeled rollers, until the aggregate is firmly embedded in the bituminous material. Where required to ensure an even distribution of aggregate, the surface shall be drag brushed after the initial rolling except that if the drag brush has any tendency to dislodge aggregate particles bedded in the binder, the Engineer may direct that drag brushing be deferred or eliminated, and that light hand brushing be substituted. Rolling shall be continued, as directed by the Engineer, for as long as is necessary to ensure thorough incorporation of the aggregate into the binder.

Immediately after the binder has hardened to the stage at which, in the opinion of the Engineer, no more aggregate can be pressed into it by rolling, any remaining loose particles shall be removed from the pavement and shoulders.

If, after spreading, the aggregate is found to contain moisture and weather conditions are suitable for drying, the Engineer may allow the rolling of the aggregate to be deferred for a short time to permit the moisture to evaporate providing that satisfactory adhesion of the binder to the aggregate is obtained. If the Engineer considers that the adhesion of the binder to the aggregate

is unsatisfactory, he shall reject the work and direct that no further work be carried out until the conditions improve.

3.9.3.7 Control of Traffic

The Contractor shall comply with Section 1.1 of this Specification. In addition the Contractor shall take all necessary precautions to protect the work from damage until such time as the seal coat or surface treatment has developed sufficient strength to carry normal traffic without disturbance of the aggregate. Where it is necessary to allow early use of the new work to facilitate the movement of traffic, vehicles may be allowed to run on the work after rolling is completed provided that vehicles are controlled to such slow speeds that no displacement of aggregate occurs.

No traffic shall be permitted to pass the working area during the application of bituminous material nor shall traffic be permitted to encroach upon the edge of bituminous material until such time as it is covered with aggregate.

3.9.4 Measurement

The Bituminous Surface Treatment works of the type stated in the Bill of Quantities shall be measured in square metres of the completed and accepted works as detailed on the drawings or as directed by the Engineer.

3.9.5 Payment

The quantities, measured as provided above, shall be paid for at the Contract unit price per unit of measurement, shown in the Bill of Quantities. The prices and payment shall be full compensation for trial mixes, furnishing, and placing all materials, including all labour, equipment, tools and incidentals necessary to complete the Works.

Where defective work is corrected, or additives used which have not been specified or ordered by the Engineer, no payments will be made in respect of extra work or materials used in excess of the quantities specified or ordered. The use of Adhesive and anti stripping Agent bitumen Additive will not be paid for separately, and any costs involved should be included within 3/9/2. Pre-coating of chippings shall be carried out without any additional payment.

Pay items shall be:

3/9/1	Single Bituminous Surface Treatment	Square Metres
3/9/2(a)	Double Bituminous Surface Treatment- 20mm nominal size aggregate followed by 10mm (Machine Method)	Square Metres
3/9/2(b)	Double Bituminous Surface Treatment- 14mm nominal size aggregate followed by 10mm (Machine Method)	Square Metres

3.10 DENSE BITUMINOUS SURFACING (PLANT METHOD)

3.10.1 Description

3.10.1.1 General

This work shall consist of a surfacing of dense graded bituminous material, constructed on a prepared aggregate base in accordance with these Specifications, to the lines, levels, grades, dimensions and cross sections shown on the Drawings, or as required by the Engineer.

All the provisions of Section 3.5, "General Requirements for Bituminous Surfacing" shall form a part of this Section of the Specifications unless otherwise stipulated herein.

The surfacing shall consist of one or two layers of the thickness shown on the Drawings. If the surfacing is of two layers the top layer shall be denoted as the wearing course and the lower layer as the base course.

3.10.1.2 General Composition of the Mixture

The mixture shall consist of mineral aggregate added with 2% hydrated lime powder or Portland Cement filler complying with section 3.5.2.3 of these Specifications, if needed, coated with bitumen with the materials complying with Section 3.5.2 of these Specifications and with Table 3.10-1. The mixture shall not contain more than 15% of natural sand by weight of total aggregate.

When the total thickness of bituminous surfacing exceeds 75 mm, the material may be laid in two courses if directed by the Engineer.

The base course shall be within the limits set by mix classification 1 or 2 in Table 3.10-1 and the wearing course by mix classification 2 or 3 in the same table. The mix classification shall be as specified in the contract; in case the mix classification is not specified in the contract, it shall be the one instructed by the Engineer.

When the total thickness of bituminous concrete is 50 mm or less the material shall be laid in a single course within the limits set by mix classification 2 in Table 3.10-1.

Table 3.10-1

Mix Classification	1	2	3
Course	Base	Base/ Wearing Course	Wearing Course
Thickness (mm)	60 - 75	40 - 60	40 - 50
Sieve Size (mm)	Total % by weight passing (including filler)		
25	100	–	–
20	90 - 100	100	100
14	-	85 - 100	85 - 100
10	55 - 82	65 - 90	70 - 90
5	35 - 57	45 - 65	52 - 72
2.4	20 - 40	25 - 45	40 - 58
1.2	15 - 33	15 - 35	30 - 48
0.600	10 - 26	12 - 30	20 - 38
0.300	6 - 20	9 - 20	14 - 28
0.150	5 - 13	5 - 15	8 - 20
0.075	3 - 7	3 - 7	6 - 10
	Bitumen Content by total weight of mixture. Percentage by weight found by analysis		
	4.0 – 6.0	4.5 – 6.5	5.0 – 7.0

The ratio of total material passing the 0.075 mm sieve to effective bitumen content shall be within the range 0.6 to 1.2.

In addition to meeting the requirements of the job-mix formula and the allowable tolerances in Section 3.5, laboratory samples shall be prepared according to standard Marshall methods as specified in PTP 10.9 using 50 blows per face. The sample shall be of approved material to the gradation and bitumen content stated and shall have the following characteristics.

1. Marshall Stability at 60°C not less than 550 kg.

2. Marshall Flow not less than 2 mm nor more than 4 mm.

3. Air voids in mix, base course, 3 – 5%'.

4. Air voids in Mix, wearing course, 3 - 5%

5. Voids filled with Bitumen, base course, 65 - 80%

6. Voids filled with Bitumen, wearing course, 70 - 80%

The bituminous mix for base/wearing course, when subjected to Water Sensitivity Test as per AASHTO-T283, the loss in strength shall not exceed 20% of the original mix. This test shall be carried out at the time of mix design and subsequently as and when required by the Engineer.

7. Voids in Mineral Aggregates, 15 - 20%

For road pavements carrying heavy traffic, the requirement for Marshall sample preparation may be increased, at the discretion of the Engineer, from 50 blows per face to 75 blows per face; the requirement for Marshall stability shall be correspondingly increased to min. 820 kg.

3.10.2 Materials

3.10.2.1 General

The materials shall conform to Section 3.5.2 of these Specifications with the additional requirements noted below.

3.10.2.2 Bituminous Materials

These materials shall conform to the requirements of Section 3.4. The bituminous material shall be of 60/70 or 80/100 penetration grade.

3.10.2.3 Bitumen Additive

An adhesion and anti-stripping agent shall be added to the bituminous material where so specified or when the Engineer's so directs or approves. The additive shall be of a type approved by the Engineer and the required percentage of additive shall be thoroughly mixed with the bituminous material in accordance with the manufacturer's instructions, or as directed by the Engineer, for such time as is necessary to produce a homogeneous mixture.

3.10.2.4 Coarse Mineral Aggregates

The provisions of Section 3.5.2.1 shall apply.

3.10.2.5 Fine Mineral Aggregate

The provisions of Section 3.5.2.2 shall apply.

3.10.2.6 Mineral Filler

The provisions of Section 3.5.2.3 shall apply.

3.10.2.7 Mixture

Regular checks shall be made on the composition of the mixed material. The Contractor shall take samples at either the batching plant or at the job site, as directed by the Engineer, and shall arrange for Marshall specimens to be prepared (STP 10.9) and tested for stability and flow. Samples shall also be analysed to determine the mix composition, by extraction of the bitumen in accordance with STP 10.4 and aggregate grading.

A minimum of three Marshall specimens shall be prepared for each day or part of a day that the batching plant is operated and dense bituminous surfacing is laid and a minimum of two bitumen extractions and aggregate gradings shall also be carried out. If the contractor can demonstrate good quality control of the plant, through consistent and acceptable test results being obtained, then less frequent testing may be permitted, at the discretion of the Engineer.

3.10.3 Construction Methods

3.10.3.1 General

Construction methods shall conform to the requirements of Section 3.5.3 of these Specifications subject to the following modifications.

3.10.3.2 Preparation of Bituminous Material

Bitumen shall be heated to a temperature between 121°C and 163°C. The Contractor shall submit a single definite temperature for the Engineer's approval.

3.10.3.3 Preparation of Mineral Aggregate

The mineral aggregates shall be dried and heated to a temperature between 135°C and 177°C so that the surfaces of aggregates are clean and free of carbon and unburned fuel oil. The Contractor shall submit a single definite temperature for the Engineer's approval.

The mineral aggregates shall be dried so that no steaming, bubbling, foaming, brown colouring or slumping of the newly produced mixture can be seen when the mix is loaded on the trucks or placed on the road.

If any traces of insufficient drying are observed, the Contractor shall take such of the following steps as are necessary to provide properly dried aggregates:

1) Maintain the level of the material in the hot bins above the two-thirds level.

2) Reduce the rate of cold feed.

3) Lower the slope of the drier as much as practicable.

4) Adjust exhaust fan, burner and air intake so as to provide longer flame penetration into the drier.

If all the preceding steps have been carried out and the mineral aggregate is still not dried to the satisfaction of the Engineer, double drying will be required for all or part of the aggregate.

3.10.3.4 Preparation of Mixture

The mixture shall when emptied from the mixer be at a temperature within the absolute limits of 135°C and 165°C. A single definite temperature shall be submitted for the Engineer's approval in accordance with Section 3.5.1.3.

3.10.3.5 Spreading and Compaction

Unless the bituminous premix is laid directly onto a clean prime coat, a tack coat shall be applied in accordance with Section 3.7, to the underlying surface prior to spreading the base and wearing courses.

Non-inclusion of Tack Coat as a separate BOQ item or insufficient quantity of Tack Coat in the Bill of Quantities (BOQ) shall not relieve the contractor from the obligation of applying Tack Coat to the underlying surfaces.

For regulation courses the thickness of a compacted layer shall not be less than twice the maximum stone size.

To avoid traffic disruption, the spreading and compaction is often carried out over half the road width only. Rollers shall not be allowed to stand on newly laid material that may be deformed thereby. Sections of newly laid base course shall be kept clean prior to laying the surface course and no traffic except in connection with laying the surface course shall be permitted on the prepared base course.

The mixture shall be compacted as soon after being placed as the material will support the roller without undue displacement or cracking and sufficient compaction plant should be deployed so that the required degree of compaction is achieved before the mat has cooled to a temperature of 107°C. Smoothing rolling may continue longer, if necessary, as long as the temperature of the mat is above 90°C. The average field density of any bed of base course and wearing course shall not be less than 98% of the laboratory density. No individual density test result shall fall below 97% of the laboratory density of the Marshall density.

3.10.3.6 Joints

The work shall be organised so that transverse joints are kept to a minimum and , where practical, only occur at specified positions (i.e. bridges etc.). All transverse joints are to be cut back to well compacted full depth material to produce a straight vertical joint which is to be painted with bitumen before laying of new material.

To attain a strong and even connection in the longitudinal direction, joints shall be pre-heated in front of laying the adjacent bituminous mix. Alternatively, if approved by the Engineer, the joint can be cut back and painted with bitumen.

3.10.3.7 Protection of the Pavement

Sections of the newly finished work shall be protected from traffic of any kind until the mixture has cooled to approximately ambient air temperature. Traffic shall not normally be permitted on

the newly laid surface less than 6 hours after completion of the pavement, except with the approval of the Engineer.

3.10.3.8 Pavement Samples

The Contractor shall, after final rolling and before opening the surface to traffic, cut samples from the finished work for testing. Samples for the full depth of the course shall be cores with diameters of 100 or 150 mm, as directed, and cut using an approved coring machine, from the locations directed by the Engineer.

At least two samples for density measurement shall be taken for each day or part of a day that the plant operates or if the output exceeds 100 tonnes per day, then at the rate of two per 100 tonnes or part thereof.

Samples for analysis and other tests shall be taken from the surfacing when the Engineer so directs. Where samples have been taken from the surface course, fresh material shall be placed, thoroughly compacted and finished to the satisfaction of the Engineer.

3.10.3.9 Surfacing Texture

The surface finish of the base course shall be close and tight, while the surface finish of the wearing course shall be equally well bound, though where the mix permits the surface shall be textured so as to enhance surface friction, but free from dragging cracks or other surface blemishes. Back casting shall not normally be permitted but when dragging occurs under the screed of the spreader, fine bituminous material may be cast over the surface to fill the dragging cracks, providing that this is done before the initial rolling and providing that rolling is carried out at specified temperature. Should dragging occur frequently the reason is to be determined and rectified.

3.10.4 Measurement

The quantities of dense bituminous pavement measured for payment shall be the number of cubic metres of accepted and completed surfacing, of the widths and thickness shown on the Drawings. However, the Contractor should allow in his rates for additional material used for forming sloping edges, waste, over spill, joints, cut-backs etc. Should the widths and/or thickness of completed and accepted surfacing be less than indicated on the Drawings, the quantities measured for payment will be based on the actual widths and/or thickness. No adjustment in payment will be made where the pavement widths and thickness as laid and approved are greater than those specified.

The surface profiles of courses will be used in the measurement of course thickness, unless an alternative method, such as core thickness, is approved by the Engineer.

3.10.5 Payment

The quantities of dense bituminous surfacing measured as provided above shall be paid for at the Contract unit rates. The rates and payments shall be full compensation for furnishing and placing all materials including all labour, equipment, tools, trials, preparation of job-mix formulae, testing, making good test holes and all incidentals necessary to complete the work. Tack coat shall not be paid for separately except where specifically provided in the Contract Documents.

When Tack Coat is included as a separate BOQ item in the Contract Document, but the quantity is not sufficient to cover all the bituminous works under the BOQ, the cost of quantity of Tack Coat required in addition to the BOQ provision shall be considered to be included within the rates of bituminous layer. The contractor is advised to make necessary adjustments accordingly in his rates of bituminous layers.

Pay items shall be:

3/10/1	Dense Bituminous Surfacing - Base Course	Cubic Metre
3/10/2	Dense Bituminous Surfacing - Wearing Course	Cubic Metre

3.11 PREMIX BITUMINOUS CARPETING (MANUAL METHOD)

3.11.1 Description

3.11.1.1 General

This work shall consist of a surfacing of bituminous material, constructed on a prepared base in accordance with these Specifications, to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

The provisions of Section 3.5, "General Requirements for Bituminous Surfacing" shall form a part of these Specifications except that the requirements for plant mixing and laying by paving machine may be relaxed for smaller works provided that the contractor proposes and demonstrates effective alternative methods to the full satisfaction of the Engineer. However, the requirement for plant mixing shall not be relaxed for bituminous works exceeding 01 km in total length. Such methods shall take account of the total quantity of material to be mixed and laid within the stipulated programme. Any alternative methods shall only be employed after receipt of written approval from the Engineer. Such approval may be withdrawn at any time if the work is found to be unsatisfactory.

Bituminous carpeting shall consist of one or two layers of binder course of the total thickness shown on the drawings or as directed by the Engineer. The upper layer shall be given a premixed seal coat as specified in section 3.12 to provide a close textured surface finish.

3.11.1.2 General Composition of the Mixture

The mixture shall consist of mineral aggregate and filler if needed, coated with bitumen, with the materials complying with Section 3.5.2 of these Specifications.

When the total thickness of bituminous base (binder) course exceeds 50 mm, the material may be laid in two layers if so directed by the Engineer. The material shall conform to the mix classification 1 in Table 3.11-1.

The selected job-mixes shall conform to Table 3.11-1, unless with the specific approval of the Engineer.

Table 3.11-1

Mix classification Course Thickness (mm)	**1** **Base (Binder)** 25	**2** **Base (Binder)** 38 or 50
Sieve Size (mm)	Total % by weight passing	
25	100	100
20	100	75-100
12.5	75-100	60-80
10	60-80	-
5.0	40-60	40-60
2.4	20-35	20-38
0.6	10-20	6-18
0.075	2-8	2-8
Bitumen Content % by weight of total mixture.	5.5% ± 0.3% **(5.2% - 5.8%)**	5.2% ± 0.3% **(4.9% - 5.5%)**

The Contractor shall meet the requirements of the job-mix formula and the allowable tolerances in Section 3.5.

3.11.2 Materials

3.11.2.1 General

The materials shall conform to Section 3.5.2 of these Specifications with the additional requirements noted below.

3.11.2.2 Bituminous Materials

These materials shall conform to the requirements of Section 3.4. The bituminous material shall be 60/70 or 80/100 penetration grade.

3.11.2.3 Coarse Mineral Aggregate

The provision of Section 3.5.2.1 shall apply.

3.11.2.4 Fine Mineral Aggregate and Mineral Filler

The provision of Sections 3.5.2.2 and 3.5.2.3 shall apply.

3.11.2.5 Mixture

The Contractor shall carry out regular checks at frequency to be determined by the Engineer on the composition of the mixed material and shall submit results to the Engineer within 3 days of sampling.

3.11.3 Construction Methods

3.11.3.1 General

A prime coat shall be applied to the surface of the granular base material or a tack coat to an existing bituminous surface in accordance with Section 3.6 or 3.7 before spreading the bituminous carpet.

Construction methods shall conform to the general requirements of Section 3.5.3 of these Specifications subject to the following modifications. For smaller works, where the requirement for plant mixing has been relaxed by the Engineer, the relevant provisions contained in Section 3.5.3 shall be replaced by those under Sections 3.11.3.2, 3.11.3.3 and 3.11.3.4 of these Specifications.

Following approval of the mix formula the Contractor shall lay trial sections of surfacing of approximately 10 metres length prior to commencing contract surfacing. These trials are to demonstrate that the contractor and the laying staff understand, and can apply the specification correctly to produce the quality of works specified on a consistent basis. The trials will also be used to fine tune the mix design if required.

If the trial works are suitable, they may be accepted in the contract works. If the trial work has to be rejected, they can be permitted to remain in the works until replacement near the end of the contract, so that unspecified work can be monitored and used to demonstrate to other contractors and supervision staff the defects that will manifest themselves if work is carried out using unspecified materials, workmanship or methodology.

Once the Contractor has demonstrated an acceptable procedure he shall submit in writing his full method statement for the Engineer's approval. No surfacing works will be permitted until the Engineer's approval has been granted in writing and once approved the method should not be varied in any way without reference to, and approval of the Engineer.

The Contractor shall furnish a thermometer at each mixing unit to ensure that temperature of bitumen, mineral aggregates and bituminous mixture shall be within the specified ranges stipulated in 3.11.3.2 through 3.11.3.5.

3.11.3.2 Preparation of Bituminous Material

Bitumen shall be heated to a temperature between 121°C and 163°C. Locally produced, wood fired boilers are satisfactory for this purpose, however, the boiler should be approximately 30% full before the firebox is filled with wood and the wood ignited.

In practice the boilers are generally kept over 50% full during operation by allowing up to two drums of bitumen to drain down through a manhole, on top of the boiler, into the main heating tank.

The temperature control at the boiler is critical to the success of this methodology. When the thermometer within the mass of bitumen in the main tank reaches 150°C the firebox must be emptied or the fire extinguished. The residual heat within the tar boiler will continue to heat the bitumen to the required maximum temperature of 163° C. When the temperature is falling and reaches 155° C the fire box should be refilled with wood and re-ignited as the temperature will soon fall below 150°C. The operation is repeated as the temperature again regains 150°C. With experience the operator can soon judge how much firewood is required to achieve and maintain the specified temperatures.

3.11.3.3 Preparation of Mineral Aggregate

Once the aggregates and the job mix has been approved, the Contractor shall construct gauging boxes to the required size which, when filled and struck off level, deliver the desired volume of each size of aggregate to provide the optimum gradation, for each batch.

The stone is batched into a rectangular steel pan with handles at each corner and heated on top of a metal frame under which heating is provided by firewood and sawdust. The aggregates are continually raked to ensure thorough mixing and even heating. The temperature of the aggregate must reach above 163°C after which the pan shall be transferred to an unheated frame where raking should continue until the aggregate temperature has reduced to the maximum mixing temperature permitted in the specification (163°C).

3.11.3.4 Preparation of Mixture

The heated bitumen is drawn off from the tar boiler, decanted into gauge tins and added to the aggregate in the pan on the unheated frame. As the two ingredients are at approximately the same temperature there is no risk of fire, overheating or the clouds of black smoke (indicating hot bitumen being applied to very hot aggregates) associated with other manual methods. The mixing is carried out on the unheated frame and, when satisfactorily completed, the pan is carried to the adjacent work head for placing.

The mixture shall after mixing be at a temperature within the limits of 135°C and 163°C. The Contractor shall record and submit the measured temperatures for the Engineer's records.

3.11.3.5 Spreading and Compaction

Unless the bituminous premix is laid directly onto a clean prime coat, a tack coat shall be applied in accordance with Section 3.7, to the underlying surface prior to spreading the binder course.

The depth of the finished surfacing, and the density of the material after compaction, is controlled by using mild steel angles as side shutters (32 × 32 mm for a finished 25 mm surfacing, 50 x 50mm for a finished 38 mm thick surfacing, and 65 × 65 mm for a finished 50 mm surfacing) and marking on the prime coat with chalk the area that each pan of mixed material should cover. The cross-fall or super elevation is controlled in a similar way using 32 mm rods for 25 mm surfacing and 50 x 6 mm steel plate for 38mm thick surfacing, and 65 × 6 mm steel plate

for 50 mm surfacing at intermediate points between the edge of the road and the crown of the road.

The mixture shall be compacted as soon after being placed as the material will support the roller without undue displacement or cracking and sufficient compaction plant should be deployed so that the required degree of compaction is achieved before the mat has cooled to a temperature of 107°C.

If the Contractor is using a 3.5 ton vibrating roller the initial pass shall be with NO vibration. The side and intermediate shutters are then moved to their next location while the roller, with vibration ON, completes the compaction process. Trials will be required to assess the number of passes to achieve full compaction for each type of roller and is relative to the thickness of the surfacing provided and the ambient temperature. Compaction is generally achieved when all roller marks have been removed.

Rollers shall not be allowed to stand on newly laid material that may be deformed thereby. Sections of newly laid base course and binder course shall be kept clean prior to laying the surface course and no traffic except in connection with laying the surface course shall be permitted on the prepared base course or binder course.

To avoid traffic disruption, the spreading and compaction is often carried out over half the road width only.

For regulation courses the thickness of a compacted layer shall not be less than twice the maximum grain size.

Unless the Engineer directs otherwise the seal coat specified in section 3.12 shall be applied immediately after laying of the carpet course and the seal coat and carpet course shall be rolled together. The combined thickness of the two layers shall not be less than the sum of the two specified layer thickness.

3.11.3.6 Joints

The work shall be organised so that transverse joints are kept to a minimum and , where practical, only occur at specified positions (i.e. bridges etc.). All transverse joints are to be cut back to well compacted full depth material to produce a straight vertical joint which is to be painted with bitumen before laying of new material.

To attain a strong and even connection in the longitudinal direction, joints shall be pre-heated in front of laying the adjacent bituminous mix. Alternatively, if approved by the Engineer, the joint can be cut back and painted with bitumen.

3.11.3.7 Edge Treatment

On 38 mm Bituminous Carpeting works the mix at the edge of the road may be open textured after compaction and chippings can be displaced by traffic during the initial maturing period (four to eight weeks). This will be overcome by placing a narrow strip of pea-gravel bitumen seal (approximately 75 mm wide) against the shoulder side steel angle prior to the placing of the Bituminous Carpeting. This, when compacted along with the Bituminous Carpeting, will provide a dense, true edge to the road and will minimise ragged edges.

3.11.3.8 Protection of the Pavement

Sections of the newly finished work shall be protected from traffic of any kind until the mixture has cooled to approximately ambient air temperature. Traffic shall not normally be permitted on

the newly laid surface less than 6 hours after completion of the pavement, except with the approval of the Engineer.

3.11.3.9 Pavement Samples

The Contractor shall, after final rolling and before opening the surface to traffic, cut samples from the finished work for testing. Samples for the full depth of the course shall be cores with diameters of 100 or 150 mm as directed, and cut by an approved coring machine, from the locations directed by the Engineer.

At least one sample for density and thickness measurement shall be taken for each 50 m of completed surfacing.

Samples for analysis and other tests shall be taken from the surfacing when the Engineer so directs. Where samples have been taken from the surface course, fresh material shall be placed, thoroughly compacted and finished to the satisfaction of the Engineer.

3.11.3.10 Surface Texture

The surface finish of the finished surfacing shall be close and tight.

3.11.4 Measurement

The quantity of bituminous carpeting measured for payment shall be the number of cubic metres accepted and completed surfacing to the width and thickness shown on the Drawings. Should the widths and/or thickness of the surfacing be less than indicated on the Drawings, the quantities measured for payment will be based on the actual widths and/or thickness.

The bituminous carpeting shall be measured as the net dimensions of the top surface of each course and the Contractor will make allowance in his rate for additional material used for forming sloping edges and over spill.

3.11.5 Payment

The quantities measured as provided above, shall be paid for at the Contract unit price rates. The prices and payments shall be full compensation for furnishing and placing all materials including all labour, equipment, tools, trials, preparation of job-mix formulas, testing, making good test holes, and incidentals necessary to complete the work. Tack coat shall not be paid for separately except where specifically provided for in the Contract Documents.

Pay items shall be:

3/11/1	Premix Bituminous Carpeting	Cubic Metre

3.12 PREMIX BITUMINOUS SEAL COAT (MANUAL METHOD)

3.12.1 Description

3.12.1.1 General

This work shall consist of a premix bituminous seal coat applied to newly laid binder course of bituminous carpeting, or a prepared and primed granular base course, or existing bituminous surface in accordance with these Specifications. The thickness of the premix bituminous seal coat shall be 7 mm, 12 mm or 15 mm as directed and shall be to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

The provisions of Section 3.5, "General Requirements for Bituminous Surfacing" shall form a part of these Specifications except that the requirements for plant mixing and laying by paving machine may be relaxed for smaller works provided that the contractor proposes and demonstrates effective alternative methods to the full satisfaction of the Engineer. However, the requirement for plant mixing shall not be relaxed for bituminous works exceeding 01 km in total length. Such methods shall take account of the total quantity of material to be mixed and laid within the stipulated programme. Any alternative methods shall only be employed after receipt of written approval from the Engineer. Such approval may be withdrawn at any time if the work is found to be unsatisfactory.

3.12.1.2 Composition of the Mixture

The mixture shall consist of aggregate and sand, coated with bitumen with the materials complying with Section 3.5.2 of these specifications. The Contractor shall meet the requirements of the job mix formula in section 3.5.1.3 and the tolerances in Section 3.5.1.4.

The material shall conform to Table 3.12-1 below, unless otherwise directed by the Engineer in writing.

Table 3.12-1

Mix Classification Course Compacted Thickness (mm)	**1 Seal Coat 7**	**2 Seal Coat 12 or 15**
Sieve Size (mm)	Total % by weight passing	
10	–	100
6.3	100	90 - 100
5	90 - 100	75 - 95
2.4	70 - 95	20 - 50
0.6	20 - 50	5 - 15
0.075	5 - 15	2 - 10

3.12.2 Materials

3.12.2.1 General

The materials shall conform to Section 3.5.2 of these Specifications with the additional requirements noted below.

3.12.2.2 Bituminous Materials

These materials shall conform to the requirements of Section 3.4. The bituminous material shall be 60/70 or 80/100 penetration grade.

3.12.2.3 Mineral Aggregate

Aggregates shall consist of 6.3mm or 10mm down graded pea 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 FM 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.

The mix of the aggregates and sand combined shall comply with the following grading given in Table 3.12-1.

3.12.2.4 Mixture

The Contractor shall carry out regular checks at frequency to be determined by the Engineer on the composition of the mixed material and shall submit results to the Engineer within 3 days of sampling.

3.12.3 Construction Methods

3.12.3.1 General

Construction methods shall conform to the general requirements of Section 3.5.3 of these Specifications subject to the following modifications. For smaller works, where the requirement for plant mixing has been relaxed by the Engineer, the relevant provisions contained in Section 3.5.3 shall be replaced by those under Sections 3.12.3.2, 3.12.3.3 and 3.12.3.4 of these Specifications.

Following approval of the mix formula the contractor shall undertake short trial sections of approximately 10 metres length, prior to commencing contract surfacing. These trials are to demonstrate that the contractor and the laying staff understand, and can apply the specification correctly to produce the quality of work specified on a consistent basis. The trials will also be used to fine tune the mix design if required.

If the trial works are suitable, they may be accepted in the contract works. If the trial work has to be rejected, they can be permitted to remain in the works until replacement near the end of the contract, so that unspecified work can be monitored and used to demonstrate to other contractors and supervision staff the defects that will manifest themselves if work is carried out using unspecified materials, workmanship or methodology.

Once the Contractor has demonstrated an acceptable procedure he shall submit in writing his full method statement for the Engineer's approval. No surfacing works will be permitted until the Engineer's approval has been granted, in writing, and once approved the method shall not be varied in any way without reference to, and approval of the Engineer.

The Contractor shall furnish a thermometer at each mixing unit to ensure that temperature of bitumen, mineral aggregates and bituminous mixture shall be within the specified ranges stipulated in 3.12.3.2 through 3.12.3.5.

3.12.3.2 Preparation of Bituminous Material

Bitumen shall be heated in a tar boiler to a temperature between 121°C and 163°C. Locally produced, wood fired boilers are satisfactory, and at the ambient temperatures experienced in Bangladesh the 80/100 penetration grade bitumen required under the specification can be poured (albeit slowly) into the tar boiler. When the boiler is approximately 30% full the fire box is filled with wood and the wood ignited. In practice the boilers are generally kept over 50% full during operation by allowing up to two drums of bitumen to drain down through a manhole, on top of the boiler, into the main heating tank.

The temperature control at the boiler is critical to the success of this methodology. When the thermometer within the mass of bitumen in the main tank reaches 150°C the firebox must be emptied or the fire extinguished. The residual heat within the tar boiler will continue to heat the bitumen to the required maximum temperature of 163°C. When the temperature is falling and reaches 155°C the fire box should be refilled with wood and re-ignited as the temperature will soon fall below 150°C. The operation is repeated as the temperature again regains 150°C. With experience the operator can soon judge how much firewood is required to achieve and maintain the specified temperatures.

3.12.3.3 Preparation of Mineral Aggregate

Once the aggregates and the job mix has been approved, the Contractor shall construct gauging boxes to the required size which, when filled and struck off level, deliver the desired volume for that size of stone.

The pea gravel and sand are batched into a rectangular steel pan with handles at each corner and heated on top of a metal frame under which heating is provided by firewood and sawdust. The mixture is continually raked to ensure thorough mixing and even heating. The temperature of the mixture must reach 163°C after which the pan shall be transferred to an unheated frame where raking should continue until the mixture temperature has reduced to the maximum temperature permitted in the specification (163°C).

3.12.3.4 Preparation of Premix Seal Coat

The heated bitumen is drawn off from the tar boiler, decanted into gauge tins and added to the aggregate in the pan on the unheated frame in the proportion of 1.0kg of bitumen to 0.01m^3 of aggregate mixture, which shall be laid on 1.0m^2 of road surface for 7mm thickness seal coat. The proportions will be increased to 1.36kg of bitumen to 0.016m^3 of aggregate mixture on 1.0m^2 of road surface for 12 mm thickness seal coat. As the two ingredients are at approximately the same temperature there is no risk of fire, overheating or the clouds of black smoke (indicating hot bitumen being applied to very hot aggregates) associated with other manual methods. The mixing is carried out on the unheated frame and, when satisfactorily completed, the pan is carried to the adjacent work head for placing.

The mixture shall after mixing be at a temperature within the limits of 135°C and 163°C. The Contractor shall record and submit the measured temperatures for the Engineer's approval.

3.12.3.5 Spreading and Compaction

The mixed bituminous seal coat shall be placed and spread over the granular base course which has been primed or bituminous carpeting to a uniform thickness which shall be a minimum of 25% greater than the specified compacted thickness, and immediately compacted with a power driven road roller to the satisfaction of the Engineer.

Static tandem steel wheel rollers will require trials to assess the number of passes to achieve full compaction. Compaction is generally achieved when all roller marks have been removed. Rollers shall not be allowed to stand on newly laid material that may be deformed thereby.
The mixture shall be compacted as soon after being placed as the material will support the roller without undue displacement or cracking and sufficient compaction plant should be deployed so that the required degree of compaction is achieved before the mat has cooled to a temperature of 107°C.

To avoid traffic disruption, the spreading and compaction on sections of existing bituminous surface is often carried out over half the road width only.

Unless the Engineer directs otherwise the seal coat where specified shall be applied immediately after laying of the bituminous carpeting and the seal coat and bituminous carpeting shall be rolled together. The combined thickness of the two layers shall not be less than the sum of the two specified layer thickness.

3.12.3.6 Joints

The work shall be organised so that transverse joints are kept to a minimum and , where practical, only occur at specified positions (i.e. bridges etc.). All transverse joints are to be cut back to well compacted full depth material to produce a straight vertical joint which is to be painted with bitumen before laying of new material.

To attain a strong and even connection in the longitudinal direction, joints shall be pre-heated in front of laying the adjacent bituminous mix. Alternatively, if approved by the Engineer, the joint can be cut back and painted with bitumen.

3.12.3.7 Protection of the Pavement

Sections of the newly finished work shall be protected from traffic of any kind until the mixture has cooled to approximately ambient air temperature. Traffic shall not normally be permitted on the newly laid surface less than 6 hours after completion of the pavement, except with the approval of the Engineer.

3.12.3.8 Pavement Samples

If the seal coat is placed on to the carpet course specified in Section 3.11 the Contractor shall, after final rolling and before opening the surface to traffic, cut samples from the finished work for testing. Samples for the full depth of the course and seal shall be cores with diameters of 100 or 150 mm as directed, and cut by an approved coring machine, from the locations directed by the Engineer. At least one sample for density and thickness measurement shall be taken for each 50 m of completed surfacing.

When the seal coat is placed over an existing bituminous surfacing samples for analysis and other tests shall be taken from the surfacing when the Engineer so directs.

Where samples have been taken from the surface course, fresh material shall be placed, thoroughly compacted and finished to the satisfaction of the Engineer.

3.12.3.9 Surface Texture

The surface finish of the finished surfacing shall be close and tight.

3.12.4 Measurement

The quantity of bituminous seal coat measured for payment shall be the number of square metres completed and accepted to the thickness shown on the Drawings or as directed by the Engineer. Bitumen used in the mix shall be deemed to be included and shall not be measured separately irrespective of its quantity. No price adjustment shall be made if the quantity of bitumen used increases or decreases due to a change in the job mix formula during the works.

3.12.5 Payment

The quantities measured as provided above, shall be paid for at the Contract unit rates. The prices and payments shall be full compensation for furnishing and placing all materials including all labour, equipment, tools, trials, preparation of job-mix formulas, testing, making good test holes, and incidentals necessary to complete the work.

Pay items shall be :

3/12/1	7mm Compacted Premix Bituminous Seal Coat	Square Metre
3/12/2	12mm Compacted Premix Bituminous Seal Coat	Square Metre
3/12/3	15mm Compacted Premix Bituminous Seal Coat	Square Metre

3.13 BRICK PAVEMENT

3.13.1 Description

This work shall consist of furnishing and laying bricks on a prepared and accepted subgrade or improved subgrade to form brick pavement in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections shown on the Drawings, or as directed by the Engineer.

3.13.2 Subgrade and Improved Subgrade

The subgrade or improved subgrade shall conform to the provisions of Sections 2.7 and 2.8.

3.13.3 Materials

The materials shall consist of first class bricks, which meet the requirements of Section 5.5.2, and sand, which meets the requirements of grading envelope E in Table 2.8-1 of Section 2.8.2.

3.13.4 Brick on End Edging

3.13.4.1 Description

This work consists of providing and placing brick on end edging along the road adjacent to the side of the pavement of single layer brick flat soling and herringbone bond brick.

3.13.4.2 Construction Methods.

Bricks shall be laid on end edging with their longest side vertical and shortest side perpendicular to 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 then be sprinkled with water.

3.13.5 Single Layer Brick Flat Soling

3.13.5.1 Description.

This item consists of providing single layer brick flat soling on accepted subgrade or improved subgrade.

3.13.5.2 Construction Methods.

The bricks shall be laid flat on a 75 mm thick compacted sand cushion layer over the prepared subgrade or improved subgrade surface. Bricks shall be laid in a regular and uniform manner. Interstices of bricks shall be filled with sand, and water shall be applied by sprinkling. No bricks shall be laid on loose earth or earth filling which has not been compacted to the required density and no bricks shall be laid on any surface which has not been inspected and approved by the Engineer.

3.13.6 Brick on Edge Pavement in Herringbone Bond

3.13.6.1 Description

This work shall consist of a base composed of bricks, laid on edge in a herringbone pattern on a 12 mm sand cushion, placed on a prepared single layer brick flat soling in accordance with these Specifications and to the lines, grades, levels, dimensions and cross sections shown on the Drawings or as required by the Engineer.

3.13.6.2 Construction Methods

The bricks shall be laid on edge in a single layer in a herringbone pattern to the lines, grades, levels, dimensions and cross section shown on the Drawings or as required by the Engineer. The edge of the layer shall be made with cut bricks to produce a line, which is compatible with brick edging.

The joints shall be filled with sand brushed in and the completed layer shall be sprinkled liberally with water.

3.13.6.3 Surface Tolerance

In those areas in which pavement is to be placed, any deviation in excess of 10 mm from a straight edge 3 metres long applied to the surface parallel to the centreline of the road and 12 mm from a 3 metres straight edge laid transversely, shall be corrected by removal, reshaping and relaying.

3.13.7 Measurement

Brick on end edging shall be measured in linear metres of completed and accepted work. Brick flat soling and herringbone bond brick pavement shall be measured in square metres of completed and accepted work.

3.13.8 Payment

This work, measured as described above shall be paid for at the Contract unit rates detailed below. The rates shall include the supply of all required materials and all labour, equipment, tools and incidentals necessary to complete the works as specified.

Pay items shall be:

3/13/1	Brick on End Edging	Linear Metre
3/13/2	Single Layer Brick Flat Soling including 75 mm thick Compacted Sand Cushion	Square Metre
3/13/3	Herring Bond Brick Pavement including 12 mm Sand Cushion	Square Metre

3.14. DRY LEAN CEMENT CONCRETE

3.14.1. Scope

3.14.1.1. The work shall consist of construction of dry lean concrete sub-base for cement concrete pavement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer. The work shall include furnishing of all plant and equipment, materials and labour including all operations in connection with the work as approved by the Engineer.

3.14.1.2. The design parameters of dry lean concrete sub-base, viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as stipulated in the Contract drawings.

3.14.2. Materials

3.14.2.1. Cement: Cement shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.14.2.2. Aggregates: Aggregates shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.14.2.3. Water: Water shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.14.3. Proportioning of Materials for the Mix

3.14.3.1. The mix shall be proportioned to comply with Section-5.1.2.3 and Section-5.1.2.4 of General Specifications. The water content shall be adjusted to the optimum as per Clause 3.14.3.2 for facilitating compaction by rolling. The strength and density requirements of concrete shall be determined in accordance with Clause 3.14.5 by making trial mixes.

3.14.3.2. Moisture content: Moisture content shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.14.3.3. Cement content : Cement content shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.14.3.4. Concrete strength: Concrete strength shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.14.4. Construction

3.14.4.1. General: The place and programme of the lean concrete sub-base construction shall be matching suitably with the programme of construction of the cement concrete pavement over it. The dry lean concrete sub-base shall be overlaid with cement concrete pavement only after 7 days of its construction.

3.14.4.2. Batching and mixing: The batching plant shall be capable of proportioning the materials by weight, each type of material being weighed separately in accordance with Clause 3.15.9.3.2. The cement from the bulk stock shall be weighed separately. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity for

the laying arrangements. The batching and mixing shall be carried out preferably in a forced action central batching and mixing plant having necessary automatic controls to ensure accurate proportioning and mixing. Other types of mixers shall be permitted subject to demonstration of their satisfactory performance during the trial length. The type and capacity of the plant shall be got approved by the Engineer before commencement of the trial length. The weighing balances shall be calibrated by weighing the aggregates, cement, water and admixtures physically either by weighing with large weighing machine or in a weigh bridge. The accuracy of weighing scales of the batching plant shall be within ± 2 per cent in the case of aggregates and ±1 percent in the case of cement and water.

The design features of Batching Plant should be such that the shifting operations of the plant will not take very long time when they are to be shifted from place to place with the progress of the work.

3.14.4.3. Transporting: Plant mix lean concrete shall be discharged immediately from the mixer, transported directly to the point where it is to be laid and protected from the weather by covering the tippers/ dumpers with tarpaulin during transit. The concrete shall be transported by tipping trucks, sufficient in number to ensure a continuous supply of material to feed the laying equipment to work at a uniform speed and in an uninterrupted manner. The lead of the batching plant to paving site shall be such that the travel time available from mixing to paving as specified in Clause 3.14.5.5.2 will be adhered to.

3.14.4.4. Placing: Lean concrete shall be laid/placed by a paver with electronic sensor. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bars to give good initial compaction to the sub-base.

The laying of the two-lane road subbase may be done either in full width or lane by lane. Preferably the lean concrete shall be placed and compacted across the full width of the road, by constructing it in one go or in two lanes running forward simultaneously. Transverse and longitudinal construction joints shall be staggered by 500-1000 mm and 200-400 mm respectively from the corresponding joints in the overlaying concrete slabs.

3.14.4.5. Compaction

3.14.4.5.1. The compaction shall be carried out immediately after the material is laid within the initial setting time of cement and leveled. In order to ensure thorough compaction, which is essential, rolling shall be continued on the full width till there is no further visible movement under the roller and the surface is closed.

3.14.4.5.2. The spreading, compacting and finishing of the lean concrete shall be carried out as rapidly as possible and the operation shall be so arranged as to ensure that the time between the mixing of the first batch of concrete in any transverse section of the layer and the final finishing of the same shall not exceed 90 minutes when the concrete temperature is above 25 and below 30 degree Celsius and 120 minutes if less than 25 degree Celsius. This period may be reviewed by the Engineer in the light of the results of the trial run but in no case shall it exceed 2 hours. Work shall not proceed when the temperature of the concrete exceeds 30 degree Celsius. If necessary, chilled water or addition of ice may be rescued to for bringing down the temperature. It is desirable to stop concreting when the ambient temperature is above 35°C. After compaction has been completed, roller shall not stand on the compacted surface for the duration of the curing period except during commencement of next day's work near the location where work was terminated the previous day.

3.14.4.5.3. Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 kN static weight are considered to be suitable for rolling dry lean concrete. In case any other roller is proposed, the same shall be got approved from the Engineer, after demonstrating its performance. The number of passes required to obtain maximum compaction depends on the thickness of the lean concrete, the compactibility of the mix, and the weight and type of the roller etc., and the same as well as the total requirement of rollers for the job shall be determined during trial run by measuring the in-situ density and the scale of the work to be undertaken.

3.14.4.5.4. The final lean concrete surface on completion of compaction and immediately before overlaying, shall be well closed, free from movement under roller and free from ridges, low spots, cracks, loose material, pot holes, ruts or other defects. The final surface shall be inspected immediately on completion and all loose, segregated or defective areas shall be corrected by using fresh lean concrete and compacted as per Specification. For repairing honeycombed surface, concrete with aggregates of size 10 mm and below shall be spread and compacted. It is necessary to check the level of the rolled surface for compliance. Any level/thickness deficiency should be corrected after applying cement concrete with aggregates of size 10 mm and below after roughening the surface. Similarly the surface regularity also should be checked with 3m straight edge. The deficiency should be made up with concrete with aggregates of size 10 mm and below.

3.14.5. Trial Mixes : Trial Mixes shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.14.6. Curing: Curing shall confirm to the requirements of Section-5.1.3.11 of General Specifications.

3.14.7 Removal of Scaffolding and Formwork : Forms and scaffolding shall confirm to the requirements of Section-5.1.3.12 of General Specifications.

3.14.8 Repair of Concrete : Repair of Concrete shall confirm to the requirements of Section-5.1.3.12 of General Specifications.

3.14.9. Traffic

No heavy commercial vehicles like trucks and buses shall be permitted on the lean concrete sub-base after its construction. Light vehicles if unavoidable may, however, be allowed after 7 days of its construction with prior approval of the Engineer.

3.14.10 Tolerances for Surface Regularity, Level, Thickness and Strength

The tolerances for surface regularity, level, thickness and strength shall conform to the requirements and Control of quality of materials and works shall be exercised satisfactory to the Engineer.

3.14.11. Measurements

The unit of measurement for dry lean concrete pavement shall be the unit of volume in cubic metre of concrete placed, based on the net plan areas for the specified thickness shown on the drawings or as directed by the Engineer.

3.14.12. Payment

The Contract unit rate payable for dry lean concrete sub-base shall be payment in full for carrying out the required operations including full compensation for all labour, materials and equipment, mixing, transport, placing, compacting, finishing, curing, testing and incidentals to complete the work as per Specifications, all royalties, fees, storage and rents where necessary and all leads and lifts.

Pay items shall be:

03/14/01	Dry Lean Concrete (as specified in Design)	cu. metre

3.15. CEMENT CONCRETE PAVEMENT

3.15.1. Scope

3.15.1.1. The work shall consist of construction of cement concrete pavement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross sections shown on the drawings. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations in connection with the work, as approved by the Engineer.

3.15.1.2. The design parameters, viz., thickness of pavement slab, grade of concrete, joint details etc. shall be as stipulated in the contract drawings.

3.15.2. Materials

3.15.2.1. Cement : Cement shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.15.2.2. Admixtures : Admixtures shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.15.2.3. Aggregates : Aggregates shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.15.2.4. Water: Water shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.15.2.5. Admixtures : Admixtures shall confirm to the requirements of Section-5.1.2 of General Specifications.

3.15.2.6. High Yield Deformed Steel Reinforcing Bars for dowels and tie bars : Reinforcing bars for dowels and tie bars shall confirm to the requirements of Section-5.2 of General Specifications.

3.15.2.7. Premoulded joint filler: Joint filler board for expansion joints which are proposed for use only at some abutting structures like bridges and culverts shall be of 20-25 mm thickness within a tolerance of ± 1.5 mm and of a firm compressible' material and complying with the requirements of BS Specification Clause No. 2630 or Specification for Highway Works, Vol. I Clause 1015. It shall be 25 mm less in depth than the thickness of the slab within a tolerance of ± 3 mm and provided to the full width between the side forms. It shall be in suitable lengths, which shall not be less than one lane width. Holes to accommodate dowel bars shall be accurately bored or punched out to give a sliding fit on the dowel bars.

3.15.2.8. Joint sealing compound: The joint sealing compound shall be of hot poured, elastomeric type or cold polysulphide type having flexibility, resistance to age hardening -and durability. If the sealant is of hot poured type it shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

3.15.2.9. Storage of materials: Storage of materials shall confirm to the requirements of Section-5.1.3.3 of General Specifications.

3.15.3. Proportioning of Concrete

3.15.3.1. After approval by the Engineer of all the materials to be used in the concrete, the Contractor shall submit the mix design based on weighed proportions of all ingredients for the approval of the Engineer. The mix design shall be submitted at least 30 days prior to the paving of trial length and the design shall be based on laboratory trial mixes using the approved materials and methods as agreed to by the Engineer. The mix design shall be based on the flexural strength of concrete.

3.15.3.2. Cement content: Cement content shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.15.3.3. Concrete strength : Concrete strength shall confirm to the requirements of Section-5.1.2.3 of General Specifications.

3.15.3.4. Workability

3.15.3.4.1. The workability of the concrete at the point of placing shall be adequate for the concrete to be fully compacted and finished without undue flow. The optimum workability for the mix to suit the paving plant being used shall be determined by the Contractor and approved by the Engineer. The control of workability in the field shall be exercised by the slump test as per STP.

3.15.3.4.2. The workability requirement at the Batching Plant and paving site shall be established by slump tests carried during trial paving. These requirements shall be established from season to season and also when the lead from Batching plant site to the paving site changes. The workability shall be established for the type of paving equipment available. A slump value in the range of 30 ± 15 mm is reasonable for paving works but this may be modified depending upon the site requirement and got approved by the Engineer. These tests shall be carried out on every truck/dumper at Plant site and paving site initially when the work commences but subsequently the frequency can be reduced to alternate trucks or as per the instructions of the Engineer.

3.15.3.5. Design mix

3.15.3.5.1. The Contractor shall carry out laboratory trials of design mixes with the materials from the approved sources to be used. Trial mixes shall be made in presence of the Engineer or his representative and the design mix shall be subject to the approval of the Engineer. They shall be repeated if necessary until the proportions that will produce a concrete, which complies in all respects with this Specification, and conforms to the requirement of the design/drawings have been determined.

3.15.3.5.2. The proportions determined as a result of the laboratory trial mixes may be adjusted if necessary during the construction of the trial length. Thereafter, neither the materials nor the mix proportions shall be varied in any way except with the written approval of the Engineer.

3.15.3.5.3. The Contractor shall submit results of material tests on the proposed materials 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.

3.15.4 Separation Membrane

A separation membrane shall be used between the concrete slab and the subbase. Separation membrane shall be impermeable plastic sheeting 125 microns thick laid flat without creases. Before placing the separation membrane, the sub-base shall be swept clean of all the extraneous materials using air compressor. Wherever overlap of plastic sheets is necessary, the same shall be at least 300 mm and any damaged sheeting shall be replaced at the Contractor's expense. The separation membrane may be nailed to the lower layer with concrete nails.

3.15.5. Joints

3.15.5.1. The location and type of joints shall be as shown in the drawing. Joints shall be constructed depending upon their functional requirement as detailed in the following paragraphs. The location of the joints should be transferred accurately at the site and mechanical saw cutting of joints done as per stipulated dimensions. It should be ensured that the full required depth of cut is made from edge to edge of the pavement. Transverse and longitudinal joints in the pavement and sub-base shall be staggered so that they are not coincident vertically and are at least 1m and 0.3m apart respectively. Sawing of joints shall be carried out with diamond studded blades soon after the concrete has hardened to take the load of the sawing machine and personnel without damaging the texture of the pavement. Sawing operation could start as early as 6-8 hours depending upon the season.

3.15.5.2. Transverse joints

3.15.5.2.1. Transverse joints shall be contraction and expansion joints constructed at the spacing described in the Drawings. Transverse joints shall be straight within the following tolerarices along the intended line of joints which is the straight line transverse to the longitudinal axis of the carriageway at the position proposed by the Contractor and agreed to by the Engineer, except at road junctions or roundabouts where the position shall be as described in the drawings:

Deviations of the filler board in the case of expansion joints from the intended line of the joint shall not be greater than ± 10 mm.

The best-fit straight line through the joint grooves as constructed shall be not more than 25 mm from the intended line of the joint.

Deviations of the joint groove from the best-fit straight line of the joint shall not be greater than 10 mm.

Transverse joints on each side of the longitudinal joint shall be in line with each other and of the same type and width. Transverse joints shall have a sealing groove, which shall be sealed in compliance with Clause 3.15.11.

3.15.5.2.2. Contraction joints : Contraction joints shall consist of a mechanical sawn joint groove, 3 to 5 mm wide and 1/4 to 1/3 depth of the slab ± 5 mm or as stipulated in the drawings and dowel bars complying with Clause 3.15.6.5 and as detailed in the drawings.

The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take the load of joint sawing machine without causing damage to the slab.

3.15.5.2.3. Expansion joints : The expansion joints shall consist of a joint filler board complying with Clause 3.15.2.7 and dowel bars complying with Clause 3.15.6.5 and as detailed in the drawings. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within the tolerances given in Clause 3.15.6.2.1 and at such depth below the surface as will not impede the passage of the finishing straight edges or oscillating beams of the paving machines. The adjacent slabs shall be completely separated from each other by providing joint filler board. Space around the dowel bars, between the sub-base and the filler board shall be packed with a suitable compressible material to block the flow of cement slurry.

3.15.5.3. Transverse construction joint: Transverse construction joints shall be placed whenever concreting is completed after a day's work or is suspended for more than 30 minutes. These joints shall be provided at the regular location of contraction joints using dowel bars. The joint shall be made butt type. At all construction joints, steel bulkheads shall be used to retain the concrete while the surface is finished. The surface of the concrete laid subsequently shall conform to the grade and cross sections of the previously laid pavement. When positioning of bulk head/ stop-end is not possible, concreting to an additional 1 or 2 m length may be carried out to enable the movement of joint cutting machine so that joint grooves may be formed and the extra 1 or 2 m length is cut out and removed subsequently after concrete has hardened.

3.15.5.4. Longitudinal joint

3.15.5.4.1. The longitudinal joints shall be saw cut as per details of the joints shown in the drawing. The groove may be cut after the final set of the concrete. Joints should be sawn to at least 1/3 the depth of the slab ± 5 mm as indicated in the drawing.

3.15.5.4.2. Tie bars shall be provided at the longitudinal joints as per dimensions and spacing shown in the drawing and in accordance with Clause 3.15.6.6.

3.15.6 Dowel bars

3.15.6.1. Dowel bars shall be mild steel rounds in accordance with Clause 3.15.2.6 with details/dimensions as indicated in the drawing and free from oil, dirt, loose rust or scale. They shall be straight, free of irregularities and burring restricting slippage in the concrete. The sliding ends shall be sawn or cropped cleanly with no protrusions outside the normal diameter of the bar. The dowel bar shall be supported on cradles/dowel chairs in pre-fabricated joint assemblies positioned prior to the construction of the slabs or mechanically inserted with vibration into the plastic concrete by a method which ensures correct placement of the bars besides full re-compaction of the concrete around the dowel bars.

3.15.6.2. Unless shown otherwise on the drawings, dowel bars shall be positioned at mid depth of the slab within a tolerance of ± 20 mm, and centered equally about intended lines of the joint within a tolerance of ± 25 mm. They shall be aligned parallel to the finished surface of the slab and to the centre line of the carriageway and to each other within tolerances given hereunder, the compliance of which shall be checked as per Clause 3.15.10.7.

For bars supported on cradles prior lo the laying of the slab:

All bars in a joint shall be within ± 3 mm per 300 mm length of bar
2/3rd of the bars shall be within ± 2 mm per 300 mm length of bar
No bar shall differ in alignment from an adjoining bar by more than 3 mm per 300 mm length of bar in either the horizontal or vertical plane
Cradles supporting dowel bar shall not extend across the line of joint i.e. no steel bar of the cradle assembly shall be continuous across the joint

For all bars inserted after laying of the slab:
Twice the tolerance for alignment as indicated in (i) above.

3.15.6.3. Dowel bars, supported on cradles in assemblies, when subject to a load of 110 N applied at either end and in either the vertical or horizontal direction (upwards and downwards and both directions horizontally) shall conform to be within the following limits:

Two-thirds of the number of bars of any assembly tested shall not deflect more than 2 mm per 300 mm length of bar

The remainder of the bars in that assembly shall not deflect more than 3 mm per 300 mm length of bar.

3.15.6.4. The assembly of dowel bars and supporting cradles, including the joint filler board in the case of expansion joints, shall have the following degree of rigidity when fixed in position:-

For expansion joints, the deflection of the top edge of the filler board shall be not greater than 13 mm, when a load of 1.3 kN is applied perpendicular to the vertical

face of the joint filler board and distributed over a length of 600 mm by means of a bar or timber packing, at mid depth and midway between individual fixings, or 300 mm from either end of any length of filler board, if a continuous fixing is used. The residual deflection after removal of the load shall be not more than 3 mm.

The joint assembly fixings to sub-base shall not fail under the 1.3kN load applied for testing the rigidity of the assembly but shall fail before the load reaches 2.6 kN.

The fixings for contraction joint shall not fail under 1.3 kN load and shall fail before the load reaches 2.6 kN when applied over a length of 600 mm by means of a bar or timber packing placed as near to the level of the line of fixings as practicable.

Fixings shall be deemed to fail when there is displacement of the assemblies by more than 3 mm with any form of fixing, under the lest load. The displacement shall be measured at the nearest part of the assembly to the centre of the bar or timber packing.

3.15.6.5. Dowel bars shall be covered by a thin plastic sheath for at least two-thirds of the length from one end for dowel bars in contraction joints or half the length plus 50 mm for expansion joints. The sheath shall be tough, durable and of an average thickness not greater than 1.25 mm. The sheathed bar shall comply with the following pull-out tests:

Four bars shall betaken at random from stock and without any special preparation shall be covered by sheaths as required in this Clause. The ends of the dowel bars which have been sheathed shall be cast centrally into concrete specimens 150 x 150 x 600 mm, made of the same mix proportions to be used in the pavement, but with a maximum nominal aggregate size of 20 mm and cured in accordance with IS: 516. At 7 days a tensile load shall be applied to achieve a movement of the bar of at least 0.25 mm. The average bond stress to achieve this movement shall not be greater than 0.14 MPa.

3.15.6.6. For expansion joints, a closely fitting cap 100 mm long consisting of waterproofed cardboard or an approved synthetic material like PVC or GI pipe shall be placed over the sheathed end of each dowel bar. An expansion space at least equal in length to the thickness of the joint filler board shall be formed between the end of the cap and the end of the dowel bar by using compressible sponge. To block the entry of cement slurry between dowel and cap it may be taped.

3.15.6.7. Tie bars

3.15.6.7.1. Tie bars in longitudinal joints shall be deformed steel bars of strength in accordance with Clause 3.15.2.6. The bars shall be free from oil, dirt, loose rust and scale.

3.15.6.7.2. Tie bars projecting across the longitudinal joint shall be protected from corrosion for 75mm on each side of the joint by a protective coating of bituminous paint with the approval of the Engineer. The coating shall be dry when the tie bars are used.

3.15.6.7.3. Tie bars in longitudinal joints shall be made up into rigid assemblies with adequate supports and fixings to remain firmly in position during the construction of the slab. Alternatively, tie bars at longitudinal joints may be mechanically or manually inserted into the plastic concrete from above by vibration using a method, which ensures correct placement of the bars and re-compaction of the concrete around the tie bars.

3.15.6.7.4. Tie bars shall be positioned to remain within the middle third of the slab depth as indicated in the drawings and approximately parallel to the surface and approximately perpendicular to the line of the joint, with the centre of each bar on the intended line of the joints within a tolerance of ± 50mm, and. with a minimum cover of 30 mm below the joint groove.

3.15.7. Weather and Seasonal Limitations

3.15.7.1. Concreting during monsoon months: When concrete is being placed during monsoon months and when it may be expected to rain, sufficient supply of tarpaulin or other water proof cloth shall be provided along the line of the work. Any time when it rains, all freshly laid concrete which had not been covered for curing purposes shall be adequately protected. Any concrete damaged by rain shall be removed and replaced. If the damage is limited to texture, it shall be retextured in accordance with the directives of the Engineer.

3.15.7.2. Concreting in hot weather: No concreting shall be done when the concrete temperature is above 30 degree Centigrade. Besides, in adverse conditions like high temperature, low relative humidity, excessive wind velocity, imminence of rains etc., if so desired by the Engineer, tents on mobile trusses may be provided over the freshly laid concrete for a minimum period of 3 hours as directed by the Engineer. The temperature of the concrete mix on reaching the paving site shall not be more than 30° C. To bring down the temperature, if necessary, chilled water or ice flakes should be made use of.

No concreting shall be done when the concrete temperature is below 5 degree Centigrade and the temperature is descending.

3.15.8. Side Forms, Rails

3.15.8.1. Side forms and rails: All side forms shall be of mild steel of depth equal to the thickness of pavement or slightly less to accommodate the surface regularity of the sub-base. The forms can be placed on series of steel packing plates or shims to take care of irregularity of sub-base. They shall be sufficiently robust and rigid to support the weight and pressure caused by paving equipment. Sideforms for use with wheeled paving machines shall incorporate metal rails firmly fixed at a constant height below the top of the forms. The forms and rails shall be firmly secured in position by not less than 3 stakes/pins per each 3 m length so as to prevent movement in any direction. Forms and rails shall be straight within a tolerance of 3 mm in 3 m and when in place shall not settle in excess of 1.5 mm in 3 m while paving is being done. Forms shall be cleaned and oiled immediately before each use. The forms shall be bedded on a continuous bed of low moisture content lean cement mortar or concrete and set to the line and levels shown on the drawings within tolerances ± 10 mm and ± 3 mm respectively. The bedding shall not extend under the slab and there shall be no vertical step between adjacent forms of more than 3 mm. The forms shall be got inspected from the Engineer for his approval before 12 hours on the day before the construction of the slab and shall not be removed until at least 12 hours afterwards.

3.15.8.2. At all times sufficient forms shall be used and set to the required alignment for at least 200 m length of pavement immediately in advance of the paving operations, or the anticipated length of pavement to be laid within the next 24 hrs whichever is more.

3.15.9. Construction

3.15.9.1. General: A systems approach may be adopted for construction of the pavement, and the

Method Statement for carrying out the work, detailing all the activities including indication of lime-cycle, equipment, personnel etc., shall be got approved from the Engineer before the commencement of the work. The above shall include the type, capacity and make of the batching and mixing plant besides the hauling arrangement and paving equipment. The capacity of paving equipment, batching plant as well as all the ancillary equipment shall be adequate for a paving rate of atleast 300 m in one day.

3.15.9.2. Batching and mixing: Batching and mixing of the concrete shall be done at a central batching and mixing plant with automatic controls, located at a suitable place which takes into account sufficient space for stockpiling of cement, aggregates and stationary water tanks. This shall be, however, situtated at an approved distance, duly considering the properties of the mix and the transporting arrangements available with the Contractor.

3.15.9.3. Equipment for proportioning of materials and paving

3.15.9.3.1. Proportioning of materials shall be done in the batching plant by weight, each type of material being weighed separately. The cement from the bulk stock may be weighed separately from the aggregates and water shall be measured by volume. Wherever properly graded aggregate of uniform quality cannot be maintained as envisaged in the mix design, the grading of aggregates shall be controlled by appropriate blending techniques. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity of the laying/paving equipment.

3.15.9.3.2. Batching plant and equipment:

General- The batching plant shall include minimum four bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dust during operation. Approved safety devices shall be provided and maintained for the protection of all personnel engaged in plant operation, inspection and testing. The batch plant shall be equipped with a suitable non-resettable batch counter, which will correctly indicate the number of batches proportioned.

Bins and hoppers- Bins with minimum number of four adequate separate compartments shall be provided in the batching plant.

Automatic weighing devices-Batching plant shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices using load cells.

Mixers- Mixers shall be pan type, reversible type or any other mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specific mixing period, and of discharging the mixture, without segregation. Each stationary mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds or as per the manufacturer's recommendation. The mixer shall be equipped with a suitable non-resettable batch counter, which shall correctly indicate the number of batches mixed.

The mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down 20 mm or more. The Contractor shall (1) have available at the job site a copy of the manufacturer's design, showing dimensions andarrangements of blades in reference to original height and depth, or (2) provide permanent marks on blade to show points of 20 mm wear from new conditions. Drilled holes of 5 mm diameter near each end and at midpoint of each blade are recommended. Batching Plant shall be calibrated in the beginning and thereafter at suitable interval not exceeding 1 month.

Control cabin - An air-conditioned centralised control cabin shall be provided for automatic operation of the equipment.

3.15.9.3.3. Paving equipment :

The concrete shall be placed with an approved fixed form or slip from paver with independent units designed to (i) spread,(ii) consolidate, screed and float-finish, (iii) texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary and so as to provide a dense and homogeneous pavement in conformity with the plans and Specifications. The paver shall be equipped with electronic controls to control/sensor line and grade from either or both sides of the machine.

Vibrators shall operate at a frequency of 8300 to 9600 impulses per minute under load at a maximum spacing of 60 cm. The variable vibration setting shall be provided in the machine.

3.15.9.4. Hauling and placing of concrete

3.15.9.4.1. Freshly mixed concrete from the central batching and mixing plant shall be transported to the paver site by means of trucks/tippers of sufficient capacity and approved design in sufficient numbers to ensure a constant supply of concrete. Covers shall be used for protection of concrete against the weather. The trucks/tippers shall be capable of maintaining the mixed concrete in a homogeneous state and discharging the same without segregation and loss of cement slurry. The feeding to the paver is to be regulated in such a way that the paving is done in an uninterrupted manner with a uniform speed throughout the days work.

3.15.9.4.2. Placing of concrete

Concrete mixed in central mixing plant shall be transported to the site without delay and the concrete which, in the opinion of the Engineer, has been mixed too long before laying will be rejected and shall be removed from the site. The total time taken from the addition of the water to the mix, until the completion of the surface finishing and texturing shall not exceed 120 minutes when concrete temperature is less than 25°C and 90 minutes when the concrete temperature is between 25°C to 30°C. Trucks/tippers delivering concrete shall not run on plastic sheeting nor shall they run on completed slabs until after 28 days of placing the concrete. The Paver shall be capable of paving the carriageway as shown in the drawings, in a single pass and lift.

3.15.9.4.3. Where fixed form pavers are to be used, forms shall be fixed in advance as per Clause 3.15.8. of the Specifications. Before any paving is done, the site shall be shown to the Engineer, in order to verify the arrangement for paving besides placing of dowels, tie-bars etc., as per the relevant Clauses of this Specification. The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

3.15.9.4.4. In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

3.15.9.4.5. The addition of water to the surface of the concrete to facilitate the finishing operations will not be permitted except with the approval of the Engineer when it shall be applied as a mist by means of approved equipment.

3.15.9.4.6. If considered necessary by the Engineer, the paving machines shall be provided with approved covers to protect the surface of the slab under construction from direct sunlight and rain or hot wind.

3.15.9.4.7. While the concrete is still plastic, its surface shall be brush textured in compliance with Clause 3.15.9.8 and the surface and edges of the slab cured by the application of a sprayed liquid curing membrane in compliance with Clause 3.15.9.9. After the surface texturing, but before the curing compound is applied, the concrete slab shall be marked with the chainage at every 100 m interval.

3.15.9.4.8. As soon as the side forms are removed, edges of the slabs shall be corrected wherever irregularities have occurred by using fine concrete composed of one part of cement to 3 parts of fine chips and fine aggregate under the supervision of the Engineer.

3.15.9.4.9. If the requirement for surface regularity fails to be achieved on two consecutive working days, then normal working shall cease until the cause of the excessive irregularity has been identified and remedied.

3.15.9.5. Construction by fixed form paver

3.15.9.5.1. The fixed form paving train shall consist of separate powered machines which spread, compact and finish the concrete in a continuous operation.

3.15.9.5.2. The concrete shall be discharged without segregation into a hopper spreader which is equipped with means for controlling its rate of deposition on to the subbase. The spreader shall be operated to strike off concrete upto a level requiring a small amount of cutting down by the distributor of the spreader. The distributor of spreader shall strike off the concrete to the surcharge adequate to ensure that the vibratory compactor thoroughly compacts the layer. If necessary, poker vibrators shall be used adjacent to the side forms and edges of the previously constructed slab. The vibratory compactor shall be set to strike off the surface slightly high so that it is cut down to the required level by the oscillating beam. The machine shall be capable of being rapidly adjusted for changes in average and differential surcharge necessitated by changes in slab thickness or cross fall- The final finisher shall be able to finish the surface to the required level and smoothness as specified, care being taken to avoid bringing up of excessive mortar to the surface by overworking.

3.15.9.6. Construction by slip form paver

3.15.9.6.1. The slip form paving train shall consist of power machine which spreads, compacts and finishes the concrete in a continuous operation. The slip form-paving machine shall compact the concrete by internal vibration and shape it between the side forms with either a conforming plate or by vibrating and oscillating finishing beams. The concrete shall be deposited without segregation in front of slip form paver across the whole width and to a height, which at all times is in excess of the required surcharge. The deposited concrete shall be struck off to the necessary average and differential surcharge by means of the strike off plate or a screw auger device extending across the whole width of the slab. The equipment for striking-off the concrete shall be capable of being rapidly adjusted for changes of the average and differential surcharge necessitated by change in slab thickness or crossfall.

3.15.9.6.2. The level of the conforming plate and finishing beams shall be controlled automatically from the guide wires installed as per Clause 3.15.8 by sensors attached at the four comers of the slip form paving machine. The alignment of the paver shall be controlled automatically from the guide wire by at least one set of sensors attached to the paver. The alignment and level of ancillary machines for finishing, texturing and curing of the concrete shall be automatically controlled relative to the guide wire or to the surface and edge of the slab.

3.15.9.6.3. Slip-form paving machines shall have vibrators of variable output, with a maximum energy output of not less than 2.5 KW per metre width of slab per 300 mm depth of slab for a laying speed upto 1.5 m per minute or pro-rata for higher speeds. The machines shall be of sufficient mass to provide adequate reaction during spreading and paving operations on the traction units to maintain forward movements during the placing of concrete in all situations.

3.15.9.6.4. If the edges of the slip formed slab slump to the extent that the surface of the top edge of the slab does not comply with the requirements of Clause 3.15.14, then special measures approved by the Engineer shall be taken to support the edges to the required levels and work shall be stopped until such time as the Contractor can demonstrate his ability to slip form the edges to the required levels.

3.15.9.7. Construction by hand-guided method: Areas in which hand-guided methods of construction become indispensable shall be got approved by the Engineer in writing in advance. Such work may be permitted only in restricted areas in small lengths. Work shall be carried out by skilled personnel as per methods, approved by the Engineer. The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures shall be the same as in the case of machine laid work.

3.15.9.8. Surface texture

3.15.9.8.1. After the final regulation of the slab and before the application of the curing membrane, the surface of concrete slab shall be brush-textured in a direction at right angles to the longitudinal axis of the carriageway.

3.15.9.8.2. The brushed surface texture shall be applied evenly across the slab in one direction by the use of a wire brush not less than 450 mm wide but longer brushes are preferred. The brush shall be made of 32-gauge tape wires grouped together in tufts spaced at 10 mm centres. The tufts shall contain an average of 14 wires and initially be 100 mm long. The brush shall have two rows of tufts. The rows shall be 20 mm apart and the tufts in one row shall be opposite the centre of the gap between tufts in the other row. The brush shall be replaced when the shortest tuft wears down to 90 mm long.

3.15.9.8.3. The texture depth shall be determined by the Sand Patch Test as described in Clause 602.12. This test shall be performed at least once for each day's paving and wherever the Engineer considers it necessary at times after construction as under:

Five individual measurements of the texture depth shall be taken at least 2 m apart anywhere along a diagonal line across a lane width between points 50 m apart along the pavement. No measurement shall be taken within 300 mm of the longitudinal edges of a concrete slab constructed in one pass.

3.15.9.8.4. Texture depths shall not be less than the minimum required when measurements are taken as given in Table 600-2 nor greater than a maximum average of 1.25 mm.

TABLE 3.15-1

Time of Test		Number of Measurements	Required Texture Depth (mm)	
			Specified Value	Tolerance
1.	Between 24 hours and 7 days after the constn., of the slab or until the slab is first used by vehicles	An average of 5 measurements	1.00	± 0.25
2.	Not later than 6 weeks before the road is opened to public traffic.	An average of 5 measurements	1.00	+0.25 -0.35

3.15.9.8.5. After the application of the brushed texture, the surface of the slab shall have a uniform appearance.

3.15.9.8.6. Where the texture depth requirements are found to be deficient, the Contractor shall make good the texture across the full lane width over length directed by the Engineer, by retexturing the hardened concrete surface in an approved manner.

3.15.10. Preparation and Sealing of Joint Grooves

3.15.10.1. General

All transverse joints in surface slabs shall be sealed using sealants described in Clause

3.15.2.8. Joints shall not be sealed before 14 days after construction.

3.15.10.2. Preparation of joint grooves for sealing

3.15.10.2.1. Joint grooves usually are not constructed to provide the minimum width specified in the drawings when saw cut joints are adopted. They shall be widened subsequently by sawing before sealing. Depth/width gauges shall be used to control the dimension of the groove.

3.15.10.2.2. If rough arises develop when grooves are made, they shall be ground to provide a chamfer approximately 5 mm wide. If the groove is at an angle upto 10 degree from the perpendicular to the surface, the overhanging edge of the sealing groove shall be sawn or ground perpendicular. If spalling occurs or the angle of the former is greater than 10 degrees, the joint sealing groove shall be sawn wider and perpendicular to the surface to encompass the defects upto a maximum width, including any chamfer, of 35 mm for transverse joints and 20 mm for longitudinal joints. If the spalling cannot be so eliminated then the arrises shall be repaired by an approved thin bonded arris repair using cemeiititious materials.

3.15.10.2.3. All grooves shall be cleaned of any dirt or loose material by air blasting with filtered, oil-free compressed air. If need arises the Engineer may instruct cleaning by pressurised water jets. Depending upon the requirement of the sealant manufacturer, the sides of the grooves may have to be sand blasted to increase the bondage between sealant and concrete.

3.15.10.2.4. The groove shall be cleaned and dried at the time of priming and sealing.

3.15.10.2.5. Before sealing the temporary seal provided for blocking the ingress of dirt, soil etc., shall be removed. A highly compressible heat resistant paper-backed debonding strip as per drawing shall be inserted in the groove to serve the purpose of breaking the bond between sealant and the bottom of the groove and to plug the joint groove so that the sealant may not leak through the cracks. The width of debonding strip shall be more than the joint groove width so that it is held tightly in the groove. In the case of longitudinal joints, heat resistant tapes may be inserted to block the leakage through bottom of the joint.

3.15.10.3. Sealing with sealants :

3.15.10.3.1. When sealants are applied, an appropriate primer shall also be used if recommended by the manufacturer and it shall be applied in accordance with their recommendation. The sealant shall be applied within the minimum and maximum drying times of the primer recommended by the manufacturer. Priming and sealing with applied sealants shall not be carried out when the naturally occurring temperature in the joint groove to be sealed is below 7° C.

3.15.10.3.2. If hot applied sealant is used it shall be heated and applied from a thermostatically controlled, indirectly heated preferably with oil jacketed melter and pourer having recirculating pump and extruder. For large road projects, sealant shall be applied with extruder having flexible hose and nozzle. The sealant shall not be heated to a temperature higher than the safe heating temperature and not for a period longer than the safe heating period, as specified by the manufacturer. The dispenser shall be cleaned out at the end of each day in accordance with the manufacturer's recommendations and reheated material shall not be used.

3.15.10.3.3. Cold applied sealants with chemical formulation like polysulphide may be used. These shall be mixed and applied within the time limit specified by the manufacturer. If primers are recommended they shall be applied neatly with an appropriate brush. The Movement Accommodation Factor (MAF) shall be more than 10 per cent.

3.15.10.3.4. The sealants applied at contraction phase of the slabs would result in bulging of the sealant over and above the slab. Therefore, the Contractor in consultation with the Engineer shall establish the right temperature and time for applying the sealant. Thermometer shall be hung on a pole in the site for facilitating control during the sealing operation.

3.15.10.3.5. Sealant shall be applied, slightly to a lower level than the slab with a tolerance of 5 ± 2 mm.

3.15.10.3.6. During sealing operation, it shall be seen that no air bubbles are introduced in the sealant either by vapours or by the sealing process.

3.15.9.6. Curing: Curing shall confirm to the requirements of Section-5.1.3.11 of General Specifications.

3.15.11 Removal of Scaffolding and Formwork : Forms and scaffolding shall confirm to the requirements of Section-5.1.3.12 of General Specifications.

3.15.12 Repair of Concrete : Repair of Concrete shall confirm to the requirements of Section-5.1.3.12 of General Specifications.

3.15.13 Measurement of Texture Depth - Sand Patch Method

3.15.13.1. The following apparatus shall be used:

A cylindrical container of 25 ml internal capacity

A flat wooden disc 64 mm diameter with a hard rubber disc, 1.5 mm thick, stuck to one face, the reverse face being provided with a handle

Dry natural sand with a rounded panicle shape passing a 300 micron IS sieve and retained on a 150 micron IS sieve.

3.15.13.2. Method: The surface to be measured shall be dried, any extraneous mortar and loose material removed and the surface swept clean using a wire brush both at right angles and parallel to the carriageway. The cylindrical container shall be filled with the sand, tapping the base 3 times on the surface to ensure compaction, and striking off the sand level with the top of the cylinder. The sand shall be poured into a heap on the surface to be treated. The sand shall be spread over the surface, working the disc with its face kept flat in a circular motion so that the sand is spread into a circular patch with the surface depressions filled with sand to the level of peaks.

3.15.13.3. The diameter of the patch shall be measured to the nearest 5 mm. The texture depth of concrete surface shall be calculated from 31000/(DxD) mm where D is the diameter of the patch in mm.

3.15.14. Opening to Traffic

No vehicular traffic shall be allowed to run on the finished surface of a concrete pavement within a period of 28 days of its construction and until the joints are permanently sealed. The road may be opened to regular traffic after completion of the curing period of 28 days and after sealing of joints is completed including the construction of shoulder, with the written permission of the Engineer.

3.15.15. Tolerances for Surface Regularity, Level, Thickness and Strength

The tolerances for surface regularity, level, thickness and strength shall conform to the requirements and Control of quality of materials and works shall be exercised satisfactory to the Engineer.

3.15.16. Measurements for Payment

3.15.16.1. Cement Concrete pavement shall be measured as a finished work in square metres with specified thickness. The volume to be paid for will be calculated on the basis of thickness and plans shown on the project drawings and adjusted for the deficiency in thickness. No additional payment shall be made for extra thickness of the slab. The full payment will be made to this item after 28 days strength of the concrete is found to be satisfactory.

The unit for measurement for concrete pavement shall be the cubic metre of concrete placed, based on the net plan areas for the specified thickness shown on the Drawings or directed by the Engineer. The rate shall include all provisions of this Specification and shall include the provision of all materials including polythene film, concrete, stock piling, mixing, transport, placing, compacting, finishing, curing together with all formwork, and including testing and submission of test certificates and records. No deduction shall be made in measurement for

openings provided that the area of each is less than 0.5 sq. m. The unit rate as entered in the Bill of Quantities shall also include the full costs of contraction, expansion, construction, and longitudinal joints. It shall also include joint filler, keys, caulking rod, debonding strip, sealant primer, joint sealant, dowel bar and tie rod.

3.15.16.2. Pavement thickness

All precautions and care shall be taken to construct pavement having uniform thickness as called for on the plans.

Thickness of the cement concrete pavement shall be calculated on the basis of level data of the cement concrete pavement and the underlying sub-base taken on a grid of 5 m x 3.5 m or 6.25 m x 3.5 m, the former measurement being in longitudinal direction.

A day's work is considered as a 'lot' for calculating the average thickness of the slab. In calculating the average thickness, individual measurements which are in excess of the specified thickness by more than 10 mm shall be considered as the specified thickness plus 10 mm.

Individual areas deficient by more than 25 mm shall be verified by the Engineer by ordering core cutting and if in his opinion the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness shown on the plans.

3.15.17. Payment

The Contract unit rate for the construction of the cement concrete shall be payment in full for carrying out the operations required for the different items of the work as per these Specifications including full compensation for all labour, tools, plant, equipments, testing and incidentals to complete the work as per Specifications, providing all materials to be incorporated in the work including all royalties, fees, storage, rents where necessary and all leads and lifts.

Pay items shall be:

03/15/01	Cement Concrete Pavement (Concrete class-30)	cu metre
03/15/02	Cement Concrete Pavement (Concrete Class - 35)	cu metre

DIVISION 4
FOUNDATION WORK

DIVISION 4 - FOUNDATION WORK

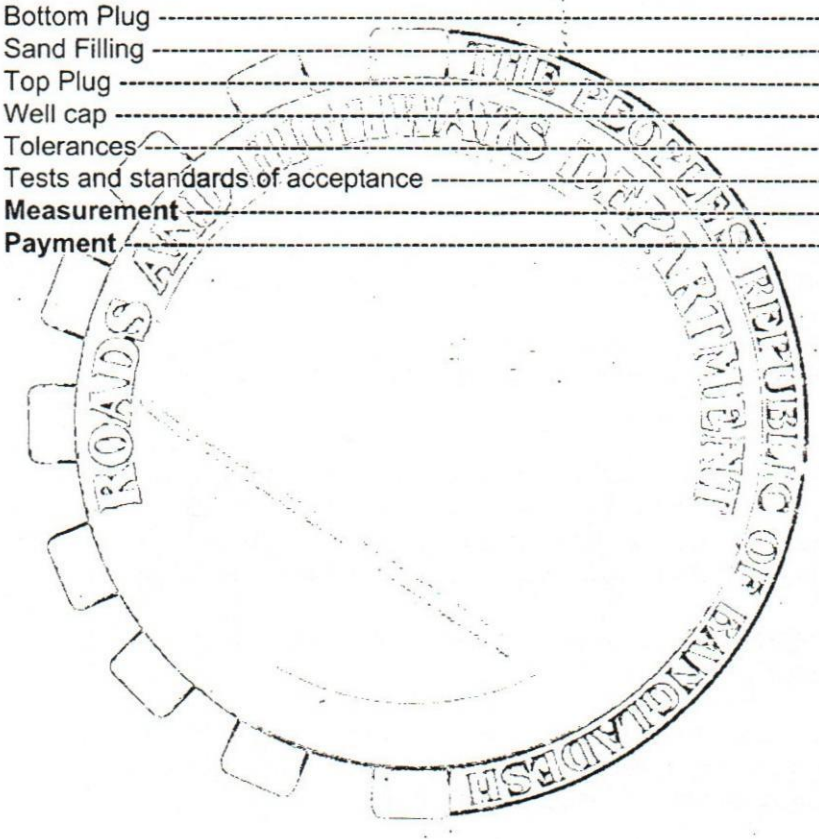
		Page
4.1	**BORED CAST IN PLACE PILES**	1
4.1.1	**Description**	1
4.1.2	**Materials**	1
4.1.2.1	Steel Casing	1
4.1.2.2	Concrete	1
4.1.2.3	Reinforcement	2
4.1.2.4	Drilling Fluid	2
4.1.3	**Construction Methods**	3
4.1.3.1	General	3
4.1.3.2	Setting Out Piles	4
4.1.3.3	Diameter of Piles	4
4.1.3.4	Tolerances	4
4.1.3.5	Boring	4
4.1.3.6	Placing Reinforcement	6
4.1.3.7	Placing Concrete	6
4.1.3.8	Extraction of Temporary Casing	8
4.1.3.9	Temporary Support	8
4.1.3.10	Records	9
4.1.3.11	Measures in Case of Rejected Piles	9
4.1.4	**Measurement**	10
4.1.5	**Payment**	10
4.2	**PRECAST CONCRETE DRIVEN PILES**	11
4.2.1	**Description**	11
4.2.2	**Materials**	11
4.2.2.1	Concrete	11
4.2.2.2	Formwork	11
4.2.2.3	Prestressing Steel	11
4.2.2.4	Reinforcement	11
4.2.3	**Production of Piles**	12
4.2.3.1	Casting	12
4.2.3.2	Tensioning Procedure (Prestressed Piles Only)	12
4.2.3.3	Curing	12
4.2.3.4	Release (Pretensioned Piles Only)	12
4.2.3.5	Finishing	13
4.2.3.6	Marking of Piles	13
4.2.3.7	Handling and Storage of Piles	13
4.2.3.8	Spliced Piles	13
4.2.4	**Driving Piles**	13
4.2.4.1	Strength of Piles	13
4.2.4.2	Leaders and Trestles	13
4.2.4.3	Driving Equipment	14
4.2.4.4	Driving Procedure and Redrive Checks	14
4.2.4.5	Final Set	14
4.2.4.6	Driving Sequence and Risen Piles	15
4.2.4.7	Jetting	15
4.2.4.8	Length of Piles	15
4.2.4.9	Repair or Damaged Pile Heads	15
4.2.4.10	Cut off and Extension	16
4.2.4.11	Damage to Adjacent Structures and Services	16
4.2.4.12	Records	16

4.2.5	**Tolerances**	16
4.2.5.1	Setting Out	16
4.2.5.2	Position	16
4.2.5.3	Verticality	17
4.2.5.4	Rake	17
4.2.6	**Defective Piles**	17
4.2.7	**Measurement**	17
4.2.8	**Payment**	17
4.3	**PRECAST CONCRETE UNITS FOR RIVER TRAININGAND RETAINING STRUCTURES**	19
4.3.1	**Description**	19
4.3.2	**Materials**	19
4.3.3	**Construction Methods**	19
4.3.3.1	King Post & Anchor Piles	19
4.3.3.2	Precast Planks	19
4.3.4	**Tolerances**	19
4.3.5	**Measurement**	19
4.3.6	**Payment**	20
4.3.7	***PILE INTEGRITY TEST***	
4.3.7.1	Description	20
4.3.7.2	Test procedure	20
4.3.7.3	Results of Testing	21
4.3.7.4	Measurement	21
4.3.7.5	Payment	21
4.4	**PILE TEST LOADING**	22
4.4.1	**Descriptions**	22
4.4.1.1	General	22
4.4.1.2	Definitions	22
4.4.2	**Supervision**	23
4.4.3	**Safety Precautions**	23
4.4.3.1	General	23
4.4.3.2	Kentledge	23
4.4.3.3	Tension Piles and Ground Anchors	23
4.4.3.4	Testing Equipment	24
4.4.4	**Construction of a Pilot Pile to be Test Loaded**	24
4.4.4.1	Notice of Construction	24
4.4.4.2	Method of Construction	24
4.4.4.3	Boring or Driving Record	24
4.4.4.4	Cut Off Level	24
4.4.4.5	Pile Head for Compression Tests	24
4.4.5	**Preparation of a Working Pile to be Tested**	24
4.4.6	**Reaction Systems**	25
4.4.6.1	Compression Tests	25
4.4.6.2	Working Piles	25
4.4.6.3	Spacing	25
4.4.6.4	Adequate Reaction	25
4.4.6.5	Care of Piles	25
4.4.6.6	Loading Arrangement	25
4.4.7	**Equipment for Applying Load**	25
4.4.8	**Measurement of Load**	25
4.4.9	**Adjustability of Loading Equipment**	26

THE PUBLIC WORKS DEPARTMENT
ISSUED FOR TENDER

4.4.10	**Measuring Movement of Pile Heads**	26
4.4.10.1	General	26
4.4.10.2	Levelling Method	26
4.4.10.3	Independent Reference Frame	26
4.4.10.4	Other Methods	27
4.4.11	**Protection of Testing Equipment**	27
4.4.11.1	Protection from Weather	27
4.4.11.2	Prevention of Disturbance	27
4.4.12	**Supervision**	27
4.4.12.1	Notice of Test	27
4.4.12.2	Records	27
4.4.13	**Test Procedure**	27
4.4.13.1	Proof Test by Maintained Load Test	27
4.4.14	**Presentation of Results**	28
4.4.14.1	Results to be Submitted	28
4.4.14.2	Schedule of Recorded Data	28
4.4.15	**Completion of a Test**	30
4.4.15.1	Measuring Equipment	30
4.4.15.2	Kentledge	30
4.4.15.3	Temporary Piles	30
4.4.16	**Measurement and Payment**	30
4.5	**BITUMEN SLIP LAYER FOR PILES**	32
4.5.1	**Description**	32
4.5.2	**Materials**	32
4.5.2.1	Primer	32
4.5.2.2	Bitumen	32
4.5.3	**Field Storage and Installation**	32
4.5.4	**Measurement**	33
4.5.5	**Payment**	33
4.6	**DRIVEN BULLAH PILES**	34
4.6.1	**Description**	34
4.6.2	**Materials**	34
4.6.3	**Driving Piles**	34
4.6.3.1	Driving Equipment	34
4.6.3.2	Leaders and Trestles	34
4.6.3.3	Hammers	34
4.6.3.4	Length of Piles	34
4.6.3.5	Records	34
4.6.4	**Measurement**	35
4.6.5	**Payment**	35
4.7	**WELL FOUNDATION**	36
4.7.1	**Description**	36
4.7.2	**Materials**	36
4.7.2.1	Steel cutting edge	36
4.7.2.2	Concrete	36
4.7.2.3	Reinforcement	37
4.7.2.3	Sand	37

4.7.3 Construction Methods
4.7.3.1 Setting Out and Preparations for Sinking ---- 37
4.7.3.2 Cutting Edge Erection ---- 37
4.7.3.3 Well curb ---- 38
4.7.3.4 Well Steining ---- 38
4.7.3.5 Well Sinking ---- 39
4.7.3.5.1 General ---- 39
4.7.3.5.2 Sand blows in wells ---- 39
4.7.3.5.3 Use of Kentledge as Sinking Load ---- 39
4.7.3.5.4 Use of Water Jetting ---- 40
4.7.3.5.5 Use of Explosives ---- 40
4.7.3.5.6 Use of Divers ---- 40
4.7.3.6 Precautions during sinking ---- 41
4.7.3.7 Tilts and Shifts ---- 42
4.7.3.10 Bottom Plug ---- 43
4.7.3.11 Sand Filling ---- 44
4.7.3.12 Top Plug ---- 44
4.7.3.13 Well cap ---- 45
4.7.3.14 Tolerances ---- 45
4.7.3.15 Tests and standards of acceptance ---- 45
4.7.4 Measurement ---- 45
4.7.5 Payment ---- 46



4.1 BORED CAST IN PLACE PILES

4.1.1 Description

This work comprises the construction of bored cast in place piles for bridges, including the provision of all materials and structures in accordance with these Specifications and in conformity with the requirements of the Drawings or other parts of the Contract Documents. Piles through water and soft upper soil layers shall be provided with a permanent steel casing if shown on the Drawings.

The pile boring shall be carried out using a temporary steel casing bored to the pile toe or to a level approved by the Engineer. The temporary casing shall be withdrawn.

Under certain circumstances the Contractor may be permitted to bore all or part of the pile without casing under water or use drilling fluid to stabilise the borehole as referred to in Section 4.1.2.4.

The piles shall be concreted and reinforced to resist pile loads and horizontal forces on the pile caps according to the Drawings and these Specifications.

4.1.2 Materials

4.1.2.1 Steel Casing

This part of the Specifications only deals with the permanent steel casing. For steel casing used during boring of the pile see Section 4.1.3, Construction Methods.

When permanent steel casing is shown on the Drawings, the steel shall conform to the AASHTO Standard Specification M 183 79 (ASTM A36) or equivalent.

The minimum thickness of the permanent steel casing shall be 10 mm. The minimum length shall be from 100 mm above the bottom of the pile cap to 5 metre under the riverbed or into firm strata. If the permanent casing is used in the boring operation or if the handling and transport require a greater thickness to avoid deformation or buckling, the increase in thickness shall be provided by the Contractor at his own expense.

The steel casing shall be furnished in appropriate lengths and the joints shall be approved by the Engineer.

The casing shall be handled and stored in a manner that shall prevent buckling and other deformation as well as accumulation of dirt, oil and paint. When placed in the work it shall be free from dirt, oil, grease, paint, millscale and loose or thick rust.

The outside surface of the permanent casing of piles to river piers, for the depth indicated on the Drawings from the underside of the pile cap shall receive two coats of anti-corrosion tar type paint. The paint shall be approved by the Engineer and its application shall follow the manufacturer's instructions.

4.1.2.2 Concrete

The concrete shall conform to Section 5.1 of these Specifications. Concrete class 20 with type 1 cement shall be used.

Concrete placed under water or drilling mud by tremie shall have a cement content of not less than 350 kg/m^3.

The density and consistency of the concrete shall conform to the tremie casting method and the maintenance of sufficient workability (slump) of all the concrete during the casting and casing handling period, including reasonably calculated delays, shall be secured by a design mix, (including the necessary retarders and plasticisers), tested by trial mixes prior to the pile construction.

All relevant concrete properties such as slump, time of setting, temperature and strength shall be measured on the trial mixes.

4.1.2.3 Reinforcement

The reinforcement shall conform to Section 5.2 of these Specifications.

4.1.2.4 Drilling Fluid

The following clauses shall be complied with if bentonite mud is used to stabilise the boreholes:

A) Supply

The Contractor shall obtain a certificate from the manufacturer of the bentonite powder, showing the properties of the consignment delivered to the site. This certificate shall be made available to the Engineer on request. The properties to be given by the manufacturer are the apparent viscosity range (in centipoises) and the gel strength range for solids in water.

Any other material proposed by the Contractor for the drilling fluid shall be approved by the Engineer.

B) Mixing

Bentonite and any other material shall be mixed thoroughly with clean water to make a suspension which shall maintain the stability of the pile excavation for the period necessary to place concrete and complete construction.

Where saline or chemically contaminated groundwater occurs, special precautions shall be taken to modify the bentonite in fresh water so as to render it suitable in all respects for the construction of piles.

C) Tests

The frequency of testing drilling fluid and the method and procedure of sampling shall be proposed by the Contractor and approved by the Engineer prior to the commencement of the work. The frequency may subsequently be varied as required depending on the consistency of the results obtained. The control tests shall cover the determination of density, viscosity, gel strength and pH values.

The Contractor shall supply all equipment and experienced operators required to carry out tests on the drilling mud. No additional payment shall be made for these tests which shall be considered as an essential part of the drilling operations.

4.1.3 Construction Methods

4.1.3.1 General

The Contractor shall demonstrate to the satisfaction of the Engineer that his proposed construction methods for the piles do not result in the pile shafts being weakened by contamination of the concrete, by sectional reduction, by washing out of cement, by breaking during pulling of temporary casings or in any other way, including the construction of neighbouring piles.

A) Assumed Procedure

The following construction procedure has been assumed in the tender design. The final construction procedure shall be as approved by the Engineer prior to commencing piling operations.

1. Place permanent steel casing, if required, in position and embed casing toe into river bed or firm strata. If no permanent steel casing is specified a sufficient length of temporary steel casing shall be used to stabilise the upper part of the borehole.

2. Bore and excavate inside the steel casing down to casing toe level, or to a level approved, and continue excavation to final pile tip level using either temporary casing under water, or using drilling mud. The fluid level inside casings shall at all times be at least 2 metres higher than outside the casings.

3. Carefully clean up all mud or sedimentation from the bottom of borehole.

4. Place reinforcement cage, inspection pipes etc.

5. Concrete continuously under water, or drilling fluid, by use of the tremie method.

6. Withdraw the temporary boring casing concurrently with concreting to the instructed level.

7. After hardening, break out the top section of the concrete pile to reach sound concrete.

B) Approval of Construction Method

In the tender, the Contractor shall describe the construction method he proposes, including name of proposed Sub-contractor (if any), information on boring equipment, materials, methods of work and control of quality. The Contractor shall submit references from similar jobs carried out by him and/or his proposed Sub contractor.

During contract negotiations, the Contractor shall submit all requested supplementary detailed information in writing.

After the Contract has been awarded, the Contractor shall prepare a detailed programme and establish a procedure for the pile construction. The detailed programme shall contain all required information on materials, equipment, methods of work etc. and be approved in writing by the Engineer. Such approval shall not, however, relieve the Contractor of his responsibilities for pile construction.

The import of any boring equipment or materials by the Contractor, before he has received the Engineer's approval of proposed construction methods, shall be at the Contractor's risk.

4.1.3.2 Setting Out Piles

The Contractor shall check the casing position for each pile during and immediately after placing the casing, and agree it with the Engineer.

4.1.3.3 Diameter of Piles

The diameter of a pile shall be not less than the specified diameter.

4.1.3.4 Tolerances

The centre of the completed pile at the cut off level shall not deviate more than 100 mm from the theoretically correct position shown on the Drawings. The inclination of the pile shall not deviate more than 1:100 from vertical. The Contractor shall provide suitable equipment, such as an inverted pendulum, to check the verticality of the boreholes at intervals during drilling and prior to concreting.

4.1.3.5 Boring

A) Methods

Method of excavation shall be proposed by the Contractor and approved by the Engineer. Water or air jetting for boring of the piles shall not be allowed.

B) Boring Near Recently Cast Piles

Piles shall not be bored so close to other piles which have recently been cast and which contain workable or unset concrete so that a flow of concrete could be induced from or damage caused to any of the piles. Boring and excavation for a pile shall not be commenced until 24 hours after completion of any pile within a radius of 6 metres, centre to centre.

C) Temporary Casings

Temporary casing of approved quality or an approved alternative method shall be used to maintain the stability of pile excavations, which might otherwise collapse.

Temporary casings shall be free from significant distortion. They shall be of uniform cross section throughout each continuous length. During concreting they shall be free from internal projections and encrusted concrete which might prevent the proper formation of piles.

D) Stability of Pile Excavation Using Drilling Fluid

Where a borehole is formed without casing under water or using drilling fluid for maintaining the stability of a boring, the level of the water or fluid in the excavation shall be maintained so that the water or fluid pressure always exceeds the pressure exerted by the soils and external ground water. The water or fluid level shall be maintained at a level not less than 2 metres above the level of the river water level or any artesian pressure level.

In the event of a rapid loss of water or bentonite suspension from the pile excavation, the excavation shall be backfilled without delay and the instructions of the Engineer shall be obtained before excavation at that location is resumed.

E) Disposal of Excavated Material

No excavated material shall be dumped into the river or any connecting waterway without the written approval of the Engineer. Excavated material shall be removed from site and dumped either beyond areas affected by dredging, or taken to the Contractors approved dumping areas on land. The Contractor shall be fully responsible for costs involved in removing the excavated material to spoil.

F) Pumping from Boreholes

Pumping from a borehole shall not be permitted unless a casing has been placed into a stable stratum which prevents the flow of water from other strata in significant quantities into the boring, or unless it can be shown that pumping will not have a detrimental effect on the surrounding soil or property.

G) Obstructions

Where boulders or other obstructions render it impossible to bore the pile, excavation operations inside pile casing as directed by the Engineer shall be carried out to remove obstructions and the Contractor shall be reimbursed for such operations only when the largest dimension of the obstruction exceeds 200 mm and the obstruction is found more than 2 metres below river bed.

H) Unexpected Ground Conditions

The Contractor shall report immediately to the Engineer any circumstances which indicate that in the Contractor's opinion the ground conditions differ from those expected by him from his interpretation of the site investigation reports.

I) Boring Records

During the boring of the pile, the Contractor shall compile a 'boring log' indicating depths and types of the various soil layers encountered. Disturbed samples shall be submitted to the Engineer as requested.

The Contractor shall allow for carrying out sampling and tests to check soil strengths as required by the Engineer.

J) Final Pile Toe Level

The final pile toe level shall be as indicated on the Drawing or as instructed by the Engineer after due consideration of the Contractor's proposals, boring logs and test results.

The final toe level of other piles may subsequently be altered according to the results of the test loadings detailed in Section 4.4.

K) Inspection and Cleaning Bottom of Excavation

The time between final excavation and bottom cleaning and the start of concreting shall be kept as short as possible and shall not exceed 6 hours. To achieve this, the final 2 metres of excavation shall not start until all preparations for cleaning, reinforcing and concreting are finished. In case of unexpected delay the Contractor shall dump sand or gravel in the bore to 2 metres above toe level.

On completion of the drilling an interval is required, to allow the fine materials to settle (15 minutes unless otherwise approved by the Engineer). Thereafter the bottom of the excavation shall be carefully cleaned of mud, sedimentation and other soft material by an approved method.

The Contractor shall show, to the satisfaction of the Engineer, that the bottom of the excavation is clean. Sedimentation tests shall be carried out by the Contractor in the presence of the Engineer.

If boring without casing, the diameter of the boring hole for a representative number of piles shall be measured by calliper prior to the placing of concrete. The verticality of boreholes will be checked as directed by the Engineer. These measurements shall be done by the Contractor using approved equipment and no reimbursement shall be made.

4.1.3.6 Placing Reinforcement

The reinforcement shall be placed as indicated on the Drawings. Reinforcement in the form of a cage shall be assembled with additional support, such as spreader forks and lacings, necessary to form a rigid cage. Hoops, links or helical reinforcement shall fit closely around the main longitudinal bars and be bound to them by approved wire, the ends of which shall be turned into the interior of the pile or pour. Reinforcement shall be placed and maintained in position.

The cover to all reinforcement shall be not less than 75 mm.

Joints in longitudinal steel bars shall be permitted unless otherwise specified. Joints in reinforcement shall be such that the full strength of the bar is effective across the joint and shall be made so that there is no relative displacement of the reinforcement during the construction of the pile.

Joints in longitudinal bars in piles with tension (for instance for test loading) shall be carried out by welding unless another method has been approved by the Engineer.

If the final pile toe level instructed by the Engineer is deeper than that indicated on the Drawings, the section of the pile deeper than the toe level indicated on the Drawings is not required to be reinforced, unless otherwise instructed by the Engineer.

4.1.3.7 Placing Concrete

A) Approval

No concreting shall take place before the bottom of the excavation has been cleaned, the borehole inspected and approval obtained in writing from the Engineer.

The method for placing concrete requires to be approved and conform with the following:

- The method of placing and the workability of the concrete shall be such that a continuous monolithic concrete shaft of the full cross section is formed.
- The concrete shall be placed continuously, and without such interruption as would allow the previously placed batch to have hardened. In this respect the Contractor shall submit details of his contingency plans, standby plant etc. to be utilised in the event of an equipment failure.
- The use of pumped concrete and the methods in its use shall be approved.
- The Contractor shall take all precautions in the design of the mix and placing of the concrete to avoid arching of the concrete in a casing. No spoil, liquid or other foreign matter shall be allowed to contaminate the concrete.

B) Workability of Concrete
Slump measured at the time of discharge into the pile boring shall be in accordance with Table 4.1-1.

Table 4.1-1

Piling Mix Workability	Slump		Typical Conditions of Use
	Minimum (mm)	Range (mm)	
A	75	75 - 150	Placed into water-free unlined or permanently lined bore of 600 mm diameter or over, or where casting level lies below temporary casing: reinforcement widely spaced, leaving ample room for free movement of concrete between bars.
B	100	100 - 200	Where reinforcement is not spaced widely; where cut-off level of concrete is within temporary casing; where pile bore is water-free and the diameter is less than 600 mm.
C	150	150 or more	Where concrete is to be placed by tremie under water or drilling mud or by pumping.

C) Placing Concrete Under Water or Drilling Fluid

Concrete to be placed under water or drilling fluid shall be placed by tremie and shall not be discharged freely into the water or drilling fluid.

Before placing concrete, the Contractor shall ensure that there is no accumulation of silt, other material, or heavily contaminated bentonite suspension at the base of the boring, which could impair the free flow of concrete from the pipe of the tremie. A sample of the bentonite suspension shall be taken from the base of the boring using an approved sampling device. If the specific gravity of the suspension exceeds 1.25, the placing of concrete shall not proceed. In this event the Contractor shall modify the mud quality.

The concrete shall be a rich coherent mix of high workability in accordance with Section 4.1.2.2 and shall be placed in such a manner that segregation does not occur.

During and after concreting, care shall be taken to avoid damage to the concrete from pumping and dewatering operations.

The hopper and pipe of the tremie shall be clean and watertight throughout. The pipe shall extend to the base of the boring and a sliding plug or barrier shall be placed in the pipe to prevent direct contact between the first charge of concrete in the pipe of the tremie and the water or drilling fluid. The pipe shall at all times penetrate the concrete, which has previously been placed and shall not be withdrawn from the concrete until completion of concreting. The bottom of the tremie pipe shall be kept at least 1.5 metres under the surface of concrete once that amount of concrete has been placed. At all times a sufficient quantity of concrete shall be maintained within the pipe to ensure that the pressure from it exceeds that from the water or drilling fluid. The internal diameter of the pipe of the tremie shall be not less than 150 mm for concrete made with 20 mm aggregate and not less than 200 mm for concrete

made with 40 mm aggregate. It shall be so designed that external projections are minimised, allowing the tremie to pass through reinforcing cages without causing damage. The internal face of the pipe of the tremie shall be free from projections.

The Contractor shall maintain a continuous record of the volume of concrete used and the level of the concrete in the pile. Any deviations from the theoretical, or expected, volume/level relationship shall be immediately reported to the Engineer.

4.1.3.8 Extraction of Temporary Casing

A) Workability of Concrete

Temporary casings shall be extracted while the concrete within them remains sufficiently workable to ensure that the concrete is not lifted.

B) Concrete Level

When the casing is being extracted a sufficient quantity of concrete shall be maintained within it to ensure that pressure from external water, drilling fluid or soil is exceeded and that the pile is neither reduced in section nor contaminated. The toe of the temporary casing shall be kept a minimum of 2 metres under the outlet of the tremie.

No concrete shall be placed in the boring once the bottom of the casing has been lifted above the top of the concrete; it shall be placed continuously as the casing is extracted until the desired head of concrete is obtained.

Adequate precautions shall be taken in all cases where excess heads of water or drilling fluid could be caused as the casing is withdrawn because of the displacement of water or fluid by the concrete as it flows into its final position against the walls of the shaft.

The pile shall be concreted with a certain overheight to allow for chiselling off the top concrete down to sound hard concrete.

The pile top shall after clean cutting be embedded 100 mm in the foundation.

C) Vibrating Extractors

The use of vibrating casing extractors shall be permitted.

D) Reinforcement Cage

During concreting and pulling the casing, the reinforcement cage shall be secured against uplift and the top shall be kept under close inspection.

E) Supervision

The execution of the pile concreting shall be supervised by a qualified person of the Contractor's staff, who will keep records on the relation between quantity of concrete used, level of concrete and withdrawal of casing.

4.1.3.9 Temporary Support

The Contractor shall ensure that free standing piles are temporarily braced or stayed immediately after driving to prevent loosening of the piles in the ground and to ensure that no damage resulting from oscillation, vibration or movement of any free standing pile length can occur.

4.1.3.10 Records

The Contractor shall keep records as indicated below for the installation of each pile and shall submit two signed copies of these records to the Engineer not later than noon of the next working day after the pile was installed. The signed records shall form a record of the work. The following data are required:

a) Pile location
b) Pile reference number
c) Pile type
d) Nominal cross sectional dimensions or diameter
e) Date and time of boring
f) Date and time of concreting
g) River bed level at commencement of installation of pile
h) Working level
i) Pile toe level
j) River water levels
k) Pile head level
l) Length of temporary casing
m) Length of permanent casing
n) Soils samples taken and in situ tests carried out
o) Standing water level
p) Length and details of reinforcement
q) Concrete mix
r) Volume of concrete supplied to pile and corresponding levels of concrete and casings
s) All information regarding obstructions, delays and other interruptions to the sequence of work.

4.1.3.11 Measures in Case of Rejected Piles

If any pile is found unsatisfactory in the opinion of the Engineer for utilisation in the structure, it shall be cut off below the pile cap if so ordered by the Engineer.

The pile shall be replaced as directed by the Engineer. All extra expenses shall be borne by the Contractor and payment shall be made on the basis that no replacement pile had to be provided for the unsatisfactory pile.

When the safe bearing value of any pile is found by test to be less than the design load, longer piles or additional piles shall be installed as ordered in writing by the Engineer.

4.1.4 Measurement

The unit of measurement for bored cast in place piling shall be the linear metre of pile constructed and accepted in the structure. The payable lengths of the satisfactory bored piles shall be measured from the toe level to cut off 100 mm above the bottom level of pile cap. Pile permanent steel casing shall be measured separately in linear metres of the installed and accepted length of casing. Reinforcement steel shall be measured in accordance with Specifications Section 5.2.4.

4.1.5 Payment

Bored piles shall be paid for at the Contract unit price per linear metre. The rate shall constitute full compensation for all materials including temporary casings & concrete and integrity testing of pile (The integrity test shall be done as per Clause no 4.3.7), but excluding reinforcement steel and Permanent Steel Casing, which items will be paid for separately. The rate shall also include boring equipment, standard penetration testing, split spoon sampling, boring, excavation, concreting, inspection and control, cutting off, welding, coupling and all related tools, rigs, cranes, jets, frames, leads, labour, and other incidental equipment and work necessary to complete the work.

Payment for bored cast in place pilot piles (see Section 4.4.1.2(e) for definition of pilot pile), completed and accepted, shall be made at the Contract unit price per linear metre for providing piles of the size specified. When pilot piles are incorporated in the foundation as working piles, no additional payment shall be made for the piles.

Payment for reinforcement steel shall be at the Contractor's rates per tonne for mild steel and high yield deformed steel bars.

Payment for Pile Permanent Steel Casing shall be at the Contract unit price per linear metre. The rate shall constitute full compensation for all materials, labour and plant necessary for providing and installing the casing, including all jointing, testing and coatings.

No payment shall be made for unauthorised, defective, unsound or unsatisfactorily piles or for any costs incurred by the Contractor for such piles.

Payment for testing of piles shall be made separately, as detailed in Section 4.4.

Pay items shall be:

04/01/01(a) Bored Cast in Place Piles (Dia 400mm)	Linear Metre
04/01/01(b) Bored Cast in Place Piles (Dia 600mm)	Linear Metre
04/01/01(c) Bored Cast in Place Piles (Dia 750mm)	Linear Metre
04/01/01(d) Bored Cast in Place Piles (Dia 900mm)	Linear Metre
04/01/01(e) Bored Cast in Place Piles (Dia 1000mm)	Linear Metre
04/01/03Mild Steel Reinforcing Bars	Tonne
04/01/04High Yield Deformed Steel Reinforcing Bars	Tonne
04/01/05(a) Permanent Steel Casing (6mm thick, dia 400mm)	Linear Metre
04/01/05(b) Permanent Steel Casing (6mm thick, dia 600mm)	Linear Metre
04/01/05(c) Permanent Steel Casing (6mm thick, dia 750mm)	Linear Metre
04/01/05(d) Permanent Steel Casing (10mm thick, dia 600mm)	Linear Metre
04/01/05(e) Permanent Steel Casing (10mm thick, dia 750mm)	Linear Metre
04/01/05(f) Permanent Steel Casing (10mm thick, dia 900mm)	Linear Metre
04/01/05(g) Permanent Steel Casing (10mm thick, dia 1000mm)	Linear Metre

4.2 PRECAST CONCRETE DRIVEN PILES

4.2.1 Description

This work shall consist of precast reinforced or prestressed concrete piles furnished and driven in accordance with these Specifications and in conformity with the requirements shown on the Drawings or elsewhere in the Contract Documents.

The type and sizes of piling to be used shall be as indicated on the Drawings. Where precast concrete driven piles have been used for the design, the Engineer shall consider and may give approval for the use of alternative types of piling proposed by the Contractor. The Contractor in submitting an alternative type of pile shall provide design data, piling experience records and calculations supporting the pile design and any variations in the substructure.

4.2.2 Materials

4.2.2.1 Concrete

Precast concrete piles shall be constructed in accordance with the details shown on the Drawings, and of the concrete class, proportions, method of mixing and placing in accordance with the provisions of Section 5.1. All cement used shall be type 1 and concrete shall contain not less than 350 kg of cement per m^3.

The cross sectional dimensions of the pile shall be not less than those specified and shall not exceed them by more than 10 mm.

Any face of a pile shall not deviate by more than 6 mm from a straight edge 3 metres long laid on the face, and the centroid of any cross section of the pile shall not deviate by more than 1/1,000 of the length of the pile from the straight line connecting the centroids of the end faces of the pile.

4.2.2.2 Formwork

The formwork for square precast concrete piles shall conform to the general requirement for concrete formwork as described in Section 5.1.

The head of each square pile shall be square to the longitudinal axis. The corners of the head and the corners of the pile shaft for a distance of 300 mm from the head shall be chamfered 25 mm x 25 mm.

4.2.2.3 Prestressing Steel

All prestressing steel shall comply with the general provisions of Section 5.3. All prestressing tendons shall comply with the details shown on the Drawing as to the quality, size, position and prestressing force introduced to the pile.

4.2.2.4 Reinforcement

Reinforcement steel shall be in accordance with the provisions set out in Specifications Section 5.2 and positioned as shown on the Drawings.

4.2.3 Production of Piles

4.2.3.1 Casting

Square piles shall be cast in a horizontal position. Special care shall be taken to place the concrete so as to produce a pile free from any air pockets, honeycombing or other defect.

Concrete shall be placed continuously and shall be compacted by vibrating or by other means satisfactory to the Engineer. The forms shall be slightly overfilled, the surplus concrete screeded off, and the top surfaces finished to a uniform, even texture similar to that produced by the forms.

Piles may only be constructed in separate shorter elements with the approval of the Engineer. Joints made after casting and/or stressing shall be at least as strong as the piles themselves in every respect.

4.2.3.2 Tensioning Procedure (Prestressed Piles Only)

Tensioning shall be carried out only in the presence of the Engineer, or his representative, unless otherwise approved in writing.

As used here the word "tendon" shall be defined as any single prestressing element used to apply prestressed forces to the concrete. For pretensioning this shall be each strand or straight wire.

All tendons to be stressed in a group shall be brought to a uniform tension of approximately 500 kilograms per tendon prior to being given their full tension. After this initial stressing the group shall be stressed to a total tension as required on the Drawings by means of hydraulic jacks or other approved appliances equipped with gauges graduated to read directly to 1% of the total load applied, and calibrated to measure accurately the stress induced in the steel. This induced stress shall be measured by elongation of the tendons and checked by gauge pressure. The results obtained shall be within 5% of each other.

Means shall be provided for measuring the elongation to an accuracy of one millimetre in twenty metres of length between jacking heads. In the event of apparent discrepancies of more than five percent between stresses indicated by gauge pressure and elongation, the entire operation shall be checked carefully and the source of error determined and corrected before proceeding further.

Independent references shall be established adjacent to each anchorage to indicate any yielding or slippage that may occur between the time of initial stressing and final release of the tendons.

4.2.3.3 Curing

Curing of the concrete shall be commenced prior to the formation of surface shrinkage cracks and as the concrete has hardened sufficiently to prevent injury. Curing shall conform to the requirements of Section 5.1.

4.2.3.4 Release (Pretensioned Piles Only)

For precast pretensioned members the tendon stress shall be maintained between anchorages until the concrete has reached a compressive strength equal to the "Transfer Strength" specified on the Drawings. After strength requirements are attained, the tension in the tendons shall be gradually and simultaneously released and the tendons cut off as required in such a way as to prevent shock. It shall be the Contractor's responsibility to transfer the prestress safely and to the Engineer's satisfaction in all respects.

A recess shall be cut at the ends of piles around each tendon to allow cutting off the tendon and filling the recess with grout so that the cover to the end of the tendon is not less than 20 mm.

4.2.3.5 Finishing

Piles shall present a true, smooth, even surface free from any surface blemishes and true to the dimensions shown on the Drawings, within the tolerance limits.

4.2.3.6 Marking of Piles

After a pile has been cast, the date of casting, reference number, length and, where appropriate, the prestressing force shall be clearly inscribed on the top surface of the pile and also clearly and legibly marked on the head of the pile. In addition, each pile shall be marked at intervals of 250 mm along the top 3 metres of its length before being driven.

4.2.3.7 Handling and Storage of Piles

The method and sequence of lifting, handling, transporting and storing piles shall be such that the piles are not damaged. The lifting point of each size of pile shall be proposed by the Contractor with supporting calculations for approval of the Engineer which verifies the pile will not be damaged during lifting, handling, transporting and storage. During transport and storage, piles shall be stored on adequate supports located under the lifting points of the piles.

Concrete shall at no time be subjected to loading, including its own weight, which will induce a compressive stress in it exceeding one third of its strength. For this purpose the assessment of the strength of the concrete and of the stresses produced by the loads shall be subject to the agreement of the Engineer.

All piles within a stack shall be in groups of the same length. Packings of uniform thickness shall be provided between piles at the lifting points.

4.2.3.8 Spliced Piles

Where the Drawings do not detail any splices in piles, the Contractor may adopt spliced piles provided details of the splicing method and drawings are submitted to the Engineer for approval prior to the manufacture of the piles.

4.2.4 Driving Piles

4.2.4.1 Strength of Piles

Piles shall not be driven until the concrete has achieved the specified 28 day strength.

4.2.4.2 Leaders and Trestles

At all stages during driving and until incorporation in the superstructure, the pile shall be adequately supported and restrained by means of leaders, or other guide arrangements to maintain position and alignment and to prevent buckling. These arrangements shall be such that damage to the pile does not occur. Leaders shall be of sufficient length to make the use of followers unnecessary.

4.2.4.3 Driving Equipment

Before any piling work is commenced the Contractor shall submit to the Engineer full details of the pile driving equipment and the method he intends to use in carrying out the work.

For special types of piling, driving head mandrels, or other devices in accordance with requirements shall be provided so that piles may be driven without injury.

The driving equipment shall be of a type which assures that the energy needed to penetrate the pile to the required depth is transmitted to the pile head without damaging the pile. Efficiency factor of the hammer, i.e. the relation between the theoretical energy developed by the hammer and the energy submitted to the pile, shall be minimum 0.7.

Piles shall be driven with steam, air, diesel or gravity hammers. When diesel hammers are used, they shall be calibrated by load tests if necessary.

When gravity hammers are used for driving concrete piles, the drop of the hammer shall not exceed 1 metre and the hammer shall have a weight of not less than 80% of the weight of the pile and the driving head. The fall shall be regulated so as to prevent injury to the pile.

The minimum energy developed by other types of hammers shall be the same as specified for gravity hammers.

4.2.4.4 Driving Procedure and Redrive Checks

Each pile shall be driven continuously until the specified or approved set and/or depth has been reached, except that the Engineer may permit the suspension of driving if he is satisfied that the rate of penetration prior to the cessation of driving will be substantially re-established on its resumption or if he is satisfied that the suspension of driving is beyond the control of the Contractor. A follower (long dolly) shall not be used.

The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is noted. A detailed record of the driving resistance over the full length of the nearest available pile shall be taken if required.

At the start of work and in a new area or section, sets shall be taken at intervals during the last 3 metres of the driving to establish the behaviour of the piles.

The Contractor shall give adequate notice and provide all facilities to enable the Engineer to check driving resistances. A set shall be taken only in the presence of the Engineer unless otherwise approved.

Redrive checks, if required, shall be carried out to an approved procedure.

4.2.4.5 Final Set

The final set of each pile shall be recorded either as the penetration in millimetres per 10 blows or as the number of blows required to produce a penetration of 250 mm.

When a final set is being measured, the following requirements shall be met:

a) The exposed part of the pile shall be in good condition without damage or distortion.
b) The dolly and packing, if any, shall be in sound condition.
c) The hammer blow shall be in line with the pile axis and the impact surfaces shall be flat and at right angles to the pile and hammer axis.

d) The hammer shall be in good condition and operating correctly.
e) The temporary compression of the pile shall be recorded if required.

4.2.4.6 Driving Sequence and Risen Piles

Piles shall be driven in an approved sequence to minimise the detrimental effects of heave and lateral displacement of the ground.

When required, levels and measurements shall be taken to determine the movement of either the ground or of any pile which results from the driving process.

When a pile has risen as a result of adjacent piles being driven, the Contractor shall submit to the Engineer his proposals for correcting this and the avoidance of it in subsequent work.

4.2.4.7 Jetting

Water jetting shall not be allowed. Continuous vibratory percussive methods shall be used to drive a pile to both its design depth as well as the required set where the upper strata affords high resistance to driving.

4.2.4.8 Length of Piles

The lengths of the piles shown on the Drawings are based on information which has been obtained from a site investigation prior to the driving of test piles.

Before pile lengths are finally settled, the Contractor shall construct to the lengths shown on the Drawings such pilot piles as may be found necessary and these piles shall be driven in the positions specified by the Engineer who shall be notified in advance of the driving. The Contractor shall furnish the Engineer daily with a detailed record of the pilot piles for the full depth of driving. After attaining the approved set, driving shall be continued until the Engineer directs that it shall cease. Driving of pilot piles beyond the point at which the approved set is obtained shall be called for to demonstrate that driving resistance continues to increase. The Contractor shall then provide the remainder of the piles. In determining the lengths of piles the Contractor shall base his order list on the lengths assumed to remain in the completed structure. The Contractor at his own expense can increase the lengths to provide for fresh heading and for such lengths as may be necessary to suit his method of operation.

Reference is made to Section 4.4 with regard to load tests on selected pilot piles.

4.2.4.9 Repair or Damaged Pile Heads

When repairing the head of a pile, the head shall be cut off square at sound concrete, and all loose particles shall be removed by wire brushing, followed by washing with water. If the pile is to be subjected to further driving, the head shall be replaced with concrete of an approved grade.

If the driving of a pile has been accepted but sound concrete of the pile is below the cut off level, the pile shall be made good to the cut off level with concrete of a grade not inferior to that of the concrete of the pile.

Repaired piles shall not be driven until the added concrete has reached the specified characteristic strength of the concrete of the pile.

4.2.4.10 Cut off and Extension

Prestressed concrete piles shall be cut off at such elevation that they shall extend into the cap or footing as indicated on the Drawings. In the case of hollow core piles starter bars shall be cast into the core at the top of the piles and extended into the cap or footing, all as shown on the Drawings. Extensions to prestressed concrete piles shall generally not be permitted, unless a provision for lengthening prestressed piles was incorporated at the time of manufacture. Any method for lengthening shall be such that joints are capable of taking safely the stresses during driving and under load.

4.2.4.11 Damage to Adjacent Structures and Services

The Contractor will take all necessary precautions to avoid damage to any adjacent structures and services. If during the execution of the work damage is, or is likely to be, caused to any adjacent structures or services, the Contractor shall submit to the Engineer his proposals for repair or avoidance of such damage.

4.2.4.12 Records

The Contractor shall keep records as indicated below of the installation of each pile and shall submit two signed copies of these records to the Engineer not later than noon of the next working day after the pile is installed. The signed records shall form a record of the work.

The following data are required:

a) Pile location
b) Pile reference number
c) Pile type
d) Nominal cross sectional dimensions or diameter
e) Length of preformed pile
f) Date and time of driving or redriving
g) Ground level at commencement of installation of pile
h) Working level
i) Pile toe level
j) Type, weight, drop and mechanical condition of hammer and equivalent information for other equipment
k) Number and type of packing used and type and condition of dolly used during driving the pile
l) Set of pile in mm per 10 blows or number of blows per 250 mm of penetration
m) If required, the sets taken at intervals during the last 3 metres of driving
n) If required, temporary compression of ground and pile from time of a marked increase in driving resistance until pile reaches its final level
o) All information regarding obstructions delays and other interruptions to the sequence of work

4.2.5 Tolerances

4.2.5.1 Setting Out

Setting out shall be carried out from the main grid lines of the proposed structure. Before installation of the pile, the pile position shall be agreed with the Engineer and marked with suitable identifiable pins or markers.

4.2.5.2 Position

For a pile cut off at or above ground level the maximum permitted deviation of the pile centre from the centre point shown on the setting out drawing shall be 75 mm in any direction.

An additional tolerance for a pile head cut off below ground level shall be permitted in accordance with Sections 4.2.5.3 and 4.2.5.4.

4.2.5.3 Verticality

The maximum permitted deviation of the finished pile from the vertical shall be 1 in 50.

4.2.5.4 Rake

The piling rig shall be set and maintained to attain the required rake. The maximum permitted deviation of the finished pile from the specified rake shall be 1 in 25.

4.2.6 Defective Piles

The procedure of driving the piles shall not subject them to excessive and undue abuse producing crushing and spalling of the concrete or deformation of the steel. Manipulation of piles to force them into proper position, considered by the Engineer to be excessive, shall not be permitted. Any pile damaged by reason of internal defects, or by improper driving or driven out of its proper location or driven below the elevation fixed by the plans or by the Engineer, shall be corrected at the Contractor's expense by one of the following methods approved by the Engineer for the pile in question:

1) The pile shall be withdrawn and replaced by a new and if necessary, a longer pile.
2) A second pile shall be driven adjacent to the defective or low pile.
3) The pile shall be spliced or built up as otherwise provided herein or a sufficient portion of the footing extended to properly embed the pile.

4.2.7 Measurement

The unit of measurement shall be the linear metre of pile furnished, driven and accepted in the structure. The pay lengths of the satisfactorily driven piles shall be measured from the toe to the cut off.

Cut off lengths shall not be measured for payment.

Reinforcement steel shall be measured in accordance with Specifications Section 5.2.4.

4.2.8 Payment

Precast concrete driven piles shall be paid for at the Contract unit rate per linear metre. The rate shall constitute full compensation for all materials but excluding reinforcement, which shall be paid for separately. The rate shall also include all shoes, equipment, hardware, formwork etc., driving, cutting off, lengthening and splicing, welding and coupling and all related tools, rigs, cranes, boilers, hammers, leaders, labour and other incidental equipment and work.

Payment for precast concrete driven pilot piles (see Section 4.4.1.2(e) for definition of pilot pile), completed and accepted, shall be made at the Contract unit price per linear metre for providing piles of the size specified. When pilot piles are incorporated in the foundation as working piles, no additional payment shall be made for the piles.

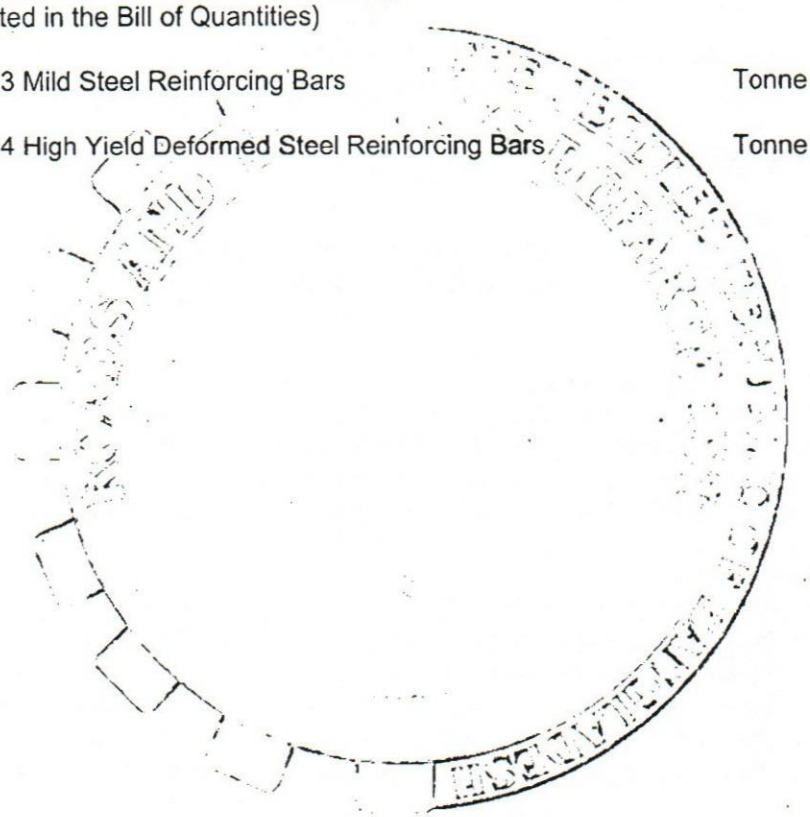
Payment for reinforcement steel shall be at the Contractor's rates per tonne for mild steel and high yield deformed steel bars.

No payment shall be made for unauthorised, defective, unsound or unsatisfactorily driven piles or for any costs incurred by the Contractor for such piles.

Payment for testing of piles shall be made separately, as detailed in Section 4.4.

Pay items shall be:

04/02/01(a) Driven Precast Piles (300mm X 300mm)	Linear Metre
04/02/01(b) Driven Precast Piles (350mm X 350mm)	Linear Metre
04/02/01(c) Driven Precast Piles (400mm X 400mm)	Linear Metre
04/02/02Driven Precast Pilot Piles (Dimensions as indicated on the Drawings and stated in the Bill of Quantities)	Linear Metre
04/02/03 Mild Steel Reinforcing Bars	Tonne
04/02/04 High Yield Deformed Steel Reinforcing Bars	Tonne



4.3 PRECAST CONCRETE UNITS FOR RIVER TRAINING AND RETAINING STRUCTURES

4.3.1 Description

This work shall consist of furnishing and placing all precast members of retaining and river training structures and anchor arrangements, all in accordance with these Specifications and in conformity with the requirements on the Drawings or of other parts of the Contract Documents.

The precast structures consist essentially of precast and driven "I" shaped concrete piles (King Posts) laterally supporting precast concrete planks. The king posts may be laterally anchored through tie bars to raker piles.

4.3.2 Materials

The king posts and raker piles shall conform to the requirements of Section 4.2.2.

The precast concrete planks shall be constructed in accordance with the details shown on the Drawings, and in accordance with Sections **5.1** and 5.2. Cement used shall be type 1.

4.3.3 Construction Methods

4.3.3.1 King Post & Anchor Piles

All production and construction methods for king posts and anchor piles shall conform to Sections 4.2.3 and 4.2.4 except that load testing shall not normally be required.

4.3.3.2 Precast Planks

The precast planks shall be placed between the king posts as shown on the Drawings. The planks shall be excavated or driven down to the levels indicated on the Drawings or as otherwise directed. In this connection it may be necessary to clear up the bed to the prescribed level and make local excavations along the planks as they are lowered. The method of placing the planks shall be agreed with the Engineer.

4.3.4 Tolerances

The horizontal position of the king posts after being driven shall not deviate from the correct position more than +10 mm perpendicular to the line of the wall and +10 mm in the direction of the wall. The precast planks in between the piles are designed to allow for a longitudinal tolerance of king post position of +10 mm. If the Contractor during construction establishes that the above tolerance is too small, the Engineer may accept minor changes in the tolerance. Such changes will require corresponding changes in plank sizes.

4.3.5 Measurement

King posts shall be measured by linear meter in accordance with Section 4.2.7. No distinction shall be made for different sizes or shapes of king posts which shall be as shown on the Drawings.

Precast planks shall be measured by square meter of plank used.

Raker piles shall be measured by linear metre in accordance with Section 4.2.7. No distinction shall be made for different sizes or rakes of raker piles which shall be as shown on the Drawings. Tie bars shall not be measured separately but are deemed included in the rate for raker piles.

Reinforcement steel in king posts and raker piles shall be measured in accordance with Specifications Section 5.2.4. Reinforcement steel in precast planks shall not be measured separately.

4.3.6 Payment

The Contractor's rates for king posts and raker piles will constitute full compensation for the supply of all materials excluding reinforcement steel, which shall be paid for separately. The rates shall also include handling, placing and all other related works.

The Contractor's rate for precast planks will constitute full compensation for the supply of all materials including reinforcement steel, handling, placing and all other related works.

Stone protection, if required, will be measured and paid for separately in accordance with Section 6.

Pay items shall be:

04/03/01	King Post	Linear Metre
04/03/02	Raker Piles (including Tie Bars)	Linear Metre
04/03/03	Precast Planks (including Reinforcement Steel)	Square Metre
04/03/04	Mild Steel Reinforcing Bars to King Posts and Raker Piles	Tonne
04/03/05	High Yield Deformed Steel Reinforcing Bars to King Posts and Raker Piles	Tonne

4.3.7 PILE INTEGRITY TEST

4.3.7.1 Description

Pile Integrity test is to be performed by the Procuring Entity through BRRL or Bridge unit Professionals or any reputed organization appointed by the Engineer on a number of constructed working piles at the location of each abutment and pier position of a structure to verify the integrity of the installed piles. The apparatus for the Integrity Test shall be selected and arranged by the testing organization. Tests shall be carried out only under the direction of experienced and competent professionals conversant with the test equipment and test procedure.

4.3.7.2 Test procedure

All piles are to be selected for testing. With the permission from the Design unit selected piles can be tested. The contractor shall provide detailed records as recorded during installation of each pile which is to be tested. The contractor shall cut down all pile heads at the cut off level or otherwise prepare the piles for testing as required by the Engineer. The pile head shall be formed to give plane surface which is normal to the axis of the pile. The reinforcement of the pile shall be bent in such a way to ease the testing.

4.3.7.3 Results of Testing

Pile Integrity test or sonic test is a quick method to check the continuity of pile shape and size up to desired level. This method detects pile defects like cracks, Breaking, Necking, soil intrusion and variation of pile shape. The final length can also be measured indirectly.
If any pile after Integrity test is found unsatisfactory in the opinion of the Engineer for utilization in the structure, the pile shall be replaced as suggested by the design unit and directed by the Engineer/Project Manager. All extra expanses shall be borne by the contractor and payment shall be made in accordance with clause 4.1.3.11 of these specifications.

4.3.7.4 Measurement

The unit of measurement shall be number of pile tested.

4.3.7.5 Payment

The test performed in the number of piles shall be paid for at the rate charged by the approved testing organization. The rate shall constitute full compensation for all materials, equipments and labour for test purpose. The payment shall be made by the contractor to the test performer and the amount shall be reimbursed to the contractor by the procuring Entity from the provisional sum as indicated in the bill of quantities.

The bill for integrity test shall not be paid separately to the contractor because it is already included in the item number 4.1.5.

4.4 PILE TEST LOADING

4.4.1 Descriptions

4.4.1.1 General

This Section deals with the testing of a pile by the application of an axial load or force. It covers vertical piles tested in compression.

4.4.1.2 Definitions

A) Allowable Load

The load which may be safely applied to a pile after taking into account its ultimate bearing capacity, negative friction, pile spacing, overall bearing capacity of the ground below and allowable settlement.

B) Compression Pile

A pile which is designed to resist an axial force such as would cause it to penetrate further into the ground.

C) Kentledge

The dead weight used in a loading test.

D) Maintained Load Test

A loading test in which each increment of load is held constant either for a defined period of time or until the rate of movement (settlement or uplift) falls to a specified value.

E) Pilot Pile

A pile installed before the commencement of the main piling works or a specific part of the works for the purpose of establishing the suitability of the chosen type of pile and for confirming its design, dimensions and bearing capacity. Pilot piles may be utilised as working piles, subject to the Engineer's approval.

F) Proof Load

A load applied to a selected pile to confirm that it is suitable for the load at the settlement specified. A proof load should not normally exceed 200% of the working load on a pile except in circumstances where Special Provisions are provided for the testing of precast piles driven to a set. In these circumstances, 300% is specified.

G) Reaction System

The arrangement of kentledge, piles, anchors or rafts that provides a resistance against which the pile is tested.

H) Tension Pile

A pile which is designed to resist an axial force such as would cause it to be extracted from the ground.

I) Test Pile

Any pile to which a test loading is, or is to be, applied.

J) Ultimate Bearing Capacity

The load at which the resistance of the soil becomes fully mobilised.

K) Working Load

The load which the pile is designed to carry.

L) Working Pile

One of the piles forming the foundation of a structure.

4.4.2 Supervision

All tests shall be carried out only under the direction of an experienced and competent supervisor conversant with the test equipment and test procedure. All personnel operating the test equipment shall have been trained in its use.

4.4.3 Safety Precautions

4.4.3.1 General

When preparing for, conducting and dismantling a pile test the Contractor shall carry out the requirement of the various regulations and other statutory instruments that are applicable to the work for the provision and maintenance of safe working conditions, and shall in addition make such other provision as may be necessary to safeguard against any hazards that are involved in the testing or preparations for testing.

4.4.3.2 Kentledge

Where kentledge is used the Contractor shall construct the foundations for the kentledge and any cribwork, beams or other supporting structure in such a manner that there will not be differential settlement, bending or deflexion of an amount that constitutes a hazard to safety or impairs the efficiency of the operation. The kentledge shall be adequately bonded, tied or otherwise held together to prevent it falling apart, or becoming unstable because of deflection of the supports.

The weight of kentledge shall be greater than the maximum test load and if the weight is estimated from the density and volume of the constituent materials an adequate factor of safety against error shall be allowed.

4.4.3.3 Tension Piles and Ground Anchors

Where tension piles or ground anchors are used the Contractor shall ensure that the load is correctly transmitted to all the tie rods or bolts. The extension of rods by welding shall not be permitted unless it is known that the steel will not be reduced in strength by welding. The bond stresses of the rods in tension shall not exceed normal permissible bond stresses for the type of steel and grade of concrete used.

4.4.3.4 Testing Equipment

In all cases the Contractor shall ensure that when the hydraulic jack and load measuring device are mounted on the pile head the whole system shall be stable up to the maximum load to be applied. Means shall be provided to enable dial gauges to be read from a position clear of the kentledge stack or test frame so that failure in any part of the system due to overloading, buckling, loss of hydraulic pressure will not constitute a hazard to personnel.

The hydraulic jack, pump, hoses, pipes, couplings and other apparatus to be operated under hydraulic pressure shall be capable of withstanding a test pressure of 1.5 times the maximum working pressure without leaking.

The maximum test load or test pressure expressed as a reading on the gauge in use shall be displayed and all operators shall be made aware of this limit.

4.4.4 Construction of a Pilot Pile to be Test Loaded

4.4.4.1 Notice of Construction

The Contractor shall give the Engineer at least 48 hours notice of the commencement of construction of any pilot pile, which is to be test loaded.

4.4.4.2 Method of Construction

Each pilot test pile shall be constructed in a manner similar to that to be used for the construction of the working piles, and by the use of similar equipment and materials. Any variation shall only be permitted with prior approval.

Extra reinforcement and concrete of increased strength shall be permitted in the shafts of pilot piles at the discretion of the Engineer.

4.4.4.3 Boring or Driving Record

For each pilot pile which is to be tested a detailed record of the soils encountered during boring, or of the progress during driving shall be made and submitted to the Engineer daily not later than noon on the next working day.

4.4.4.4 Cut Off Level

The pile shaft shall terminate at the normal cut off level, or at a level required by the Engineer.

The pile shaft shall be extended where necessary above the cut off level of working piles so that gauges and other apparatus to be used in the testing process are not damaged by water or falling debris.

4.4.4.5 Pile Head for Compression Tests

For a pile that is tested in compression, the pile head or cap shall be formed to give a plane surface which is normal to the axis of the pile, sufficiently large to accommodate the loading and settlement measuring equipment and adequately reinforced or protected to prevent damage from the concentrated application of load from the loading equipment.

4.4.5 Preparation of a Working Pile to be Tested

If a test is required on a working pile the Contractor shall cut down or otherwise prepare the pile for testing as required by the Engineer in accordance with Sections 4.4.4.4 and 4.4.4.5.

4.4.6 Reaction Systems

4.4.6.1 Compression Tests

Compression tests shall be carried out using kentledge, tension piles or specially constructed anchorages.

Where kentledge is to be used, it shall be supported on cribwork disposed around the pile head so that its centre of gravity is on the axis of the pile. The bearing pressure under supporting cribs shall be such as to ensure stability of the kentledge stack. Kentledge shall not be carried directly on the pile head, except when directed by the Engineer.

4.4.6.2 Working Piles

Where working piles are used as reaction piles their movement shall be measured to within an accuracy of 0.5 mm.

4.4.6.3 Spacing

Where kentledge is used for loading vertical piles in compression, the distance from the edge of the test pile to the nearest part of the crib supporting the kentledge stack in contact with the ground shall be not less than 1.3 metres.

The centre to centre spacing of vertical reaction piles, including working piles used as reaction piles, from a test pile shall be not less than three times the diameter of the test pile or the reaction piles or 2 metres, whichever is the greatest.

4.4.6.4 Adequate Reaction

The size, length and number of the piles or anchors, or the area of the rafts, shall be adequate to transmit the maximum test load to the ground in a safe manner without excessive movement or influence on the test pile.

4.4.6.5 Care of Piles

The method employed in the installation of any reaction piles, anchors or rafts shall be such as to prevent damage to any test pile or working pile.

4.4.6.6 Loading Arrangement

The loading arrangement used shall be designed to transfer safely to the test pile the maximum load required in testing. Full details shall be submitted to the Engineer prior to any work related to the testing process being carried out on the Site.

4.4.7 Equipment for Applying Load

The equipment used for applying load shall consist of one or more hydraulic rams or jacks with the total capacity of the jacks being at least equal to the required maximum load. The jack or jacks shall be arranged in conjunction with the reaction system to deliver an axial load to the test pile. The complete system shall be capable of transferring the maximum load required for the test.

4.4.8 Measurement of Load

Suitable approved measuring devices for determining the load on the pile shall be supplied by the Contractor. Certificates of calibration shall be supplied to the Engineer.

In addition, large diameter (i.e. exceeding 1.2 metre) test piles shall be instrumented at 5 different depths to measure the load distribution along the piles. The instrumentation shall consist of both a mechanical system and strain gauges for measuring the pile deformation. The mechanical system shall consist of 6 mm steel rods or high tensile steel wires gauge No. 23, placed in steel tubes down to the various depths, and connected to dial gauges at the top. The strain gauges shall be of a stable type, wholly protected by a steel capsule. They shall be welded to the steel reinforcement, 2 gauges at each depth.

The Engineer shall approve the type of gauges to be used and other details on the instrumentation.

4.4.9 Adjustability of Loading Equipment

The loading equipment shall be capable of adjustment throughout the test to obtain a smooth increase of load or to maintain each load constant at the required stages of a maintained loading test.

4.4.10 Measuring Movement of Pile Heads

4.4.10.1 General

In a maintained load test movement of the pile head shall be measured by two of the methods as described below. One method for settlement measurements, the other method for control.

4.4.10.2 Levelling Method

An optical or any other levelling method by reference to an external datum may be used.

Where a level and staff are used, the level and scale of the staff shall be chosen to enable readings to be made to within an accuracy of 0.5 mm. A scale attached to the pile or pile cap may be used instead of a levelling staff. At least two datum points shall be established on permanent objects or other well founded structures, or deep datum points shall be installed. Each datum point shall be situated so that only one setting up of the level is needed.

No datum point shall be affected by the test loading or other operations on the site.

Where another method of levelling is proposed this shall be approved in writing.

4.4.10.3 Independent Reference Frame

An independent reference frame may be set up to permit measurement of the movement of the pile. The supports for the frame shall be founded in such a manner and at such a distance from the test pile, kentledge support cribs, reaction piles, anchorages and rafts that movements of the ground in the vicinity of the equipment do not cause movement of the reference frame during the testing. Check observations of any movements of the reference frame shall be made and a check shall be made of the movement of the pile head relative to an external datum during the progress of the test. In no case shall the supports be less than three test pile diameters or 2 metres, whichever is the greater, from the centre of the test pile.

The measurement of pile movement shall be made by two dial gauges rigidly mounted on the reference frame that bear on surfaces normal to the pile axis fixed to the pile cap or head. Alternatively the gauges may be fixed to the pile and bear on surfaces on the reference frame. The dial gauges shall be placed in diametrically opposed positions and be

equidistant from the pile axis. The dial gauges shall enable readings to be made to within an accuracy of 0.1 mm.

The reference frames shall be protected from sun and wind.

4.4.10.4 Other Methods

The Contractor may submit for approval any other method for measuring the movement of pile heads.

4.4.11 Protection of Testing Equipment

4.4.11.1 Protection from Weather
Throughout the test period all equipment for measuring load and movement shall be protected from the weather.

4.4.11.2 Prevention of Disturbance
Construction equipment and persons who are not involved in the testing process shall be kept at a sufficient distance from the test to avoid disturbance to the measurement apparatus.

4.4.12 Supervision

4.4.12.1 Notice of Test
The Contractor shall give the Engineer at least 24 hours notice of the commencement of the test.

4.4.12.2 Records
During the progress of a test, the testing equipment and all records of the test as required in Section 4.4.14.2 shall be available for inspection by the Engineer.

4.4.13 Test Procedure

4.4.13.1 Proof Test by Maintained Load Test
The maximum load, which shall be applied in a proof test, is shown on the Drawings. The loading and unloading shall be carried out in stages as shown in Table 4.4 1 or as required by the Engineer.

Following each application of an increment of load the load shall be held for not less than the period shown in Table 4.4 1 or until the rate of settlement is less than 0.25 mm/hour and is slowing down. The rate of settlement shall be calculated from the slope of the curve obtained by plotting values of settlement versus time and drawing a smooth curve through the points.

Each stage of unloading shall proceed after the expiry of the period shown in Table 4.4 1.

For any period when the load is constant, time and settlement shall be recorded immediately on reaching the load and at approximately 15 minute intervals for 1 hour, at 30 minute intervals between 1 hour and 4 hours, and at 1 hour intervals between 4 hours and 12 hours after the application of the increment of load.

The Engineer may require that the full loading, or any portion of the loading, be maintained on the pile for periods longer than shown in Table 4.4 1.

Table 4.4 1

Loading Sequence			
Load as Percentage of Working Load		Minimum Time of	
Bored Piles	Driven Piles	Holding Load	
25	50	1 hour	
50	100	1 hour	
75	125	1 hour	
100	150	1 hour	
75	125	10 minutes	
50	100	10 minutes	
25	50	10 minutes	
0	0	1 hour	
100	150	6 hours	
125	200	1 hour	
150	250	6 hours	
175	275	1 hour	
200	300	24 hours	Proof Load
175	275	10 minutes	
150	250	10 minutes	
125	225	10 minutes	
100	200	10 minutes	
75	150	10 minutes	
50	100	10 minutes	
25	50	10 minutes	
0	0	1 hour	

4.4.14 Presentation of Results

4.4.14.1 Results to be Submitted
Results shall be submitted as:

a) A summary in writing to the Engineer, unless otherwise directed, within 24 hours of the completion of the test, which shall give for a proof test by maintained load for each stage of loading, the period for which the load was held, the load and the maximum settlement or uplift recorded.

b) The completed schedule of recorded data as in Section 4.4.14.2 within seven days of the completion of the test.

4.4.14.2 Schedule of Recorded Data
The Contractor shall provide information about the tested pile in accordance with the following schedule where applicable.

A) General

1) Site location
2) Contract identification
3) Proposed structure
4) Date of test

B) Pile Details

1) Identification (number and location of the test pile)
2) Ground level at pile position
3) Head level as which test load is applied
4) Type of pile
5) Length in ground
6) Level in ground
7) Level of toe
8) Details of Permanent casing

C) Installation Details

1) Dates and times of boring, driving and concreting of test pile and adjacent piles
2) Date and time of casting concrete
3) Driven length of pile or temporary casing at final set
4) Hammer type, size or weight
5) Dolly and packing, type and condition before and after driving
6) Driving log (depth, blows per 250 mm, interruptions or breaks in driving)
7) At final set and at redrive set, for drop or single acting hammers the length of the drop or stroke, for diesel hammers the length of the stroke and the blows per minutes, for double acting hammers the number of blows per minute
8) Condition of pile head or temporary casing after driving

D) Test Procedure

1) Weight of kentledge
2) Tension pile, ground anchor or compression pile details
3) Plan of test arrangement showing position and distances of kentledge supports, rafts, tension or compression piles and reference frame to test pile
4) Jack capacity
5) Method of Load measurement
6) Method(s) of penetration measurement
7) Relevant dates and times

E) Test Results

1) In tabular form
2) In graphical form: loads plotted against movements and time

4.4.15 Completion of a Test

4.4.15.1 Measuring Equipment

On completion of a test all equipment and measuring devices shall be dismantled, checked and either stored so that they are available for use in further tests or removed from the Site.

4.4.15.2 Kentledge

Kentledge and its supporting structure shall be removed from the test pile and stored so that they are available for use in further tests or removed from the Site.

4.4.15.3 Temporary Piles

On completion of a preliminary test, temporary tension piles shall be cut off below ground level, removed from the Site and the ground made good with approved material as specified.

4.4.16 Measurement and Payment

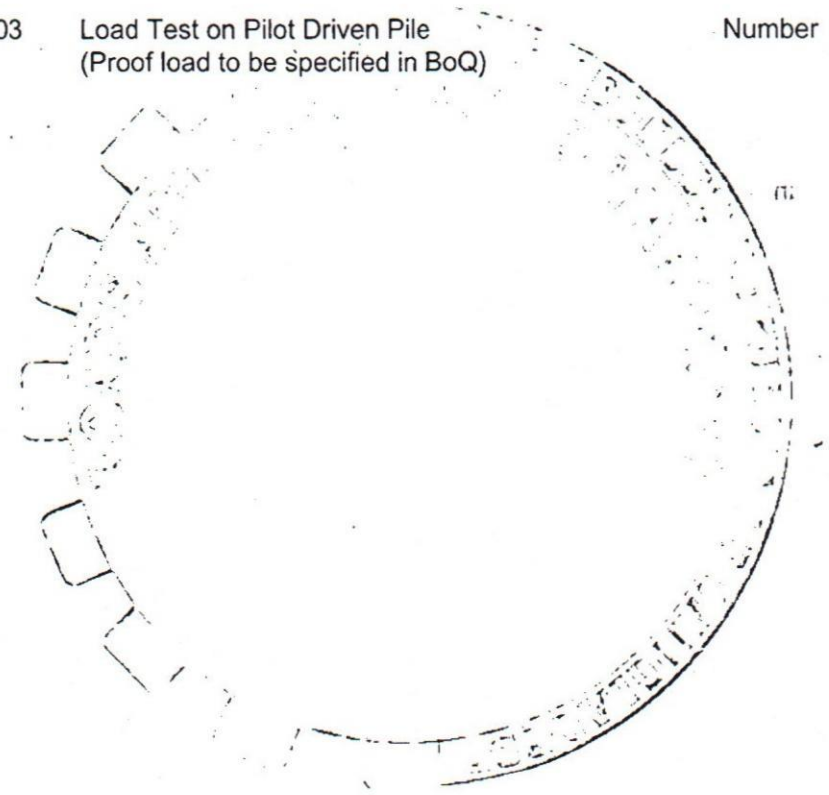
Load tests on large diameter (i.e. exceeding 1.2 metre) cast in place bored piles shall normally be carried out on working piles using other working piles as anchor piles. The test pile and anchor piles will be paid for at the normal rates for working piles as provided in Section 4.1. Separate payments will be made for carrying out each load test, individual rates shall be provided for different proof loads, which are specified in the Bill of Quantities. Payment for load tests on large diameter cast in place bored piles shall include provision of special instrumentation to test piles, anchor bars to reaction piles, provision of all testing equipment, carrying out of the tests, dismantling of equipment and removal from site, breaking out pile heads etc. in accordance with the requirements for working piles, preparation of all reports etc.

Load tests on pilot driven piles shall normally be carried out using temporary anchor piles or kentledge. The pilot pile will be paid for at the rates provided for pilot piles in Section 4.2. Separate payment shall not be made for anchor piles. Separate payments will be made for carrying out each load test and individual rates shall be provided for different proof loads, which are specified in the Bill of Quantities. Payment for load tests on pilot driven piles shall include provision of anchor piles or kentledge, provision of all test equipment, carrying out of the tests, dismantling of equipment and removal from site, cutting off below level of temporary anchor piles, preparation of all reports etc.

Load tests on pilot cast in place piles, less than 1.2 metre diameter, shall normally be carried out using temporary anchor piles or kentledge. The pilot pile will be paid for at the rates provided for pilot piles in Section 4.1. Separate payment shall not be made for anchor piles. Separate payments will be made for carrying out each load test and individual rates shall be provided for different proof loads, which are specified in the Bill of Quantities. Payment for load tests on pilot piles shall include provision of anchor piles or kentledge, provision of all test equipment, carrying out of the tests, dismantling of equipment and removal from site, cutting off below level of temporary anchor piles, preparation of all reports etc.

Pay items shall be:

04/04/0 (a)	Load Test on Cast in Place Working Pile (Proof load to be specified in BoQ) 50 Ton	Number
04/04/01(b)	Load Test on Cast in Place Working Pile (For 100 Ton)	Number
04/04/01(c)	Load Test on Cast in Place Working Pile (For 200 Ton)	Number
04/04/02	Load Test on Cast in Place Pilot Pile (Proof load to be specified in BoQ)	Number
04/04/03	Load Test on Pilot Driven Pile (Proof load to be specified in BoQ)	Number



4.5 BITUMEN SLIP LAYER FOR PILES

4.5.1 Description

This work shall consist of a bitumen slip layer placed on the upper part of concrete piles before driving.

Bitumen slip layer is provisional, and shall be used only if directed by the Engineer. The use of a slip layer to reduce negative skin friction on the piles will be evaluated after completion of pile load tests.

The bitumen layer shall be used on the upper part of the pile through soft and medium stiff clay. Any shorter length may be decided by the Engineer. This part of the pile shall be primed and uniformly coated with a bituminous material as specified below. No priming or coating shall be allowed below the designated elevation of the installed pile.

4.5.2 Materials

4.5.2.1 Primer

Before priming, the pile shall be completely clean and dry. The primer shall consist of the relevant bitumen for the slip layer and a petroleum solvent, or RC 250 as decided by the Engineer. The bitumen and the solvent shall be suitably blended to produce a liquid coating which may be applied cold, and which produces a suitable bond between the pile surface and the asphalt enamel. The primer shall have good spraying, brushing and levelling properties and a minimum tendency to produce bubbles during application. It shall be homogeneous and free from water.

The amount of primer shall be 0.2 litre/m^2, applied with brushing or spraying to achieve a uniform continuous film.

The primer shall be allowed to set thoroughly, for minimum 6 hours or more as needed, before the slip layer is applied.

4.5.2.2 Bitumen

The bitumen slip layer shall consist of a straight run bitumen, penetration grade 80 100.

The bitumen shall be heated to a liquid state, that is approximately 200°C, and applied by brushing or other approved means. The thickness shall be minimum 3 mm.

Special measures such as wrapping sprayed surfaces with suitable paper or plastic sheet shall be taken to prevent the bitumen from flowing and stripping and from damage during handling and storage. During storage the piles shall be protected from sun heat, and if necessary cooled with spraying of water.

4.5.3 Field Storage and Installation

Precautions shall be taken to prevent damage to the bitumen slip layer during installation as deemed necessary by the Engineer.

Piles shall not be placed directly on the ground: wood sleepers shall always be used. The sleepers shall be placed beneath the uncoated end parts. When lifting piles the wire rope should not be in direct contact with the bitumen slip layer.

4.5.4 Measurement

The unit of measurement shall be square meters of pile covered by bitumen slip layer and accepted by the Engineer. Cut off lengths shall not be measured for payment.

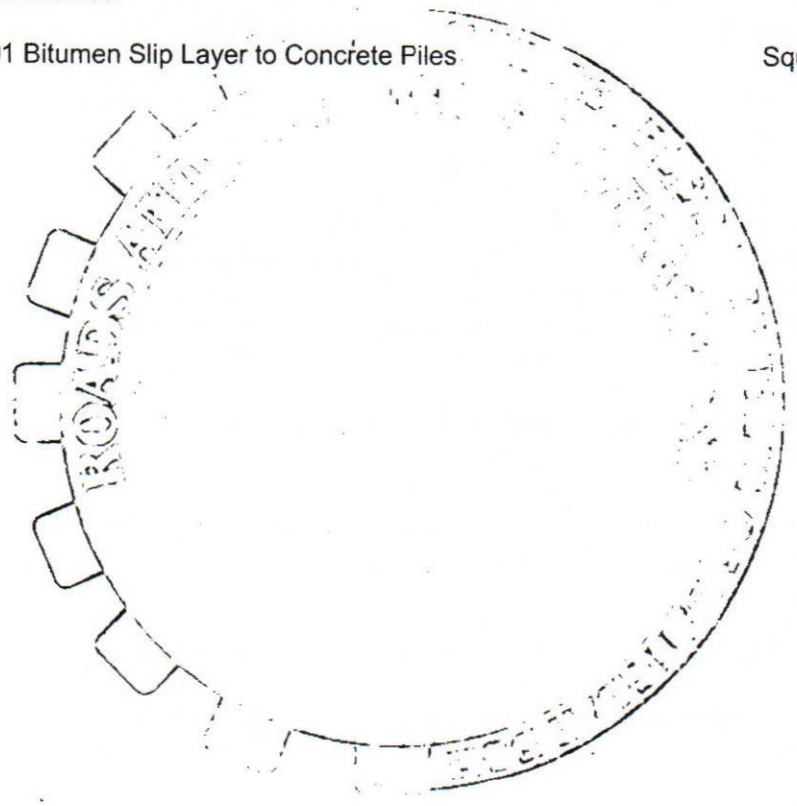
4.5.5 Payment

This work measured as provided above shall be paid for at the Contract unit prices per square metre. The unit rate shall constitute full compensation for all materials, equipment and workmanship necessary to provide the slip layer and the protective layer inclusive of protective metal rings if required, and the additional costs incurred during handling and driving of the piles.

Payment shall only be made if bitumen slip layer is selected and ordered in writing by the Engineer.

Pay item shall be:

04/05/01 Bitumen Slip Layer to Concrete Piles	Square Metre



4.6 DRIVEN BULLAH PILES

4.6.1 Description

This work shall consist of providing and driving wooden piles in accordance with these Specifications and in conformity with the requirements of the Drawings or the Engineer's instructions.

4.6.2 Materials

Bullah piles shall consist of best quality timber; Sal, Sundari, or Garzon. The diameter shall be 200 250 mm and the length shall be such that not less than 4.5 metres of acceptable pile can be driven.

Each pile shall be fitted with a metal shoe.

4.6.3 Driving Piles

4.6.3.1 Driving Equipment

Before any piling work is commenced the Contractor shall submit to the Engineer full details of the pile driving equipment and the methods he intends to use in carrying out the work.

4.6.3.2 Leaders and Trestles

At all stage of driving the pile shall be adequately supported and restrained by means of leaders or other guide arrangements to maintain position and alignment. These arrangements shall be such that damage to the pile does not occur.

4.6.3.3 Hammers

Any kind of hammer may be used provided that it is of a type which assures that the energy needed to penetrate the pile to the required depth is transmitted to the pile head without damaging the pile.

When gravity hammer are used the drop shall not exceed 1.0 metre. The fall shall be regulated so as to prevent damage to the pile. The efficiency factor of the hammer, i.e., the relationship between the theoretical energy developed by the hammer and the energy transmitted to the pile, shall be a minimum of 0.7.

4.6.3.4 Length of Piles

The length of piles to be driven shall be as shown on the Drawings or as approved or directed by the Engineer. Piles shall be neatly cut off at the specified level.

4.6.3.5 Records

The Contractor shall keep records as indicated below for each pile and submit two signed copies to the Engineer not later that the next working day that a pile is driven.

a) Pile Location
b) Pile Reference Number
c) Pile Type and Diameter
d) Date and Time of Driving
e) Ground Level
f) Details of Hammer and Drop
g) Details of any Delay or Interruptions

4.6.4 Measurement

The unit of measurement shall be the linear metre of pile furnished, driven and accepted in the structure. The pay length of the satisfactorily driven piles shall be measured from the toe to the cut off.

Cut off lengths shall not be measured for payment.

4.6.5 Payment

The work measured as provided above shall be paid for at the Contract unit rate per linear metre. The rate shall constitute full compensation for all materials, equipment, driving, cutting off and all related tools, rigs, cranes, hammers, leaders and other incidental equipment and work.

No payment shall be made for unauthorised, defective, unsound or unsatisfactorily driven piles or for any costs incurred by the Contractor for such piles.

Pay item shall be:

04/06/01(a) Driven Bullah Piles (Dia 125-150mm)	Linear Metre
04/06/01(b) Driven Bullah Piles (Dia 150-175mm)	Linear Metre
04/06/01(c) Driven Bullah Piles (Dia 175-200mm)	Linear Metre
04/06/01(d) Driven Bullah Piles (Dia 200-225mm)	Linear Metre

4.7 Well Foundations

4.7.1 Description

This work shall consist of construction of well foundation, taking it down to the founding level through all kinds of sub-strata, plugging the bottom, filling the inside of the well, plugging the top and providing a well cap in accordance with the details shown on the drawings and as per these Specifications, or as directed by the Engineer.

Wells may have a circular, rectangular or D-shape in plan and may consist of one, two or more compartments in plan. The outer wall of the well, known as well steining may be cellular.

The process of taking down the well to the founding level is known as well sinking. After reaching the founding level, the hollow inside the well, ("dredge hole") is plugged at the bottom by concrete ("bottom plug"). The dredge hole is then filled with approved filling up to the level indicated on the drawings and provided with a concrete plug ("top plug").
To facilitate sinking of well, steel cutting edge is fabricated and connected to a concrete well curb of required shape. On top of the well curb, adequate height of well steining is cast and the process of sinking is carried out. After a portion of the well has been sunk, another height of well steining is cast on top of the previous section and further sinking carried out. This process is continued till the bottom level of the well reaches the founding level.

At the top of the well steining, "well cap" is laid which transmits the loads and forces from the sub-structure (piers or abutments) to the foundations.

At least one bore-hole must be available/carried out in accordance with these specifications at each well foundation location, prior to commencement of work. The depth of bore-holes should extend upto a depth equal to one and a half times the outer diameter/ least dimension of the well below the anticipated founding level. In case the well foundation is to rest on a rocky strata, it may be necessary to undertake additional borings/probings prior to commencement of work to ascertain the actual profile and the quality of the rocky strata, at the level at which the well has to be seated, etc.

4.7.2 Materials

4.7.2.1 Steel cutting edge

The mild steel cutting edge shall be made from structural steel sections and shall be strong enough to facilitate sinking of the well through the type of strata expected to be encountered. The weight of the cutting edge shall not be less than 40 kg per metre length and be properly anchored into the well curb, as shown in the drawing.

When there are two or more compartments in a well, the bottom end of the cutting edge of the inner walls of such wells shall be kept at about 300 mm above that of outer walls.

In V shaped cutting edge, the inclined plate should meet the vertical plate in such a way that full strength connection by welding is feasible.

4.7.2.2 Concrete

The concrete for well curb/steining, Bottom &Top plug, and well cap shall conform to section5.1 of these specifications.

4.7.2.3 Reinforcement

The reinforcement shall conform to section 5.2 of these specifications.

4.7.2.3 Sand

Sand for filling the inside of well shall be non-plastic and free from vegetable matter , soft particles and clay. It shall conform to either grading b or grading C of table 2.8-1 of these specifications.

4.7.3 Construction Methods

4.7.3.1 Setting Out and Preparations for Sinking

Necessary reference points shall be fixed, away from the zone of blow-ups or possible settlements resulting from well sinking operations. Such reference points shall be connected to the permanent theodolite stations with the base line on the banks. The center of the individual wells shall be marked with reference to these stations. The distance, wherever practicable, shall be checked with the help of accurate tapes and precision distomat. Reference points shall also be fixed to mark X-X axis (usually traffic direction) and Y-Y axis (normal to X-X axis) accurately. A temporary bench mark shall also be established near the well foundation, away from the zones of blow-ups or possible settlement. The bench mark shall be checked regularly with respect to the permanent bench mark established at the bridge site.

For wells which are to be located in water, an earthen or sand island shall be constructed. Sand islands are practicable for water depths of about 5 m under stable bed soil conditions. For greater depths or in fast flowing rivers or for locations where soil is too weak to sustain sand island, floating caissons may have to be adopted.

The plan dimensions of sand islands shall be such as to have a working space of at least 2 m all around the steining. The dimension of the sand islands shall however be not less than twice the dimension in plan of the well or caisson. Sand islands shall be maintained to perform their functions, until the well is sunk to a depth below the bed level at least equal to the depth of water.

Sand island shall be protected against scour and the top level shall be sufficiently above the prevailing water level to be decided by the Engineer so that it is safe against wave action.

While sand islands are constructed at well location, floating caissons are generally fabricated at or near the banks on dry land or dry docks. Floating caissons are towed into position in floating condition.

For well placed in the banks of the river or in the dry area, the bed may be prepared by excavating the soil up to 1.5 m followed by leveling and dressing before placing the cutting edge.

4.7.3.2 Cutting Edge Erection

The parts of cutting edge shall be erected on level firm ground. Temporary supports shall be provided to facilitate erection and maintaining the assembly in true shape. The fabrication may be carried out in the shop or at site. Steel sections shall not be heated and forced into shape. However, "V" cuts may be made in the horizontal portion, uniformly throughout the length, to facilitate cold bending. After bending, such "V" cuts should be closed by welding. Joints in the lengths of structural sections, unless otherwise specified shall be filler welded using single cover plate to ensure the requisite strength of the original section.

4.7.3.3 Well curb

The well curb shall be such that it shall offer minimum resistance while sinking, but shall be strong enough to be able to transmit superimposed loads from the steining to the bottom plug. The shape and the outline dimension of the curb as given in Appendix -3 (Fig. 2) of IRC:78 may be referred for guidance. The internal angle of the curb as shown in Appendix 3 shall be about 30o to 37o. depending upon geotechnical data.

The well curb may be pre-cast or cast-in-situ. The well curb shall be reinforced concrete of mix not leaner than M 25 with minimum reinforcement of 72 kg/cu.m excluding bond rod. The steel shall be suitably arranged to prevent spreading and splitting of curb during sinking. Steel formwork for well curb shall be fabricated strictly in conformity with the drawing. The outer face of the curb shall be vertical. The bottom ends of vertical bond rods of steining shall be fixed securely to the cutting edge with check nuts or by welds. The formwork on outer face of curb may be removed within 24 hours after concreting. The formwork on inner face shall be removed after 72 hours. All concreting in the well curb shall be done in one continuous operation.

In case blasting is anticipated, the inner faces of the well curb shall be protected with the steel plates of thickness not less than 10 mm up to the top of the well curb. If it is desired to increase the steel lining above the well curb then the thickness in the extended portion can be reduced to 6 mm. This extra height of the steel shall not exceed 3 m, unless specific requirement exists, as decided by the Engineer. The curb in cases involving blasting, shall be provided with additional hoop reinforcement consisting of 10 mm dia mild steel or deformed bars at 150 mm spacing which shall also extend up to a height of liner.

4.7.3.4 Well Steining

The dimensions, shape, concrete strength and reinforcements of the well shall strictly conform to those shown on the drawings. The formwork shall preferably be of M.S. sheets shaped and stiffened suitably. In case timber forms are used, they shall be lined with plywood or M.S. sheets.

Steining built in the first lift above the well curb shall not be more than 2 m and in subsequent lifts it shall not exceed the diameter of the well or the depth of well sunk below the adjoining bed level at any time. For stability, the first lift of steining shall be cast only after sinking the curb at least partially for stability. Concreting of steining may be carried out in subsequent lifts of about 2 to 2.5 m. Attempts should be made to minimize the number of construction joints. The concreting layers shall be limited to 450 mm restricting the free fall of concrete to not more than 1.5 m. Laitance formed at the top surface of a lift shall be removed to expose coarse aggregates before setting of concrete at the proposed construction joint. As far as possible, construction joints shall not be kept at the location of laps in the vertical steining bars.

The steining of the well shall be built in one straight line from bottom to top such that if the well is titled, the next lift of steining will be aligned in the direction of the tilt. The work will be checked carefully with the aid of straight edges of lengths approved by the Engineer. Plumb bob or spirit level shall not be used for alignment. After sinking of a stage is complete, damaged portions if any, of steining at top of the previous stage shall be properly repaired before constructing the next stage.

The height of steining shall be calibrated by making at least 4 gauges (preferably in traffic direction and in a direction normal to traffic direction) distributed equally on the outer periphery of the well each in the form of a 100 mm wide strip painted on the well, with every metre mark shown in black paint. The gauges shall start with zero at the bottom of the cutting edge. Marking of the gauges shall be done carefully with a steel tape.

After reaching the founding level, the well steining shall be inspected to check for any damage or cracks. The Engineer will direct and the Contractor shall execute the remedial measures before acceptance of the well steining. In case the well cannot be accepted even with any remedial measure, then the well shall stand rejected.

4.7.3.5 Well Sinking

4.7.3.5.1 General

The well shall as far as possible be sunk true and vertical through all types of strata.

Sinking or loading of the well with kentledge shall be commenced only after the steining has been cured for at least 48 hours or as specified in the drawings.

No well shall be permitted to be placed in a pre-dredged hole.

The well shall be sunk by excavating material uniformly from inside the dredge hole. Use of water jetting, explosives and divers may be adopted for sinking of wells through difficult strata with prior approval of the Engineer.

Normally dewatering of well should not be permitted as a means for sinking the well. It shall never be resorted to if there is any danger of sand blowing under the well. Dewatering shall however be done when well is to be founded into rock. Pneumatic sinking may have to be resorted to where obstacles such as tree trunks, large size boulders, etc. are met at the bottom or when there is hard strata which cannot be removed by open dredging. The necessity for pneumatic sinking shall be decided by the Engineer.

Sinking history of well shall be maintained in the format given bellow :

Chart of Sinking

LOWEST BED LEVEL ———— LOWEST WATER LEVEL ———— HIGHT FLOOD LEVEL ———— FOUNDATION LEVEL ————
HEIGHT OF CURB ———— HEIGHT OF CUTTING EDGE ————

Date	Steining					Sinking					Depth of sump below cutting edge	Inclination with	Kentledge			Quantity of dredged material	Reasons & critical R.L. of sand blow during sinking	Reasons any special method of sinking overlong	Remarks	Signature of supervising officer
	R.L. of bottom of cutting edge	R.L. of top of steining before casting	R.L. of top of steining after casting	Height for casting (col.4 - col.3)	Total height of steining (including curb and cutting edge) (col.4-col.2) Mtrs	R.L. of reference level (at which cutting edges is placed)	Initial gauge reading Mtrs	Final gauge reading Mtrs	Sinking during the day (col.8 - col.9)	R.L. of bottom of cutting edge (col.7 - col.10)			Weight Tonnes	Eccentricity along X axis Mtrs	Eccentricity along Y axis Mtrs	Cubic Mtrs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

4.7.3.5.2 Sand blows in wells

Dewatering shall be avoided, if sand blows are expected. Any equipment or men working inside the well shall be brought outside the well as soon as there are any indications of sand blow. Sand blow often can be minimized by keeping the level of water inside the well higher than the water table and also by adding heavy kentledge.

4.7.3.5.3 Use of Kentledge as Sinking Load

Kentledge shall be placed in an orderly and safe manner on the loading platform and in such a way that it does not interfere with the excavation of the material from inside the dredge hole and also does not in any way damage the steining of the well.

Where tilts are present or there is a danger of well developing a tilt, the position of the load shall be regulated in such a manner as to provide greater sinking effort on the higher side of the well.

4.7.3.5.4 Use of Water Jetting

Water jetting and jack down method may be employed for well sinking as per requirement.

4.7.3.5.5 Use of Explosives

Mild explosive charges may be used as an aid for sinking of the well only with prior permission of the Engineer. Blasting of any sort shall only be done in the presence of the Engineer and not before the concrete in the steining has hardened sufficiently and is more than 7 days old. When likelihood of blasting is predicted in advance, protection of the bottom portion of the well shall be done as per these Specifications.

After blasting operations are completed, the well curb and steining should be examined for any cracks and remedial measures taken.

If blasting has been used after the well has reached the design foundation level, normally 24 hours shall be allowed to lapse before the bottom plug is laid.

The charges shall be exploded well below the cutting edge by making a sump so as to avoid chances of any damage to the curb or to the steining of the well. A minimum sump of 1 m depth should be made before resorting to blasting. Use of large charges, 0.7 kg or above, may not be allowed except under expert direction and with the permissions from the Engineer. Suitable pattern of charges may be arranged with delay detonators to reduce the number of charges fired at a time. The burden of the charge may be limited to 1 m and the spacing of holes may normally be kept as 0.5 to 0.6 m.

All prevalent laws concerning handling, storing and using of explosives shall be strictly followed.

All safety precautions shall be taken as per IS: 4081 "Safety Code for Blasting and related Drilling Operations", to the extent applicable, whenever blasting is resorted to.
There should be no equipment inside the well nor shall there be any worker in the closed vicinity of the well at the time of exploding the charges.

If rock blasting is to be done for seating of the well, the damage caused by flying debris should be minimised by covering blasting holes by rubber mats before blasting.

4.7.3.5.6 Use of Divers

Use of divers may be made both for the sinking purpose like removal of obstructions, rock blasting and for inspection. All safety precautions shall be taken as per any acceptable safety code for sinking with divers or any statutory regulations in force.

Only persons trained in the diving operation shall be employed and shall be certified to be fit for diving by an approved doctor.

They shall work under expert supervision. The diving and other equipments shall be of acceptable standard and certified to this effect by an approved independent agency. It shall be well maintained for safe use.

Arrangement for ample supply of low pressure clean cool air shall be ensured through an armoured flexible hose pipe. Standby compressor plant shall be provided in case of breakdown.

Separate high pressure connection for use of pneumatic tools shall be made. Electric lights where provided shall be at 50 volts (maximum). The raising of the diver from the bottom of wells shall be controlled so that decompression rate conforms to the rate as laid down in appropriate regulations.

Size of different types of Well :

1. 12750mm X 5500mm (RCC Well)
2. 7940mm X 4270mm (Brick Well)
3. 10000mm X 5000mm (Brick Well)

Size may differ based on designer requirement.

4.7.3.6 Precautions during sinking

a) When the wells have to be sunk close to each other and clear distance between them is not greater than the diameter of wells, sinking shall be taken up on all wells and they shall be sunk alternately so that sinking of wells proceeds uniformly. Simultaneous and even dredging shall be carried out in the wells in such a manner that the difference in the levels of the sump and cutting edge in the adjacent wells does not exceed half the clear gap between them. Plugging of all the wells shall be done together.

b) During sinking of dumb-bell or double D-shaped wells, the excavation in both the dredge holes should be carried out simultaneously and equally.

c) Bore chart shall be referred to constantly during sinking for taking adequate care while piercing different types of strata. The type of soil as obtained during the well sinking should be compared with bore chart so as to take prompt decisions.

d) Before seasonal floods, all wells on which sinking is in progress shall be sunk to sufficient depths below the designed scour level. Further, they shall be temporarily filled and plugged so that they do not suffer any tilt or shift during the floods.

e) All necessary precautions shall be taken against any possible damage to the foundations of existing structures in the vicinity of the wells, prior to commencement of dredging from inside the well.

f) The dredged material shall not be allowed to accumulate over the well. It shall be dumped and spread, as far away as possible, and then continuously and simultaneously removed, as directed by the Engineer. In case the river stream flows along one edge of the well being sunk, the dredged material shall not be dumped on the dry side of the bank but on the side on which the river current flows.

g) Very deep sump shall not be made below the well curb, as it entails risk of jumping (sudden sinking) of the well. The depth of sump shall be generally limited to one-sixth of the outer diameter/least lateral dimension of the well in plan. Normally the depth of sump shall not exceed 3.0 m below the level of the cutting edge unless otherwise specially permitted by the Engineer.

h) In case a well sinks suddenly with a jerk, the steining of the well shall be examined to the satisfaction of the Engineer to see that no damage has occurred to it.

i) In pneumatic sinking, the well shall not, at any time, be dropped to a depth greater than 500 mm by the method of "blowing down".

j) Dewatering shall be avoided if sand blows are expected. Any equipment and men working inside the well shall be brought out of the well as soon as there are any indications of a sand-blow.

k) Sand blowing in wells can often be minimised by keeping the level of water inside the well higher than the water table and also by adding heavy kentledge.

l) In soft strata prone to settlement/creep, the construction of the abutment wells shall be taken up only after the approach embankment for a sufficient distance near the abutment has been completed.

4.7.3.7 Tilts and Shifts

The inclination of the well from the vertical is known as tilt and the horizontal displacement of the center of the well at the founding level from its theoretical position is known as shift.

Unless otherwise specified, the tilt of any well shall not exceed 1 (horizontal) in 80 (vertical), and the shift at the well base shall not be more than 150 mm in any resultant direction.
Tilts and shifts shall be carefully checked and recorded in the format vide Appendix 1200/II regularly during sinking operations. For the purpose of measuring the tilts along the two axes of the bridge, reduced level of the marks painted on the surface of the steining of the well shall be taken. For determination of shift, locations of the ends of the two diameters shall be precisely measured along the two axes, with reference to fixed reference points.

Whenever any tilt is noticed, adequate preventive measures like placing eccentric kentledge, pulling, strutting, anchoring or dredging unevenly and depositing dredge material unequally, putting obstacles below cutting edge. Water jetting etc., shall be adopted before any further sinking. After correction, the dredged material shall be spread out uniformly.

A pair of wells close to each other have a tendency to come closer while sinking. Timber struts may be introduced in between the steining of these wells to prevent tilting. The chart of tilt and shifting of well is given below :

CHART OF TILT AND SHIFTING IN WELL NO:

DATE	TOTAL STEINING METRE	TOTAL SINKING METRE	REDUCED LEVELS (RL'S) OF GAUGE MARKS						TILT			SHIFT			ACTION TAKEN FOR RECTIFI CATION	REMARKS	SIGNATURE OF SUPERVISING OFFICER
			ALONG X-AXIS			ALONG Y-AXIS			TILT ALONG X-AXIS COL.6 DIVIDED BY WELL DIA	TILT ALONG Y-AXIS COL.6 DIVIDED BY WELL DIA	RESULTANT TILT (COL.10^2+COL.11^2	ALONG X-AXIS WITH DERECTION METRE	ALONG Y-AXIS WITH DERECTION METRE	(COL.13^2-COL.14^2)^1/2			
			(PLACE) END	(PLACE) END	DIFFERENCE (COL.5-COL.4) METRE	(U/S)	(D/S)	DIFFERENCE (COL.8-COL.7) METRE									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Tilts occurring in a well during sinking in dipping rocky strata can be safeguarded by suitably supporting the curb.

In the event of a well developing tilt or shift beyond the specified permissible values, the Contractor shall have to carry out, at his own cost, suitable remedial measures to the satisfaction of the Engineer, to bring the tilt and shift within permissible values.

If the resultant tilt and / or shift of any well exceeds the specified permissible values, generally it should not exceed 1 in 50 and 300 mm respectively. The well so sunk shall be regarded as not conforming to specifications and a sub-standard work. The Engineer in his sole discretion, may consider accepting such a well, provided:

i) Calculations for foundation pressures and steining stresses, accounting for the actual tilt and shift furnished by the Contractor show that the well is safe. Remedial measures required to bring the stresses within permissible values (such as increase in the dimension of the well cap, provision of dummy weights on the well cap etc.), shall be carried out by the Contractor at his own cost.

ii) The Contractor shall be subjected to reduction in rates as a penalty in accordance with Clause 4.7.5(g).

In case the Engineer, in his discretion, rejects the well, the Contractor shall dismantle the rejected well to the extent directed by the Engineer and remove the debris. Further, the Contractor shall, at his own risk and cost complete the bridge with modified span arrangement acceptable to the Engineer.

4.7.3.8 Floating caissons

Floating caissons may be of steel, reinforced concrete or any suitable material. They shall have at least 1.5 m free board above the water level and increased, if considered necessary, in case there is a possibility of caissons sinking suddenly owing to reasons, such as scour likely to result from lowering of caissons, effect of waves, sinking in very soft strata, etc.

Well caissons should be checked for stability against over-turning and capsizing while being towed and during sinking, due to the action of water current, wave pressure, wind etc.

The floating caisson shall not be considered as part of foundation unless proper shear transfer at the interface is ensured.

4.7.3.9 Seating of Wells

The well shall be uniformly seated at the founding strata. It shall be ensured by test borings that the properties of the soil encountered at the founding strata and upto a depth of one and a half times the well diameter is identical to that adopted in the design. The procedure for test borings shall satisfy the provisions of these specifications. In case the soil encountered is inferior to that adopted in design, the well shall be re-designed by the Engineer adopting the soil properties actually encountered and the founding level intimated to the Contractor, who shall carry out the work accordingly.

In case of seating of wells in hard rocky strata, where the rock profile is steeply sloping, pneumatic methods of sinking may be adopted to seat the well evenly as directed by the Engineer. The decision of adopting pneumatic sinking shall be taken by the Engineer. The cutting edge may also be embedded for a suitable depth in the rocky strata, as decided by the Engineer keeping in view the quality of rock. As an additional measure of safety, the well shall be anchored to the rocky strata by anchor bars provided in the steining of the well, as shown on the drawing irrespective of the fact that tension develops or not at the base of the well under design loads. After the well has been evenly seated on good hard rock, arrangements shall be made to facilitate proper inspection in dry and visible conditions before the bottom plug is laid.

4.7.3.10 Bottom Plug

The bottom plug shall be provided in all wells and the top shall be kept not lower than 300 mm in the centre above the top of the curb, as shown in Appendix-3 of IRC:78. A suitable sump shall be below the level of the cutting edge. Before concreting the bottom plug, it shall be ensured that its inside faces have been cleaned thoroughly.

The concrete mix used in bottom plug shall have a minimum cement content of 330 kg per cu.m with a slump about 150 mm to permit easy flow of concrete through tremie to fill-up all cavities. Concrete shall be laid in one continuous operation till the dredge hole is filled to the required height. For under water concrete, the concrete shall be placed by tremie under still water condition and the cement content of the mix be increased by 10 percent. Admixtures, if required may be added to the concrete to achieve the required characteristics.

In case of grouted concrete, the grout mix shall not be leaner than 1:2. It shall be ensured that the grout fills up all interstices up to the top of the bottom plug by suitable means such as, controlling the rate of pumping etc.

Any dewatering required, shall be done 14 days after concreting of bottom plug.

The concrete production equipment and placement equipment should be sufficient to enable under water concreting within stipulated time. Necessary standby equipment should be available for emergency situation.

Before commencing plugging, all loose material from the bottom of the well shall be removed.

Concreting shall be done in one continuous operation till the dredge hole is filled up to the required height and thereafter sounding shall be taken up to ensure that the concrete has been laid to the required height.

Least disturbance shall be caused to the water inside the well while laying concrete in the bottom plug.

Concrete shall not be disturbed in any way for at least 14 days.

In order to check any rise in the level of the bottom plug soundings should be taken at the close of concreting and once every day for the subsequent 3 days.

The soundness of the bottom plug may be tested by dewatering the well by 5 m below the surrounding water level and checking the rise of water. The rate of rise shall preferably be less than 10 cm per hour. In case the rate is higher, suitable remedial measures as directed by the Engineer, shall be taken by the Contractor at his own cost.

4.7.3.11 Sand Filling

Sand filling shall commence after a period of 14 days of laying of bottom plug. Also, the height of the bottom plug shall be verified before starting sand filling.
Sand shall be clean and free from earth, clay clods, roots, boulders, shingles, etc. and shall be compacted as directed. Sand filling shall be carried out up to the level shown on the drawing or as directed by the Engineer.

4.7.3.12 Top Plug

After filling sand up to the required level a plug of 300 mm thick concrete shall be provided over it as shown on the drawing or as directed by the Engineer.

4.7.3.13 Well cap

A reinforced cement concrete well cap will be provided over the top of the steining in accordance with the drawing. Formwork will be prepared conforming to the shape of well cap. Concreting shall be carried out in dry condition. A properly designed false steining may be provided where possible to ensure that the well cap is laid in dry condition.

The bottom of the well cap shall be laid preferably as low as possible but not below the LWL, taking in to account for this purpose, the water level prevalent at the time of casting Where the bed level is higher than the LWL, the bottom of the well cap may be suitably raised.

Bond rods of steining shall be anchored into the well cap.

4.7.3.14 Tolerances

The permissible tilt and shift shall not exceed 1 (horizontal) in 80 (vertical) and the shift at the well base shall not be more than 150 mm in any resultant direction.

For the well steining and well cap, the permissible tolerances shall be as follows:

a)	Variation in dimension	+50 mm, –10 mm
b)	Misplacement from specified position in plan	±15 mm
c)	Surface irregularities measured with 3 m straight edge :	5 mm
d)	Variation of level at the top :	± 25 mm

4.7.3.15 Tests and standards of acceptance

The materials shall be tested in accordance with these Specifications and shall meet the prescribed criteria.

The work shall conform to these Specifications and shall meet the prescribed standards of acceptance.

4.7.4 Measurement

All quantities shall be measured from the drawing, or as ordered by the Engineer, excepting those required to be provided by the Contractor at his cost.

a) The cutting edge shall be measured in tonnes based on the net weight of metal used in it.
b) The concrete in curb, well steining and well cap shall be measured in cubic metres in each of the items as per Section 5.1.4. The reinforcements shall be measured in tonnes separately in each of the items, as per Section 5.2.4.
c) The measurement for well sinking shall be made in running metres for different depths and in different types of strata (for example, predominantly sand/clay soil, soft rock, hard rock, etc.) as specified in the Contract. The depth of sinking shall be measured from the level specified in the Contract. If no level has been specified in the Contract, sinking shall be measured from the low water level or from the level at which the cutting edge was laid, whichever is higher.
d) The quantity of concrete in bottom and top plug shall be measured in cubic metres as per Section 5.1.4.
e) The quantity of sand filling shall be measured in cubic metres.

4.7.5 Payment

All quantities shall be measured from the drawing or as ordered by the Engineer, excepting those required to be provided by the Contractor at his cost.

a) The Contract unit rates of cutting edge shall cover all costs of labour, material, tools, plant and equipment, including placing in position, sampling and testing, and, supervision, all as per respective Section of Structural Steel Work and as described in this section.

b) The Contract unit rates for concrete in curb, steining, bottom plug, top plug and well cap, shall cover all costs of labour, material, tools, plant and equipment, formwork and staging including placing in position, sampling and testing, and, supervision, all as per respective Section of Structural Concrete and as described in this section.

c) The Contract unit rates for reinforcement in curb, steining, and well cap, shall cover all costs of labour, material, tools, plant and equipment, including bending to shape, placing in position, sampling, testing and supervision, all as per respective Section of Steel Reinforcement and as described in this section.

d) The Contract unit rates for sand filling shall cover all costs of labour, material, tools, plant and equipment, including placing in position, sampling testing and supervision, all as described in this section.

e) The Contract unit rates for sinking shall cover the costs of labour, tools, and equipment and plant and for all operations and other incidentals for sinking of well including seating excepting provisions of pneumatic sinking as described in this Section. The unit rates shall specify the strata such as types of soil, rock, etc. The rate shall cover all testing and supervision required for the work.

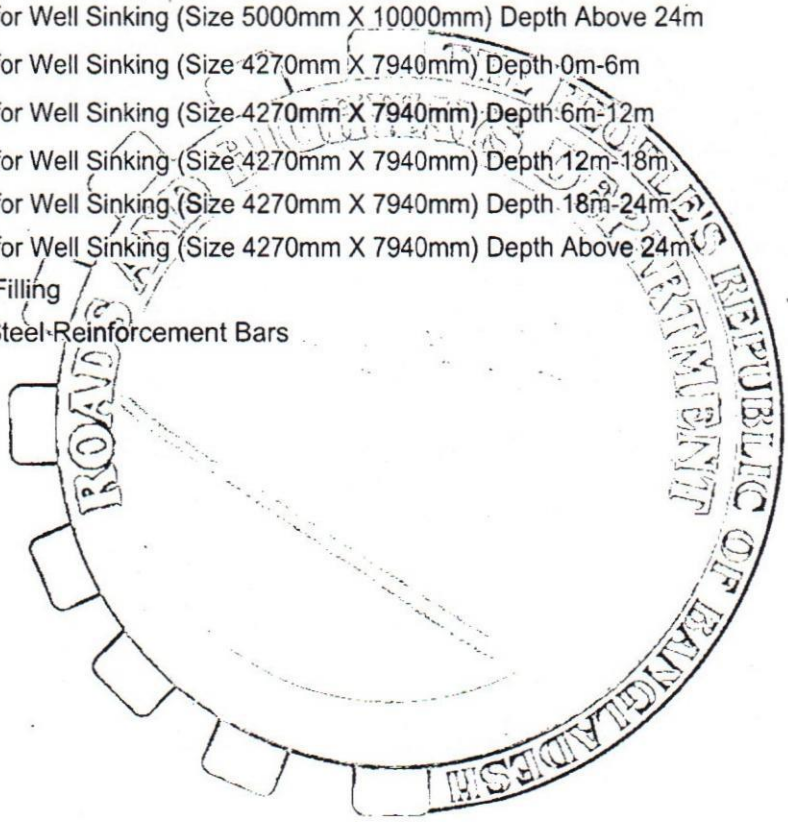
g) Reduction in contract unit rates for sinking as a penalty, in pursuance of Clause 4.7.3.14

If any well with tilt and/or shift exceeding the permissible values is accepted by the Engineer, the Contractor shall be subjected to a reduction in the rates for payments as follows:

Sl. No.	Amount of tilt and/or shift	Percent deduction on the rate (s) for sinking of whole well
1.	Tilt exceeding the specified permissible value but equal to or within 1 in 60	5 percent
2.	Tilt exceeding 1 in 60 but equal to or within 1 in 50	10 percent
3.	Tilt exceeding 1 in 50	20 percent
4	Shift exceeding the specified permissible value but equal to or within 200 mm	2 percent
5.	Shift exceeding 200mm but equal to or within 300mm	5 percent
6.	Shift exceeding 300 mm	10 percent

Pay items shall be:

04/07/01	Cutting Edge (Well Shoe)	Ton
04/07/02	Class-20 Concrete for RCC Well	cum
04/07/03	Concrete in Top/Bottom Plugging	cum
4/07/04(a)	Labor for Well Sinking (Size 5000mm X 10000mm) Depth 0m-6m	Metre
4/07/04(b)	Labor for Well Sinking (Size 5000mm X 10000mm) Depth 6m-12m	Metre
4/07/04(c)	Labor for Well Sinking (Size 5000mm X 10000mm) Depth 12m-18m	Metre
4/07/04(d)	Labor for Well Sinking (Size 5000mm X 10000mm) Depth 18m-24m	Metre
4/07/04(e)	Labor for Well Sinking (Size 5000mm X 10000mm) Depth Above 24m	Metre
4/07/04(f)	Labor for Well Sinking (Size 4270mm X 7940mm) Depth 0m-6m	Metre
4/07/04(g)	Labor for Well Sinking (Size 4270mm X 7940mm) Depth 6m-12m	Metre
4/07/04(h)	Labor for Well Sinking (Size 4270mm X 7940mm) Depth 12m-18m	Metre
4/07/04(i)	Labor for Well Sinking (Size 4270mm X 7940mm) Depth 18m-24m	Metre
4/07/04(j)	Labor for Well Sinking (Size 4270mm X 7940mm) Depth Above 24m	Metre
04/07/05	Sand Filling	cum
04/07/06	High Steel Reinforcement Bars	Ton



DIVISION 5
STRUCTURES

DIVISION 5 - STRUCTURES

Page

5.1 **CONCRETE FOR STRUCTURES** ---- 1
5.1.1 **Description** ---- 1
5.1.2 **Materials** ---- 1
5.1.2.1 Specifications for Materials ---- 1
5.1.2.2 Testing of Materials ---- 3
5.1.2.3 Composition of Concrete ---- 4
5.1.2.4 Control of Concrete Quality ---- 6
5.1.3 **Construction Methods** ---- 9
5.1.3.1 General ---- 9
5.1.3.2 Scaffolding and Formwork ---- 9
5.1.3.3 Care and Storage of Concrete Materials ---- 11
5.1.3.4 Preparations Before Casting ---- 11
5.1.3.5 Measuring Materials ---- 12
5.1.3.6 Mixing Concrete ---- 12
5.1.3.7 Handling and Placing Concrete ---- 14
5.1.3.8 Perforations and Embedment of Special Devices ---- 17
5.1.3.9 Finishing Concrete Surfaces ---- 17
5.1.3.10 Construction Joints ---- 18
5.1.3.11 Curing Concrete ---- 19
5.1.3.12 Removal of Scaffolding and Formwork ---- 19
5.1.3.13 Repair of Concrete ---- 19
5.1.3.14 Depositing Concrete under Water ---- 20
5.1.3.15 Factory Made Precast Concrete Elements ---- 20
5.1.3.16 Control of Heat in Structures ---- 21
5.1.3.17 Grouting of Ducts for Prestressing Tendons ---- 21
5.1.3.18 Loading ---- 23
5.1.3.19 Backfill to Structures ---- 24
5.1.3.20 Cleaning Up ---- 24
5.1.4 **Measurement** ---- 24
5.1.5 **Payment** ---- 24
5.2 **REINFORCEMENT** ---- 25
5.2.1 **Description** ---- 25
5.2.2 **Materials** ---- 25
5.2.2.1 Bar Reinforcement ---- 25
5.2.2.2 Wire Mesh ---- 25
5.2.2.3 Binding Wire ---- 25
5.2.2.4 Bar Sizes ---- 25
5.2.2.5 Ordering Material ---- 25
5.2.2.6 Additional Tests ---- 26
5.2.3 **Construction Methods** ---- 26
5.2.3.1 Protection and Storage ---- 26
5.2.3.2 Cutting and Bending ---- 26
5.2.3.3 Placing, Supporting and Fastening ---- 26
5.2.3.4 Splicing ---- 27
5.2.3.5 Substitutions ---- 27
5.2.4 **Measurement** ---- 27
5.2.5 **Payment** ---- 27
5.3 **PRESTRESSING REINFORCEMENT** ---- 29
5.3.1 **Description** ---- 29
5.3.1.1 General ---- 29
5.3.1.2 Definitions ---- 29

5.3.2 **Materials** ---- 29
5.3.2.1 Tendons for Post Tensioning Systems ---- 29
5.3.2.2 Anchorage Assemblies ---- 29
5.3.2.3 Sheathing ---- 30
5.3.3 **Construction Methods** ---- 30
5.3.3.1 General ---- 30
5.3.3.2 Storage of Materials ---- 31
5.3.3.3 Manufacture of Tendons ---- 31
5.3.3.4 Placing Tendons and Sheathing ---- 31
5.3.3.5 Placing Anchorages ---- 32
5.3.3.6 Jacks for Prestressing ---- 32
5.3.3.7 Post-tensioning Procedure ---- 32
5.3.3.8 Grouting ---- 33
5.3.3.9 Finishing off Tendons ---- 33
5.3.3.10 Pre-Tensioning ---- 33
5.3.4 **Measurement** ---- 34
5.3.5 **Payment** ---- 34

5.4 **EXISTING CONCRETE** ---- 35
5.4.1 **Description** ---- 35
5.4.2 **Materials** ---- 35
5.4.2.1 Concrete ---- 35
5.4.2.2 Reinforcement ---- 35
5.4.2.3 Prestressing Reinforcement ---- 35
5.4.2.4 Cement Grout and Mortar ---- 35
5.4.2.5 Resin Repair Mortars ---- 35
5.4.3 **Construction Methods** ---- 35
5.4.3.1 General ---- 35
5.4.3.2 Workmanship ---- 37
5.4.4 **Measurement** ---- 37
5.4.5 **Payment** ---- 37

5.5 **BRICKWORK** ---- 38
5.5.1 **Description** ---- 38
5.5.2 **Materials** ---- 38
5.5.2.1 Specifications for Materials ---- 38
5.5.2.2 Specifications for Mortar ---- 39
5.5.3 **Construction Methods** ---- 39
5.5.3.1 General ---- 39
5.5.3.2 Workmanship ---- 39
5.5.3.3 Brick Drainage Layers ---- 40
5.5.4 **Measurement** ---- 41
5.5.5 **Payment** ---- 41

5.6 **PAINTING METAL STRUCTURES** ---- 42
5.6.1 **Description** ---- 42
5.6.2 **Materials** ---- 42
5.6.2.1 General ---- 42
5.6.2.2 Prime Coat ---- 42
5.6.2.3 Undercoat ---- 42
5.6.2.4 Finish Coat ---- 42
5.6.3 Construction Methods ---- 43
5.6.3.1 Cleaning of Surfaces ---- 43
5.6.3.2 Number of Coats and Colour ---- 44
5.6.3.3 Weather Conditions ---- 44

5.6.3.4 Mixing of Paint ---- 44
5.6.3.5 Application ---- 44
5.6.3.6 Painting Galvanised Surfaces ---- 45
5.6.4 **Measurement** ---- 45
5.6.5 **Payment** ---- 45

5.7 **BRIDGE STEELWORK** ---- 46
5.7.1 **Description** ---- 46
5.7.2 **Materials** ---- 46
5.7.3 **Construction Methods** ---- 46
5.7.3.1 Unit Bridging ---- 46
5.7.3.2 Steel Beams for Composite Bridges ---- 47
5.7.4 **Measurement** ---- 47
5.7.5 **Payment** ---- 47

5.8 **MOVEMENT JOINTS** ---- 48
5.8.1 **Description** ---- 48
5.8.2 **Materials** ---- 48
5.8.2.1 Expansion Joints ---- 48
5.8.2.2 Bridge Deck Joints ---- 49
5.8.2.3 Storage of Materials ---- 49
5.8.3 **Construction Methods** ---- 49
5.8.4 **Measurement** ---- 49
5.8.5 **Payment** ---- 50

5.9 **DRAINAGE OF STRUCTURES** ---- 51
5.9.1 **Description** ---- 51
5.9.2 **Materials** ---- 51
5.9.2.1 Bridge Gullies ---- 51
5.9.2.2 Cast Iron Piping ---- 51
5.9.2.3 PVC Pipes ---- 51
5.9.2.4 Cleaning Boxes ---- 51
5.9.2.5 Catch Basins ---- 51
5.9.2.6 Culvert Pipes ---- 51
5.9.2.7 Inserts ---- 51
5.9.2.8 Fittings and Other Incidentals ---- 51
5.9.3 Construction Methods ---- 51
5.9.3.1 Storage and Handling of Materials ---- 51
5.9.3.2 Bridge Gullies ---- 52
5.9.3.3 Cast Iron Piping ---- 52
5.9.3.4 PVC Pipes ---- 52
5.9.3.5 Cleaning Boxes ---- 52
5.9.3.6 Catch Basins ---- 52
5.9.3.7 Culvert Pipes ---- 52
5.9.3.8 WeepHoles ---- 52
5.9.3.9 Inserts ---- 52
5.9.4 **Measurement** ---- 53
5.9.5 **Payment** ---- 53

5.10 **INSERTS AND FITTINGS IN STRUCTURES** ---- 54
5.10.1 **Description** ---- 54
5.10.2 **Materials** ---- 54
5.10.3 **Construction Methods** ---- 54
5.10.4 **Measurement** ---- 54
5.10.5 **Payment** ---- 54
5.11. **BRIDGE BEARINGS (ELASTOMER)**
5.11.1 **Descriptions** ---- 55
5.11.2 **Materials** ---- 55
5.11.2.1Elastomer ---- 55

5.11.2.2 Steel Laminates ---- 55
5.11.2.3 Bond ---- 55
5.11.3 Fabrication and Installation
5.11.3.1General ---- 56
5.11.3.2 Fabrication tolerances ---- 56
5.11.3.3 Permission for fabrication ---- 56
5.11.3.4 Testing facilities for fabrication ---- 56
5.11.3.5 Quality control certificate ---- 57
5.11.3.6 Sample Testing of Bearings ---- 57
5.11.4 Installation
5.11.4.1 Cement Mortar Bearings pad ---- 58
5.11.4.2 Bearings ---- 58
5.11.4.3 Maintenance ---- 59
5.11.5 Measurement ---- 59
5.11.6 Payment ---- 59

5.12 BRIDGE BEARINGS (POT BEARING)
5.12.1 Description ---- 60
5.12.1.1 Design and Applicable Codes ---- 60
5.12.1.2 Manufacturers ---- 60
5.12.1.3 Substituted Bearings ---- 60
5.12.2 Materials
5.12.2.1 Metals ---- 60
5.12.2.2 Poly tetra fluoro ethylene (PTFE) ---- 61
5.12.2.3 Elastomer ---- 62
5.12.2.4 Coal Tar Epoxy ---- 63
5.12.2.5 Preformed Fabric Pads ---- 63
5.12.2.6 Sealing Rings ---- 63
5.12.2.7 Grouts ---- 63
5.12.3 Design Requirements
5.12.3.1 Elastomeric Disc ---- 63
5.12.3.2 Sliding Surfaces ---- 63
5.12.3.3 Rotation ---- 64
5.12.3.4 Movement ---- 64
5.12.3.5 Welding ---- 64
5.12.3.6 Submission of shop drawings ---- 64

5.12.4 Certifications ---- 65
5.12.5 Fabrication
5.12.5.1 PTFE ---- 65
5.12.5.2 Bolts and Bolt Holes ---- 65
5.12.5.3 Welding ---- 65
5.12.5.4 Protective Measures ---- 66
5.12.6 Testing
5.12.6.1Testing facilities for fabrication ---- 66
5.12.6.2 Sample testing: Procedures and Compliance ---- 66
5.12.7 Products Delivery Storage and Handling
5.12.7.1Assembly and Marking ---- 67
5.12.7.2 Care and Protection ---- 67
5.12.8 Installation
5.12.8.1 General ---- 67
5.12.8.2 Tolerances ---- 68
5.12.9 Shock Transmission Units
5.12.9.1General ---- 68
5.12.9.2 Model Testing of Yielding shock Transmission Unit ---- 68
5.12.10 Measurement ---- 69
5.12.11Payment ---- 69

5.1 CONCRETE FOR STRUCTURES

5.1.1 Description

This work shall consist of the construction of all or portions of structures of Portland cement concrete, of the required grades and types, with or without reinforcement, prestressed reinforcement and with or without admixture, in accordance with these Specifications and to the lines, levels, grades and dimensions shown on the Drawings and required by the Engineer.

Portland cement concrete shall consist of a mixture of Portland cement, water and coarse and fine aggregate with or without admixture.

5.1.2 Materials

5.1.2.1 Specifications for Materials

A) Cement

Cement shall conform to the requirements of AASHTO Standard Specification M 85 type 1, normal Portland cement, unless other types are indicated on the Drawings or specified by the Engineer.

Cement shall be sampled and tested in accordance with STP Sections 2.6 and 8.

Bagged or bulk cement which has partially set or which contains lumps of caked cement shall be rejected. The use of cement reclaimed from discarded or used bags shall not be permitted.

B) Water

The water used in mixing and curing concrete shall be tested by methods described in AASHTO Test Method T 26. All water shall be clean and free from salt, oil, acid, vegetable or other substance injurious to the finished product. The use of river water will be subject to the approval of the Engineer. Such approvals may be withdrawn from time to time depending on the condition of the river.

C) Admixtures

Admixtures or any other additions shall not be used except with the written approval of the Engineer.

Admixtures, if specified or permitted, shall fully conform to the requirements of AASHTO Standard Specification M 194-74.

D) Coarse Aggregate

Coarse aggregate for all types of concrete with the exception of blinding concrete shall consist of hard durable crushed or broken rock and generally conform to the requirements of AASHTO Standard Specification M 80. Coarse aggregate shall be clean, free from dust and other deleterious material.

The amounts of deleterious substances shall not exceed the following limits:

1) Soft fragments; 2% by mass

2) Clay lumps; 0.25% by mass

3) Material Passing the 0.075 mm sieve; 0.50% by mass if clay,
1.50% by mass if fracture dust

In addition, coarse aggregates shall comply with the following:

1) Thin or elongated pieces; Flakiness Index (STP 7.3.1) less than 30

2) The aggregate crushing value (STP 7.7.1) shall be less than 30% and the ten percent fines value (STP 7.7.2) shall be greater than 150 kN.

The grading of coarse aggregate of Nominal maximum size 20 mm shall conform to Table 5.1-1 below. The grading of 40 mm maximum size coarse aggregate shall be in accordance with AASHTO Standard Specification M 80.

Table 5.1-1

Grading Requirements for 20 mm Nominal Maximum Size Coarse Aggregate	
Sieve Size (mm)	% Passing by Weight
25	100
20.0	90 - 100
12.5	20 - 55
10.0	5 - 20
5.0	0 - 5
2.4	-
1.2	-

In heavily reinforced structures with difficult casting conditions smaller size aggregates may be used if approved by the Engineer.

E) Fine Aggregate

Fine aggregate shall consist of natural sand and fine aggregates from different sources of supply shall not be mixed or stored in the same pile.

The amounts of deleterious substance when tested in accordance with STP 3.4 shall not exceed the following limits:

1) Friable Particles; 0.5% by mass

2) Coal and Lignite; 0.5% by mass

3) Material passing the 0.075 mm sieve; 3.0% by mass

4) Any other deleterious materials shall not cause a strength reduction of the concrete of more than 5% in relation to the strength of concrete free of the concerned deleterious material.

The grading shall normally be in accordance with Table 5.1-2. In the event that it is not possible to obtain regular supplies of sand conforming to this grading, the Engineer may approve the adoption of a grading conforming to the requirements of table 4 with additional limits of either C or M of BS 882: 1992. However, any additional costs resulting from changes in aggregate proportions or additional cement contents required to achieve the specified strengths, when using these alternative gradings, shall be borne by the Contractor and shall not be reimbursed.

Table 5.1-2

Grading Requirements for Fine Aggregate	
Sieve Size (mm)	% Passing by Weight
10.0	100
5.0	95 – 100
1.2	45 – 80
0.30	10 – 30
0.15	2 – 10

5.1.2.2 **Testing of Materials**

A) Cement

Cement shall be in accordance with AASHTO M 85. The Contractor must provide the Engineer with manufacturer's certificates indicating compliance.

Cement shall be sampled and tested for fineness, setting time and strength in accordance with STP 8.1, STP 8.2 and STP 8.3, respectively, at the Contractor's expense. The Contractor shall notify the Engineer of delivery dates so that there will be sufficient time for sampling the cement, either at the mill or upon delivery. If this is not done, the Contractor may be required to re-handle the cement in the store for the purpose of obtaining the required samples.

Sampling shall normally be instructed by the Engineer for every batch of cement prior to this cement being incorporated in the Works.

B) Water

The water proposed by the Contractor to be used in mixing or curing concrete shall be tested by methods described in AASHTO Test Method T 26.

In sampling water for testing, care shall be taken that the containers are clean and that samples are representative.

When comparative tests are made with a water of known satisfactory quality, any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in mortar strength, shall be sufficient cause for rejection of the water under test.

The water shall be tested at a recognised laboratory approved by the Engineer. The test result shall be signed by the laboratory. The water shall be tested before commencement of work or if the source is changed or at any time required by the Engineer. All testing shall be carried out at the Contractor's expense.

C) Admixtures

The Contractor shall submit specifications and samples of any admixtures or additives that he proposes to use to the Engineer at least 28 days before the commencement of construction or manufacture of the particular structure on which he intends to use such admixtures.

Any tests the Engineer may require on concrete mixes on account of the Contractor's proposal to use additives shall be carried out at the expense of the Contractor.

D) Aggregates

1) Selection and Approval

From the aggregate materials proposed by the Contractor, samples shall be selected according to STP Section 2.4 and in the presence of the Engineer. The samples shall be tested at the site laboratory or at an approved testing laboratory for conformance with Section 5.1.2.1 of these Specifications.

2) Quality Control

The quality control of the aggregate shall be as directed by Engineer. Gradings shall normally be checked daily.

Moisture contents of fine aggregate shall be determined daily and at any time when a change in moisture content is expected.

If the Contractor proposes to change the source of aggregate, the Engineer shall be informed in advance and in no case less than 3 weeks before the new aggregate shall be used.

5.1.2.3 Composition of Concrete

A) Classes of Concrete
Concrete with cement type 1 for incorporation in the Works shall be of the classes indicated on the Drawings and shall comply with Table 5.1-3.

Concrete Class	Concrete Characteristic Strength (N/mm² @ 28 days)		Nominal Maximum Size of Coarse Aggregate (mm)	Minimum Cement Content (Kg/m³)
	Cylinder (150 x 300 mm)	Cube (150 mm)		
7	7	9	40	180
			20	210
10	10	13	40	210
			20	240
15	15	19	40	250
			20	280
20	20	25	40	300
			20	320
25	25	31	40	340
			20	360
30	30	37	40	370
			20	400
35	35	44	40	400
			20	430
40	40	50	40	400
			20	430

B) Proportioning

When designing the concrete mix, the Contractor shall consider the following conditions:

1) Strength

The class of the concrete is to be as shown on the Drawings. The class is the specified characteristic cylinder strength at 28 days. Concrete mixes shall be designed to comply with Specifications Section 5.1.2.4.

2) Water/Cement Ratio

The ratio of free water to cement when using saturated surface dry aggregate shall be as low as possible and not exceed 0.50 by weight for all concrete, except for blinding concrete where it shall not exceed 0.6, unless approved by the Engineer.

For concrete in barriers, edge beams and bridge decks directly exposed to traffic or concrete in pile caps or abutments in contact with the ground, the water cement ratio shall not exceed 0.40, unless approved by the Engineer.

3) Minimum Cement Content

As indicated for the respective class in Table 5.1-2

4) Minimum Filler Content

Filler content (fine aggregate less than 0.25 mm and cement) shall not be less than as follows (except for mass concrete).

Maximum coarse aggregate size (mm)	20	40
Minimum filler content (kg/m^3 of concrete)	435	350

5) Coarse Aggregate

The maximum size of coarse aggregate will generally be stated on the Drawings; either 40 mm or 20 mm, in accordance with Table 5.1-1. Grading and quality is to comply with the requirements of Section 5.1.2.1(D).

6) Fine Aggregate

The grading and quality is to comply with the requirements of Section 5.1.2.1.

7) Workability

The concrete shall be of suitable workability to obtain full compaction. Slumps measured in accordance with STP 9.1 shall not exceed 75 mm unless otherwise indicated on the Drawings or approved by the Engineer.

C) Trial Mixes

After the Contractor has received approval for the cement and aggregate to be used, he shall prepare trial mixes with concrete of designed proportions to prove and establish workability, strength, water cement/ratio, surface criteria etc. Methods of transporting fresh concrete and the compaction equipment shall be considered. The trial mixes shall be made and compacted in the presence of the Engineer, using the same type of plant and equipment as will be used for the Works.

From each trial mix, cylinders or cubes shall be made and tested in accordance with Section 5.1.2.4.

From the same mix as that from which the test specimens are made, the workability of the concrete shall be determined by the slump test in accordance with STP 9.1. The remainder of the mix shall be cast in a wooden mould and compacted. After 24 hours the sides of the mould shall be struck and the surface examined in order to satisfy the Engineer that an acceptable surface can be obtained with the mix.

The trial mix proportions should be approved if the required strength is obtained from tests carried out in accordance with Section 5.1.2.4 and the consistency and surface is to the satisfaction of the Engineer.

When a mix has been approved, no variations shall be made in the mix proportions, or in the type, size, grading zone or source, of any of the constituents without the consent of the Engineer, who may require further trial mixes to be made before any such variations are approved.

Until the results of trial mixes for a particular class have been approved by the Engineer, no concrete of the relevant class shall be placed in the Works.

When the Contractor intends to purchase factory-made precast concrete units, trial mixes may be dispensed with provided that evidence is given to satisfy the Engineer that the factory regularly produces concrete which complies with the Specifications. The evidence shall include details of mix proportions, water/cement ratios, slump tests and strengths obtained at 28 days.

5.1.2.4 Control of Concrete Quality

A) General

The Contractor shall assume the full responsibility for the quality of the concrete conforming to these Specifications and this responsibility shall not be relieved by the testing carried out and approved by the Engineer.

The Contractor shall thus at his own discretion establish additional testing procedures as necessary.

B) Control of Concrete Production

1) Materials

Materials used shall be tested in accordance with Section 5.1.2.2.

2) Plant and Equipment

Batching plants will be tested by the Contractor in a manor approved by the Engineer before any major concrete casting and at any other time if requested by the Engineer.

3) Fresh Concrete

The frequency of slump tests shall be as directed by the Engineer, with at least one test per 25 m^3 of concrete.

C) Control of Strength

1) Sampling and Testing

Cube tests may be substituted for cylinder tests if acceptable to both the Engineer and the Contractor. If cube tests are adopted, the concrete characteristic strengths shall be as shown in Table 5.1-2. All other requirements of the Specifications shall equally apply to cubes or cylinders.

The Contractor shall take samples of the concrete for testing. The number, frequency and location shall be decided by the Engineer. A minimum of 3 concrete cubes/cylinders should be taken for each day's casting, or for every 15 m^3 of concrete cast in large pours. The slump of concrete samples shall be measured.

The procedures for sampling and making cubes/cylinders and testing them shall be as described in STP 9.2.

2) Strength Requirement

The results of the testing shall conform to the strength requirements according to British standard BS5400: Part 7, as given below, or to any mathematically correct statistical test for each casting section.

D) General

The characteristic strength of concrete is the 28 days strength below which not more than 5% of the test results may be expected to fall.

E) Target Mean Strength

The concrete mix should be designed to have a mean strength greater than the required characteristic strength by at least the current margin.

The current margin for each particular type of concrete mix shall be determined; it may be taken as having the smaller of the values given by (1) or (2) below.

1) 1.64 times the standard deviation of tests on at least 100 separate batches of concrete of nominally similar proportions of similar materials and produced over a period not exceeding 12 months by the same plant under similar supervision.

2) 1.64 times the standard deviation of tests on at least 40 separate batches of concrete of nominally similar proportions of similar materials and produced over a period exceeding 5 days but not exceeding 6 months by the same plant under similar supervision.

Where there are insufficient data to satisfy (1) or (2) above, the margin for the initial mix design should be taken as two-thirds of the characteristic strength for concrete. This margin should be used as the current margin only until sufficient data are available to satisfy (1) or (2) above. However, when the required characteristic strength approaches the maximum possible strength of concrete made with a particular aggregate, a smaller margin may be permitted by the Engineer for the initial mix design.

F) Testing Plan

Each cube shall be made from a single sample taken from randomly selected batches of concrete.

Compliance with the specified characteristic strength may be assumed if:

1) The average strength determined from any group of four consecutive test cubes exceeds the specified characteristic strength by not less than 0.5 times the current margin, and

2) Each individual test result is greater than 85% of the specified characteristic strength.

The current margin should be taken to be two-thirds of the specified characteristic strength for concrete, unless as mentioned above a smaller margin has been established to the satisfaction of the Engineer.

If only one cube result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that cube was taken provided the average strength of the group satisfies the first requirement.

If more than one cube in a group fails to meet the second requirement or if the average strength of any group of four consecutive test cubes fails to meet the first requirement then all the concrete in all the batches represented by all such cubes shall be deemed not to comply with the strength requirements. For the purposes of this sub-Section, the batches of concrete represented by a group of four consecutive test cubes shall include the batches from which samples were taken to make the first and the last cubes in the group of four, together with all the intervening batches.

G) Action to be Taken in the Event of Non-Compliance with the Testing Plan

When the average strength of four consecutive test cubes fails to meet the first requirement in (F), above, the mix proportions of subsequent batches of concrete should be modified to increase the strength.

The action to be taken in respect of the concrete which is represented by the test-cubes which fail to meet either of the requirements (or not by correct statistical proof can be verified to have the required strength) shall be determined by the Engineer. This may range from qualified acceptance in less severe cases, to rejection and removal in the most severe cases.

The Engineer may also require the Contractor at his own expenses to prove statistically the strength, by boring out cores and testing them according to a programme approved by the Engineer. The age of the concrete and degree of hardening at the time of the new testing shall be considered. The equivalent cylinder/cube strength shall comply the minimum characteristic strength or as decided by the Engineer.

H) Control of Hardening

If the Contractor wants to remove forms and scaffolding earlier than specified herein, extra test specimens shall be cast by the Contractor in accordance with the instruction of the Engineer. These specimens shall be tested the day before removal of the form. On the basis of the test results the Engineer shall take the final decision on the time for the removal of forms.

For prestressed concrete, extra test specimens shall be cast by the Contractor in accordance with the instructions of the Engineer, to determine the time for tensioning the tendons. On the basis of the test results, the Engineer shall decide upon the time for prestressing the concrete.

5.1.3 Construction Methods

5.1.3.1 General

The Contractor shall in due time and as soon as possible present and discuss his construction methods and work programme with the Engineer and shall obtain his approval before commencement of any work.

The Contractor shall maintain an adequate number of trained and experienced supervisors and foremen at the Site to supervise and control the work.

All construction, other than concrete, shall conform to the requirements prescribed in other Sections of the Specifications, for the particular items of work comprising the complete structure.

5.1.3.2 Scaffolding and Formwork

A) Scaffolding (Falsework)

Details, plans and structural calculations for scaffolding shall be submitted by the Contractor to the Engineer for approval, but in no case shall the Engineer's approval relieve the Contractor of his Contract responsibilities. All scaffolding shall be designed and constructed by the Contractor to provide the necessary rigidity and to support dead and live loads without deflection or deformation. The Engineer may require the Contractor to employ screw jacks or hardwood wedges to take up any settlement in scaffolding and formwork, either before or during the placing of concrete.

Tests may be required by the Engineer of materials proposed by the Contractor for scaffolding. Test loadings of the completed scaffolding may also be required for the determination of flexibility and strength. All expenses associated with testing shall be borne by the Contractor.

Scaffolding which cannot be founded on a satisfactory footing shall be supported on piles, which shall be spaced, driven and removed in a manner approved by the Engineer. When the Contractor wishes to support scaffolding on existing structures, he shall submit his proposals in due time to the Engineer, in writing, including loads from the scaffolding. The Engineer will consider the proposals and respond in writing.

Scaffolding shall be set to give the finished structure a camber, if indicated on the Drawings or specified by the Engineer.

Scaffolding shall remain in place for periods which shall be determined by the Engineer.

B) Formwork

Formwork shall include all temporary or permanent moulds for forming the concrete. Formwork shall be of wood, metal or other approved materials and shall be built mortar tight and rigid enough to maintain the concrete in position during placing, compacting, setting and hardening.

Formwork for exposed surfaces ("wrought form") shall be made of dressed lumber of uniform thickness with or without a form liner of an approved type or shall be of metal sufficiently rigid in itself with no surface blemishes that will impair the quality of the concrete surface finish. No rusty or bent metal forms shall be used. Exposed concrete arrises shall be provide with formed chamfers, as indicated on the Drawings or instructed by the Engineer.

Rough lumber may be used for surfaces that will not be exposed in the finished structure ("rough form").

All lumber shall be sound, free from warps and twists, sap, shakes, large or loose knots, wavy edge or other defects affecting the strength or appearance of the finished structure.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods, which shall be determined by the Engineer. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer may order the work stopped until the defects are corrected.

If requested, the Contractor shall submit to the Engineer working drawings of the forms and also, if requested, calculations to verify the rigidity and strength of the forms.

The shape, strength, rigidity, watertightness and surface smoothness of reused formwork shall be maintained at all times. Any warped or bulged lumber must be re-sized before being reused. Formwork that is unsatisfactory in any respect shall not be reused.

Metal ties or anchorages within the form shall be so constructed as to permit their removal to a depth of at least 50 mm from the face without injury to the concrete. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

Formwork shall be so constructed that easy cleaning out of any extraneous material inside the formwork can be achieved without disturbing formwork already checked and approved by the Engineer.

Formwork shall be treated with approved non-staining oil or saturated with water, to facilitate formwork removal. The Engineer may require trials to be carried out before approval is given for the use of a particular type of oil, to ascertain that the oil proposed by the Contractor does not discolour or injure the finished concrete face in any way.

Before placing any concrete, all shavings, loose binding wires, soil, rubbish and all foreign matter shall be removed from the formwork and the formwork shall be carefully and thoroughly washed with water. If not indicated otherwise, the following tolerances of the finished concrete structures shall apply:

Foundations: horizontally + 30 mm; vertically + 20 mm

Piers: Horizontally + 20 mm, vertically + 10 mm, inclination 1:400

Dimensions of other structural members: + 10 mm, -5 mm

Edge beams and parapets shall be made to such accuracy that no deviations from the correct alignment are visible.

The cross sectional areas of the superstructure of bridges shall in no place deviate more than 3% from the theoretically correct cross sectional areas.

Anchors for bearings, expansion joints, railings, etc. shall be placed within the tolerances indicated on the Drawings or specified by the Engineer.

C) Blinding Concrete on Single Layer Brick Flat Soling

A levelling layer of blinding concrete shall be provided as the permanent bottom form for all concrete structures that will directly bear on prepared soil, whether this blinding concrete is shown on the Drawings or not. The levelling layer of blinding concrete shall be of thickness not less than 75 mm and shall be constructed on single layer brick flat soling.

D) Approval of Scaffolding and Formwork

If plans and calculations of scaffolding and formwork are requested by the Engineer, no construction of such scaffolding and formwork shall take place before approval by the Engineer, in writing. Such approval shall not relieve the Contractor of his responsibilities under the Contract for the adequacy of scaffolding and formwork.

The Engineer shall have reasonable time for his examination of the Contractor's plans and calculations, especially if scaffolding is introducing temporary loading on new structures. The Contractor shall not be allowed extensions of Contract time due to awaiting such approval.

The Engineer shall inspect all formwork and scaffolding and no concrete shall be placed until the Engineer's approval has been given. Such approval shall not relieve the Contractor of any of his responsibilities under the Contract for the successful completion of the structure.

5.1.3.3 Care and Storage of Concrete Materials

A) Storage of Cement

All cement shall be stored in suitable weatherproof buildings or silos which will protect the cement from dampness. These buildings or silos shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such manner as to provide easy access for the identification and inspection of each shipment. Storage buildings shall have a capacity for the storage of a sufficient quantity of cement to allow sampling at least 14 days before the cement is to be used. Cement shall meet the test requirements at any time and any cement stored for an elongated time shall be checked and tested before use regardless of whether it has previously been tested.

B) Storage of Aggregates

Aggregates shall be so stored as to prevent the inclusion of foreign material. Aggregates shall not be placed upon the finished roadbed. Aggregates of different sizes and kinds shall be placed in different stockpiles. Stockpiles of blended coarse aggregates shall be built up in successive horizontal layers not more than 1 metre thick. Each layer shall be completed before the next is started. Should segregation occur, the aggregates shall be recombined to conform to the grading requirements.

Washed aggregates and aggregates produced or manipulated by methods which involve the use of water shall be allowed to drain at least 12 hours before use.

5.1.3.4 Preparations Before Casting

Before any major casting, the Contractor shall prepare a complete "casting programme" describing staff and labour, consumption of materials, plant, tools and equipment, reserves of materials, standby plant and equipment, proposed means of handling and placing the concrete, quality controls etc.

No concrete shall be mixed and placed until the Contractor's casting programme has been approved in writing by the Engineer.

Equipment and tools necessary for handling materials and performing the work, and satisfactory to the Engineer as to design, capacity, and mechanical condition, shall be at the site of the work before casting is started.

If any equipment is not maintained in full working order, or if the equipment as used by the Contractor proves inadequate to obtain the result prescribed, such equipment shall be repaired or other suitable equipment substituted or added at the discretion of the Engineer.

5.1.3.5 Measuring Materials

All material in the mix shall be proportioned by weight or volume, subject to the approval of the Engineer.

When volume batching is proposed by the Contractor, the exact proportions must be converted from trial mix weights to volumes, from bulk densities determined in the laboratory. Written approval from the Engineer is required.

5.1.3.6 Mixing Concrete

A) General

All concrete shall be mixed in batch mixers, either at the site of construction, at a central plant, or in transit. Each mixer shall have attached to it in a prominent place, a manufacturer's plate showing the capacity of the drum in terms of mixed concrete and the speed of rotation of the mixing drum.

B) Mixers at Local Site of Construction

Mixers at local sites shall be approved drum-type capable of combining the aggregate, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period and of discharging the mixture without segregation. The mixer shall be equipped with a suitable charging hopper, water storage and a water measuring device, accurate within 1%. Controls shall be so arranged that the water can be applied only while the mixer is being charged. Suitable equipment for discharging the concrete shall be provided. The mixer shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum shall be replaced when they have lost 10% of their depth.

The mixer shall be operated at a drum speed of between 15 and 20 revolutions per minute. The batched materials shall be so charged into the drum that a portion of the water shall enter in advance of the cement and aggregates and the water shall continue to flow into the drum for a minimum time of 5 seconds after all the cement and aggregates are in the drum. Mixing time shall be measured from the time all materials except water are in the drum and shall, in the case of mixers having a capacity of 1 cubic metre or less, not be less than 50 seconds nor more than 70 seconds. In the case of dual drum mixers, the mixing time shall not include transfer time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein. Any concrete mixed less than the specified minimum time shall be discarded and disposed of by the Contractor at his own expense.

The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet or cubic metres as shown on the manufacturer's guaranteed capacity standard rating plate on the mixer; except that an overload up to 20% of the mixers nominal capacity may be permitted provided concrete test data for strength, segregation and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

Retempering concrete by adding water or by other means shall not be permitted. Concrete which is not of the required consistency at the time of placement shall not be used and shall be discarded and disposed of by the Contractor at his own expense.

C) Central Plant Mixers

These mixers shall be of approved drum type capable of combining the aggregate, cement and water into a thoroughly mixed and uniform mass within the specified mixing period and of discharging the mixture without segregation. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer.

The mixers shall be cleaned at suitable intervals. They shall be examined daily for changes in interior condition. The pick up and throw-over blades in the drum shall be replaced when they have lost 10% of their depth.

In addition to the requirements for mixers at local sites detailed above, central plant mixers which have a capacity of between 2 and 5 cubic metres, or greater than 5 cubic metres, should have a minimum mixing time of 90 and 120 seconds respectively, provided tests indicate that the concrete produced is equivalent in strength and uniformity to that attained as stated in the preceding paragraphs.

Mixed concrete shall be transported from the central mixing plant to the site of work in agitator trucks or, upon written permission of the Engineer, in non-agitator trucks. Delivery of concrete shall be so regulated that placing is at a continuous rate unless delayed by the placing operations. The intervals between delivery of batches shall not be so great as to allow the concrete in place to harden partially, and in no case shall such an interval exceed 30 minutes.

D) Agitator Trucks

Unless otherwise permitted in writing by the Engineer, agitator trucks shall have watertight revolving drums suitably mounted and shall be capable of transporting and discharging the concrete without segregation. The agitating speed of the drum shall not be less than two or more than six revolutions per minute. The volume of mixed concrete permitted in the drum shall not exceed the manufacturer's rating nor exceed 80% the gross volume of the drum.

Upon approval by the Engineer, open-top, revolving-blade truck mixers may be used in lieu of agitating trucks for transportation of central plant mixed concrete.

Gross volume of agitator bodies expressed in cubic feet or cubic metres shall be supplied by the mixer manufacturer. The interval between introduction of water into the mixer drum and final discharge of the concrete from the agitator shall not exceed 45 minutes. During this interval the mix shall be agitated continuously.

E) Non-Agitator Trucks

Bodies of non-agitating equipment shall be smooth, water-tight metal containers equipped with gates that will permit control of the discharge of the concrete. Covers shall be provided when needed for protection against the weather.

The non-agitating equipment shall permit delivery of the concrete to the site of the work in a thoroughly mixed and uniform mass with a satisfactory degree of discharge.

Uniformity shall be satisfactory if samples from the one-quarter and three quarter points of the load do not differ by more than 30 mm in slump. Discharge of concrete shall be completed within 30 minutes after the introduction of the mixing water to the cement and aggregate.

F) Truck or Transit Mixers

These shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may readily be verified and the counters shall be actuated at the commencement of mixing operations at designated mixing speeds. The mixer when loaded shall not be filled to more than 60% of the drum gross volume. The mixer shall be capable of combining the ingredients of the concrete into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

Except when intended for use exclusively as agitators, truck mixers shall be provided with a water measuring device to measure accurately the quantity of water for each batch. The delivered amount of water shall be within plus or minus 1% of the indicated amount.

Truck mixers may be used for complete mixing at the batch plant and as truck agitators for delivery of concrete to job sites, or they may be used for complete mixing of the concrete at the job site. They shall either be a closed watertight revolving drum or an open top revolving blade or paddle type.

The amount of mixing shall be designated in number of revolutions of the mixer drum. When a truck mixer is used for complete mixing, each batch of concrete shall be mixed for between 70 and 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as the "mixing speed". Such designation shall appear on a metal plate attached to the mixer. If the batch is at least 0.5 cubic metres less than guaranteed capacity, the number of revolutions at mixing speed may be reduced to not less than 50. Mixing in excess of 100 revolutions shall be at the agitating speed. All materials, including the mixing water, shall be in the mixer drum before actuating the revolution counter which will indicate the number of revolutions of the drum or blades.

When wash water (flush water) is used as a portion of the mixing water for the succeeding batch, it shall be accurately measured and taken into account in determining the amount of additional mixing water required. When wash water is carried on the truck mixer, it shall be carried in a compartment separate from the one used for carrying or measuring the mixing water. The Engineer will specify the amount of wash or flush water, when permitted, any may specify a "dry" drum if wash water is used without measurement or without supervision.

When a truck is used for complete mixing at the batch plant, mixing operations shall begin within 30 minutes after the cement has been added to the aggregate. After mixing, the truck mixer shall be used as an agitator, when transporting concrete, at the speed designated by the manufacturer of the equipment as agitating speed. Concrete discharge shall be completed within 45 minutes after the addition of the cement to the aggregates. Each batch of concrete delivered at the job site shall be accompanied by a time slip issued at the batching plant, bearing the time of departure therefrom. When the truck mixer is used for the complete mixing of the concrete at the job site, the mixing operation shall begin within 30 minutes after the cement has been added to the aggregates.

The rate of discharge of the plastic concrete from the mixer drum shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

5.1.3.7 Handling and Placing Concrete

The temperature of concrete at the time of placing shall not exceed 35°C.

In preparation for the placing of concrete all sawdust, chips and other construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces,

serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete.

Concrete must reach its final position in the forms within 20 minutes of the completion of mixing, or as directed by the Engineer.

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The use of long troughs, chutes and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorisation of the Engineer. In case an inferior quality of concrete is produced by the use of such conveyors, the Engineer may order discontinuance of their use and the institution of a satisfactory method of placing.

Open troughs and chutes shall be of metal or metal lined. Where long steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure.

When placing operations would involve dropping the concrete more than 1.5 m, it shall be deposited through sheet metal or other approved pipes. As far as practicable, the pipes shall be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of reinforcement bars which project.

Concrete, during and immediately after depositing, shall be thoroughly compacted. The compaction shall be done by mechanical vibration subject of the following provisions:

1) The vibration shall be internal unless special authorisation of other methods is given by the Engineer or as provided herein.
2) Vibrators shall be of a type and design approved by the Engineer. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.
3) The intensity of vibration shall be such as to visibly affect a mass of concrete of 20 mm slump over a radius of at least 450 mm.
4) The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.
5) Vibrators shall be manipulated to thoroughly work the concrete around the reinforcement and embedded fixtures, and into the corners and angles of the forms.

   Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localised areas of grout are formed.

   Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.
6) 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 be plastic

under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation; and vibrators shall not be used to transport concrete in the forms.

7) Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators.

8) The provisions of this Section shall also apply to precast piling, concrete cribbing and other precast members except that, if approved by the Engineer, the manufacturer's methods of vibration may be used.

Concrete shall be placed in horizontal layers not more than 600 mm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between the batches. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer which has not taken initial set.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 150 mm in the succeeding layer. Work shall not be discontinued within 450 mm of the top of any face, unless provision has been made for a coping less then 450 mm thick, in which case, if permitted by the Engineer, a construction joint may be made at the under side of the coping.

Immediately following the discontinuance of placing concrete all accumulations of mortar splashed upon the reinforcement steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete, while cleaning the reinforcement steel.

For simple spans, concrete shall preferably be deposited by beginning at the centre of the span and working from the centre toward the ends. Concrete in girders shall be deposited uniformly for the full length of the girder and brought up evenly in horizontal layers. For continuous spans, the concrete placing sequence shall be as shown on the plans or agreed on by the Engineer.

Concrete in slab and girder haunches less than 1.0 metre in height shall be placed at the same time as that in the girder stem.

Concrete in slab spans shall be placed in one continuous operation for each span unless otherwise provided.

Concrete in T-beam or deck girder spans may be placed in one continuous operation if permitted by the Engineer.

Concrete in columns and pier shafts shall be placed in one continuous operation, unless otherwise directed.

Unless otherwise permitted by the Engineer, no concrete shall be placed in the superstructure until the column forms have been stripped sufficiently to determine the character of the concrete in the columns. The load of the superstructure shall not be applied to the supporting structures until they have been in place at least 14 days, unless otherwise permitted by the Engineer.

Pneumatic placing of concrete shall be permitted only if authorised by the Engineer. The equipment shall be so arranged that vibration does not damage freshly placed concrete.

Where concrete is conveyed and placed by pneumatic means the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the place of deposit. The position of the discharge end of the line shall not be more than 3 metres from the point of deposit. The discharge lines shall be horizontal or inclined upwards from the machine. At the conclusion of placement the entire equipment shall be thoroughly cleaned.

Placement of concrete by pumping shall be permitted only if authorised by the Engineer. The equipment shall be so arranged that vibrations do not damage freshly placed concrete. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there is not contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned.

5.1.3.8 Perforations and Embedment of Special Devices

The Contractor is responsible for determining in advance of making any concrete pours, all requirements for perforation of concrete sections or embedment therein of special devices of other trades, such as conduits, pipes, weep holes, drainage pipes, fastenings, etc. Any concrete poured without prior provision having been made, shall be subject to correction at the Contractor's expense.

Special devices to be embedded:

- Expansion joints
- Drain outlets including fixing bolts for down pipes
- Bolts and inserts for sign posts
- Bolts and inserts for various purposes regarding inspection and maintenance as directed by the Engineer

Other devices not mentioned above shall be shown on the Drawings, or directed by the Engineer. The inserts and fittings should conform to Sections 5.9 and 5.10 of this Specification.

5.1.3.9 Finishing Concrete Surfaces

One of the following types of finishing shall be applied to concrete surfaces:

Type A - Concrete Decks

Immediately after placing concrete, concrete decks shall be struck off using templates to provide proper crowns and shall be finished smooth to the correct levels. Finish shall be slightly but uniformly roughened by brushing. The finished surface shall not vary more then 10 mm from a 3 metre straight edge placed in any direction on the roadway. Deviation from the grade line shall not be more than + 30 mm in any 20 metre length.

Type B - Kerb and Sidewalk Surface

Exposed faces of kerbs and sidewalks shall be finished to true lines and grades. The kerb surface shall be wood floated to a smooth but not slippery finish. Sidewalk surfaces shall be slightly but uniformly roughened by brushing.

Type C - Ordinary Finish

An ordinary finish is defined as the finish left on a surface after the removal of the forms when all holes left by form ties have been filled, and any minor surface defects have been repaired. The surface shall be true and even, free from depressions or projections.

The concrete in bridge seats, caps, and tops of walls shall be struck off with a straight edge and floated to true grade. Under no circumstances shall the use of mortar topping for concrete surfaces be permitted.

Type D - Rubbed Finish

After the removal of forms the rubbing of concrete shall be started as soon as its condition permits. Immediately before starting this work the concrete shall be kept thoroughly saturated with water for a minimum period of three hours. Sufficient time shall have elapsed before the wetting down to allow the mortar used in patching to have thoroughly set. A medium coarse carborundum stone shall be used for rubbing a small amount of mortar on the face. The mortar used shall be composed of cement and fine aggregate mixed in the same proportions as that used in the concrete being finished. Rubbing shall be continued until all form marks, projections, and irregularities have been removed, all voids filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this time. The final finish shall be obtained by rubbing with a fine carborundum stone and water until the entire surface is of a smooth texture and uniform colour.

After the final rubbing has been completed and the surface has dried, burlap shall be used to remove loose powder. The final surface shall be free from unsound patches, paste, powder and objectionable marks.

Type E - Bushhammer Finish

Bushhammering shall be carried out by treating the surface with an approved heavy duty power hammer fitted with a multi-point tool which shall be operated over the surface to remove 5 to 6 mm of concrete paste and expose maximum areas of coarse aggregate.

Aggregate left embedded shall not be fractured or loose. 25 mm wide bands at all corners and arrises shall be left as cast. The finish surface shall be even and of uniform appearance and shall be washed with water upon completion.

Type F - Ribbed Finish

Ribs shall be vertical and to the dimensions shown on the Drawings. The direction of the grain of the timber forming the ribs shall be vertical.

5.1.3.10 Construction Joints

A) General

Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved by the Engineer.

If not detailed on the plans, or in the case of emergency, construction joints shall be placed as directed by the Engineer. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or bond the two sections together.

B) Bonding

Before depositing new concrete on or against concrete which has hardened, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened as required by

the Engineer, in a manner that does not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water. To ensure an excess of mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces, including vertical and inclined surfaces, shall first be thoroughly covered with a thin coating of mortar or neat cement grout against which the new concrete shall be placed before the grout has attained its initial set.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

5.1.3.11 Curing Concrete

All concrete surfaces shall be kept thoroughly wet for at least 7 days after placing. Bridge deck and sidewalk slabs shall be covered with wet hessian immediately after final finishing of the surface. This material shall remain in place for the full curing period or may be removed and replaced with sand when the concrete has hardened sufficiently to prevent marking. In both cases the materials shall be kept thoroughly wet for the entire curing period. All other surfaces if not protected by forms, shall be kept thoroughly wet, either by sprinkling or by the use of wet burlap until the end of the curing period. The wood forms are allowed to remain in place during the curing period, but they shall be kept moist at all times to prevent openings at joints.

After a period of 7 days, the concrete shall be watered daily at certain intervals approved by the Engineer to avoid drying out of the surface. This shall take place during the following 2 weeks. The water used shall be the same as used in concrete mixes unless otherwise approved by the Engineer.

Any proposal from the Contractor for the use of liquid membrane curing compound shall be subject to the approval of the Engineer.

5.1.3.12 Removal of Scaffolding and Formwork

Forms and scaffolding shall not be removed without the approval of the Engineer. The Engineer's approval shall not relieve the Contractor of his Contract responsibilities. Any kentledge blocks and bracing shall be removed at the same time as the forms and in no case shall any portion of the wood forms be left in the concrete.

Forms used on exposed vertical faces shall remain in place for periods which shall be determined by the Engineer and normally not less than 3 days.

Supporting scaffolding and forms under slabs, beams and girders shall normally remain in place until the full required strength of the concrete has been obtained. If a shorter period is requested, this may be permitted by the Engineer. In such case, special test specimens (see Section 5.1.2.4) shall be cast to monitor the hardening.

All structures shall be fully stripped before adjacent structures are cast.

5.1.3.13 Repair of Concrete

As soon as the form has been stripped, the Contractor shall advise the Engineer who shall inspect the concrete before any improvement of the surface takes place.

All wire or metal devices used for securing the formwork which project from or appear on the surface of the finished concrete shall be removed or cut back to at least a depth equal to the required reinforcement cover. All holes and pockets so formed shall be filled with cement mortar mixed in the same proportions as the fine aggregate to cement of the concrete mix

used for that particular section of the structure, after the surface to be patched has been thoroughly cleaned and wetted to receive the patch.

Excessive honeycombing shall be sufficient to cause rejection of portions of the structure containing this honeycombing. The Contractor, on receipt of written orders from the Engineer, shall remove and rebuild such portions of the structure at his own expense.

Smaller honeycombing and other defects can be repaired if permitted by the Engineer. Structural, maintenance and aesthetical points of view shall be taken into consideration before such approval, if any, may be given. The method of repair shall be approved by the Engineer and an extension of period for a certain part of the performance bond may be required.

5.1.3.14 Depositing Concrete under Water

Concrete shall not be deposited in water except with the approval of the Engineer and under his immediate supervision; and in this case the method of placing shall be as defined in this Section.

Concrete placed under water shall be carefully placed in a compact mass, in its final position, by means of a tremie tube and shall not be disturbed after being deposited. Special care must be exercised to maintain still water at the point of deposit. Concrete shall not be placed in running water. The method of depositing concrete shall be so regulated as to produce approximately horizontal surfaces.

Concrete seals shall be placed in one continuous operation. When a tremie tube or pipe is used, it shall consist of a tube or pipe not less than 150 mm in diameter. All joints in the tube shall be watertight. The means of supporting the tremie tube shall be such as to permit free movement of the discharge end over the entire top of the concrete and to permit its being lowered rapidly when necessary to choke off or retard the flow. The tremie tube shall be filled by a method that prevents washing of the concrete. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall be kept full. Concrete slump shall not be less than 150 mm.

Dewatering shall proceed only when the concrete seal is considered strong enough to withstand any pressure to be exerted upon it. This time shall be decided by the Engineer.

All laitance or other unsatisfactory material shall be removed from the exposed surface by scraping, jetting, chipping or other means, which do not injure the seal unduly.

5.1.3.15 Factory Made Precast Concrete Elements

Any supplier of precast concrete elements shall be approved in writing by the Engineer. Such approval can be withdrawn at any time.

Concrete work in precast concrete elements shall fully conform with all relevant Sections of these Specifications.

The supplier shall maintain laboratory facilities of the same standard as the site laboratory.

Unless otherwise approved by the Engineer, precast concrete members shall not be moved from the casting position until the concrete has attained a compressive strength of 80% of the specified 28 day strength, nor transported until it has developed a strength of 90% of the specified 28 day strength.

Extreme care shall be exercised in handling and moving precast concrete members. Precast girders and slabs shall be transported in an upright position. Shock shall be avoided and the points of support and directions of the reactions with respect to the member shall be approximately the same during transportation and storage as when the member is in its

final position. If the Contractor deems it expedient to transport or store precast units in other than this position, this shall be at the Contractor's risk, after notifying the Engineer of his intention to do so. Any rejected unit shall be replaced at the Contractor's expense by an acceptable unit.

Proposed details on the handling and transportation of precast concrete members shall be submitted in writing by the Contractor, to the Engineer, for his approval.

Each precast member is to be uniquely and permanently marked so as to show its type, date of casting and any other information required by the Engineer.

5.1.3.16 Control of Heat in Structures

In structures of major dimensions i.e., pile caps, etc. the heat deriving from the hardening of the concrete shall be controlled by the Contractor. Temperature gradients introducing risk of cracking shall not occur and the temperature shall not exceed 70°C.

The Contractor shall submit timely proposals for avoiding excessive heat generation, such as the cooling of aggregates before mixing, to the Engineer for approval.

5.1.3.17 Grouting of Ducts for Prestressing Tendons

A) General

The purpose of grouting is to provide permanent protection to the post-tensioning steel and to achieve bond between the prestressing steel and the concrete.

The time of commencement of grouting shall be approved by the Engineer. The Contractor shall give timely notice of grouting to the Engineer.

B) Definition of Terms

1) Admixture. Any material added to the grout other than Portland cement and water.
2) Duct. The hole or void provided in the concrete for the tendon used in post-tensioning, formed by sheathing.
3) Grout. A mixture of cement and water with or without admixtures.
4) Grout opening or vent. An inlet, outlet or vent in the duct for grout, water or air.

C) Grout Openings or Vents

All ducts shall have grout openings at both ends. For draped cables, all high points should have a grout vent except where cable curvature is small, such as in continuous slabs. All grout openings or vents shall include provisions for preventing grout leakage.

D) Equipment

1) The grouting equipment shall include a mixer capable of continuous mechanical mixing which will produce a grout free of lumps and undispersed cement. The equipment shall be able to pump the mixed grout in a manner which will comply with all provisions of the recommended practice.
2) Accessory equipment which will achieve accurate solid and liquid measures shall be provided to batch all materials.
3) The pump shall be a positive displacement type and be able to produce an outlet pressure of at least 10.5 kg/cm². The pump should have seals adequate to prevent introduction of oil, air or other foreign substances into the grout and to prevent loss of grout or water.

4) A pressure gauge having a full scale reading of no greater than 21 kg/cm² shall be placed at some point in the grout line between the pump outlet and the duct inlet.

5) The grouting equipment shall contain a screen having clear openings of 3.2 mm maximum size to screen the grout prior to its introduction into the grout pump. If a pump with a thixotropic additive is used, a screen opening of 4.8 mm is satisfactory. This screen shall be easily accessible for inspection and cleaning

6) The grouting equipment shall utilise gravity feed to the pump inlet from a hopper attached to and directly over it. The hopper must be kept at least partially full of grout at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

7) Under normal conditions, the grouting equipment shall be capable of continuously grouting the largest tendon on the Works in no more than 20 minutes.

E) Materials

1) Portland Cement.
Portland cement shall confirm to one of the following: Specifications for Portland cement - AASHTO M 85, type 1, 2 or 3.
Cement used for grouting shall be fresh and shall not contain any lumps or other indication of hydration or "pack set".

2) Water
The water used in the grout shall be potable, clean and free of injurious quantities known to be harmful to Portland cement or prestressing steel.

3) Admixtures
Admixtures, if used, shall impart the properties of low water content, good flowability, minimum bleed and moderate expansion. Their formulation shall contain no chemicals in quantities that may have harmful effects on the prestressing steel or cement. Admixtures containing chlorides, fluorides, sulphites and nitrates shall not be used.
Aluminium powder of the proper fineness and quantity or other approved gas evolving material which is well dispersed through the other admixture may be used to obtain 5 to 10 percent unrestrained expansion of the grout.
All admixtures shall be approved by the Engineer and used in accordance with the instructions of the manufacturer.

F) Mixing of Grout

1) Water shall be added to the mixer first, followed by Portland cement and admixture, or as required by the admixture manufacturer.

2) Mixing shall be of such duration as to obtain a uniform thoroughly blended grout, without excessive temperature increase or loss of expansive properties of the admixture. The grout shall be continuously agitated until it is pumped.

3) Water shall not be added to increase grout flowability which has been decreased by delayed use of the grout.

4) Proportions of materials shall be based on tests made on the grout before grouting is begun, or may be selected based on prior documented experience with similar materials and equipment and under comparable field conditions (weather, temperature, etc.).

The water content shall be the minimum necessary for proper placement and when type 1 or 2 cement is used shall not exceed a water/cement ratio of 0.45.

The water content required for type 3 cement shall be established for a particular brand based on tests.

The pumpability of the grout may be determined by the Engineer in accordance with the U.S. Corps of Engineers Method CRD-C79. When this method is used, the efflux time of the grout sample immediately after mixing shall not be less than 11 seconds. The flow cone test does not apply to grout which incorporates a thixotropic additive.

Trial mixes shall be carried out on site with the selected constituents to demonstrate the physical properties of the grout.

G) Grouting

Preparation of duct:

- Flushing of metal ducts shall be carried out, if considered necessary by the Engineer.
- The pumping pressure at the tendon inlet shall not exceed the value which may develop cracking in surrounding concrete.
- If the actual grouting pressure exceeds the maximum recommended pump pressure, grout may be injected at any vent which has been or is ready to be capped, as long as one-way flow of grout is maintained. If this procedure is used, then the vent, which is to be used for injection, shall be fitted with a positive shutoff.
- When one-way flow of grout cannot be maintained as outlined above, the grout shall be immediately flushed out of the duct with water.

Grout shall be pumped through the duct and continuously wasted at the outlet pipe until no visible slugs of water or air are ejected. To ensure that the tendon remains filled with grout, the outlet and/or inlet shall then be closed. Plugs, caps or valves thus required shall not be removed or opened until the grout has set.

H) Temperature

Grout shall not be above 35°C during mixing or pumping. If necessary the mixing water shall be cooled.

5.1.3.18 Loading

No superstructure load shall be placed upon finished bents, piers, or abutments until the Engineer so directs but in no case shall any load of any kind be placed until the concrete has completed curing.

The Contractor shall not place any temporary loads on deck slabs unless allowed by the Engineer in writing (see Section 5.1.3.2). Bridge deck slabs shall be opened to traffic only when so directed by the Engineer and generally not sooner than 28 days after the placing of the concrete has been completed.

5.1.3.19 Backfill to Structures

All spaces which have been excavated and the volumes of which are not occupied by the concrete structure shall be backfilled and compacted with acceptable material in accordance with the provisions of Section 2.5 as directed by the Engineer.

5.1.3.20 Cleaning Up

Upon completion of a structure and before final acceptance, the Contractor shall remove all forms and scaffolding etc. down to 0.5 metres below the finished ground line. Excavated, or useless materials, rubbish etc. shall be removed from the Site and the Site shall be left in a neat and tidy condition satisfactory to the Engineer.

5.1.4 Measurement

Concrete shall be measured by the number of cubic metres of class and maximum coarse aggregate size indicated on the Drawings complete in place and accepted by the Engineer. In computing quantities, the dimensions used shall be those shown on the Drawings. No deduction from the measured quantity shall be made for drainage, pipes less than 300 mm in diameter, conduits, chamfers, reinforcement bars, prestressing tendons, expansion joints, water stops or pile heads embedded in concrete.

Reinforcing and prestressing steel shall be measured for payment as described in Specifications Sections 5.2 and 5.3.

Formwork, scaffolding (falsework), construction joints and surface finishes shall not be measured separately but shall be deemed to be an integral part of the concrete items.

Single layer brick flat soling under blinding concrete for concrete structures bearing directly on prepared soil shall be measured in m^2. The measured area will be the same as that of the base area of the concrete structure.

5.1.5 Payment

Concrete of the classes and maximum coarse aggregate sizes shown on the Drawings and measured as provided in Section 5.1.4 shall be paid for at the Contract unit prices per cubic metre. The Contractor's rates shall include all trial mixes (as specified in Section 5.1.2.3), mixing, transporting, placing and compacting the concrete. The rates shall also include all concrete finishing, the supply, placing and building in of weep pipes or pipe sleeves, forming construction joints, forming holes or pockets not exceeding 0.15 m^3 each.

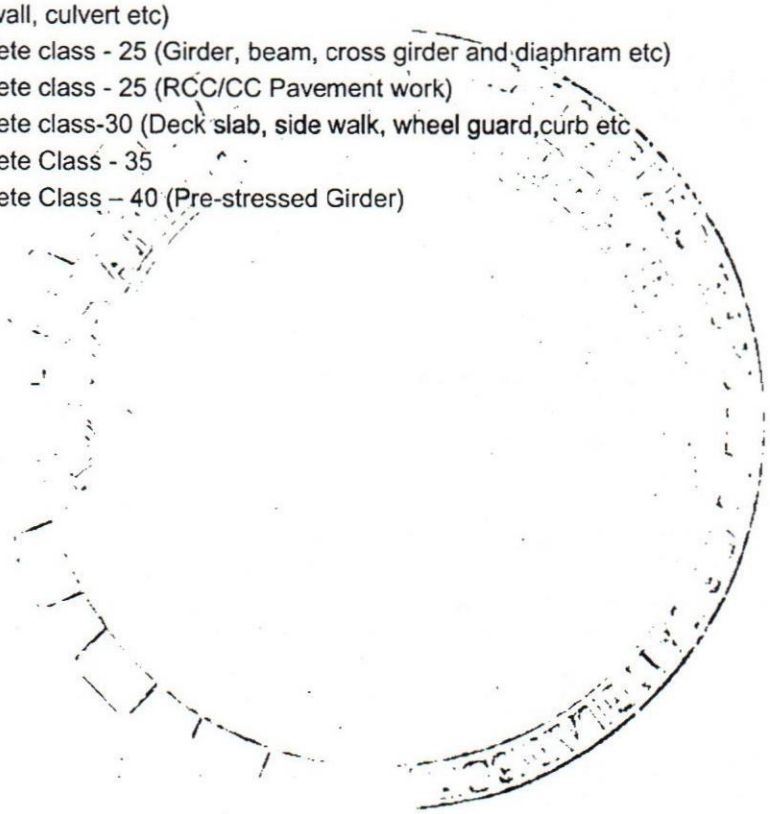
The Contractor's rates shall be fully inclusive of the cost of all labour and materials in providing and erecting all formwork, falsework and centering and for their subsequent removal.

Payment for precast units shall include all concrete, prestressing tendons, formwork, finishing, transport and erection and where applicable any bolts, bedding or other devices necessary to fix them in their permanent position.

Payment for single layer brick flat soling shall include the supply of all required materials and all labour, equipment, tools and incidentals necessary to complete the work.

Pay items shall be:

05/01/01	Single Layer Brick Flat Soling	sq. metre
05/01/02a	Concrete Class as Detailed on Drawings (Class10)	cu metre
05/01/02b	Concrete class-20 (Foundation)	cu metre
05/01/02c	Concrete class - 20 (Vertical member col. pier, abutment / wing wall, culvert etc.)	cu metre
05/01/02d	Concrete class-20 (Girder, cross girder, diaphram, beam etc)	cu metre
05/01/02e	Concrete class-20 (Deck slab, side walk, wheel guard, curb etc	cu metre
05/01/02f	Concrete class -20 (rail & post)	cu metre
05/01/02g	Concrete Class - 25 (Foundation)	cu metre
05/01/02h	Concrete class -25 (Vertical member col, pier, abutment/ wing wall, culvert etc)	cu metre
05/01/02i	Concrete class - 25 (Girder, beam, cross girder and diaphram etc)	cu metre
05/01/02j	Concrete class - 25 (RCC/CC Pavement work)	cu metre
05/01/02k	Concrete class-30 (Deck slab, side walk, wheel guard,curb etc	cu metre
05/01/02l	Concrete Class - 35	cu metre
05/01/02m	Concrete Class – 40 (Pre-stressed Girder)	cu metre



5.2 REINFORCEMENT

5.2.1 Description

This work shall consist of furnishing and placing bars of the grade, type and size shown in accordance with these Specifications and in conformity with the requirements shown on the Drawings.

5.2.2 Materials

5.2.2.1 Bar Reinforcement

All mild steel bars shall have a yield stress not less than 240 N/mm² and shall conform to ASTM A 615 or the latest such equivalent standard or specification in force that is considered by the Engineer to apply.

All high yield steel bars shall be deformed bars with a yield stress not less than 400 N/mm² and shall conform to ASTM A 615 or the latest such equivalent standard or specification in force that is considered by the Engineer to apply.

The use of cold twisted bars is not permitted. Steel for all bars shall be produced by open hearth, basic oxygen or electric arc furnace methods, unless otherwise called for on the Drawings or in special provisions.

5.2.2.2 Wire Mesh

Wire mesh shall conform to the requirements of AASHTO Standard Specification M 55 - Welded Steel Wire Fabric for Concrete Reinforcement.

5.2.2.3 Binding Wire

Reinforcement binding wire shall be best black annealed mild steel wire, approximately 1.6 mm in diameter.

5.2.2.4 Bar Sizes

AASHTO Standard Specifications refer to the Imperial measurement system. However, metric sizes of steel are shown on the Drawings and shall be used.

5.2.2.5 Ordering Material

The name of the proposed supplier (or names of proposed suppliers) of the reinforcement shall be submitted as soon as possible to the Engineer for his approval. The Contractor shall also submit all relevant data on the steel required by the Engineer, such as breaking strength, yield strength, characteristics on elongation, chemical composition etc.

Copies of orders placed shall be submitted to the Engineer.

Bar reinforcement shall be transported in standard bundles, tagged and marked in accordance with the Code of Standard Practice of the Concrete Reinforcing Steel Institute.

No steel shall be delivered without a manufacturers certificate guaranteeing the yield stress, which shall be submitted to the Engineer.

The steel shall be stored on Site and marked in a way that later enables identification of the steel corresponding to each certificate.

5.2.2.6 Additional Tests

The Contractor shall cut out steel samples as directed by the Engineer and these shall be tested according to the Engineer's instructions by an approved Testing Institution. Expenses incurred in connection with cutting out, transporting and testing of the samples shall be paid for by the Contractor. In general, two samples shall be tested from each batch of a particular size of reinforcement delivered to the site.

5.2.3 Construction Methods

5.2.3.1 Protection and Storage

Reinforcement for structures shall be handled and stored in a manner that will prevent bending out of the desired shape and any accumulation of dirt, oil and paint. When placed in the works it shall be free from dirt, oil, grease, paint, mill scale and loose or thick rust.

5.2.3.2 Cutting and Bending

Bars shall be cut and bent cold to the dimensions indicated and with equipment and methods approved by the Engineer.

Stirrups and tie bars shall be bent around a pin having a diameter not less than four times the minimum thickness of the bar. Bends for other bars, where full tension in the bar may occur, shall be made around a pin having a diameter not less than twenty times the bar diameter. Hooks shall conform to American Concrete Institute Standard Building Code Requirements for reinforced concrete ACI 318-83, or as shown on the Drawings.

5.2.3.3 Placing, Supporting and Fastening

All bar reinforcement shall be placed, supported and secured prior to any concreting operations. The reinforcement shall be checked and approved by the Engineer before pouring of concrete.

Cover blocks required for ensuring that the reinforcement is correctly positioned shall be as small as possible, consistent with their purpose, of a shape and material acceptable to the Engineer, and designated so that they will not overturn when the concrete is placed. If made of concrete, the maximum size of aggregate shall be 6 mm and the mix proportion shall be one part of Portland cement to 2 parts of sand by weight. Wire shall be cast in the block for the purpose of tying it to the reinforcement. The wire must not be closer than 30 mm from the concrete surface. The use of small stones or wood blocks shall not be permitted.

The reinforcement shall be held securely in place at the exact position and at the exact spacing as indicated on the Drawings by the use of wire ties at bar intersections, supports and cover blocks. Wire ties shall be securely tied and folded so that they do not project beyond the planes formed by the reinforcing bars. The adequacy of the supports and ties to secure the reinforcement properly shall be subject to the approval of the Engineer.

5.2.3.4 Splicing

Reinforcement shall be furnished in the lengths indicated on the Drawings. When the Contractor wishes to use more splices than are indicated and/or necessary, the Contractor shall furnish Working Drawings to the Engineer for approval in accordance with the guidelines provided on the Contract Drawings. If such additional splices are approved, the extra weight occasioned by such splices shall not be included in the measurement of reinforcement for payment.

All splices for high yield deformed steel bars and mild steel plain steel bars shall have lap lengths as shown on the Drawings. Lap splices shall generally be located at points of minimum tension in bars. Except where otherwise shown on the Drawings lap splices shall be made with the bars placed in contact and securely wired together.

Welding of reinforcing steel shall be done only if detailed on the Drawings or approved in writing by the Engineer. Before the Engineer may approve of such welding, the Contractor shall submit and test any samples as the Engineer may require and make due allowance for the time elapsing before results are available.

5.2.3.5 Substitutions

Substitutions of bars shall be permitted only with specific authorisation by the Engineer and at the expense of the Contractor. If bars are substituted they shall have a cross sectional area equivalent to the design area, or larger. If substitutions of bars are permitted, the Contractor shall produce working drawings and reinforcing detailing at his own expense and to the approval of the Engineer.

5.2.4 Measurement

The quantity of reinforcement to be measured under this Section shall be the computed weight in tonnes of material used and accepted as shown on the Drawings provided that the quantity shall not include the reinforcement in any item of work for which the basis of payment includes the reinforcement. In computing the weight to be measured, the theoretical weights of bars of the cross section shown on the Drawings or authorised, shall be used. The weight shall be calculated based on a constant mass of 0.00785 kg/mm² per metre run.

The computed weight shall not include the extra material incurred when bars larger than those specified are used, or the extra material necessary for splices when bars shorter than those specified are used with the permission of the Engineer, or the weight of any devices used to support or fasten the reinforcement in the correct position including any necessary chairs.

However, payment shall be allowed for lap splices not shown when the bars are longer than 12 metres. Only one lap splice per every started 12 metres will be paid for.

5.2.5 Payment

This work measured as provided above, shall be paid for at the Contract unit price per metric tonne of reinforcement of the particular type. The payment shall be full compensation for furnishing and placing reinforcement of any size and for all labour, binding wire, equipment, tools and incidentals necessary to complete the work prescribed in this Section.

Pay items shall be:

05/02/01 Mild Steel Reinforcing Bars	Tonne
05/02/02 High Yield Deformed Steel Reinforcing Bars	Tonne
05/02/03 Wire Mesh Reinforcement	Tonne

5.3 PRESTRESSING REINFORCEMENT

5.3.1 Description

5.3.1.1 General

This work shall consist of the furnishing and placing, pretensioning or post tensioning of bars, strands or wires as specified on the Drawings and these Specifications.

5.3.1.2 Definitions

Post tensioning is defined as any method of prestressing concrete in which the tensioned reinforcement is tensioned after the concrete is placed.

Pretensioning is defined as any method of prestressing concrete in which the tensioned reinforcement is tensioned before the concrete is placed.

Prestressing reinforcement is defined as any reinforcement to which prestress is applied by post tensioning or pretensioning.

Non-prestressing reinforcement ("ordinary reinforcement" or only "reinforcement") is defined as any reinforcement to which no prestressing tension is applied externally.

5.3.2 Materials

5.3.2.1 Tendons for Post Tensioning Systems

Prestressing steel shall be Stress-Relieved Wire according to AASHTO M 204, Stress-Relieved Strand according to AASHTO M 203 or High-Strength Steel bar according to ASTM A 722.

The Contractor may propose any other internationally acknowledged prestressing steel subject to approval of the Engineer. Detailed drawings showing the tendon arrangement and calculations shall be submitted, which verify that the proposed tendons introduce into bridge structures the prestressing effect equivalent to the original design shown on the Drawings.

No tendons shall be used in the construction before testing has been carried out and approved by the Engineer.

5.3.2.2 Anchorage Assemblies

The end anchorages (stressing anchorages and dead end anchorages) shall be especially designed for the actual type of tendon and must have been used on other similar work and thus have demonstrated proper functioning and durability for this purpose.

Allowance shall be made to test anchorages to destruction. The anchorages shall be capable of fixing the prestressing steel at a load of not less than 95% of the specified minimum tensile strength of the prestressing steel.

The manufacturer shall submit appropriate test certificates from an approved testing laboratory.

Information on all details of the design and the steel quality of the anchorages shall be submitted to the Engineer.

5.3.2.3 Sheathing

All sheathing shall be of the metallic corrugated type, galvanised and fully mortar tight. The sheathings shall be strong enough to maintain their shape under such forces as may be expected to act on them.

All information on proposed sheathings shall be submitted by the Contractor to the Engineer for his approval.

5.3.3 Construction Methods

5.3.3.1 General

The Contractor shall provide a technician skilled in the use of the actual system of prestressing to supervise the work to the satisfaction of the Engineer.

The Contractor shall provide all equipment necessary for the construction and the prestressing. Prestressing shall be done with approved jacking equipment. If hydraulic jacks are used they shall be equipped with accurate reading pressure gauges. The combination of jack and gauge shall be calibrated and a graph or table showing the calibration shall be furnished to the Engineer. Should other types of jacks be used, calibrated proving rings or other devices shall be furnished to accurately establish jacking forces.

If alternative systems are adopted, the Contractor shall submit, for the approval of the Engineer, drawings and calculations which show the arrangements of tendons, anchorage assemblies, etc. and verify that the prestress occurring at every section is equal to that produced by the system originally used in the design.

A) Pre-Tensioning Systems

Prestressing strand and wire to precast piles shall be seven wire strand and wire in accordance with ASTM A 416-74.

Prestressing tendons can be directly substituted by other types of equivalent strength tendons conforming to JIS G 3109-1971, BS 3617-1971 and BS 2691-1969.

B) Certificates

Manufacturer's test certificate for breaking strength shall be obtained for each delivered coil or bundle and a stress/strain diagram shall be obtained for every fifth coil or bundle.

Each coil or bundle of prestressing steel shall be delivered with charge No. and markings to allow identification of the corresponding tests carried out.

Copies of the manufacturer's dated test certificates of his Routine Testing shall be submitted to the Engineer for his approval.

C) Tests

Tests in addition to those to be carried out by the manufacturer as specified herein will be required.

Supervised by the Engineer, the Contractor shall cut out samples (approximately 1.0m long) for each 25 tons of steel, or as directed by the Engineer. The breaking load, 0.2% proof load and elongation tests shall be carried out according to ASTM A 370, by an approved independent testing laboratory.

Expenses incurred in connection with cutting out, transport and testing of the samples shall be borne by the Contractor.

No tendons shall be used in the construction before the testing has been carried out and approved by the Engineer.

5.3.3.2 Storage of Materials

Coils and bundles of prestressing steel shall be stored flat on a floor raised off the ground and under full cover from the weather. They shall be protected from damage, oil, corrosion or any deleterious matter, and shall not be opened until required. Before being fabricated into prestressing tendons the strands or bars shall be cleaned of loose rust and any deleterious matter, and inspected by the Engineer for approval. Prestressing steel reinforcement which shows signs of pitting or has any surface defects such as splits, roughness or necking is not to be used, and any lengths of wire or strand so affected shall be cut off and rejected.

Corrugated sheathing is to be delivered to the site coiled on to large diameter wooden drums, securely fastened and protected from damage. They shall be stored on site under cover from the weather, and shall be protected from rusting, damage, oil or any other deleterious matter and shall be clean and free from all such matter before being used in the Works.

5.3.3.3 Manufacture of Tendons

Prestressing cables shall be prepared on site from coils of wires or strands. Tendons, which consist of a number of high tensile steel strands, shall be formed in a manner approved by the Engineer. In estimating the length of all cables, extra allowance must be made for applying either one or two tensioning jacks.

Sheathing shall be carefully examined prior to use and any damaged lengths shall be cut away and rejected.

Suitable spacers shall be provided, if required, to hold the strands or bars in correct position in the sheathings to ensure that there is sufficient space around each wire or cable to allow proper grouting.

Joints in corrugated sheathing shall be formed by the use of couplers and/or by wrapping the joints with tape. They shall be so designed as to prevent the ingress of concrete or other material during casting. All joints in sheathing shall be approved by the Engineer.

5.3.3.4 Placing Tendons and Sheathing

Tendons shall be carefully handled so as to avoid sharp bends or kinks. The sheathing and/or the tendon shall be rigidly supported in the exact positions as shown on the Drawings so that no movement can take place during casting of elements to be prestressed.

The tendons shall be placed with the following tolerances:

Vertical ± 10 mm, horizontal ± 20 mm.

The tendons shall be supported by special supporting arrangements as proposed by the Contractor and approved by the Engineer. If the sheathing is supported by reinforcement bars, they shall be plain round bars of mild steel. The supports shall be placed at adequate centres to ensure the tendons in all positions are placed along the prescribed curve. Care must be taken to prevent the supports from penetrating into the sheathings and if necessary special means must be used.

5.3.3.5 Placing Anchorages

Anchor cones, blocks and plates shall be positioned and maintained during concreting so that the centreline of the duct passes axially through the anchorage assembly.

All bearing surfaces of the anchorage shall be clean prior to concreting and tensioning. The anchorage itself shall be adequately protected against corrosion following the completion of the final stressing operation.

5.3.3.6 Jacks for Prestressing

All jacks used for prestressing shall be of the type applicable to the system adopted.

The accuracy of all load measuring equipment shall be checked to the satisfaction of the Engineer at the start of work each day it is to be used and whenever the equipment is moved to a different jack.

5.3.3.7 Post-tensioning Procedure

1) Prior to construction work, the Contractor shall submit a table which shows the tensioning order of all tendons to be tensioned at each construction stage, pressure of hydraulic jacks or pumps, anchor pull-in and elongation of each tendon. This proposed post-tensioning procedure is subject to approval by the Engineer.

The Contractor shall carry out tensioning tests on a few tendons designated by the Engineer, and the results shall be taken into consideration for the table preparation. The result of the tensioning work for each tender shall be submitted in a form designated by the Engineer.

2) Tensioning shall be carried out only in the presence of the Engineer unless permission in writing has been obtained to the contrary.

3) Immediately before tensioning, the Contractor shall prove that all tendons are free to move between jacking joints and that members are free to accommodate the horizontal and vertical movements due to the application of prestress.

4) Unless otherwise described in the Contract, concrete shall not be stressed until it has reached at least the age at which two test cylinders taken from it attain the specified transfer strength. The test cylinders shall be made and tested in accordance with Section 5.1.2.4. The Contractor shall cast sufficient additional cylinders to demonstrate that the required strength of the concrete at transfer has been reached.

5) Where members consist of jointed elements, the strength at transfer of the jointing material shall be at least equivalent to the specified transfer strength of the member.

6) The Contractor shall establish the datum point for measuring extension and jack pressure to the satisfaction of the Engineer.

7) The Contractor shall add to the forces described in the Contract an allowance for anchorage friction and jack losses. The total forces and calculated extensions shall be agreed with the Engineer before stressing is commenced.

8) Immediately after anchoring, the stresses in the prestressing tendons shall not exceed 70% of their specified characteristic loads. During stressing the value shall not exceed 80%.

9) The tendons shall be stressed at a gradual and steady rate. The forces in the tendons shall be obtained from readings on two load cells or pressure gauges incorporated in the equipment. The extensions of the tendons under agreed total forces shall be within 5% of the agreed calculated extensions.

If the required elongation cannot be reached, the jacking force may be increased to 80% of the specified characteristic load of the tension. If the difference between the measured and calculated elongation is more than 10%, however, no further tensioning shall be made until the calculations and the equipment is checked.

10) When stressing tendons with stressing anchorage at both ends, the pull-in at the ends remote from the jack shall be accurately measured and the appropriate allowances made in the measured extensions at the jack ends.

11) When the prestressing has been applied to the satisfaction of the Engineer, the tendons shall be anchored. The jack pressures shall then be released in such a way as to avoid shocks to the anchorages or tendons.

12) If the pull-in of the tendons at completion of anchoring is greater than agreed by the Engineer, the loads shall be released at a gradual and steady rate and tensioning carried out afresh.

13) The Contractor shall keep full records of all tensioning operations including the measured extensions, pressure gauge or load cell readings and the amount of pull-in at each anchorage. Copies of these records shall be supplied to the Engineer within 24 hours of each tensioning operation.

14) The men employed shall be experienced in this class of work. Every precaution shall be taken to ensure the safety of the workmen during the tensioning period.

5.3.3.8 Grouting

Grouting shall be carried out as specified in Section 5.1.3.17.

5.3.3.9 Finishing off Tendons

After grouting, the ends of the anchorages and any projecting ends of cut-off tendons shall be covered by concrete or special mortar mix.

5.3.3.10 Pre-Tensioning

The specified force shall be maintained by the use of fixing devices at the ends of the tensioning steel during concreting and curing until the concrete has attained the specified strength or other strength approved by the Engineer. The tensioning steel shall then be released gradually and uniformly.

All details and function of the "prestressing bed" shall be approved by the Engineer.

The amount of tensioning shall be as shown on the Drawings or as instructed by the Engineer.

The amount of jacking force and the elongation shall be measured on each strand wire or bar in a way approved by the Engineer.

Test specimens manufactured and cured in accordance with Section 5.1.2.4 may be requested for the verification of the concrete strength before releasing the tensioning steel.

5.3.4 Measurement

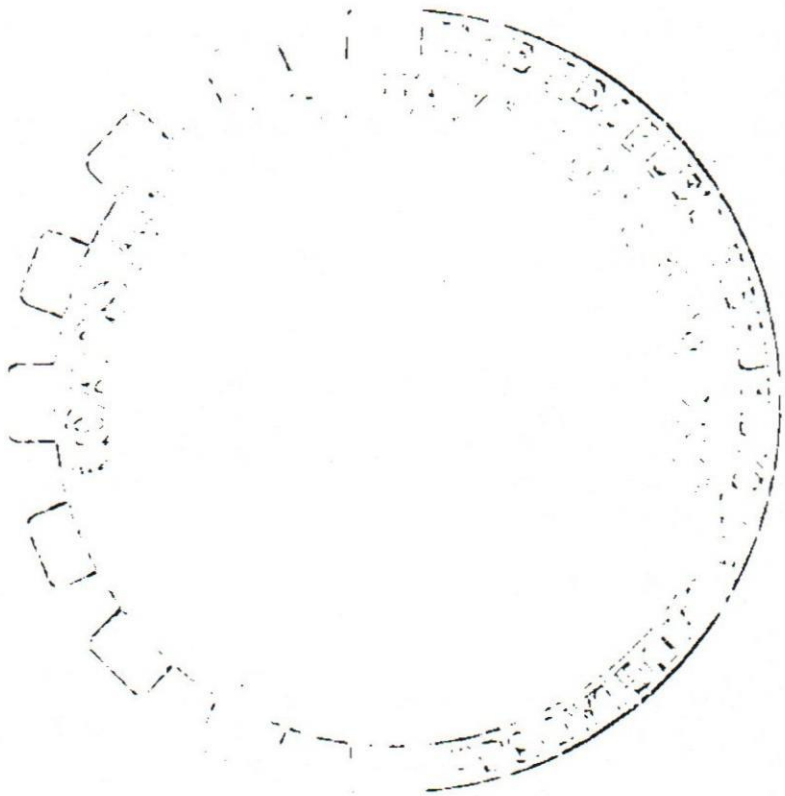
The quantity to be measured shall be the theoretical weight in metric tons of the prestressing steel as shown on the Drawings without sheathings, anchorages etc., and measured between the outer faces of the anchorage blocks.

5.3.5 Payment

The work measured as provided above shall include all works as specified including provision of sheathings, anchorages, couplers, spirals, supports for the tendons, tensioning, grouting and finishing works.

Pay item shall be:

05/03/01	Prestressing Wire or Strand as detailed on the Drawings and as stated in the Bill of Quantities.	Tonne



5.4 EXISTING CONCRETE

5.4.1 Description

This work shall consist of the construction of small extensions; reconstruction of localised defective concrete; rehabilitation of existing concrete facing; reinforcing, anchoring, tying and nominal stressing together of concrete elements; ground anchors; and sealing and treatment of structural cracks in various forms of members, all in accordance with these Specifications and the lines, levels, grades, dimensions and locations shown on the Drawings and as required by the Engineer.

5.4.2 Materials

5.4.2.1 Concrete

Concrete shall comply with the requirements of Section 5.1 of these Specifications.

5.4.2.2 Reinforcement

Reinforcement shall comply with the requirements of Section 5.2 of these Specifications.

5.4.2.3 Prestressing Reinforcement

Prestressing reinforcement shall comply with the requirements of Section 5.3 of these Specifications.

5.4.2.4 Cement Grout and Mortar

Cement grout and mortar shall comply with the requirements of Section 5.1 of these Specifications.

5.4.2.5 Resin Repair Mortars

Epoxy resins, unsaturated reactive polyester resins or unsaturated acrylic resins specified on the Drawings and detailed in the Bill of Quantities shall conform to the requirements of the Manufacturers recommendations or other suitable alternatives, subject to the approval of the Engineer, where it can be demonstrated that the proposed alternatives are at least equivalent to the materials proposed.

5.4.3 Construction Methods

5.4.3.1 General

The Contractor shall in due time and as soon as possible present and discuss his construction proposals and work programmes for nominal extensions to existing concrete structures; for implementing repairs to existing structural cracks in concrete structure; for implementing repairs to existing concrete surfaces and for the rehabilitation of existing defective concrete.

The details of Works shall cover the requirements specified on the Drawings and as directed by the Engineer at each location. The scope of new Works shall be as confirmed by the Engineer. The precise extent of all concrete extensions or repairs shall be jointly surveyed by the Contractor and the Engineer at the commencement of the Works and the locations of all extensions, repairs or strengthenings shall be recorded and carefully marked in paint on each structures to permanently identify the Works to be implemented.

In locations where existing concrete sections are to be extended or joined, the existing concrete shall be carefully broken back at the locations where sections are to be joined. The breaking will be done to ensure the damage to existing concrete is the absolute minimum. Sufficient concrete will be removed to expose where appropriate the reinforcement of the

existing section. Sufficient reinforcement will be exposed to enable additional reinforcement to be lapped to the existing steel. The reinforcement will be carefully cleaned and all loose concrete shall be removed. The existing concrete will be cleaned of all dust and a construction joint shall be prepared accordingly on the exposed face to ensure a good feature can be obtained between the new work and the existing concrete section. Concrete and reinforcement for the construction of the new section shall conform in all respects to Sections 5.1 and 5.2 respectively.

Defective concrete on the front face of substructure walls such as piers, abutments etc., particularly adjacent to the water line; and in soffits to beams, slabs and other superstructures; on the wet faces of main beams and other superstructures shall be carefully removed in a sequence and in accordance with the strict instructions of the Engineer. Such works shall be permanently supervised by a technical representative of the Engineer and the Contractor shall also ensure technical staff are permanently available on the Site to receive specific instructions. The existing structural integrity of existing members shall not be impaired during this operation and the Contractor shall be fully responsible for ensuring strict procedures are followed. Defective concrete on main structural members shall be carefully and cleanly removed by manual methods using hammers and chisels to expose the main and secondary reinforcement. This reinforcement shall be carefully cleaned using wire brushes unless the Engineer gives alternative instructions. The concrete shall also be carefully broken back and the surface shall be cleaned of all dust and loose material. The removed defective concrete shall be replaced by a method proposed by the Contractor that shall be subject to the approval of the Engineer. In this respect, the Contractor shall propose and clearly demonstrate that the method he proposes to adopt is capable of giving a guaranteed facing of concrete that would be equivalent in all respects to the workmanship standards that would be accepted in new works. Depending on the extent of the repair works, sprayed concrete or gunite will be allowed provided acceptable procedures are proposed. Traditional formwork methods with "letter boxes" will also be allowed for large volume repairs.

Strategic structural cracks on highly stressed structural members such as shear cracks at scarf joints or shear cracks in beam webs shall be sealed by resin repair mortars. The Contractor shall ensure temporary access is provided to effectively implement critical repairs. The final decision of the repair resin will be made on completion of the inspection immediately prior to undertaking the sealing operation. Initially, cracks will be cleaned of all dust and debris in accordance with manufacturers recommendations once the resin to be adopted has been identified. Depending on the method to be adopted, nipples shall be inserted along the cracks or vacuum impregnation procedures shall be prepared to enable grout to be effectively injected into the structural cracks. The Engineer shall assess the effectiveness of crack repairs, generally on the basis of the quantity of resin injected.

Structural concrete members that exhibit cracking and relative movement may be anchored or tied in accordance with the Engineer's instructions. Wingwalls and abutments shall be tied and anchored at the locations and to the details indicated on the Drawings and as specified in the Bill of Quantities. Prior to commencing any of the work, the Contractor shall obtain the approval of the Engineer of the methods to be adopted for all temporary arrangements. This shall cover the provision of temporary stages; the proposed drilling methods; proposed safety measures; proposed anchoring methods and subsequent testing for ground anchors to ensure tie bars are capable of carrying twice working load; proposed stressing methods and ultimate grouting of anchor bars. The Contractor shall take instructions from the Engineer on the precise requirements for the provision, installation and anchoring of all tie bars incorporated in the Works.

5.4.3.2 Workmanship

Repairs and the like to existing concrete shall be constructed as shown on the Drawings or as may be required, by skilled and experienced personnel well versed in this type of work. The Contractor shall clearly demonstrate that his workforce proposed to be used on concrete repair works have a capability to complete this form of work to a satisfactory standard. Such demonstrations may take the form of pilot repair works not directly associated with the Works.

5.4.4 Measurement

Concrete Extensions and Repairs shall be measured in either cubic metres or square metres depending on the form of work ordered, placed and accepted. In computing quantities, the dimensions of concrete extensions where appropriately shown on the Drawings for new work and extensions shall be used as the basis for measurement. Remedial repairs of defective concrete facework and replacement of defective concrete shall be measured by the area of square metres ordered, marked up and accepted. The sealing of cracks with resin repair mortars shall be measured by the weight of resin used in the injection process of cracks ordered to be repaired, marked up and accepted. The sealing of cracks with cement mortar shall be measured by the cumulative length of cracks ordered to be repaired, marked up and accepted. The provision of tie bars and ground anchors, and installation (including fixing, drilling, grouting in stages, stressing etc.) shall be measured by the weight of bar ordered, installed and accepted.

No incidental works necessary to perform the repair works shall be measured; the Contractor shall include in the payment items for all necessary temporary works to undertake and complete every operation.

5.4.5 Payment

The Work measured as provided above shall be paid for at the Contract unit prices per cubic metre of concrete or square metre of concrete refacing. Resins used in cracks shall be paid for at the Contract unit prices per kg of material used. Anchor and tie bars shall be paid for at the Contract unit prices per tonne of bar used. Concrete cracks filled with cement mortar shall be paid for at the Contract unit prices per length of crack required. The rates shall be fully inclusive of all cost of all labour and materials temporary works and equipment to complete the works in a professional manner.

Pay items shall be:

05/04/01	Modifications to Existing Concrete as Detailed on the Drawings and as stated in the Bill of Quantities	Cubic Metre
05/04/02	Concrete Surface Repair Works (Superstructures)	Square Metre
05/04/03	Concrete Surface Repair Works (Substructures)	Square Metre
05/04/04	Resin Repair Mortars	Kg
05/04/05	Cement Mortar in Cracks	Linear Metre
05/04/06	Anchor and Tie Bars	Tonne

5.5 BRICKWORK

5.5.1 Description

This work shall consist of the construction, reconstruction, rehabilitation, facework repairs and repointing of brickwork structures, also the construction of brick drainage layers, in accordance with these Specifications and the lines, levels, grades, dimensions and locations shown on the Drawings or as required by the Engineer.

5.5.2 Materials

5.5.2.1 Specifications for Materials

A) Bricks

First class bricks shall be made from good brick earth, free from saline deposits, and shall be sand-moulded. 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 kankar and other blemishes. A first class brick shall not absorb more than 1/6th of its weight of water after being soaked for one hour, and shall show no sign of efflorescence on drying. First class bricks not meeting these requirements shall not be used under any circumstances.

Jhama bricks are those which are so overburnt as to become vitrified or distorted, so as to be unsuitable for exact brickwork. Jhama bricks may be broken and used for aggregate in roadworks provided the vitrified mass has not become porous or spongy as a result of overburning and the aggregate satisfies the requirements of these Specifications.

Perforated bricks should be of uniform size and colour with sharp edges, square and parallel faces and have a standard number of perforations. They must be standard commercial products of approved manufactures and shall be approved by the Engineer.

Machine made pressed bricks shall be of the size shown on the Drawings and shall be standard commercial products of approved manufacturers. The use of machine made pressed bricks shall be approved by the Engineer prior to use in the Works.

First class bricks should have the following dimensions after burning: 242 mm x 115 mm x 70 mm. Picked Jhama bricks may have dimensions slightly below those for other brick but not less than 235 mm x 110 mm x 70 mm. The unit weight determined in accordance with STP 7.8.3 of 1st class bricks shall not be less than 1,100 kg/m^3 and the unit weight of Jhama bricks shall not be less than 1,200 kg/m^3.

The crushing strength of bricks shall be tested in accordance with STP 7.8.4. The average crushing strength of first class bricks shall not be less than 17 N/mm^2. The average crushing strength of Jhama Bricks shall not be less than 20 N/mm^2.

B) Cement

Cement shall be as specified in Section 5.1.

C) Fine Aggregate

Fine aggregate shall be as specified in Section 5.1. The fineness modulus of sand shall not be less than 1.50.

D) Water

Water shall be as specified in Section 5.1.

E) Steel Reinforcement in Anchors

Steel and anchorages shall be as specified in Sections 5.2 and 5.3.

5.5.2.2 Specifications for Mortar

Cement mortar shall consist of a mixture of one part by weight of cement to two parts by weight of sand. The cement and sand shall be mixed dry and in the specified proportion until the colour of the mixture is uniform. Approved 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 50% by weight, or as directed by the Engineer. The mixing shall be done on a clean board or platform with tied joints, to avoid leakage. At the close of each days work the mixing trough and pans shall be thoroughly cleaned. Cement mortar shall be mixed in such quantities as can be used in the work within 30 minutes. Mortar, which has taken initial set, shall not be used nor shall it be remixed with fresh mortar and such mortar shall be discarded and removed from the working site.

5.5.3 Construction Methods

1.1.1.1 General

The details of Works shall cover the requirements specified on the Drawings or as directed by the Engineer at each location. The scope of new Works shall be as indicated on the Drawings and as confirmed by the Engineer. The precise extent of all brickwork extensions, repairs to defective brickwork, rehabilitation of brickwork and repointing of mortar joints shall be surveyed by the Contractor and the Engineer at the commencement of the Works and the locations of all repairs shall be recorded and carefully marked in paint on each structure to permanently identify the Works to be implemented.

The Contractor shall in due time and as soon as possible present and discuss his construction proposals and work programme for building new brickwork structures; brickwork extensions to existing structures; brickwork repairs to defective bricks and rehabilitation of existing structures; and the repointing of defective joints in existing brickwork.

Excavations for new brickwork extensions such as wingwalls shall be conducted to the requirements of Division 2. Blinding concrete shall be provided in accordance with the requirements of Section 5.1 Brickwork shall be constructed in accordance with the requirements specified hereunder, to the lines and levels on the Drawings and as directed by the Engineer.

Extensions to existing brickwork shall be achieved by the careful removal of existing skin courses as directed by the Engineer to the lines and levels specified and marked in paint. The old brickwork and joints shall be carefully prepared and cleaned to enable new brickwork to be constructed on and adjacent to the old courses.

Defective brickwork in the front faces of abutment walls, particularly adjacent to the water line, and in brick arches shall be carefully removed in a sequence as instructed by the Engineer. The existing stability of walls and arches shall not be impaired during this operation and the Contractor shall be fully responsible for ensuring that temporary supports are provided to guarantee that the full structural integrity of the walls, arches etc. is at all times retained. This may entail the temporary provision of struts and beams to existing arch rings, spandrel walls and retaining walls. The defective brickwork shall all be removed on an incremental basis if this is deemed desirable and new brickwork shall be carefully constructed to guarantee that the structural integrity of the element is returned to its original condition.

Weak and defective mortar in existing brickwork shall be carefully removed from the joints to a depth instructed by the Engineer. The extent of mortar to be removed from existing joints shall also be instructed by the Engineer and shall be marked in point on existing brickwork faces. All joints shall be carefully cleaned prior to repointing with a cement mortar. The composition of the mortar will be as directed by the Engineer and will take into account the existing strength of joints that are not to be repaired. Existing joints shall be repointed in a workmanlike manner to ensure full depth penetration is attained and the finish is trimmed and flush with the face of the brickwork.

Cracks in existing brickwork shall be treated similarly to joints. Defective material shall be carefully removed and the cracks shall be filled with cement mortar.

Tie bars and pattress plates shall be incorporated in accordance with the Drawings or the instructions of the Engineer, where existing brickwork can be effectively anchored to other structural features. Tie bars and pattress plates shall be painted in accordance with the requirements of these Specifications and shall be placed and positioned before brickwork extensions are commenced. This would be specifically appropriate for the strengthening and tying of brick spandrel walls to existing brick arches that are to be either elevated or extended. The anchors to the tie bars should be nominally tightened prior to the construction of the brickwork and subsequently nominally stressed after completion of the structural work and compaction of filling.

5.5.3.2 Workmanship

Brickwork shall be built plumbed, curved or battered as shown on the Drawings or as may be required, by properly supervised skilled masons and workmen. Bricks shall be cleaned and if necessary, they shall be scrubbed. Bricks shall be soaked in water for at least three hours before use.

Where new work joins previous work, the latter shall be well cleaned and thoroughly watered. All facework bricks shall be specially selected regarding size, shape and edges. Unless otherwise specified bricks shall be laid in English Bond, with frogs upward. All horizontal joints shall be parallel and level. Vertical joints in alternate courses shall come directly over one another. Joint thickness shall be 6 mm and shall in no case exceed 8 mm. The height of four courses including 4 bed joints shall rise 300 mm. Walls shall always be carried up regularly along their entire length throughout the structure unless otherwise directed by the Engineer. The brickwork shall be cured for at least seven days. Fixtures such as clamps, pipe brackets etc. shall be provided in the brickwork during execution.

5.5.3.3 Brick Drainage Layers

Brick drainage layers to abutments, wing walls and other structures shall be constructed of "dry-laid" bricks as indicated on the Drawings and with vertical joints not exceeding a width of 10 mm.

5.5.4 Measurement

Brickwork shall be measured by the number of cubic metres that is ordered, placed and accepted. In computing quantities, the dimensions of brickwork shown on the Drawings for new work and extensions shall be used as the basis for measurement. Remedial repairs of defective brick and replacement of defective brickwork shall also be measured by the number of cubic metres ordered as indicated on the Drawings or marked up and accepted. No measurements will be taken on the defective brickwork that it is necessary to remove. The repointing of existing brickwork joints shall be measured by the number of square metres of repointing that is ordered, marked up and accepted. No measurements will be taken on the amount of defective mortar it is necessary to remove.

Tie bars and pattress plates indicated on the Drawings or ordered by the Engineer shall be measured by the Tonne.

No measurements will be taken of any temporary works.

5.5.5 Payment

The work measured as provided above shall be paid for at the Contract unit prices per cubic metre of brickwork or square metre of repointing.

The Contractor's rates shall include for all temporary measures to retain structural adequacy of an existing structure; all preparatory work in breaking out defective brickwork and removal of the same; for mixing mortar; for placing brickwork on/against prepared surfaces to the lines, levels as indicated on the Drawings or as instructed by the Engineer; for finished joints in a neat and professional manner. The Contractor's rates shall be fully inclusive of all cost of labour and materials in providing brickwork with sound mortar joints that will satisfy the structural criteria of the elements of the whole.

The Contractor shall be paid at the Contract unit rate for tie bars and pattress plates installed and accepted.

Pay items shall be:

05/05/01	New and Extended Brickwork	Cubic Metre
05/05/02	Brick Drainage Layer	Cubic Metre
05/05/03	Replacement of Defective Existing Brickwork	Cubic Metre
05/05/04	Repointing of Existing Brickwork Joints	Square Metre
05/05/05	Steel Tie Bars and Pattress Plates	Tonne

5.6 PAINTING METAL STRUCTURES

5.6.1 Description

This work shall consist of, unless otherwise provided in the Contract, the preparation of the metal surfaces on existing structures, the application, protection and drying of the paint coatings and the supplying of all tools, tackle, scaffolding, labour and materials necessary for the entire work as shown on the Drawings.

5.6.2 Materials

5.6.2.1 General

All paints to be used for the painting system shall be obtained from one manufacturer. Paint shall be supplied in sealed containers of not more than 5 litres capacity and these shall be used in strict order of delivery. The paint shall be adequate in all respects for the intended purpose and shall be obtained from the manufacturer ready for the use specified.

Paint shall be stored in sealed containers in a lock-up store where it is not exposed to extreme temperature. Any special storage conditions recommended by the manufacturer shall be observed.

Paint not used within the shelf life period specified on the containers, or within 18 months of the date of manufacture, shall be replaced.

At the end of a working period, paint with a limited pot life or any two pack primers etc. shall be discarded. Other types of paint shall be returned to the store and kept in sealed containers.

5.6.2.2 Prime Coat

The prime coat of paint for metal shall be a red lead paint and shall conform to the AASHTO Specification for Red Lead Ready-Mixed Paint, M 72.

Red lead pigment in the dry form or as a paste in oil shall conform to ASTM D 83. The 97% grade shall be specified for dry pigment.

In mixing for paint, raw linseed oil (ASTM D 234) may be replaced with boiled linseed oil (ASTM D 260) to the extent of 50% of the total oil content.

The paint, preferably, shall be factory mixed. As an alternative the pigment shall be furnished in the form of red lead paste.

5.6.2.3 Undercoat

The undercoat shall be red lead paint as specified above, tinted light brown with lamp black in an amount not exceeding 1/32 kilogram per litre of linseed oil. Dry film thickness shall be 50 micron.

5.6.2.4 Finish Coat

The finish coat shall be as shown on the Drawings or as specified by the Engineer. It shall conform to one of the following AASHTO Specifications:

1) Foliage Green Bridge Paint M 67

2) Black Bridge Paint M 68

3) Aluminium Paint (Paste-Mixing Vehicle) M 69

4) White and Tinted Ready-Mixed Paint (Lead and Zinc Base) M70

5.6.3 Construction Methods

5.6.3.1 Cleaning of Surfaces

A) General

Surfaces of metal to be painted shall be thoroughly cleaned, removing rust, loose mill scale, dirt, oil or grease and other foreign substances. Unless cleaning is to be done by sand blasting, all weld areas, before cleaning is begun, shall be neutralised with a proper chemical, after which they shall be thoroughly rinsed with water.

Cleaning may be carried out by hand, mechanical means, chemically, sand blasting or by flame cleaning. The method used in any area shall be approved by the Engineer. Methods of cleaning are described as follows. All cleaning shall be approved by the Engineer before the application of any paint.

B) Hand Cleaning

The removal of rust, scale and dirt shall be done by the use of metal brushes, scrapers, chisels, or hammers or other effective means. Oil and grease shall be removed by the use of gasoline or benzene. Bristle or wood fibre brushes shall be used for removing loose dirt.

C) Mechanical Cleaning

Steelwork shall be mechanically cleaned using power driven tools such as carborundum grinding discs, chipping hammers and needle guns, followed by steel wire brushing, washing and dusting to remove all loosened material. Excessive burnishing of the metal through prolonged application of rotary wire brushes shall be avoided. Any visible peaks and ridges produced by the use of mechanical cleaning tools shall be removed.

D) Sandblasting

The sandblasting shall remove all loose mill scale and other substances down to the bare metal. Special attention shall be given to cleaning of corners and re-entrant angles. Before painting, sand adhering to the steel in corners and elsewhere shall be removed. The cleaning shall be approved by the Engineer prior to any painting, which shall be done within 2 hours and before rust forms.

E) Flame Cleaning

Metal shall be flame cleaned in accordance with the following operations:

1) Oil, grease and similar adherent matter shall be removed by washing with a suitable solvent. Excess solvent shall be wiped from the work before proceeding with subsequent operations.

2) The surface to be painted shall be cleaned and dehydrated (free of occluded moisture) by the passage of oxyacetylene flames which shall have an oxygen to acetylene ratio of at least one. The inner cones of these flames shall have a ratio of length to port diameter of at least 8 and shall be not more than 3.7 mm centre to centre. The oxyacetylene flames shall be traversed over the surfaces of the steel in such manner and at such speed that the surfaces are dehydrated; and dirt, rust, loose scale in the form of blisters or scabs, and similar foreign matter are freed by the rapid, intense heating by the flames. The flames shall not be

traversed so slowly that loose scale or other foreign matter is fused to the surface of the steel. The number, arrangement and manipulation of the flames shall be such that all parts of the surfaces to be painted are adequately cleaned and dehydrated.

3) Promptly after the application of the flames, the surfaces of the steel shall be wire brushed, hand scraped wherever necessary, and then swept and dusted to remove all free materials and foreign particles. Compressed air shall not be used for this operation.

4) Paint shall be applied within 2 hours after the steel has been cleaned and while the temperature of the steel is still above that of the surrounding atmosphere, so that there will be no re-condensation of moisture on the cleaned surfaces.

5.6.3.2 Number of Coats and Colour

All steel shall be painted with one prime coat, and with not less than two field coats. The thickness of the prime coat shall not be less than 75 microns and the total thickness of the two field coats shall not be less than 125 microns.

The colour shall be as specified or determined by the Engineer. The coats shall be sufficiently different in colour to permit detection of incomplete application.

5.6.3.3 Weather Conditions

Paint shall not be applied when the air is misty, or when, in the opinion of the Engineer, conditions are otherwise unsatisfactory for the work. It shall not be applied upon damp surfaces.

Material painted under cover in damp weather shall remain under cover until dry or until weather conditions permit its exposure in the open. Painting shall not be done when the metal is hot enough to cause the paint to blister and produce a porous paint film.

5.6.3.4 Mixing of Paint

Paint shall be factory mixed. All paint shall be re mixed before applying in order to keep the pigments in uniform suspension.

5.6.3.5 Application

A) General

Painting shall be done in a neat and workmanlike manner. Paint may be applied with hand brushes or by spraying except that aluminum paint preferably shall be applied by spraying. By either method, the coating of paint applied shall be smoothly and uniformly spread so that no excess paint collects at any point. If work done by spraying is not satisfactory to the Engineer, hand brushing shall be required.

B) Brushing

When brushes are used, the paint shall be so manipulated under the brush as to produce a smooth, uniform, even coating in close contact with the metal or with previously applied paint, and shall be worked into all corners and crevices.

On all services, which are inaccessible for paint brushes, the paint shall be applied by spraying or applied with sheepskin daubers, to ensure thorough covering.

C) Spraying

Power spraying equipment shall apply the paint in a fine, even spray without the addition of any thinner. Paint, when applied with spray equipment, shall be immediately followed by brushing when necessary to secure uniform coverage and to eliminate wrinkling, blistering and airholes.

D) Removal of Paint

If the painting is unsatisfactory to the Engineer, the paint shall be removed and the metal thoroughly cleaned and repainted.

E) Thinning Paint

Paint as delivered in containers when thoroughly mixed is ready for use. If it is necessary to thin the paint in order that it shall spread more freely, this shall be done only by heating in hot water or on steam radiators, and liquid shall not be added nor removed unless permitted by the Engineer.

5.6.3.6 Painting Galvanised Surfaces

Galvanised surfaces, which are required to be painted, shall first be treated as follows:

For the purpose of conditioning the surface of galvanised surfaces for painting, the painting shall be deferred as long as possible in order that the surface may weather. Before painting galvanised surfaces they shall be treated as follows:

In 1 gallon of soft water dissolve 2 ounces each of copper chloride, copper nitrate, and sal ammoniac, then add 2 ounces of commercial muriatic acid. This should be done in an earthen or glass vessel, never in tin or other metal receptacle. Apply the solution with a wide flat brush to the galvanised surface, after which it will assume a dark, almost black, colour, which on drying becomes a greyish film.

The Contractor may propose any alternative process as a method of treatment subject to the approval of the Engineer.

5.6.4 Measurement

The quantity of work done under this section shall be measured in square metres to include all painting required on each structure or structural unit.

5.6.5 Payment

Payment will be made for the work, materials, labour and equipment as detailed on the Drawings and as specified in the Bill of Quantities.

Pay item shall be:

05/06/01	Preparation and Painting of Existing Structures as Detailed on the Drawings and as stated in the Bill of Quantities.	Square Metre

5.7 BRIDGE STEELWORK

5.7.1 Description

This work shall consist of the carriage of unit bridging, steel beams and other items of bridge steelwork and ancillaries from a port to the bridge site, storage on site and installation/erection in accordance with the manufacturer's standard procedures or as shown on the Drawings.

Elastomeric bearings for composite bridge construction, materials for temporary works and other ancillary materials shall be provided by the Contractor.

5.7.2 Materials

Materials provided to the Contractor shall be collected by him from the port. The Contractor shall meet any demurrage costs at the port arising from his failure to provide the requisite loading equipment and/or transport. The Contractor shall exercise great care in loading, transporting, unloading, storing and installation/erection of all components. Any damage shall be repaired by the Contractor at his expense and to the satisfaction of the Engineer. If any component is damaged beyond repair, the Contractor shall bear all direct and indirect costs associated with replacement. Similarly, the Contractor shall make good any shortfall due to loss or theft.

The Contractor shall submit detailed proposals of elastomeric bearings for composite bridges to the Engineer, for approval, prior to procurement. The proposals shall be based on the design requirements and dimensions indicated on the Drawings.

Other materials for the permanent works provided by the Contractor shall be of the quality and type shown on the Drawings, subject to the approval of the Engineer.

5.7.3 Construction Methods

5.7.3.1 Unit Bridging

Unit bridging shall be assembled and installed by the Contractor in accordance with the standard procedures provided by the manufacturer. Bearings for unit bridging shall be installed in accordance with the Drawings and the manufacturer's instructions.

The method of erection shall be subject to the approval of the Engineer.

If the bridging is to be erected by cantilevering, the Contractor will be responsible for providing any necessary kentledge, rails for access and any other materials required for temporary works.

If the bridging is to be erected in position on wooden bullah trestles, these shall be designed and constructed to provide the necessary rigidity and to support the loads without settlement or deformation. The Contractor shall submit detailed drawings and designs for the proposed trestles and falseworks to the Engineer for his approval. The Engineer's approval shall not however relieve the Contractor of his responsibility for ensuring the adequacy of his proposals and for the successful erection of the bridging.

When bridge parapet steelwork consisting of posts and barrier is provided with unit bridging, the fixing to reinforced concrete deck slabs shall be in accordance with the manufacturer's recommendations. The Contractor shall however submit his proposals for installation to the Engineer, for approval, prior to installation.

5.7.3.2 Steel Beams for Composite Bridges
The Contractor shall submit proposals for the installation of elastomeric bearings and steel beams as shown on the Drawings to the Engineer for approval.

5.7.4 Measurement

Carriage of unit bridging, steel beams and other items of bridge steelwork and ancillaries from the port to site shall be measured by the tonne.

The fixing of bearings for unit bridging which are supplied to the Contractor shall be measured by number. The supply and fixing of elastomeric bearings for composite bridge construction shall be measured by number.

The assembly and installation of unit bridging shall be measured by the linear metre of bridge. Parapet steelwork fixed to reinforced concrete deck slabs shall be measured by the linear metre of parapet.

The installation of steel beams for composite bridge construction shall be measured by the tonne.

5.7.5 Payment

Payment for carriage of bridge steelwork and ancillary items shall include for all materials, labour and equipment for loading at the port, transporting and unloading at the site.

Payment for the fixing of bearings for unit bridging and the supply and fixing of elastomeric bearings for composite bridge construction shall include the provision of all additional materials such as shims and mortar and the provision of all labour and incidentals to complete the work.

The Contractor's rates for the assembly and installation of unit bridging and steel parapet shall include all labour, temporary works and equipment required to complete the work.

The Contractor's rate for the installation of steel beams and ancillary steelwork items for composite bridge construction shall include all labour, temporary works and equipment required to complete the work.

Pay items shall be:

05/07/01	Carriage of Bridge Steelwork from Port to Site	Tonne
05/07/02	Fixing of Bearings for Unit Bridging	Number
05/07/03	Supply and Fixing of Elastomeric Bearings for Composite Bridge Construction	Number
05/07/04	Assembly and Installation of Unit Bridging	Linear Metre
05/07/05	Installation of Steelwork for Composite Bridge Construction	Tonne
05/07/06	Installation of Steel Post and Barrier Parapet to Reinforced Concrete Deck Slab	Linear Metre

5.8 movement JOINTS

5.8.1 Description

This work shall consist of furnishing and installation of materials for expansion joints in reinforced concrete structures and the furnishing and installation of fabricated bridge deck joints.

All expansion joints shall be products which have a proven successful performance record. The contractor shall submit for the approval of the engineer full details of the proposed joints. This shall include lists of projects in which the proposed product has been incorporated in similar structures and climatic conditions. The contractor shall submit substantiating information on previously installed units of the same type supporting the durability and periods free of maintenance claimed by the manufacturer.

The Design of the joint system shall facilitate inspection and replacement. Epoxy nosing joints shall not be permitted.

a) The Contractor shall furnish and install bridge deck expansion joints and accessories as shown on the Drawings or directed by the Engineer. The accessories shall include bold assemblies, welding, metal work, elastomers and sealants as required.

b) Should the proposed deck joints require changes to the basic concrete outline of the bridge decks, the Contractor shall also submit all relevant details to the Engineer for approval.

c) Grout or dry pack concrete for metalwork shall be mixed in the proportions and to the consistency approved by the Engineer. The Contractor shall furnish all cement and fine aggregate for grout of dry pack complying with the requirements of Section-5.1.2.1 (A) and Section-5.1.2.1(D). The cost of all work in connection with the grouting or dry packing operations and the cost of the cement and fine aggregate for grout shall be included in the rates tendered in the Bill of Quantities for furnishing and installing the various items of metal work for which the grout or dry pack is required. Before placing grout of dry pack, the surfaces of existing concrete on which the grout or dry pack will be placed shall be roughened and shall be cleaned of all laitance, loose or defective concrete, coatings and other foreign material by effective means followed by thorough washing. Such surfaces shall be kept moist immediately prior to the placing of the grout of dry pack.

5.8.2 Materials

5.8.2.1 Expansion Joints

The materials for expansion joints will be as detailed on the Drawings. Typically these will include compressible joint filler board, dowel bars and two part polysulphide sealant. Ancillary materials necessary for use with polysulphide sealant, such as primer and bond breaker tape shall be provided in accordance with the sealant manufacturer's recommendations. The Contractor shall obtain the Engineer's approval of all proposed materials prior to procurement.

5.8.2.2 Bridge Deck Joints

These shall be fabricated in accordance with the details shown on the Drawings. The Contractor shall obtain the Engineer's approval of any fillers and paints necessary to complete the joints, prior to procurement.

5.8.2.3 Joint Performance Requirements

a) The joints shall be completely watertight. Special attention shall be paid to the detailing to ensure full water tightness at the faces of the parapets.

b) All metal work shall be galvanized in accordance with Standard Drawing.

c) The movement capacity of deck expansion joints shall be as shown on the Drawings.

5.8.2.4 Storage of Materials and Protection against Corrosion

The Contractor shall propose the corrosion protection system for components of movement joints, full details of which shall be submitted for the approval of the Engineer. All materials for movement joints delivered to site shall be stored under cover, on platforms above the surface of the ground, to the satisfaction of the Engineer. They shall be kept free from dirt, oil, grease and other foreign substances. Any materials unused prior to the manufacturer's "use by" date shall be removed from site by the Contractor, unless written approval to the contrary is obtained from the Engineer.

5.8.2.5 Construction Methods

All materials and fabrications shall be installed in accordance with details shown on the Drawings and where applicable, in accordance with the manufacturer's instructions and recommendations. The joint gap and pre-setting to suit ambient temperatures at the time of installation shall be as directed by the Engineer.

a) Not less than 30 days prior to placing an order for a proprietary joint, of 60 days before commencing installation of the deck joints, the Contractor shall submit for approval, complete shop drawing showing details of fabrication and installation.

b) Expansion deck joints as shown on the Drawings have been located on the bridge decks showing the longitudinal movement in the bridge decks due to shrinkage, creep and thermal effects in either the precast beams or the concrete deck slab as zero. The Contractor shall take into account at the time of installation of the deck joints the actual movement that has taken place in the bridge deck and shall take such measures as directed by the Engineer to ensure that the deck joint openings as installed are satisfactory.

c) Joints shall be of uniform width and shall be accurately set, finished and aligned flush with the finished carriageway level to provide a smooth ride free from tyre slap and impact loading, all to the satisfaction of the Engineer.

5.8.2.6 Measurement

Expansion joint shall be measured by the linear meter of complete joint installed, measurement being along a straight line from base to top of a wall or one side of a slab to the other, etc. The measured length may therefore include a sealant length of over twice this value if several faces of the concrete are sealed.

Bridge deck joints shall be measured by the linear meter of joint installed.

5.8.2.7 Payment

Expansion joints measured in accordance with section 2.6 shall be paid for at the contract unit prices for providing joints in the locations indicated on the Drawing and described in the Bill of Quantities. Payment shall be full compensation for furnishing and installing all materials, including all labor, tools, equipment and incidentals necessary to complete the work.

Bridge deck joints measured in accordance with Section 2.6 shall be paid for at the Contract unit price. Payment shall be full compensation for furnishing all materials, fabrication either on or off site and labor, tools, equipment and incidentals necessary to complete the work shown on the Drawings.

Pay items shall be:

5/8/1	Expansion Joint Complete as Detailed on the Drawings in the Location Described in the bill of Quantities	Linear Meter
5/8/2	Bridge Deck Joint Complete as Detailed on the Drawings	Linear Meter

Materials shall comply with the following or equivalent as agreed with the Engineer:

a)	Structural Steel	- BS4360
b)	Fixing to Bridge Structure	- HSFG bolts to BS 4395
c)	Elastomer	- similar to elastomeric bridge bearing

Exposed steel plate shall have a 2 mm non-skid surface coating in accordance with the manufacturer's recommendations, details of which shall be submitted to the Engineer.

5.9 DRAINAGE OF STRUCTURES

5.9.1 Description

This work consists of furnishing and erection of drain outlets on bridge decks and drainage of other structures including PVC piping, cleaning boxes, catch basins, concrete drains, erosion protection, inserts, fittings and other incidental parts necessary to provide for further supports of drain pipes in accordance with the lines, levels, grades, sizes, dimensions and types shown on the Drawings.

5.9.2 Materials

5.9.2.1 Bridge Gullies
The size and strength of bridge gullies shall be as indicated on the Drawings.

5.9.2.2 Cast Iron Piping
Cast Iron Piping shall comply with AASHTO Standard Specification M129 or other approved standards.

5.9.2.3 PVC Pipes
All PVC pipes shall comply with ISO R 161 "Pipes of Plastic Materials for the Transport of Fluids", or with BS 3505 "Unplasticised PVC Pipes for Cold Water Services".

5.9.2.4 Cleaning Boxes
The Contractor shall submit to the Engineer for his approval details of boxes with cleaning lids made of approved material to be installed in the locations indicated on the Drawings.

5.9.2.5 Catch Basins
To comply with Section 6.3 of these Specifications.

5.9.2.6 Culvert Pipes
To comply with Section 6.2 of these Specifications.

5.9.2.7 Inserts
Inserts shall be made of steel conforming to AASHTO Standard Specification M 183 (ASTM A 36).

5.9.2.8 Fittings and Other Incidentals
Materials to be as indicated on the Drawings or as approved by the Engineer.

5.9.3 Construction Methods

5.9.3.1 Storage and Handling of Materials

The steel and PVC parts shall be carefully handled and stored under cover on blocking, racks or platforms so as not to be in contact with the ground and the steel parts shall be protected from corrosion. Materials shall be kept free from dirt, oil, grease and other foreign matter.

5.9.3.2 Bridge Gullies

Bridge gullies are to be cast into the structure at the location as indicated on the Drawings. Special care must be taken to avoid displacement of gullies during concreting operations.

5.9.3.3 Cast Iron Piping

Special jointing instructions relevant to the purchased types of pipe will be issued by the Engineer. The pipes shall be embedded in the locations as indicated on the Drawings. During casting of concrete the piping shall be kept in the correct position by means approved by the Engineer.

5.9.3.4 PVC Pipes

The jointing shall be of a type recommended by the manufacturer of the pipes. Bends shall be of long sweep, free from kinks. Embedded pipes shall be cast into the structure in the locations as indicated on the Drawings. During casting of concrete the piping shall be kept in the correct position by means approved by the Engineer.

Exposed pipes shall be parallel to or at right angles to walls, slabs and girders. All exposed pipes shall be attached to concrete, steel, masonry or timber by galvanised malleable iron or galvanised steel straps, clamps or hangers of an approved type, held at not less than two points by galvanised steel bolts or lag screws. The runs shall be supported at not greater than 1 metre centres on horizontal or near horizontal runs, unless otherwise specified and not less than 50 mm clear of the supporting members.

All ends of pipes installed during construction shall be closed against the intrusion of foreign material.

5.9.3.5 Cleaning Boxes

To be installed by methods proposed by the Contractor and approved by the Engineer.

5.9.3.6 Catch Basins

To comply with Section 6.3 of these Specifications.

5.9.3.7 Culvert Pipes

To comply with Section 6.2 of these Specifications.

5.9.3.8 Weep Holes

While constructing abutment, wing wall and return wall weep holes shall be provided therein unless shown otherwise in the relevant drawings and filter layer approximately 1m wide right up against the wall to its full height shall be provided. Unless otherwise shown the weep holes shall be of concrete pipe of 100 mm diameter and shall extend through the full width of the wall with slope of about 1 vertical to 20 horizontal towards the drawing face. The spacing of weep holes shall be generally 1.5 m in either direction and shall be staggered. The lowest ones shall be located at about 300 mm above the low water level or ground level whichever is higher, or as directed by the Engineer. In general, one weep hole per 1.5 square metre of vertical surface shall be provided.

5.9.3.9 Inserts

To comply with Section 5.10 of these Specifications.

5.9.4 Measurement

The individual items shall not be measured and will be paid for as a lump sum.

5.9.5 Payment

Drainage work to a particular structure or to several structures, as defined in the Bill of Quantities, will be paid for at the Contract lump sum price.

The price and payment shall constitute full compensation for furnishing all materials as indicated on the Drawings including delivery, erection, surface treatment and finishing and for all labour, equipment, tools and incidentals necessary for the completion of the work.

The payment of Catch Basins and Culvert Pipes shall be paid within Sections 6.3 and 6.2 respectively.

Pay item shall be:

05/09/01	Provision and fixing of drainage to structure(s) as detailed on the Drawings and defined in the Bill of Quantities	Lump Sum

5.10 INSERTS AND FITTINGS IN STRUCTURES

5.10.1 Description

This work consists of furnishing and embedding of inserts, fittings and other incidental parts into bridgeworks necessary to provide for further supports for utility pipes and cables and the like. The type, size and location will be indicated on the Drawings, or instructed by the Engineer.

5.10.2 Materials

Unless otherwise indicated on the Drawings, the inserts shall be made of steel conforming to AASHTO Standard Specification M 183 (ASTM A 36). Material to be as indicated on the Drawings or as approved by the Engineer.

5.10.3 Construction Methods

The inserts and fittings shall be embedded at the locations indicated on the Drawings or as instructed by the Engineer. During casting of concrete in structures, the inserts and fittings shall be kept in the correct position by means approved by the Engineer.

The inserts and fittings shall be plugged or pressed against the formwork in a way that no mortar from the concrete may enter the thread of the inserts or fittings.

After removal of the formwork, the Contractor shall clean the surface of the insert and fittings to the approval of the Engineer.

5.10.4 Measurement

The individual items shall not be measured and will be paid for as a lump sum.

5.10.5 Payment

This work will be paid for at the Contract lump sum price, which shall be fully inclusive of all working drawings, materials, installation including labour, equipment, tools and incidentals necessary to complete the work.

Pay item shall be:

05/10/01	Embedment of Inserts and Fittings	Lump Sum

5.11. BRIDGE BEARINGS (ELASTOMER)

5.11.1 Descriptions

This work shall consist of furnishing and installation of elastomeric bearings. Elastomeric bridge bearing shall be manufactured and furnished in accordance with this Specifications and Drawings and shall be installed at the locations shown on the Drawings or directed.

Throughout this Section the term 'elastomeric bearing' shall refers to a rubber bearing consisting of one or more volcanized natural rubber slabs bonded to metal plates to form a sandwich arrangement and caters for translation and / or rotation of infrastructure by elastic deformation of elastomer.

5.11.2 Materials

5.11.2.1 Elastomer

The raw elastomer shall be vergine neoprene . Natural rubber shall comply with AASHTO M251-92.The elastomer compound whose nominal hardness falls within the ranges of 46-55, 56-65, 66-75are classified as types A,B,C respectively. The elastomer compound shall meet the minimum requirements of table 5.11.2.3 when test specimens are cut from the finished product, the physical properties shall be permitted to vary from those specified in table 5.11.2.3by 10 %

5.11.2.2 Steel Laminates

Steel laminates used for reinforcement shall be made from rolled mild steel conforming to ASTM A36 or A570 , Grade 36 or ASTM A611,Grade40. The laminates shall have a minimum nominal thickness of 16 gage. The steel plates separating the elastomeric layers will be completely bonded by vulcanization to the elastomeric material on all surfaces using special metal to rubber bonding adhesive.

5.11.2.3 Bond

The vulcanized bond between fabric and reinforcement shall have a minimum peel strength of 5.2KN/m . Steel laminated bearings shall develop a minimum peel strength of 6.9 KN/m2. Peel tests shall be performed by ASTMD429 Method B.

Table 5.11.2.3

Test Method	Properties of Elastomer	unit	Type A	Type B	Type C
D2240 D412	Physical Hardness(shore a Durometer) Minimum Tensile Strength Minimum Ultimate Elongation	IRHD N/mm2/MPa	50+5 15.52 400	60+5 15.52 350	70+5 15.52 300
D573	Accelerated Ageing(70 hours at 100 dc +1dc) Maximum Change in Durometer Hardness Maximum change in Tensile strength Maximum change in Ultimate elongation	 IRHD % %	 15 -15 -40	 15 -15 -40	 15 -15 -40
D395 Method B	Compression set 22 Hours @100dc,Maximum	%	35	35	35
D1149	Ozone Resistance Test after 100 hours at 100 pphm ozone in air by volume, 20% strain, 38dc +1dc		No Cracks	No Cracks	No Cracks

5.11.3 Fabrication and Installation

5.11.3.1 General

Bearing with steel laminates shall be casted as a single unit in a mould and vulcanized under heat and pressure. Casting of elements in separate units and subsequent bonding shall not be permitted, nor shall cutting from larger size cast be permitted.

Bearing of similar size to be used in particular bridge shall be produced identical process and in one lot as far as possible. Phased production only resorted to when the total number of bearings is large enough.

The moulds used shall be sand blasted, clean of all mill scales and shall be free from all contaminations prior to bonding by vulcanization. Rusted plates with pitting shall not be used. . All edges of plate shall be rounded.

Spacers used in moulds to ensure cover and location of laminates shall be of maximum size and number practicable. Care shall be taken to ensure uniform vulcanizing conditions and homogeneity of elastomer through the surfaces and body of bearings.

5.11.3.2 Fabrication tolerances

Laminated bearings shall be built to the specified dimensions within the following tolerances and should comply with AASHTO M251-92. ;

1. Overall Height	
Design thickness 32mm or less	-0, +3mm
Design thickness over 32 mm	-0, +6mm
2. Overall horizontal Dimensions	-0, +6mm
3. Thickness of Individual Layers of Elastomer	+/-20% of design value,Max+/- 3mm
4. Edge cover	-0, +3mm
5. Thickness of Top and Bottom cover layer	-0, smaller of 1.5mmand 20% of nominal cover layer thickness
6. Position of Exposed Connection Members	-0, +3mm
7. Parallelism with opposite Face	
Top and Bottom	1 in 200
Sides	1 in 50

5.11.3.3 Permission for fabrication

At least 30 days before manufacture of the bearings is commenced, the Contractor shall submit, for approval, certificates of tests performed on natural rubber to be used in the bearings. The tests shall be in accordance with AASHTO M251-92.

Manufacture of the bearings shall not commence until the Contractor has received preliminary approval of these details.

5.11.3.4 Testing facilities for fabrication

The manufacturer shall have his plant for all the test facilities required for the process and acceptance control tests. The test facilities and their operation shall be open to inspection by the Engineer on demand.Acceptance testing shall be commenced with the prior submittal of testing programme by the manufacturer to the Engineer and after obtaining his approval.

The Contractor shall inform the Engineer at least one month in advance of the date and place of manufacture and test facilities of the bearing. The Contractor shall make necessary arrangement for the Engineer to inspect the manufacturing process of tests. If the place of manufacture or testing is located overseas, the Contractor shall allow the cost for all expenses incurred by two officers nominated by the Employer for the inspection and testing of bearings. The Contractor shall provide the Engineer with all facilities at the places of manufacture and necessary for such inspection.

5.11.3.5 Quality control certificate

A lot under acceptance shall comprise all bearings, including a pair of extra test bearings of equal or nearly equal size produced under identical conditions of manufacture to be supplied for a particular project. The manufacture shall certify for each lot of bearing under acceptance:

- That an adequate system of continuous quality control was operated in his plant
- That the entire process remained in control during the production of the lot of bearings under acceptance as verified from the quality control records /charts which shall be open to inspection of the Engineer on demand.
- A certified copy of results of process control testing done on samples of elastomar used in the production of the lot shall be appended and shall include at least the following information.

Composition of the compound-raw elastomer and ash content, the grade of raw elastomer used (including name, source, age on self).Test results of hardness, tensile strength, elongation at break, compression test, accelerated ageing etc.

An information card giving the details for the bearings duly certified by the manufacturer shall be appended.

The manufacturer of the bearings shall have not less than 5 (five) years successful experience in manufacturing similar type and capacity bearings.

5.11.3.6 Sample Testing of Bearings

a) No bearings shall be installed until tests in accordance with AASHTO M251-92 have been completed by an approved laboratory on randomly selected bearings and the bearings, having achieved all requirements, have been approved.

b) Bearings for testing shall be selected by the Engineer and the Engineer shall be present at any testing. The rate of testing of bearings shall be in accordance:

Bearing	Rate of Testing
Type A	1 in 4

c) Each bearing shall be indelibly marked with white paint with an identifying number as directed by the Engineer on the side. This number shall be the bearing identification number for test certificates.

Any bearing which fails to pass these requirements shall be indelibly marked 'FAILED' and shall not be used in the works. 'FAILED' bearings will not be paid for.

d) Each bearing which passes these tests and complies with this Specification in all other respects shall be indelibly marked 'PASSED'.

e) The Contractor shall submit, for approval, a copy of a test certificate giving test results of the bearings which have passed the tests.

f) Notwithstanding anything to the contrary contained in this Specification, the inspection, examination and testing of bearing samples by the Engineer and any consent to proceed with the manufacture of the bearings resulting from such acts shall not prohibit the Engineer from making further inspection, examination, or tests on the bearings subsequently and rejecting any bearings if shown to be in non-ompliance with this Specification. The Engineer may reject any bearing with flaws or irregularities.

5.11.4 Installation

5.11.4.1 Cement Mortar Bearings pad

The cement mortar shall have a minimum compressive strength at 7 days of 30 MPs and shall be composed of one part of cement to 2 parts of sand, unless otherwise approved. All of the sand used in preparation of the mortar shall pass a 4.75 mm sieve.

Before placing the cement mortar bearing pads, the Contractor shall prepare a trial mix of his proposed cement mortar mixture. The equipment used to make the trial mix shall be the equipment to be used during the Contract.

Three standard 95 mm test cubes shall be cast for compression strength testing and cured for 7 days to the satisfaction of the Engineer. The cubes will be air cured on site in a sheltered location.

The three cubes shall be tested for compressive strength at 7 days and each cube shall have a compressive strength of at least 30 MPa. Construction of the bearing pads shall not be started until the strength of the proposed mix has been approved.

The provision of all necessary equipment and carrying out of the sampling of the mortar, the casting, on-site curing and testing of specimens shall be done by the Contractor at his cost.

5.11.4.2 Bearings

The contractor shall supply, fix in position and maintain the bearings strictly in accordance with the drawings and designs of the contract. Care shall be taken in packing, Transportation, storage and handling to avoid any mechanical damage, contamination with oil, grease and dirt, undue exposure to sunlight and installation of multiple bearings one behind the other on a single line of support shall be of identical dimensions.

Bearings shall be placed between true horizontal surfaces (Maximum tolerance 0.2% perpendicular to load) and a true plan position of their centre lines marked on receiving surfaces (maximum tolerances+/-3mm). The level of the top surface of the elastomeric bearing when installed shall not vary from that shown on the Drawings by more than 3 mm.

Concrete surfaces shall be free from local irregularities (maximum tolerance+/-1mm in height)

If the Cement mortar bearing pads do not meet these tolerances may be repaired by either grinding the surfaces which will be in contact with the bearings to achieve the desired tolerances or by roughening these surfaces and casting a layer of an approved mortar over

the complete surface to a minimum of 3 mm and grinding as necessary. If the above tolerances are not achieved, the Engineer may direct that the bearing pad be removed and replaced by a new pad with the specified tolerances.

For cast in place concrete construction of superstructure, where bearings are installed prior to its concreting the forms around the bearings shall be soft enough for easy removal. Any mortar contamination the bearings during concreting shall be completely removed before setting.

5.11.4.3 Maintenance

After installation routine maintenance, inspection of all bearings shall be made till the expiry of the maintenance period to check for any surface cracking or signs of damage. Damaged bearings shall be replaced immediately. To avoid difference, all adjacent bearings on the same line of support shall also be checked and removed if necessary.

5.11.5 Measurement

Measurement for payment of furnishing and installing elastomeric bearing shall be made of the number of bearings furnished and installed as shown on the Drawings or directed by the Engineer.

5.11.6 Payment

The unit rate for elastomeric bearing shall include all costs of materials, labour, tools and plants, fabrication, testing, installation and maintenance as per drawing etc all complete.

Pay items shall be

05/11/01(a) - Supply and Installation of Elastomeric bearings	- Number
05/11/01(b) - Supply and Installation of Elastomeric bearings	- Number
05/11/01(c) - Supply and Installation of Elastomeric bearings	- Number
05/11/01(d) - Supply and Installation of Elastomeric bearings	- Number

Different Size of Elastromeric bearing as below :
a) 300mm x 400mm x 72mm
b) 400mm x 500mm x 72mm
c) 450mm x 500mm x 72mm
d) 500mm x 500mm x 72mm

Size may differ based on designer requirement.
Size of different type of bearing will be as per approved drawing.

5.12 BRIDGE BEARINGS (POT BEARING)

5.12.1 Description

The work specified in this Sub-Section includes the supply, manufacture and installation of pot type bearings.

5.12.1.1 Design and Applicable Codes

The bearings shall be designed, manufactured and installed in accordance with this specifications and the applicable requirements of the following standard Codes and Specifications:-

Standard specification for Highway Bridges adopted by AASHTO Part I&II.

5.12.1.2 Manufacturers

The bearing manufacturer proposed as supplier for the bearings shall have not less than 5 years successful experience in manufacturing similar type and capacity bearings and shall be subjected to the approval by the Engineer.

5.12.1.3 Substituted Bearings

The contractor may submit alternative pot bearings based on pot bearings of similar design to that shown for consideration and approval by the Engineer provided they comply with the following:-

(a) Equal or better load carrying and movement capacity;
(b) Fabricated by an approved manufacturer;
(c) All control dimensions are maintained ; no change in overall height; bearing must fit within limits of detailed masonry plate;
(d) Use unfilled Polytetrafluoroethylene ;
(e) Use elastomeric material as a confined medium within the pot;
(f) Equal or better than the bearings shown on the drawings in all structural respects.

2.2.2 Materials

5.12.2.1 Metals

(a) Stainless steel :
Stainless steel sliding surface shall either be stainless clad steel plate or solid stainless steel meeting the following requirements;-

(i) Stainless steel clad plate shall conform to the requirements of BS 1449: Part 2. The grade of material for sliding surfaces shall be 316 S16. The backing steel of base metal shall be of Grade 43A to BS 4360. The stainless steel and based metal shall be mill rolled under heat and pressure until they are integrally bonded over their entire interface.

(ii) Solid stainless steel plate shall conform to the requirements of Bs 1449: Part1.

(b) Structural Steel:

Structural steel components of the bearing shall comply with requirements of B5 4360. For pot bearings, the bases pot shall be machined from a solid steel plate.

All ferrous metal (other than stainless steel) shall be fabricated from the grade steel specified above with the additional requirements that the steel shall contain 0.35 to 0.5% copper to enhance its weathering characteristics.

(i) Anchor bolts, Hex Nuts And Washers

Anchor Bolts, Hex Nuts and Washers shall be fabricated from the steel Grade 43 and complying with the requirements of BS 4360 and be sized and threaded in conformance to the requirements of BS 3692 for Anchor Bolts and Hex Nuts and BS 4320 for washers.

(ii) Anchor Bolts, Nuts And Washers

Anchor Bolts, Nuts and Washers shall be galvanized and complying with the requirements of BS 729.

(iii) Countersunk Screws

Countersunk Screws shall be carbon steel (equivalent to alloy 43, BS 4360) cylindrical head cap screws, meeting the applicable requirements of BS 4933.

(iv) End Welded Shear Studs

End Welded shear studs shall be fabricated to the requirements of BS 4360.

5.12.2.2 Poly tetra fluoro ethylene (PTFE)

PTFE resin shall be 100 per cent virgin material meeting the requirements of BS 3784: Grade A.

The composition of filled PTFE shall be such that its coefficient of friction is not more than twice the coefficient of friction of pure PTFE when measured under the same conditions.

(a) Filler material

Filler material, when used, shall be milled glass fibers, carbon or other approved inert filler materials.

(b) Adhesives

Adhesives for bonding PTFE to Backing Plates shall produce a bond with minimum peel strength of 4N/mm width when tested in accordance with BS 5350: Part C9. They shall be resistant to the action of lubricants, atmospheric and biological agents and temperature to which bearing may be subject;

(c) Lubricant

The lubricant used shall retain its properties within the temperature range of -27^0 to + 47 ^{0}C. It shall not change its consistency or affect the constituent parts of the bridge bearings. The lubricant shall have the following properties:-

(i) Worked penetration range of 240 to 280 determined in accordance with BS 5296
(ii) a solidification point < A40 ^{0}C
(iii) a bleeding < 4% when tested in accordance with BS 5297 using 150 ^{0}C for 24 hour.

5.12.2.3 Elastomer

(a) Elastomer material shall be good quality natural rubber complying with the requirements of MS 3.51 SMR 5 Grade or better shall be used. All ingredients shall be uniformly dispersed.

(b) the physical properties of the vulcanized rubber when tested according to BS 903 shall conform to the requirements the following physical properties of rubber.

(c) physical properties of Rubber

The physical properties of the vulcanized rubber when tested according to appropriate standard shall conform to the requirements of Table 2.11 Bearings whose nominal hardness falls within the ranges of 46-55, and 66-75 are classified as types A, B and C respectively and the properties of the vulcanizates shall conform to the requirements of the respective types. However in all cases the hardness of a single size and design of bearings shall be within a maximum range of ±5 IRHD. For the purpose of verifying that the bearings conform to the requirements of this clause, all test specimens of ozone resistance shall be taken from an outside surface of a bearing and all other test specimens shall be taken from and outside and middle third of a bearing.

Table 2.12.2 Physical Properties of Elastomer

		Type A	Type B	Type C	Methods of Tests
1	Nominal Hardness (IRHD)	46 to 55	56to 65	66 to 75	ISO 48
2	Tensile strength (N/sq.mm)min	21	17	14	ISO37
3	Elongation at Break (%), min	550	450	300	ISO37
4	Compression set after 24 hours at 70`c and 25 Compression (%) Max.	30	30	30	ISO 815
5	Ozone resistance test after 96 hours at 25 pphm ozone, 40 °C 20% strain	No visible cracks	No visible cracks	No visible cracks	ISO 1431 Part 1
6	Accelerated ageing for 168 hours at 70 °C				ISO188(air oven)
	6.1) Change in tensile strength (%)	±15	±15	±15	ISO37
	6.2) Change in elongation at break,(%)	A20	A20	A20	ISO48

5.12.2.4 Coal Tar Epoxy

Coal Tar Epoxy shall comply with the requirements of BS5493 Ref Kf 3B.

5.12.2.5 Preformed Fabric Pads

Preformed Fabric Pads shall be compressed of multiple layers of 227 gram cotton duck impregnated and bound with high quality natural rubber or of equivalent and equally suitable materials compressed into resilient pads of uniform thickness the number of splices shall be subs as to produce the specified thickness after compression and vulcanizing. The finished pads shall withstand compression loads perpendicular to the plane of the laminations of not less than 69KN sq.mm without detrimental reduction in thickness of extrusion.

5.12.2.6 Sealing Rings

Sealing rings for containing the confined medium in pot bearings shall meet the following requirements:-

(a) Non-corrosive Materials;
(b) Withstands or transmit all impose loads;
(c) Allow free movement of the piston;
(d) Contains the confined medium within the pot under the maximum static dynamic loading;
(e) Prevents contamination of the confined medium with foreign matter.
(f) Designed to be flushed with the outside surface of the Elastomer to ensure proper sealing.

5.12.2.7 Grouts

Non shrink grouts for setting anchor bolts shall be of an approved quality and tested in accordance with the requirements of BS 1881,BS 4550, BS4551 and BS 5075: Part 2.

5.12.3 Design Requirements
Design parameters shall comply with the following requirements:-

5.12.3.1 Elastomeric Disc
The maximum design compressive stress shall be 40 N/sq.mm.

5.12.3.2 Sliding Surfaces

Sliding surface shall accommodate translation by sliding of a hard mating surface of stainless steel across a PTFE surface.

(a) Stainless steel
Stainless steel sliding surface shall be accurate, flat surface with Brinnell hardness of 125 minimum it shall comply with the following requirements

(i) Stainless steel sliding surface shall completely cover the PTFE surface in all operating positions of the bearing.
(ii) Stainless steel sliding surface shall be positioned so that the sliding movement causes the dirt and dust accumulation to fall from the surface of the stainless steel without contaminating the PTFE.

(b) PTFE Sliding Surface
Holes in PTFE sliding surface shall not be permitted.

(c) Coefficient of Friction
Unless otherwise specified the minimum coefficient of friction used in the design shall be as Table 5.12.

Table 5.12-1 Coefficient of Friction for Sliding

Bearing stress (N/sq.mm)	Coefficient of Friction
5	0.08
10	0.06
20	0.04
30 and over	0.03

5.12.3.3 Rotation
The rotation of pot bearings about a horizontal axis shall not exceed 0.15.

5.12.3.4 Movement
The pot bearings shall accommodate the expansion and contraction movements, as shown on the Drawings.

5.12 .3.5 Welding
Welding to steel plate has a bonded PTFE surface may be permitted provided welding procedures are established which restrict the maximum temperature reached by the bond area to less than 1500 (as determined by temperature indication wax pencils or other suitable means approved by the Engineer)

5.12.3.6 Submission of shop drawings
The Contractor shall, before the fabrication of any bearings, submit shop drawings to the Engineer for approval the shop drawings shall include

(a) Plan and elevation of the bearing ;
(b) Complete details and sections showing all materials incorporated with the bearing ;
(c) All BS, ASTM or other material designations;
(d) Vertical and horizontal load capacity;
(e) Rotation and translation capacity;
(f) Compression stress on all sliding surfaces, as well as on the surfaces of the confines medium, at maximum and minimum design loads;
(g) Complete design calculations to demonstrate compliance with the specification;
(h) Details of corrosion properties to metal components;
(i) Details of fixing to both the superstructure and the substructure;
(j) Method of installation;
(k) All other information requires by the Engineer to facilitate his consideration the contractor's proposal.

The Contractor's submission shall be made at least one month prior to the date by which approval of his proposals is required. The contractor shall be responsible for ensuring that sufficient time is allowed for the submission and approval of his proposals; and for the testing and delivery of the bearings, to avoid delaying the works.

5.12.4 Certifications

The Contractor shall furnish Certified Test Reports, Material Certificates and a Certificates of Compliance for each bearing in accordance with the Engineer's instructions.

5.12.5 Fabrication

5.12.5.1 PTFE

(a) Bonded PTFE

The surface of PTFE to be bonded shall be prepared for bonding in accordance with B5 5350: Part A1. The minimum bond strength between the PTFE and its backing plate, when tested in accordance with BS 5350: Part C9, shall be 4N/mm width

(b) Confined PTFE shall be recessed into metal backing plate. The shoulders of the recess shall be sharp and secure to restrict the flow of PTFE. The thickness of the PTFE and its protrusion from the recess shall be related to its maximum plan dimension in accordance with Table 5.12.1

Table 5.12.5.1:Thickness and Protrusion of PTPE

Maximum dimension of PTFE (diameter or diagonal) (mm)	Minimum Thickness (mm)	Maximum projection above recess (mm)
<600	4.5	2.0
>600, <1200	5.0	2.5
>1200, <1500	6.0	3.0

5.12.5.2. Bolts and Bolt Holes

Bolt holes shall be drilled or reamed. Where specified by the Engineer, bolts or screw shall be of a vibration resistant type. Taper washers of the correct angle of taper shall be provided under all heads and nuts bearing on beveled surfaces.

5.12.5.3 Welding

(a) General
Welding procedure shall be as such as to minimise distortion of the bearing components and to avoid damage to finished work or bonded materials

(b) Aluminums
Metal-arc welding of aluminum shall be in accordance with the recommendation of BS 3019: Part 1

(c) Stainless Steel
Welding of stainless steel sheet to a mild steel backing plate shall be by an inert gas shielded metal-arc tungsten inert gas metal-arc process. Electrodes used with that former method shall be austenitic steel electrodes complying with BS 2926.

5.12.5.4 Protective Measures

Permanently exposed surface shall be protected against corrosion as specified approved by the Engineer.

(a) Dissimilar Materials
Care shall be taken to prevent electrolytic action between dissimilar metals in contact by the use of suitable insulation and prevention of moisture penetration

(b) Damaged Areas

Any damaged area of protective treatment shall be made good to the satisfaction of the Engineer or the damaged parts replaced.

5.12.6 Testing

5.12.6.1 Testing facilities for fabrication

The manufacturer shall have his plant for all the test facilities required for the process and acceptance control tests. The test facilities and their operation shall be open to inspection by the Engineer on demand.
Acceptance testing shall be commenced with the prior submittal of testing programme by the manufacturer to the Engineer and after obtaining his approval.The Contractor shall inform the Engineer at least one month in advance of the date and place of manufacture and test facilities of the bearing. The Contractor shall make necessary arrangement for the Engineer to inspect the manufacturing process of tests. If the place of manufacture or testing is located overseas, the Contractor shall allow the cost for all expenses incurred by two officers nominated by the Employer for the inspection and testing of bearings. The Contractor shall provide the Engineer with all facilities at the places of manufacture and necessary for such inspection.

5.12.6.2 Sample testing: Procedures and Compliance

(a) Load Testing

Both vertical and horizontal loads shall be applied to the bearing in the most adverse combinations as specified on the Drawing or in the Schedule of Bearings. Load transfer due to tilting of bearing shall be taken into account. Before recorded measurements, the bearing shall be embedded in by applying a load equal to the serviceability limit state and then releasing it. The test loads shall then be applied in increments and load deflection measurements shall be recorded for each increment. The rate of loading shall be slow enough to avoid any adverse shock effects and the maximum load shall be maintained until any obvious short-term creep has ceased.

The load shall then be removed in decrements and load deflection measurements made each decrement. After complete unloading, the amount of set shall be checked and if significant, the loading and unloading cycle shall be repeated. If the set is shown to be progressive, then the bearing is deemed not to comply with this Specification.

For compliance, tested bearing shall show no sign of visible damage or permanent deformation of any part due to loading cycles subsequent to the initial bedding in cycle.

(b) Friction
Friction testing of sliding surfaces shall be carried out as follows:-

(i) A vertical load equal to the permanent load specified on the drawing or listed the schedule of Bearings shall be applied to a pair of sliding surface mounted back to back between the plates of a compression testing rig. A horizontal force shall be applied to the pair of sliding plates sufficient to cause movement of not less than 25mm between the stainless steel and PTFE sliding surface. The maximum force required to cause this movement shall be recorded. The load shall then be removed from the rig and inspected.

(ii) The coefficient of friction shall be calculated as (maximum horizontal force) /22x vertical load for each test position and shall in no case exceed Table2.11-2

(iii) After testing the stainless steel shall be checked for flatness, which must be within the specified limits. The bond to the backing plate shall be unaffected. The PTFE shall be free from mechanical damage

(iv) The tests shall be carried out at room temperature. The PTFE surface shall be lubricated with the lubricant to be used in service.

Fro compliance, tested bearing shall show no apparent surface flaws.

5.12.7 Products Delivery Storage and Handling

5.12.7.1 Assembly and Marking

Each pot bearing shall be assembled at the plant, marked for identification and delivered to the construction site as a complete unit. Each bearing shall be marked to indicate the normal position of the bearing

5.12.7.2 Care and Protection

During handling, transport, storage and installation, bearings shall be kept clean and protected from mechanical damage, heat, contaminates and other deleterious effects.

5.12.8 Installation

5.12.8.1 General

Bearings which have been pre-assembled shall not be dismantled except with the prior approval of the Engineer if for any reason the bearing has been dismantled, it shall be done under expert supervision and the manufacturer's assistance shall be sought. All bearings whether require providing horizontal restraint or not, shall be fixed to the superstructure with the mechanical fixings or similar. Reliance on the friction between the bearing and the superstructure or substructure to resist part of the horizontal may be permitted provided faces of safety of not less than 1 1½ is applied to the proven coefficient of friction. The worst combination of vertical load and horizontal load shall be considered.

The Contractor shall carefully check the level of any surface, plinth or bed upon which a bearing will rest and he shall make due allowance for any difference in the depth the bearing to be installed from that assumed on the Drawing. If necessary he shall adjust the levels of the substructure to ensure that the level of the superstructure will be at the required level on completion.

Unless specified all bearings shall be installed with bottom plate horizontal. For case where tapered top plate is required to take up the longitudinal elevation, welding of bolting to the top of the bearing is not allowed. The tapered top plate must be machined on the bearing itself.

Any temporary lock devices for bearings shall be removed before a post-tensioned case in-place superstructure is stressed. For other type of superstructures, the Engineer shall agree the time for removal of any locking devices shall be agreed by the Engineer.

Care shall be taken to avoid displacing bearings during formwork erection, steel fixing and concreting.

5.12.8.2 Tolerances

(a) Bearings shall be located so that their centerlines are within ±3mm of their correct position. The level of bearings shall be within tolerance of ±0.0001 times the adjacent span or lesser of the adjacent spans, but shall not exceed ±5mm. Bearings shall be set to their correct inclination within a tolerance of 1 in 200mm in any direction.

(b) Departure from the plane between twin or multiple bearings shall be within tolerance specified on the drawing.

(c) Bearing shall be installed so that the directions of their horizontal axis are within tolerance of ±0.005 radian from their correct alignment.

5.12.9 Shock Transmission Units

2.2.8 Shock Transmission Units

5.12.9.1 General

Steel components of shock transmission unit with transverse restraint bearings shall comply with the general requirements except as otherwise stated herein. Other components shall comply with Clauses 2.11. Protection of steelwork against corrosion shall be as specified in SIS 0559000,BS 729, BS 6044, BS 2992, BS 3900, BS 2569 Part-1, BS 4921, ISO 8503/Part-2, SSPC Paint, SSPC SP-2, SSPC SP-3 Seismic shock transmission devices shall comply with Clause 3.4.

Details of shock transmission unit shall be as shown on the working Drawings.

The design of the restraints shall make provision facilitate inspection of the device if construction incorporates the robust steel pintle restraint shown on the Consultant's reference Designs then replacement is not anticipated during the designs life of the structure. If, in the opinion of the Engineer, an accepted alternative device may require replacement during the design life of the bridge, then design shall facilitate replacement.

5.12.9.2 Model Testing of Yielding shock Transmission Unit

Scale model rests shall be carried out on shock transmission unit designed to yield under seismic loading.

The Contractor shall submit to the Engineer for approval full details of his proposals for such testing including where the tests are to be carried out and curricula vitae for the key personnel involved.
The Engineer shall be given access to inspect testing at all times and shall have the authority to instruct further amended tests at his discretion.

Factual reports including all results shall be submitted to the Engineer within one week of the completion of each test. An interpretative report shall be submitted to the Engineer for his approval within one week of the completion of testing.

The models shall not be smaller than one fifth of the size of the actual restraint.

A minimum of six clearly identified test specimens shall be prepared. A minimum of three specimens shall be subjected to the nominal test sequence, a minimum of two specimens shall be subjected to an arbitrary 30% excess deformation and one further specimen tested to a deformation history chosen in the light of the other test results.

Allowance shall be made for a minimum of six further specimens and having different details to assist in design optimization.

The models shall accurately represent the transmission and its fixing arrangements.

Materials tests shall be carried out to relate the material strength and ductility to the materials in the actual transmission.

The nominal test sequence shall accurately represent the deformation history expected for actual transmission. This shall cover both magnitude and rate of deformation

The maximum force developed in each direction of deformation shall be recorded for every cycle, and the force deformation relationship recorded for the first three cycles and thereafter every fifth cycle. The physical appearance of the specimen after the test shall be carefully recorded.

5.12.10 Measurement

The method of measurement for payment shall be in number for each Bearing and for each shock Transmission Unit with Transverse Restraints.

5.12.11 Payment

The Contract unit rate for the items shown in the BOQ shall include cost of all materials, equipment and other incidental charges for supply, installation and fixing in all respects per these specifications and as shown in the drawing. Pay items shall be

05/12/01(a)	Supply and Installation of Pot bearings	Number
05/12/01(b)	Supply and Installation of Pot bearings	Number
05/12/01(c)	Supply and Installation of Pot bearings	Number
05/12/02	Supply and Installation of Shock Transmission units	Number

Different size of bearing as below :

a) 500mm X 500mm X 72mm
b) 500mm X 450mm X 72mm
c) 400mm X 300mm X 72mm

Size may differ based on designer requirement.

Size of different type of bearing will be as per approved drawing.

DIVISION 6
INCIDENTALS

June 2016

6.10.1.2 Sizes, Colours and Types ---- 23
6.10.1.3 Alternative Designs and Materials ---- 23

6.10.2 Materials ---- 23
6.10.2.1 Mounting Posts ---- 23
6.10.2.2 Sign Plates ---- 23
6.10.2.3 Frames and Stiffening ---- 24
6.10.2.4 Fixtures and Fittings ---- 24
6.10.2.5 Preservatives, Paints and Finishes ---- 24
6.10.3 Construction Methods ---- 26
6.10.3.1 General ---- 26
6.10.3.2 Mounting Posts ---- 26
6.10.3.3 Sign Plates ---- 26
6.10.3.4 Frames and Stiffening ---- 26
6.10.3.5 Fixtures and Fittings ---- 27
6.10.3.6 Preparation and Painting ---- 27
6.10.3.7 Finish of Sign Faces ---- 28
6.10.3.8 Concrete Embedment of Posts ---- 28
6.10.4 Measurement ---- 29
6.10.5 Payment ---- 29

6.11 RUMBLE STRIP
6.11.1Description ---- 30
6.11.1.1General ---- 30
6.11.1.2
6.11.1.3 Alternative Designs and Materials ---- 30
6.11.2 Materials
6.11.2.1 Tack Coat ---- 31
6.11.2.2 Bituminous Mixture ---- 31
6.11.2.3 Thermoplastic Paint ---- 31
6.11.2.4 Form Work ---- 31
6.11.3 Construction Methods
6.11.3.1 Surface Preparation ---- 31
6.11.3.2 Application of Tack Coat ---- 31
6.11.3.3 Placing of Bituminous Mixture ---- 32
6.11.3.4 Compaction of Bituminous Mixture ---- 32
6.11.4 Measurement
6.11.5 Payment

6.12 PROTECTION OF WORKS ---- 33
6.12.1 Scope of Work ---- 33
6.12.2 Bricks For Mattressing ---- 33
6.12.2.1 General ---- 33
6.12.2.2 Sampling ---- 33
6.12.2.3 Dimension ---- 33
6.12.2.4 Appearance ---- 33
6.12.2.5 Unit Weight ---- 33
6.12.2.6 Crushing Strength ---- 33
6.12.2.7 Water Absorption ---- 33
6.12.3 Geotextile Filter Fabric ---- 33
6.12.4 Mattressing ---- 34
6.12.4.1 General ---- 34
6.12.4.2 Bricks ---- 34

6.12.4.3 Galvanized Wire Mesh ---- 34
6.12.4.4 Placement ---- 34
6.12.5 Measurement ---- 35

6.13 SLOPE PROTECTION WORKS BY PALISIDING ---- 36
6.13.1 Description ---- 36
6.13.2 Requirement of Wooden Piles ---- 36
6.13.3 Construction Methods ---- 36
6.13.4 Measurement ---- 36
6.13.5 Payment ---- 36

6.14 MOBILIZATION FOR DECK SLAB REPAIRING WORK, ETC ---- 37
6.14.1 Description ---- 37
6.14.2 Materials ---- 37
6.14.4 Measurement ---- 37
6.14.5 Payment ---- 37

6.15 CONCRETE GUIDE POST
6.15.1 Description ---- 38
6.15.2 Materials ---- 38
6.15.3 Construction Methods ---- 38
6.15.3.1 Guide Post ---- 38
6.15.4 Tolerances ---- 38
6.15.5 Measurement ---- 38
6.15.6 Payment ---- 38

6.16 CONCRETE KILOMETRE POSTS ---- 39
6.16.1 Description ---- 39
6.16.2 Materials ---- 39
6.16.3 Construction Methods ---- 39
6.16.4 Measurement ---- 39
6.16.5 Payment ---- 39

6.17 RCC PALISIDING ---- 40
6.17.1 Description ---- 40
6.17.2 Materials ---- 40
6.17.3 Construction Methods ---- 40
6.17.3.1 RCC Post ---- 40
6.17.3.2 Precast Planks ---- 40
6.17.4 Tolerances ---- 40
6.17.5 Measurement ---- 40
6.17.6 Payment ---- 40

6.1 SLOPE AND STREAMBED PROTECTION

6.1.1 Description

This work shall consist of the provision and installation of protection for stream banks, riverbanks, embankment slopes, cut slopes and other surfaces composed of erodible materials where protection is desired. Generally, protection to slopes will form an impervious layer constructed in or on designated surfaces and shall have at its bottom and ends anti-scour devices, such as cut-off walls or toe walls. Protection to the riverbanks shall form a graded aggregate scour protection.

The protection shall be constructed to the shapes and dimensions shown on the Drawings or as required by the Engineer.

6.1.2 Materials

6.1.2.1 Riprap Protection to Slopes

Stone for riprap shall consist of stone boulders of suitable size and shape. The stone shall be dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Alternatively concrete blocks manufactured from stone chips maybe used, if shown on the Drawings.

The minimum thickness of stone shall be 100 mm (measured perpendicular to face of riprap). No face dimension shall be less than the thickness of the stone. Unless otherwise specified, the stones shall weigh not less than 10 kilograms each. The minimum thickness of the concrete block shall be 600 mm with a weight not less than 20 kg, with the concrete being Class 20 manufactured in accordance with Section 5.1 of the Specification.

6.1.2.2 Protection to River Bank

The following materials shall be used:

- Coarse gravel with sizes ranging from 5 - 40 mm and of approved grading.
- Cobblestones with sizes ranging from 50 - 100 mm and of approved grading.
- Boulders with sizes ranging from 100 - 200 mm.

The soundness of gravel and stones shall be approved by the Engineer.

The boulders shall be dense, resistant to the action of air and water and suitable in all other respects for the purpose intended.

6.1.2.3 Mortar

Mortar shall be composed of one part of cement and two parts of sand by dry loose volume and sufficient water to make a mortar that can be easily handled and trowelled. Retempering of mortar that has not been used for periods of 45 minutes or longer will not be permitted. Cement for mortar shall conform to the requirement of Section 5.1 of these Specifications.

6.1.2.4 Concrete Slope Protection

Concrete and reinforcement used in the construction of concrete facing for slopes shall be in accordance with Sections 5.1 and 5.2 of these Specifications, respectively, except where modified by the Drawings.

6.1.3 Construction Methods

6.1.3.1 General

A) Grouted Riprap

Unless otherwise specified riprap pavement shall always be constructed as an impervious layer upon designated surfaces. Unless otherwise specified riprap pavement shall have mortared joints and 40 mm weepholes per 2 m measured in both directions.

B) Loose Stone Riprap

Stone protection shall be carried out as shown on the Drawings.

The stone protection shall consist of the following layers:

Stone Type	Grading (mm)	Layer Thickness (mm)
Boulders	100 - 200	300
Cobble Stones	50 - 100	200
Coarse Gravel	5 - 40	150
		Total 650

C) Concrete Slope Protection

Concrete slope protection shall be carried out as shown on the Drawings. Concrete shall be Class 20 and the reinforcement shall conform to the requirements of Section 5.2. The construction methods shall also conform to the requirements of Sections 5.1 and 5.2.

6.1.3.2 Preparation

A) Grouted Riprap (stone or concrete blocks) and Concrete Slope Protection

Excavation or construction of embankments shall be processed to planned shapes and dimensions, as if there were no protection, to allow some excavation immediately prior to the placing of the protection. The Contractor is responsible for discussing with the Engineer, his proposed method or constructing embankments in areas to be protected so that the proper procedure can be agreed.

The areas to be covered shall, at the proper time, be laid out to intended positions, and all necessary cut and fill stakes, batter boards, and construction lines set up. Every effort shall be made to have the surfaces in such condition as to require some excavation immediately prior to the laying of the protection. Where, however, low areas are encountered they shall be backfilled and thoroughly tamped at the earliest practical time in advance of the laying of masonry, to avoid settlement after placing riprap. It is not necessary that the entire area to be protected will be excavated and fine graded in advance of the laying. Work should always be laid upon a freshly excavated and stable surface.

B) Loose Stone Riprap

Stone protection work shall where possible be carried out during periods when low river levels allow construction in the dry. Approval of the Engineer shall be obtained prior to placing stone protection under water.

The area of the stone protection shall be prepared by excavating or dredging to the levels shown on the Drawings or as directed by the Engineer.

It is not necessary that the entire area to be protected will be excavated in advance of the laying. Gravel should always be laid upon a freshly excavated surface.

6.1.3.3 Cut-off Walls

Riprap and concrete slope protection shall always be accompanied by a bottom cut-off wall, unless otherwise instructed by the Engineer.

The cut-off wall shall be constructed of reinforced concrete to the dimensions and details shown on the Drawings. Concrete shall be in accordance with Section 5.1 and reinforcement in accordance with Section 5.2.

6.1.3.4 Laying

A) Riprap Protection and Concrete Slope Protection

After cut-off concrete has been placed and accepted, the laying of slope protection shall be commenced in tight contact with the cut-off concrete and laid from the bottom towards the top. In the case of riprap protection the stones, boulders or concrete blocks shall be bedded on 50 - 100 mm of free draining sand or gravel as directed and shall be laid in close contact. The interstices may be partly filled with spalls or small stones. For the concrete slope protection, the reinforcing steels shall be laid and the concrete poured according to the requirements described in Sections 5.1 and 5.2.

Weep holes to riprap pavement shall be covered on the inside with stones and gravel filters extending 300 mm from the hole in all directions and connecting with the porous bedding material.

All joints and openings to riprap pavement shall be filled solidly with mortar.

Weep holes for the concrete slope protection and the joints shall be prepared and constructed as shown on the Drawings.

B) Loose Stone Riprap

All materials shall be transported and laid by methods, which do not cause damage to material previously laid.

Boulders shall be placed well packed and wedged together without mortar.

6.1.4 Measurement

Riprap and concrete slope protection shall be measured for payment on the basis of the area in square metres. Linear dimensions will be taken in not less than two directions, and of sufficient number so that averages can be obtained, and the product of the averages shall be the area considered for payment. Where slopes exist, measurement will be along the surface of the slopes.

Loose Stone Riprap shall be measured in cubic metres of stone protection as the total volume delivered by truck at site.

Concrete for cut-off walls shall be measured for payment on the basis of cubic metres. Length measurement will be taken along the front of the cut-off wall, while the width and depth will be the measurements given by the Engineer in writing. Excavation, formwork or reinforcement shall not be measured separately.

Material so measured shall be directly incorporated in the works or securely stored to the satisfaction of the Engineer.

6.1.5 Payment

The work measured as provided above shall be paid for at the Contract unit prices per linear metre, square metre or cubic metre. The prices and payment shall be full compensation for furnishing all material, excavations whether shown or not and whether below water or not, concrete, reinforcement, forms if necessary, screeding, curing, handling, backfilling if any, mortar, joints, weepholes, gravel filters, porous bedding, equipment, tools, labour and incidentals necessary to complete the work.

Pay items shall be:

06/01/01	Grouted Riprap Pavement (stone/concrete blocks to be specified)	Square Metre
06/01/02	Concrete Slope Protection	Square Metre
06/01/03	Loose Stone Riprap Protection	Cubic Metre
06/01/04	Concrete Cut-off	Cubic Metre

6.2 REINFORCED CONCRETE CULVERT PIPES

6.2.1 Description

This work shall consist of concrete culvert pipes furnished and installed at such locations as are shown on the Drawings or as directed by the Engineer in accordance with these Specifications and in accordance with the classes, lines, levels, grades and dimensions shown on the Drawings.

The work shall include the furnishing and construction of such joints and such connections to other pipes, catch basins, manholes, walls and other items as may be required to complete the structure as shown on the Drawings. The work shall also include connection of existing drains, which have been interrupted by the road construction, to the new drainage system as directed by the Engineer.

6.2.2 Materials

6.2.2.1 Reinforced Concrete Pipe

Reinforced concrete pipes for culverts shall be constructed fully in accordance with the Drawings and Sections 5.1 and 5.2 of these Specifications.

6.2.2.2 Mortar

Mortar for joints shall contain one part Portland cement and two parts sand by dry volume unless otherwise required by the Drawings or the Specifications.

The amount of water in the mix shall be such that the consistency of the mortar is suitable for the purpose intended and to the satisfaction of the Engineer.

All mortar shall be used within 30 minutes of adding the water.

6.2.2.3 Reinforcement

Steel reinforcement shall be in accordance with Section 5.2 of these Specifications, except where modified by the Drawings.

6.2.2.4 Bricks

Bricks shall be in accordance with Section 5.5 of these Specifications.

6.2.3 Construction Methods

6.2.3.1 General

Pipes shall either be laid in existing ground, or if to be placed under the embankment fill this shall have been constructed to a height greater than the crown of the pipe in accordance with Section 2.6, before the Contractor will be permitted to excavate to place the pipes.

6.2.3.2 Excavation

The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe.

Before laying, the ground shall be trimmed true to line and grade, as directed by the Engineer, over sufficient width to permit satisfactory construction of the bedding. Special care shall be taken to remove any hard or deleterious material from the foundation area.

When soft, spongy or unstable soil is encountered, such soil shall be removed under the pipe for a width and to a depth as directed by the Engineer and replaced with sand or other suitable selected material properly compacted to provide adequate support for the pipe.

The prepared surface shall provide a firm foundation of uniform density throughout the length of the culvert.

Excavated materials classified as suitable should either be utilised as back filling, embankment fill or if surplus be stockpiled on site as described in Section 2.2.3.4 of these Specifications. Excavated material classed as unsuitable shall be carried stockpiled as described in Section 2.2.3.3 of these Specifications.

6.2.3.3 Bedding

Bedding for pipe culverts shall conform to the requirements given below for Class "A" or "B" bedding, whichever is called for on the Drawings or by the Engineer.

If the class of bedding is not shown, Class "B" bedding shall be provided.

A) Class "A" Bedding - Concrete cradle for pipe culverts shall consist of a continuous concrete cradle constructed of Class 15 concrete in conformity with the details shown on the Drawings and the requirements of Section 5.1 of these Specifications.

B) Class "B" Bedding - Class "B" bedding shall be constructed by bedding the pipe culverts in a trench cut in the natural ground or embankment to a depth as shown on the Drawings. The pipe culverts shall be bedded on a thickness of bedding material as shown on the Drawings accurately shaped by a template to fit the lower part of the pipe culvert exterior.

6.2.3.4 Installation

All concrete culvert pipes shall be laid with reinforced and mortared joints. The pipe shall be laid carefully and in straight lines. Before succeeding sections of pipe are laid, the lower half of the groove of the proceeding section shall be plastered on the inside with cement mortar of sufficient thickness to bring the inner surface of the abutting pipes flush and even. At the same time the upper half of the succeeding pipe shall be similarly plastered with mortar. After the pipe is laid, the remainder of the joint shall be filled with similar mortar, and sufficient additional mortar shall be used to form a bead around the joint. The inside of the joint shall be wiped and finished smooth. The mortar on the outside shall be protected with brickwork to allow backfilling to proceed.

6.2.3.5 Backfilling

Backfilling shall be carried out with material as indicated on the Drawings. It shall be placed in uniform layers not exceeding 15 centimetres in uncompacted depth and compacted as embankment fill for layers at the depths concerned below subgrade. Special care shall be taken to compact the material under the haunches of the pipe and to ensure that the backfill shall be brought up evenly on both sides of the pipe.

Sand fill for bedding shall conform to the requirements for backfill of sand to structures in Section 2.5. Embankment fill shall conform of the requirements of Section 2.6.

6.2.4 Measurement

Culvert pipe shall be measured as the linear metres from end to end of each pipe structure, complete and accepted in place.

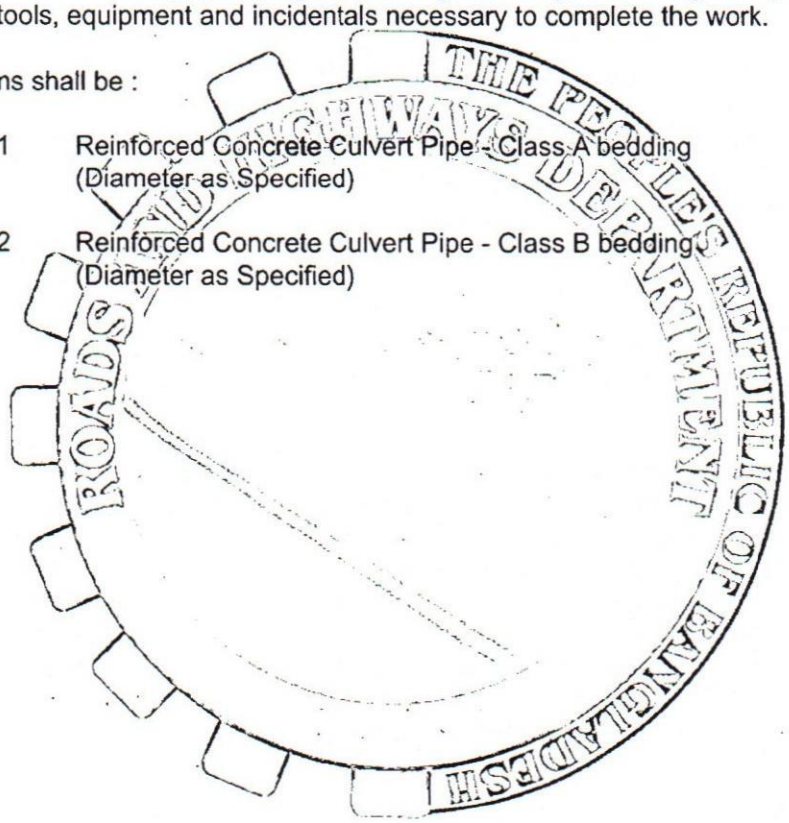
Excavation, bedding or concrete surrounding, backfill and tamped fill as well as cutting of holes for connection pipes will be considered incidental to the laying of the pipe and will not be measured as such. Headwalls shall be measured and paid for in accordance with Section 6.3.

6.2.5 Payment

Reinforced concrete culvert pipe measured as provided above shall be paid for at the Contract unit price per linear metre for the particular size specified on the Drawings. The price shall be full compensation for furnishing, hauling and installing the pipe, jointing, excavation, dewatering, pumping and bailing, bedding, backfilling, compaction and for all labour, tools, equipment and incidentals necessary to complete the work.

Pay items shall be :

06/02/01	Reinforced Concrete Culvert Pipe - Class A bedding (Diameter as Specified)	Linear Metre
06/02/02	Reinforced Concrete Culvert Pipe - Class B bedding (Diameter as Specified)	Linear Metre



6.3 DRAINAGE AND OTHER MISCELLANEOUS STRUCTURES

6.3.1 Description

This work shall consist of the construction of all kinds of manholes, catch basins, drainage channels, pipe end walls, head walls and other miscellaneous structures in brickwork or of the required class or classes of concrete, with or without reinforcement constructed in accordance with these Specifications and to the lines, levels, grades and dimensions shown on the Drawings or as required by the Engineer. The work shall also include excavation, bedding and backfilling with suitable material in accordance with the Drawings and these Specifications.

6.3.2 Materials

Concrete shall conform to the requirements of Section 5.1. The concrete shall be Class 25 unless otherwise indicated on the Drawings.

Reinforcement, where required shall conform to the requirements of Section 5.2.

Brickwork shall conform to the requirements of Section 5.5.

6.3.3 Construction Methods

6.3.3.1 General

Construction methods given under Sections 2.5, 5.1, 5.2 and 5.5 shall apply to this item unless otherwise described.

6.3.3.2 Manholes and Catch Basins

Manholes shall be completed before the adjacent roadway surfacing is placed. They shall not be constructed in Embankment areas, until the earthworks have reached sub grade level.

Frames for gratings and covers for manholes and catch basins shall be properly secured as indicated in the Drawings so as to be held rigidly in place to proper grade and alignment. Rocking gratings and covers will not be accepted.

Inlet and outlet pipe of manholes shall be set or cut flush with the inside faces of the walls of such structures and shall extend a sufficient distance beyond the outside faces of the walls to provide ample room for making proper connections. The joint around the pipe in the structure wall shall be completely and neatly closed with mortar, or other material as may be specified, so as to make it watertight.

6.3.3.3 Concrete Side Ditch and U-Drain

Concrete Side ditches and U-drains shall be constructed to the dimensions and details shown on the Drawings.

6.3.3.4 Headwalls to Culvert Pipes

All headwalls to culvert pipes shall be formed in brickwork to the dimensions and details shown on the Drawings.

6.3.4 Measurement

Manholes, catch basins drains and Headwalls to culvert pipes will be measured for payment by number of each type as indicated in the Bill of Quantities, completed and accepted in place.

Excavation, side support if necessary, sand bedding, lean concrete inlet pipes, grate bars, slide gates, covers and gratings, ladder rungs, service pipes and house connection pipes will be considered incidental to the construction of the manhole and not measured as such.

Concrete side ditches and U-drains will be measured for payment by number of linear metres completed and accepted in place. Excavation, bedding, formwork, joints, covers etc. will not be measured separately.

6.3.5 Payment

This work measured as provided above will be paid for at the Contract unit price for each particular item, such price and payment constituting full compensation for all material, labour, tools, equipment and incidentals necessary to complete the work.

The complete work includes **all** work associated with the structure as indicated on the Drawings or in these Specifications.

Pay items shall be:

06/03/01	Manhole (Diameter as stated in the Bill of Quantities)	Number
06/03/02	Catch Basin (Diameter as stated in the Bill of Quantities)	Number
06/03/03	Concrete Side Ditch / U-Drain (As detailed on the Drawings)	Linear Metre
06/03/04	Brick Headwall to Culvert Pipe (Pipe Diameter as stated in the Bill of Quantities)	Number

6.4 KERB, GUTTER AND EDGE DETAIL

6.4.1 Description

This work shall consist of kerb, gutter, or combination of kerb and gutter, made of concrete or edging to the road pavement using whole bricks 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.

6.4.2 Materials

Concrete shall be of the grades and types indicated on the Drawings and shall conform to the requirements of Section 5.1.

Brick shall be selected Class "A" bricks of regular shape free from any defects or distortion. They shall conform in all respects to the requirements for first class bricks as specified in Section 5.5.2.1 of these Specifications.

Sand for bedding and infilling gaps between bricks shall be non-plastic and free from vegetable matter, soft particles and clay. It shall conform to either grading B or grading C of Table 2.8-1 of these Specifications.

6.4.3 Construction Methods

6.4.3.1 Concrete Kerb and Gutters

Excavation shall be made to the required depth, and the base upon which the kerb, gutter, or combination kerb and gutter 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 and gutter 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 Section 5.1.

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.

6.4.3.2 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 the adequately compacted. Any damage caused to be the pavement materials by compaction equipment due to the contractors method of working shall be made good at the Contractors expense.

6.4.4 Measurement

The quantity measured for payment shall be the number of linear metres of the several types and sizes of concrete kerb, edge kerbs, the combination kerb and gutter or brick edging, completed in place and accepted. Concrete kerb, combination kerb and gutter and brick edging shall be measured in place along the front face of the kerb. No deduction shall be made for flattening of kerbs.

6.4.5 Payment

This work measured as provided above, will be paid for at the Contract unit price per linear metre 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, falsework, centering and incidentals necessary to complete the work.

Pay item shall be:

06/04/01	Concrete Kerb (As detailed on the drawings).	Linear Metre
06/04/02	Combined Concrete Kerb and Gutter (As Detailed on the Drawings)	Linear Metre

6.5 ROAD MARKINGS

6.5.1 Description

This work shall consist of the provision and installation of reflecting road studs and application of continuous or intermittent lines, stop lines, arrows, letters or figures as shown on the Drawings or directed by the Engineer. The work shall include the supply of all labour, tools and equipment, materials, traffic signs as necessary for the safe and efficient completion of the entire work.

6.5.2 Materials

Materials for permanent road markings shall be thermoplastic material as described in Section 6.5.2.1 or road marking paint as described in Section 6.5.2.2. Kerb markings shall be painted with road marking paint as described in Section 6.5.2.2. Road markings shall be white or yellow as shown on the drawings. Reflecting road studs are described in Section 6.5.2.3.

6.5.2.1 Hot Applied Thermoplastic Materials

The thermoplastic material shall be factory mixed, from an approved manufacturer and shall be of a tropical grade suitable for application, by the means proposed, to the specified road surfaces, and must demonstrate skid resistance appropriate to local traffic conditions. The material shall comply with BS3262 : 1987 'Specification for Hot-applied Thermoplastic Road Marking Materials'.

The material shall be supplied in containers which do not contaminate the contents and which protect the contents from contamination and shall be stored in accordance with the manufacturer's instructions.

Ballotini (glass beads) may be incorporated in the mixture during the manufacture of the thermoplastic material. The quantity of ballotini included shall be between 13% and 22% by weight of the total mix and shall be counted as part of the aggregate. The Ballotini shall comply with BS6088 : 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

Alternatively the Ballotini (glass beads) may be applied to the surface of the thermoplastic immediately application is complete. Application of the beads shall be at least 300 grams / square metre or as otherwise directed by the Engineer. The Ballotini shall comply with BS6088 : 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

6.5.2.2 Road Marking Paint

All paints shall be road marking paint conforming to BS6044 : 1987 'Specification for Pavement Marking Paints' and made by an approved manufacturer and suitable for application, by the means proposed, to the specified road surfaces.

The paint shall be suitable for applying by brush or mechanical means. The following particulars of the paint shall be supplied:

1) composition (analysis by weight)
2) application (brush or spray)
3) type and maximum amount of reducer (thinner)
4) drying time (wheel dry)

5) setting time (to recoat)

6) recommended coverage (litres per linear kilometre of 100 mm stripe)

7) heat resistance i.e. maximum road temperature

8) details of any primer, undercoat or tack coat required.

The paint shall be supplied fresh and ready for use in sealed containers which shall be stored in accordance with the manufacturer's instructions.

If required Ballotini (glass beads) may be applied to the surface of the paint immediately application is complete. Application of the beads shall be at least 300 grams / square metre or as otherwise directed by the Engineer. The Ballotini shall comply with BS6088 : 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

6.5.2.3 Reflecting Road Studs

Reflecting road studs shall conform to BS 873 :- Part 4: 1987 'Road Traffic Signs and Internally Illuminated Bollards – Specification for Road Studs'. Road studs shall show red or white and be uni-directional, bi-directional or omni-directional; as shown on the Drawings or as otherwise directed by the Engineer. They shall incorporate one or more corner cube retroreflective lenses, and the area of lens facing each direction of traffic shall be at least 300 square millimetres. The studs shall be capable of withstanding impacts and no contact shall be possible between the lenses and the vehicle tyres. The studs shall not project more than 20 mm above the level of the surrounding road surface and the lowest part of the lenses shall be more than 5 mm above the surrounding road surface. The studs may be either bonded to, or anchored within, the road surface. The design shall be such as to ensure ample key to the road pavement with adequate load distribution and such that it shall not be possible for heavy equipment such as road rollers and tracked vehicles travelling in the direction of the road axis to meet with any sharp edges whereby the removal of the stud might be facilitated.

6.5.3 Construction Methods

6.5.3.1 Thermoplastic Materials

A) Preparation of Road Surface

The material shall be applied only on a surface which is clean and dry. It shall not be laid over loose detritus, mud or similar extraneous matter, or over an old paint marking, or over an old thermoplastic marking which is faulty. New surfaces must be allowed to weather and compact for at least 72 hours before applying the marking. In the case of smooth polished surfaces, e.g. smooth concrete, old asphalt surfacings with smooth polished surface stones, and/or where the method of application requires or the Engineer directs, a tack coat shall be applied to the surface prior to the application. The tack coat shall be as recommended by the manufacturer of the thermoplastic material and to the approval of the Engineer. Faulty thermoplastic markings shall be removed if required by the Engineer.

B) Preparation of Thermoplastic Material

The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a stirrer to give a smooth consistency to the thermoplastic and such that local overheating shall be avoided. The temperature of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously

as possible and for thermoplastics which have natural resin binders or are otherwise sensitive to prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.

C) Laying of Thermoplastic Material

Markings may be applied by hand-screeding, hand propelled machine or by self propelled machine as approved or directed by the Engineer. After transfer to the laying apparatus the material shall be maintained within the temperature range specified by the manufacturer and stirred to maintain the right consistency for laying.

In the case of screeded application, material shall be laid to a thickness of not less than 3 mm or more than 6 mm, unless specifically authorised by the Engineer. In the case of sprayed application, the material shall be laid to a thickness of not less than 1.5 mm unless specifically authorised by the Engineer. In all cases, the surface produced shall be uniform, appreciably free from bubbles and streaks.

The Contractor shall not proceed with the marking work until the equipment, method of application, and rate of application, as established by a test section, have been approved by the Engineer.

The work shall be carried out very carefully to a regular alignment in accordance with the Drawings. Straight edges and templates shall be used if required by the Engineer.

Where applicable the Ballotini (glass beads) shall be applied to the surface of the thermoplastic immediately application is complete and shall be applied in a controlled manner by use of a spreading device which will permit an even spread from a fixed height of between 300mm and 400mm or otherwise as the Manufacturer may recommend. (A wheel mounted, variable width, funnel applicator may be suitable). The loss of glass beads after 3 weeks traffic shall not exceed 10 percent of the total applied.

D) Re-use of Thermoplastic Material

At the end of the day's work, as much as possible of the material remaining in the heater and/or laying apparatus shall be removed. This may be broken and used again, provided that the maximum heating temperature has not been exceeded and that the total time during which it is in a molten condition does not exceed the requirements.

6.5.3.2 Road Marking Paint

A) Preparation of Road Surface

The paint shall be applied only on a surface which is clean and dry. It shall not be laid over loose detritus, mud or similar extraneous matter or over a thermoplastic marking or over an old paint marking which is faulty or incompatible with the paint being applied. New surfaces must be allowed to weather and compact for at least 72 hours before applying the marking. If a primer or undercoat is necessary to ensure proper adhesion of the marking paint to the road surface without bleeding or discolouration, the primer or undercoat shall be fully compatible with the marking paint and the road surface, and shall be applied only if, and at the rate of application approved by the Engineer.

B) Preparation of Paint

All cold-applied paint shall be thoroughly field mixed before applying in order to keep the pigments in uniform suspension. Hot-applied paints shall be heated in a properly designed heater, to the correct laying temperature at which it shall be maintained as required for the method of application. The paint shall on no account be allowed to exceed the maximum

temperature specified by the paint manufacturer. The use of thinner or other additives shall not be permitted unless otherwise agreed to by the Engineer.

C) Laying of Paint

Markings shall be applied by brush, spray, hand-propelled or self-propelled machine according to the marking configuration and the type of paint approved for use or as directed by the Engineer. The rate of application of paint for each coat shall be that recommended by the manufacturer and shall produce a minimum total cover rate of unthinned paint of 0.5 litre per square metre, unless otherwise directed by the Engineer.

Where a spray machine is to be used the Contractor shall not proceed with the marking work until the equipment, method of application, and rate of application, as established by a test section, have been approved by the Engineer.

When more than one coat is used, the succeeding coat shall not be applied until the previous coat has fully set.

The work shall be carried out very carefully to a regular alignment in accordance with the Drawings. Straight edges and templates shall be used if required by the Engineer.

Where applicable the Ballotini (glass beads) shall be applied to the surface of the paint immediately application is complete and shall be applied in a controlled manner by use of a spreading device which will permit an even spread from a fixed height of between 300mm and 400mm or otherwise as the Manufacturer may recommend.(A wheel mounted, variable width, funnel applicator may be suitable). The loss of glass beads after 3 weeks traffic shall not exceed 10 percent of the total applied.

D) Protection of Paint Markings

All markings shall be protected from traffic until they have dried sufficiently.

6.5.3.3 Reflecting Road Studs

Road studs shall not be installed over road markings or joints in the road surface. The road surface shall be cleaned, and dust, oil, grease and other contaminants removed. New surfaces shall be allowed to compact and weather for at least 72 hours prior to the installation of the studs. Acceptable methods of fixing include: bonding with an adhesive; anchoring with a road nail; and setting the stud into a drilled cavity in the pavement. However, the method of fixing, including any adhesive or grout used, must be suitable for the specified road surface and the tropical climate. The studs shall be fixed in accordance with the manufacturer's instructions. Studs which become loose or free during the defects liability period will be considered a defect.

6.5.3.4 Tolerances

All forms of line marking and road studs shall be subject to the following tolerances where applicable:

a) Longitudinal lines such as centre lines, edge lines and other lines of a continuous nature shall not vary from the design longitudinal dimensions by more than 10%. Transverse dimensions (line width) shall have a tolerance of – 0% + 10%.

b) Longitudinal lines such as centre lines, edge lines, other lines of a continuous nature and road studs shall not vary from the designed alignment by more than 300mm on a curve or 150mm on a straight section.

c) Transverse and other incidental road markings shall not vary from the specified dimensions by more than ± 5% of the overall dimension. Alignments shall not vary by more than 20mm from the designed alignment except in the case of centre line chainage location which shall not vary by more than 0.5 metres.

6.5.3.5 Defective Materials of Workmanship

Materials which are defective or have been applied in an unsatisfactory manner or to incorrect dimensions or in a wrong location shall be removed, the road pavement made good and the materials replaced, reconstructed and/or properly located, all at the Contractor's expense and to the satisfaction of the Engineer.

6.5.3.6 Protection of Traffic

The Contractor shall protect pedestrian, vehicular and other traffic adjacent to the working area against damage or disfigurement by construction equipment, tools and materials or by splatters, splashes and smirches of paint or other construction materials and shall during the course of the work provide and maintain adequate signs and signals for the warning and guidance of traffic.

6.5.4 Measurement

Markings shall be measured for payment by the area in square metres completed and accepted in place. Where the width or length of laid marking proves to be greater than that specified and is accepted by the Engineer, the specified width or length shall be used when calculating areas for payment. Where the width or length of laid marking proves to be less than that specified and is accepted by the Engineer, the actual width or length of laid marking shall be used when calculating areas for payment.

Temporary markings will not be measured as such, the payment therefore shall be considered incidental to the lump sum for maintenance of traffic.

Reflecting road studs shall be measured by the actual number of studs supplied, installed and accepted.

6.5.5 Payment

The work measured as provided above shall be paid for at the Contract unit prices for each of the items listed in the Bill of Quantities.

The payment shall be full compensation for providing and applying the materials including all labour, equipment, tools and incidentals necessary to complete the work.

Pay items shall be:

06/05/01	Road Marking - Thermoplastic Material *(indicate whether screed or spray application is required)*	Square Metre
06/05/02	Road Marking - Road Marking Paint	Square Metre
06/05/03	Reflecting Road Studs	Number
06/05/04	Application of Ballotini *(indicate whether Ballotini is to be applied to the surface of the marking or mixed in)*	Square Metre

6.6 TOPSOIL

6.6.1 Description

This work shall consist of furnishing topsoil removed from approved sources and transporting, spreading and compacting it on prepared surfaces in accordance with these Specifications and the Drawings.

6.6.2 Materials

Topsoil furnished by the Contractor shall consist of a natural friable surface soil without admixture of undesirable soil, refuse or foreign materials. It shall be reasonably free from roots, hard clay, coarse gravel, stones larger than 50 mm in any dimension, noxious weeds, tall grass, brush, sticks, stubble or other litter and shall have indicated by a healthy growth of crops, grasses, trees or other vegetation that it is free-draining and non-toxic.

6.6.3 Construction Methods

The Contractor shall notify the Engineer at least 5 days before he intends to start topsoil stripping operations. After inspection and approval by the Engineer, and prior to stripping the topsoil, the Contractor shall remove noxious weeds and tall grass, brush, large stones and roots.

The topsoil shall be evenly spread on the designated areas to a depth, which after settlement and compaction shall be that shown on the Drawings. Spreading shall not be done when the ground or topsoil is excessively wet or otherwise in a condition detrimental to the work. The roadway surfaces shall be kept clean during hauling and spreading operations.

After spreading has been completed, any large clods, large stones, roots, stumps and litter shall be raked up and removed.

To reduce erosion as much as possible, the placing of topsoil and the subsequent grassing shall be done simultaneously with or immediately after the placing and compacting of the individual layers of fill.

6.6.4 Measurement

The quantity measured for payment shall be the number of cubic metres of required topsoil of the designated thickness complete and accepted in place. If side slopes of embankments or excavation requiring top soil are of greater area than required due to earthworks not conforming to the required dimension, the area measured shall be the required area as if the earthwork had conformed to the required dimension.

6.6.5 Payment

This work measured as provided above, shall be paid for at the Contract unit price per cubic metre. The price shall be full compensation for furnishing and placing all material, including all labour, equipment, tools and incidentals necessary to complete the work.

No payment will be made for topsoil until it has been grassed according to Section 6.7.

Pay item shall be:

06/06/01	Topsoil	Cubic Metre

6.7 GRASSING

6.7.1 Description

This work shall consist of furnishing turf and sods as required and planting them to give a healthy stable covering of grass which will maintain its growth in any weather and prevent erosion of the material in which it is planted.

6.7.2 Materials

Grass shall be of species native to Bangladesh, harmless and inoffensive to persons and animals and not of a kind recognised as a nuisance to agriculture. It shall be free of disease and noxious weeds, deep rooted and sufficiently rapid growing and spreading to give complete cover over the planted area within the Defects Liability Period.

The term "grass" embraces turf and sods and, if the Engineer permits, may include plants of other types capable of giving effective protection.

Fertiliser shall be approved lime or mixtures of plant nutrients or both.

6.7.3 Construction Methods

Sodding or turfing shall be done by planting sods or turf, as indicated on the Drawings, to give continuous cover over the whole area. They shall be planted with their root systems substantially undamaged, well buried in firm material, and packed around with moist earth in which they have grown.

Grass shall be planted at such a time and the work shall be done in such a way that at the time of the final construction inspection all areas to be grassed are substantially covered with healthy, well established, firmly rooted grass and the planted area is free from erosion channels.

Surfaces to be planted shall be trimmed in such a way that the ground surface after planting shall be as shown on the Drawings.

Fertiliser shall be added at the time of planting if necessary to ensure good ground cover within the required time.

The Contractor shall maintain the grass at his expense until the end of the Defects Liability Period. Maintenance shall consist of preserving, protecting and replacing grass and such other work as may be necessary to keep it in a satisfactory condition to prevent erosion and to present a dense and uniform appearance. The Contractor shall be responsible for satisfactory growth and shall water, fertilise, and mow the grass at such intervals as will ensure good ground cover of live grass all through the Defects Liability Period.

6.7.4 Measurement

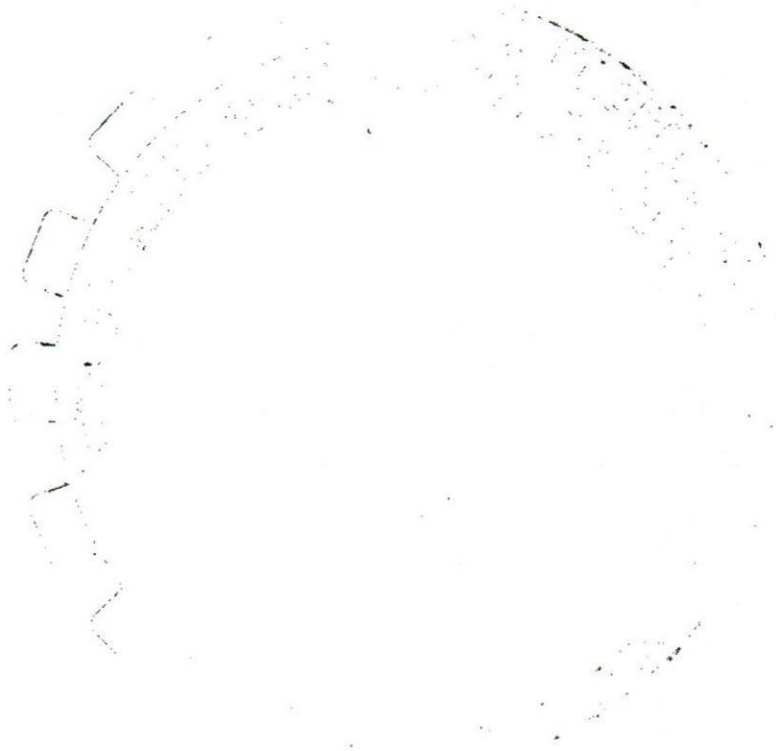
The quantity measured for payment shall be the number of square metres of turfed or sodded surface whether horizontal or sloping of required and accepted grassing well established in place. Fertiliser will not be measured separately.

6.7.5 Payment

This work measured as provided above shall be paid for at the Contract unit rate per square metre. Payment for grassing shall be made at the termination of the Defects Liability Period. The payment will be full compensation for furnishing all materials, labour, equipment, tools and incidentals necessary to complete the work to the satisfaction of the Engineer.

Pay items shall be:

06/07/01	Grass Sodding	Square Metre
06/07/02	Grass Turfing	Square Metre



6.8 GUARDRAIL

6.8.1 Description

This work shall consist of furnishing and installing of guardrail as detailed on the Drawings and at locations indicated on the Drawings or as directed by the Engineer. The work shall include all required posts, rails, fixtures and fastenings, beams, anchorages and attachments as well as aligning, galvanising and all the processes necessary to complete the work.

6.8.2 Materials

6.8.2.1 General
All metal work shall be hot galvanised in accordance with AASHTO M 111.

6.8.2.2 Concrete and Reinforcement Steel
Concrete shall conform to the requirements of Section 5.1. Reinforcement shall conform to the requirements of Section 5.2.

6.8.2.3 Steel Posts and rails
Steel posts and rails shall be of the grade or type indicated on the Drawings.

6.8.2.4 Bolts and Nuts
Bolts and nuts shall be galvanised and of the sizes and types indicated on the Drawings.

6.8.3 Construction Methods

6.8.3.1 Posts
Posts shall be set vertically in position and to the lines and levels shown on the Drawings. Post holes shall be filled with concrete as shown on the Drawings.

6.8.3.2 Rails
Rails shall be supplied to the Site fully fabricated and galvanised requiring only bolting on Site. They shall be erected in a manner that will result in smooth continuous rails closely conforming to the lines and grades of the road or as shown on the drawings or instructed by the Engineer.

6.8.4 Measurement

The quantity to be measured for payment shall be the number of linear metres of guardrail completed, including the supply and installation of all rails, posts, anchorages and fixings as specified.

6.8.5 Payment

This work measured as provided above will be paid for at the Contract rate for guardrail. The rate and payment will be full compensation for furnishing and installing all materials, including labour, equipment, tools and incidentals necessary to complete the work.

Pay item shall be:

06/08/01	Guardrail	Linear Metre

6.9 CONCRETE MONUMENTS AND POSTS

6.9.1 Description

This work shall consist of furnishing and installation of concrete monuments and posts as detailed on the Drawings and at locations indicated on the Drawings or as directed by the Engineer.

6.9.2 Materials

Concrete monuments and posts shall be precast using concrete conforming to the requirements of Section 5.1. Reinforcement steel shall conform to the requirements of Section 5.2. Paint, if indicated on the Drawings, shall be of the appropriate type and colour and to the approval of the Engineer.

6.9.3 Construction Methods

Construction, fabrication and installation of concrete monuments and posts shall be as shown on the Drawings.

6.9.4 Measurement

The quantity measured for payment shall be the actual number of concrete monuments and posts placed and accepted.

6.9.5 Payment

This work measured as provided above shall be paid for at the Contract rate for each monument and post. The price and payment shall be full compensation for furnishing and placing, including all materials, labour, equipment, tools, and incidentals necessary to complete the work.

Pay items shall be:

06/09/01	Concrete Monument	Number
06/09/02	Concrete Post	Number

6.10 TRAFFIC SIGNS

6.10.1 Description

6.10.1.1 General

This work shall consist of furnishing, assembling and erecting posts and signs of a permanent nature in accordance with the details shown on the Drawings and as specified herein, at the locations shown on the Drawings or as directed by the Engineer.
The work shall include all necessary foundations, excavation, backfill, anchorages, fixtures and fastenings, brackets, application of paints and finishes and all the processes necessary to complete the work.

6.10.1.2 Sizes, Colours and Types

Signs and their supports shall be of the sizes, colours and types indicated on the Drawings unless otherwise directed by the Engineer. Reference shall be made to the Bangladesh Road Transport Authority's Traffic Signs Manual when specific requirements are not detailed.

6.10.1.3 Alternative Designs and Materials

The Contractor may submit or recommend alternative designs and construction materials to those specified or shown on the Drawings but these must meet the requirements of the Bangladesh Road Transport Authority's Traffic Signs Manual and have the consent of the Employer.

6.10.2 Materials

6.10.2.1 Mounting Posts

Mounting posts shall be steel posts unless otherwise noted on the drawings. Unless otherwise detailed on the Drawings or directed by the Engineer, steel posts shall be in the form of heavy galvanised round tubes, or pipes, of not less than 50 mm nominal bore or other approved sections of adequate torsional rigidity and strength complying with the appropriate specifications of the American Society for Testing Materials, the British Standards Institution, the American Association of State Highway Officials or a similar internationally recognised body.

Post Caps. Caps for hollow posts or other hollow sections used in construction may be approved cast or sheet metal or a suitable weather-resisting plastics material.

6.10.2.2 Sign Plates

Prior to commencement of fabrication the Contractor shall submit details of the proposed form of manufacture of traffic signs to the Engineer for approval. Such approval will only be effective when provided in writing by the Engineer.

Aluminium alloy plates and panels shall have a minimum thickness of 2 mm. Steel plates and panels shall have a minimum thickness of 1.5 mm.

It is preferred that traffic signs be manufactured from aluminium sheet, complying with BS1470 or ASTM Specifications B209 or other internationally recognised specification as is acceptable to the Engineer.

Other types of metal sheeting may be considered but where reflective sheeting is to be applied the Contractor may be required to provide an acknowledgement from the

manufacturer of the reflective sheeting, that the reflective sheeting is compatible with the metal sheeting. The Contractor may also be requested to provide an extended guarantee in relation to the traffic signs.

6.10.2.3 Frames and Stiffening

Except as otherwise provided in the Drawings sign plates requiring frames or stiffening as specified under sub-clause 6.10.3.4, shall have adequate ribs or flanges as an integral part of the sign plate or shall have frames or stiffening members of material complying with the following:

A metal frame or stiffening bars constructed of structural sections in steel or aluminium alloy complying with the appropriate clauses of Sections 6.10.2.1 and 6.10.2.2.

The metal used for frames and stiffening shall be the same as, or compatible with, the metal used for the face plate.

6.10.2.4 Fixtures and Fittings

Brackets and clips shall be manufactured from approved cast metal, steel, stainless steel or aluminium alloy.

Screws, bolts, nuts and washers shall be of steel, aluminium alloy or of a high tensile non-corroding metal. Washers in contact with surfaces which may be damaged by overtightening of nuts or bolts shall be of a suitable soft and weather resisting material.

Steel fixings and fittings which are in contact with aluminium shall be coated with zinc or cadmium. All steel fittings shall be rustproofed. Rivets shall be made from copper, brass, aluminium alloy or pure aluminium. Brass, copper, lead or nickel shall not be used in contact with aluminium.

6.10.2.5 Preservatives, Paints and Finishes

A. General

All coatings, paints, varnishes and enamels used in the preparation and finish of the signs, posts and fittings shall be of the best quality, specially made for the purpose they shall serve, and of brands and types acceptable to the Engineer. To ensure compatibility, primers, undercoats and finishing coats shall, wherever possible, be of the same manufacture. All materials shall be stored, and used within such time limits, as specified or recommended by the manufacturers or in accordance with the directions of the Engineer.

All steel parts used shall have a Zinc coating (galvanising) which shall comply with A.S.T.M. Specification A 123 or A 153 as appropriate. Such Zinc coated parts shall not require painting unless indicated on the Drawings.

Where painting of steel parts is required, the paint shall be high zinc oxide content coating material of approved formulation containing a minimum of seven kilograms of zinc oxide (acicular type) per one hundred litres of coating material (sixty pounds per one hundred U.S. gallons). The colour of the primer shall be different from succeeding coatings.

If painting of aluminium alloy parts is noted on the Drawings, priming paint, shall be pigmented with chromates or chromes (excluding lead chromes) except on sign faces where the specified finish is unsuitable for use with such primers.

B. Reflective Sign Faces

Sign faces shall be made reflective by the application of approved reflective sheeting as described below, or be painted, as described in 6.10.3.6 and 6.10.3.7

Reflective sheeting intended for use on sign facings shall be approved in writing by the Engineer following submission by the Contractor, 15 days prior to commencement of manufacture, of a test report from an approved testing laboratory together with a sample of the intended sheeting. The Engineer may request a warranty from the Contractor, endorsed by the sheeting manufacturer, to cover the quality and field performance of the reflective sheeting per this specification for seven years. The sheeting shall generally conform to the following requirements:

a) The coefficient of retroreflection shall not be less than the minimum values specified in the table below:

Minimum Coefficient of Retroreflection
Candelas per Lux per Square metre
(0.2 degrees observation angle and – 4 degree entrance angle)

Sheeting colour	Coefficient of retroreflection	
	Initial	Minimum after 7 years
White	250	200
Yellow	170	136
Red	45	36
Green	45	36
Blue	20	16

Testing in accordance with ASTM E810

The sheeting, processed and applied to the aluminium sign plate in accordance with the sheeting manufacturer's recommendations, shall perform effectively for 7 years

b) The surface of the sheeting shall be smooth and flexible. No cracking shall occur when bent. Reflective sheeting shall have high durability under all weather conditions, heat and moisture and be strongly fungus-resistant.

c) The sheeting shall not delaminate, blister, crack, peel and chip during the manufacturing process and during its expected service life.

d) The sheeting supplied shall be free from dirt, solid lumps, scales and ragged edges.

e) The colour of the sheeting shall be even and free from any spots or loss of colour. The colour shall not fade appreciably under local weather conditions during its expected service life.

f) Colours of sheeting used must correspond to the colours of sheeting supplied as samples.

g) All inks, sheeting, and film used on the sign must either be from the same manufacturer or be approved by the main sheeting manufacturer.

h) The reflective surface of the sheeting shall be durable and remain sharp and glareless during its expected service life. Bad weather conditions such as rain, dew, etc. shall not considerably reduce the reflectivity.

i) The reflective surface of the sheeting shall be easily cleaned with soap and water with no adverse effect on its reflectivity and durability when used on the roads.

j) The adhesive used on the backing of the sheeting shall give a high quality bonding to clean, smooth and grease-free aluminium or other sign plates approved by the sheeting manufacturer. The adhesive shall withstand the conditions without allowing the sheeting to peel.

6.10.3 Construction Methods

6.10.3.1 General

Wherever possible, signs shall be mounted on existing posts, lamp columns, walls and structures. The obstruction of footways shall be avoided. Design and construction of signs shall be such that all sign plates, posts, fittings, lighting units, electrical equipment and conduit can be assembled and erected without site modification.

6.10.3.2 Mounting Posts

Posts shall be adequate in number and size to support the signs attached to the frames or posts.

The lengths of posts shall be adequate for the requirements allowing for embedment in the ground. All posts shall be effectively prevented from rotation in the ground and if necessary in the case of metal posts, suitable metal base plates shall be provided for this purpose. Unless otherwise shown on the Drawings base plates shall be not less than 4.5 mm thick and shall have an area of not less than five times the plan area of the post. Effective means for securing the base plate to the post shall be provided.

Where a post has to be sited close to a wall either the top of the post shall be angled away from the wall to provide adequate clearance for the sign or an adequate bracket or brackets shall be provided from the post for this purpose. In either case the post shall be of adequate strength and rigidity to withstand the additional bending moments and torsion resulting from the arrangement.

All open ended posts, or other hollow sections used in construction shall be effectively capped to prevent the entry of water.

Construction of reinforced concrete and prestressed reinforced concrete posts shall be in accordance with Sections 5.1, 5.2 and 5.3 of these Specifications, respectively, and as approved by the Engineer.

6.10.3.3 Sign Plates

Sign plates and panels shall be cut accurately to the shapes and sizes specified on the Drawings. All mounting holes shall be accurately located and, after drilling or punching, any burrs, rough spots and loose material shall be removed. All holes shall be drilled before painting.

6.10.3.4 Frames and Stiffening

Except where ribs or flanges are an integral part of the sign plate and provide the necessary stiffening, sheet metal sign plates exceeding 500mm in any dimension shall be stiffened by the attachment of a frame or stiffening member(s) to the back of the sign plate.

The post or posts supporting a sign may be taken into consideration for stiffening purposes. A bracket may form the stiffening frame or part of it.

The frame for a sign plate or plates shall be simple in design and shall have the minimum number of members to give it the required stiffness.

The stiffening or frame for a sheet metal sign plate may take the form of flanges round the edges of a sign, welded ribs or steel or aluminium sections with a minimum thickness of 2 mm. Where flanges are provided they shall be uniform on all edges of the sign.

Where metal frame members join they may be welded or joined with suitable brackets and nuts and bolts but in all cases the joints shall be strong enough to withstand the stresses induced in them.

6.10.3.5 Fixtures and Fittings

Where necessary or desirable signs shall be mounted on existing suitable highway furniture, buildings or structures by means of a properly designed bracket or brackets.

The method of fixing sign plates, frames and brackets to posts shall be such as will facilitate removal for replacement or maintenance purposes and permit adjustment in the position of a sign without detaching it from its post or posts, but the sign and any framing shall be held firmly enough to withstand the load to which it will be subjected. Signs mounted on single posts shall have a fixing to prevent the forced rotation of the signs on the posts. Clips and brackets shall be shaped to secure a firm hold on the post without placing any bending strain on the sign plate.

Where dissimilar metals are joined together, precautions shall be taken to prevent electrolytic action, particularly in the case of screws and rivets. This may be accomplished by using paint, lacquer or other suitable means to eliminate metal to metal contact.

Brackets used in the construction of signs may be manufactured from sheet or strip aluminium alloy, extruded sections, cast aluminium alloy or may be fabricated from steel sections. The minimum thickness of material shall be 3 mm. Welded joints shall be sound and their surfaces smooth. Holes shall be drilled before painting and shall be accurately located. Steel or aluminium strip used for clips shall not be less than 2 mm thick.

Screws and bolts shall not be less than 8 mm (5/16 inch) in diameter and of adequate length, but without excessive projection of the screwed ends. In any situation where, if a screw were removed, the assembly would be insecure, that screw shall have not less than four full threads protruding when it is tight and shall be fitted with a locknut or a spring washer.

Where hollow rivets are used to connect sign plates to frames or fixings the holes shall be effectively blocked to prevent light shining through. Screw, bolt or rivet heads on the face of a sign shall be as unobtrusive as possible and each shall match the colour of the part of the sign where it is located.

Caps for posts of hollow section shall be shaped to shed rainwater to the outside of the posts and adequate means of securing the caps to the posts shall be provided.

6.10.3.6 Preparation and Painting

A) General. All painting and finishing shall be carried out in clean, dry surroundings using heat lamps for drying and ovens for baking as may be needed. All paints shall be applied with a pressure spray to form a smooth even film and all surfaces and edges shall be coated unless stated otherwise. Paint shall be applied only when the surface or previous coat is dry.

The following requirements shall, unless otherwise provided on the Drawings, apply to preparation and painting of sign components, but excluding plastic signs and components with finishes of reflective and plastic sheeting, film, sheathings and other proprietary finishes.

B) Aluminium Alloys. Aluminium alloys, other than sign faces, shall not be treated or painted unless they are in contact with earth Surfaces.

Before painting, the surfaces of aluminium alloy sign plates shall be thoroughly degreased and pre-treated by anodising or by an equivalent process or by using an etching primer.

The prime coat shall then be applied. The back and edges of the plate shall receive a finish coat of light grey enamel.

C) Steel Surfaces - All steel components shall be rustproofed by galvanising, or other approved treatment prior to painting. Where necessary the surfaces shall be cleaned and degreased before painting. All surfaces other than screws, bolts, nuts and washers, shall then receive one prime coat of high zinc oxide paint, tinted light grey.

6.10.3.7 Finish of Sign Faces

A. Reflective Signs

Reflective sheeting used for sign facing shall be applied to the metal backing plate in a manner strictly according to the manufacturer's instructions. Such application shall take place in a clean and dry environment suitably set up with benches, clamps and forms to ensure regularity of cutting and application of symbols and lettering.

The finish on the face of a sign shall present an even surface free from twists, cracks or faults or any other blemishes. When reflecting sheeting is used it shall, where possible, be in complete sheets. Joints shall be kept to a minimum but where they are necessary they shall be constructed in accordance with the manufacturer's instructions. Care shall be taken to ensure a proper day and night colour match at joints.

B. Painted Signs

The legends, borders, symbols, designs etc shall be formed by spraying enamel paint using appropriate templates. An undercoat and a top coat shall be applied and the latter shall be of uniform thickness and homogenous and uniform in colour with an eggshell flat finish. The painted surfaces shall be free from cracks and blisters. All painted surfaces shall be considered warranted against peeling, blistering and excessive fading and as such these effects when noted will be considered as defects.

6.10.3.8 Concrete Embedment of Posts

Where so indicated on the Drawings the bases of posts shall be embedded in concrete. Concrete shall be rammed round the base of the post such that the post will be firmly held in position immediately after completion of placing and compaction.

The minimum thickness of concrete embedment and its height shall be as shown on the Drawings or be a minimum of 0.1 cubic metres of class 15 concrete.

The post shall be carefully positioned and plumbed and struts and stays applied as necessary to hold it in position during embedment. The concrete shall then be placed round the post in uniform lifts not exceeding 200 mm and each lift thoroughly rammed. Care shall be taken to avoid contamination of the concrete from the surrounding surface and soils.

Any contaminating material falling into the concrete shall be immediately removed.

All the concrete embedment for a post shall be provided in one operation and where the surface of the concrete embedment is above the level of the surrounding surface the exposed portion shall be formed to present a neat and tidy appearance and sloped to shed water away from the post.

6.10.4 Measurement

The quantity to be measured for payment shall be the actual number of completed road signs of each type and size furnished, placed and accepted. Sign Posts shall be measured separately.

6.10.5 Payment

The work, measured as provided in 6.10.4 above, shall be paid for at the Contract unit price for each type and size of sign which price and payment shall be full compensation for furnishing and erecting all materials including all labour, tools, testing and incidentals necessary to complete the work.

Payment for sign posts shall include all excavation, concreting etc.

Pay items shall be:

06/10/01	Traffic Signs (Area as stated in Bill of Quantities) *(indicate whether reflective sign faces are required)*	Number
06/10/02	Sign Post (Size as stated in Bill of Quantities)	Number

BANGLADESH HIGHWAYS DEPARTMENT THE PEOPLE'S REPUBLIC OF

6.11 RUMBLE STRIP

6.11.1 Description

6.11.1.1 General

This work shall consist of series (typically five) of strips crosswise in the road at locations shown on the Drawings. In accordance with the specifications and in conformity with the lines and grades shown on the Drawings or as directed by the Engineer.

Rumble strips give a psychological barrier-impression for reducing speed ahead of Junction, Intersection, Curves, Sharp Turnings & other important traffic points where speed should be lowered. These devices not only reduce the speed but also guide them through relevant traffic sign of hazard ahead. When driver drives over the strips he shall hear and feel the crawling sound caused by the strips.

The work shall include the furnishing all materials; application of the tack coat; screening of the aggregate; the mixing of the bituminous material with the aggregates; the placing, finishing, and compaction of the mixed materials; application of thermoplastic paints and finishing all the processes necessary to complete the work.

6.11.1.2 Sizes, Colours and Types

Rumble strips are Transverse rumble strips, which are widely used all over the world as a warning device. Key point when using rumble strips is that those are made across total asphalt width, otherwise drivers try to avoid driving over those by going around.

Rumble strips shall be of the sizes, colours and types indicated on the Drawings unless otherwise directed by the Engineer. Reference shall be made to the Bangladesh Road Transport Authority's Traffic Signs Manual when specific requirements are not detailed.

Usually height of the rumble strips **(Premix Bituminous layer)** depends on traffic composition, road hierarchy and speed limit of road. Vehicle with bigger tyres does not feel too low strips, so road link with more heavy traffic needs higher strips.

The maximum height of Thermoplastic paints shall be 3 mm. for better performance.

6.11.1.3 Alternative Designs and Materials

The Contractor may submit or recommend alternative designs and construction materials to those specified or shown on the Drawings but these must meet the requirements of the Bangladesh Road Transport Authority's Traffic Signs Manual and have the consent of the Employer.

6.11.2 Materials

Above road surface located strips could be made of premix bituminous mixture, thermoplastic road marking material etc. Unless otherwise detailed on the Drawings or directed by the Engineer.

Rumble strips should be marked with the thermoplastic markings to improve and ensure the visibility during dark hours and poor weather condition.

- Materials used for rumble strip must be tested for ensuring quality and longevity.
- Only crushed aggregate (with maximum graded grain size 6~8 mm) is allowed to be used.

- All materials used for rumble strip must be free of organic and other objectionable material.
- Machine or manual pre-mixing is allowed.
- [1]A small percent of cement (say 3% by volume) may be used during pre-mixing, which will ensure quick setting and extra bondage, thereby increased longevity under pneumatic wheel frictions.

6.11.2.1 Tack Coat

Liquid asphalt for tack coat shall be rapid-curing type cutback grades RC.2 or RC.4 as directed by the Engineer, and shall conform to the requirements of **clause 3.11 premix bituminous** carpeting of this specification.

6.11.2.2 Bituminous Mixture

The bituminous mixture for " Rumble Strips" shall conform to the requirements of **clause 3.11 premix bituminous carpeting**.

6.11.2.3 Thermoplastic Paint

Thermoplastic paint (**Asparaga**) with **Ballotini** (400-500 gm/m²) on the top of the median shall meet the requirements of **Clause no. 6.5** of this specification.

6.11.2.4 Form Work

Steel forms shall be used for construction of Rumble Strips. Forms shall be placed on the road surface tightly so that shape of the works is obtained as per drawings.

6.11.3 Construction Methods

Construction sequence are as follows:-

- Marking of line of the road section to ensure correct alignment of rumble strip.
- Measuring and marking of transverse strips.
- Cleaning of road surface.
- Adding tack coat.
- Constructing of transverse strips.
- Applying thermoplastic road marking over the strips.

Working area must be separated with empty oil barrels, robe and flags from traffic area and appropriate traffic management plan.

6.11.3.1 Surface Preparation

Immediately prior to the application of the tack coat, the bituminous surface shall be cleaned free of all dirt, dust and other foreign substances, which in the opinion of the Engineer, would prevent proper bonding of the tack coat.

6.11.3.2 Application of Tack Coat

Immediately after the surface has been cleaned and approved by the Engineer, the tack coat shall be applied to the area to receive rumble strips. The bituminous material shall be applied by means of approved hand-spraying equipment. The rate of application shall be as shown on the plans or as ordered by the Engineer, but in no case shall exceed

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one-quarter (1/4) litre per square meter. The tack coat shall be applied uniformly and to the satisfaction of the Engineer/ Engineer's and there shall be a minimum amount of pickup from traffic.

6.11.3.3 Placing of Bituminous Mixture

When the tack coat has set, the Contractor shall place a rumble strip from in position. The hot bituminous mixture shall be placed in the forms by hand methods and consolidated by wooden hand hammer and struck flush with the top of the form.

6.11.3.4 Compaction of Bituminous Mixture

After the bituminous mixture has been placed in the form and consolidated, the form shall be carefully lifted and removed from the roadway and rolling operations shall be immediately started, Rolling shall be performed with an approved pneumatic roller/vibrating roller and shall be continued until the desired compaction & thickness is obtained as determined by the Engineer. Turning of the roller on the "Rumble Strips" will not be permitted. Following the completion of rolling operations, all visible tack coats shall be blotted with locally available sand, followed by one (1) pass of the roller.

6.11.4 Measurement

Measurement of " Rumble Strips" should on the basis of compacted volume ie, in Cubic Meter of bituminous mix laid as per drawing. Measurement shall be based on the dimensions as shown on the plans or as otherwise directed or authorized by the Engineer. No measurement shall be made of unauthorized areas. This item shall include the furnishing of all materials; application of the tack coat; screening of the aggregate; the mixing of the bituminous material with the aggregates; placing, finishing, and compaction of the mixed materials.

Thermoplastic paint including ballotini shall be measured in square metre completed in accordance with this specification and accepted traffic sign also be placed both end of " Rumble Strips"'.

6.11.5 Payment

The work, measured as provided in 6.12.4 above, shall be paid for at the Contract unit rate per cubic meters. The payment shall be the full compensation for furnishing and processing all materials including all labour, tools, testing and incidentals necessary to complete the work.

Pay items shall be:

06/11/01	Rumble strips (Bituminous Concrete Volume)	Cubic Meter
06/11/02	Road Marking - Thermoplastic Material (by spray)	Square Metre

Payment for rumble strips shall include all materials, trial, testing, labor, equipment, tools, supplies and incidentals for completion of the work.

6.12 PROTECTION OF WORKS

6.12.1 Scope of Work

Bridge abutments and culvert inlets shall be protected by brick mattressing laid over geotextile filter fabric in accordance with the Drawings and these specifications.

6.12.2 Bricks For Mattressing

6.12.2.1 General

This section specifies whole bricks for use in the Works.

6.12.2.2 Sampling

Whole bricks shall be sampled in accordance with Standard Test procedures Clause 1.1. Samples thus collected will be tested for crushing strength, unit weight and water absorption. Samples shall be collected from each batch of 5,000 bricks supplied, or more frequently as the Engineer may direct.

6.12.2.3 Dimension

First Class Bricks should have the following dimensions after burning; 250 mm x 120 mm x 70 mm. Picked Jhama (PJ) Bricks may have dimensions slightly below those for other brick but not less than 235 mm x 110 mm x 70 mm.

6.12.2.4 Appearance

Bricks shall be uniform in size and colour and shall emit a clear metallic ringing sound when struck one against another. They should have an even surface without cracks.

6.12.2.5 Unit Weight

The unit weight shall be determined in accordance with STP 7.8.3 (Compacted). The unit weight of 1st Class broken bricks shall not be less than 1100 kg/m³ and Picked Jhama broken bricks shall not be less than 1200 kg/m³.

6.12.2.6 Crushing Strength

The crushing strength of bricks shall be tested in accordance with STP 7.8.4. The average crushing strength of 1st class bricks shall not be less than 17 N/mm² and for PJ bricks shall not be less than 20 N/mm².

6.12.2.7 Water Absorption

The water absorption shall be determined in accordance with STP 7.8.3 for Material between 38 mm and 10 mm. The water absorption as a percentage of the dry weight shall not exceed 20%, for 1st class bricks or 15% for PJ bricks.

6.12.3 Geotextile Filter Fabric

Geotextile filter fabric used in the works shall be equivalent to Biddam U44 or Terram 2000 or polyfelt TS 650. The material shall be supplied in rolls and installed completely in accordance with the manufacturers instructions.

6.12.4 Mattressing

6.12.4.1 General

The Contractor shall construct mattressing over geotextile filter fabric consisting of bricks enclosed by wire mesh, and metal stakes consisting of 16mm diameter round reinforcing bar as shown on the Drawings to provide scour protection around structures and elsewhere as directed by the Engineer.

The geotextile fabric shall be placed on a smooth and uniform foundation, cleared and grubbed and compacted as for roadway embankment, prior to the installation of the mattressing.

6.12.4.2 Bricks

Brick used in mattressing shall be Picked Jhama bricks complying with the requirements of Section 6.11.2.

6.12.4.3 Galvanized Wire Mesh

Wire for mattressing shall be mild steel wire conforming to the appropriate British Standard and hot dip galvanized weaving to the requirements of BS 729.

The wire shall be not less than 2.5 mm in diameter and the minimum weight of zinc coating shall be 270 grams per square metre. The adhesion of the zinc coating to the wire shall be such that when the wire is wrapped six turns around a mandrel four times the diameter of the wire, it shall not flake nor crack to such an extent that any zinc can be removed by rubbing by fingers.

The mesh shall be hexagonal woven with the size of mesh no greater than 60mm by 80mm and joints shall be formed by twisting each pair of wires through three half turns. The shorter dimension shall be taken from centre to centre of the twisted joints and the longer dimension, which is nominal, from the ends of the twisted joints. The mesh shall be laid so that the longer dimensions of both the mesh and the bricks are at right angles to each other.

6.12.4.4 Placement

Bricks shall be placed in baskets approximately 2m width by 6m long and 200mm thick. Picked Jhama whole brick shall be first placed in the baskets so that the 110mm x 240mm face of the brick is vertical. Broken brick pieces not smaller than 70mm x 57mm x 55mm shall then be randomly packed into the basket. Filling shall be carried out by raking the broken bricks to achieve compaction with a slight overfilling so that the mattress top mesh must be stretched over the bricks and then tied in place. All baskets shall be wired together to form a continuous mattress with 3mm galvanized tie wire and where the baskets abut concrete structures they shall be firmly attached to the structure with 3mm galvanized anchor wire embedded in the structure as shown on the Drawings.

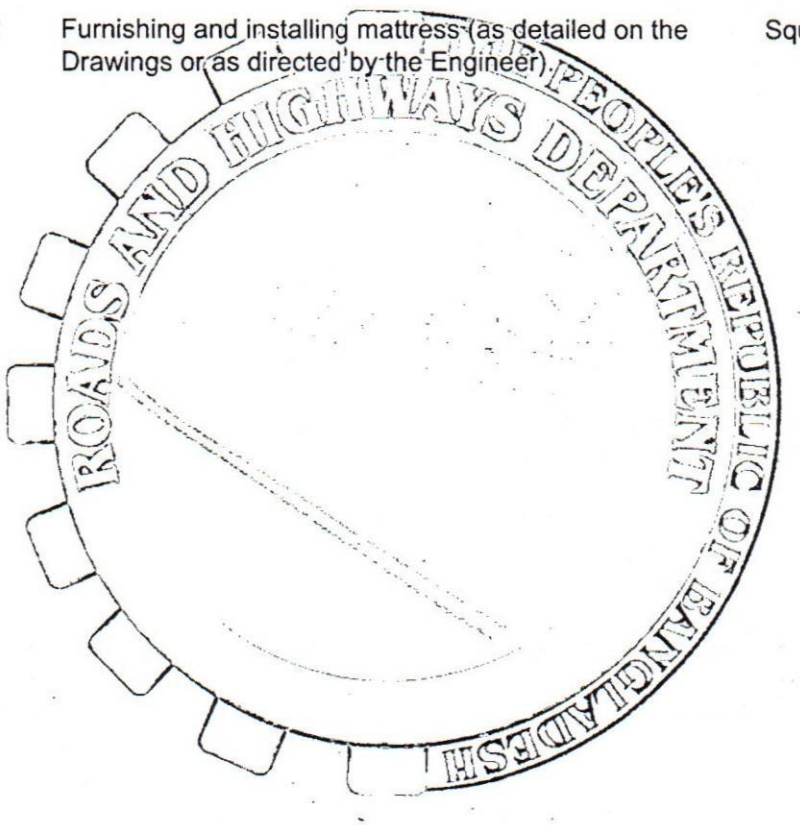
When placed on a slope, mattressing shall be constructed starting from the bottom of the slope and metal stakes consisting of steel reinforcing bars of the dimensions shown on the Drawings shall be driven through the mattressing at 1.5m centres.

6.12.5 Measurement

Measurement for payment for installing geotextile filter fabric will be made based on the area in square metres measured parallel to the face on slopes of mattressing installed as shown on the Drawings or directed by the Engineer. No additional payment will be made for fabric used to provide specified laps.

Measurement for payment for furnishing and installing mattressing will be made based on the area in square metres measured parallel to the face on slopes of mattressing installed as shown on the Drawings or directed by the Engineer. No extra measurement shall be made for cut off walls or edge thickening.

06/12/01	Geotextile filter fabric (as detailed on the Drawings, or as directed by the Engineer.	Square Metres.
06/12/02	Furnishing and installing mattress (as detailed on the Drawings or as directed by the Engineer).	Square Metres.



6.13 SLOPE PROTECTION WORKS BY PALISIDING

6.13.1 Description

This work shall consist of providing slope protection work by palisiding in accordance with these Specifications and in conformity with the requirements of the Drawings or the Engineer's instructions.

6.13.2 Requirement Of Wooden Piles

Wooden piles shall consist of best quality timber, Sal, Sundari or Garzon, the diameter of which shall be average 150 mm measured at 1/3 depth from the thick end and the length shall be minimum 6 metres.

For local bullah, wooden piles shall consist of best locally available timber, e.g., Gab, the diameter of which shall be between 150mm and 200mm and the length shall be minimum 6 metres as approved by the Engineer.

6.13.3 Construction Methods

A 1/3 rd of the length of wooden pile, but not less then 2.0 m below ground level, shall be driven at a spacing of 600 mm c/c. Two (2) layers of horizontal runners with half sawn bullah and drum sheet shall be fixed with gazali, nut, bolts etc. necessary tie wire and tie posts shall also be provided.

6.13.4 Measurement

The unit of measurement shall be the linear metre of Palisiding works completed as per the drawing and accepted.

6.13.5 Payment

The work shall be measured as provided above shall be paid at the contract unit rate per linear metre. The rate shall constitute full compensation for all labour materials, equipment, driving, fitting, fixing and all related tools, hammers and other incidental equipment and works.

No payment shall be made for unauthorized or unsatisfactory works

Pay item shall be:

06/13/01(a)	Bullah Palisiding (150mm – 175mm)	Lin. Metre
06/13/01(b)	Bullah Palisiding (Local Bullah : 150mm – 200mm)	Lin. Metre

6.14 MOBILIZATION FOR DECK SLAB REPAIRING WORK, ETC

6.14.1 Description

This work shall consist of mobilization of equipment, labour and materials for deck slab repairing work at locations as directed by the Engineer.

6.14.2 Materials

The materials for construction warning signs shall conform to the requirements of the Drawings and shall be of the appropriate type and colour and to the approval of the Engineer.

6.14.4 Measurement

The unit of measurement shall be square meters of deck slab actually repaired and accepted.

6.14.5 Payment

This work measured as provided above shall be paid for at the Contract rate for mobilization of equipment, labour and materials. The price and payment shall be full compensation for mobilizing equipment, labour and materials necessary to complete the work.

Pay items shall be:

06/14/01	Mobilization for deck slab repairing work, etc	Square Metre

6.15 CONCRETE GUIDE POST

6.15.1 Description

This work shall consist of furnishing, painting and placing precast concrete posts in accordance with these Specifications and in conformity with the requirements on the Drawings or of other parts of the Contract Documents.

The precast posts shall be cylindrical shaped (200mm dia and 1.6m long) and shall be excavated to the levels indicated on the Drawing or other parts of the Contract Documents.

6.15.2 Materials

The guide posts shall conform to the requirements of Section 4.2.2.

All painting materials shall be brought to site in original containers with seals and labels intact. Containers shall not be opened until after they have been inspected by the Engineer. Painting materials for prime and finish coats shall be determined as per instruction of the Engineer.

6.15.3 Construction Methods

6.15.3.1 Guide Post

All production and construction methods for guide posts shall conform to Sections 4.2.3.

6.15.4 Tolerances

The horizontal position of the guide posts after being driven shall not deviate from the correct position more than +10 mm perpendicular to the line of the posts and +10 mm in the direction of the line of the posts. If the Contractor during construction establishes that the above tolerance is too small, the Engineer may accept minor changes in the tolerance.

6.15.5 Measurement

The quantity to be measured for payment shall be the actual number of completed guide posts furnished, placed and accepted.

6.15.6 Payment

The Contractor's rates for guide posts will constitute full compensation for the supply of all materials including reinforcement steel. The rates shall also include handling, painting, placing and all other related works.

Pay items shall be:

06/15/01	Concrete Guide Post (1.6 m long, 200mm dia)	Number

6.16 CONCRETE KILOMETRE POSTS

6.16.1 Description

This work shall consist of furnishing and installation of concrete kilometre posts as detailed on the Drawings and at locations indicated on the Drawings or as directed by the Engineer.

6.16.2 Materials

Concrete kilometre posts shall be precast using concrete conforming to the requirements of Section 5.1. Reinforcement steel shall conform to the requirements of Section 5.2. Paint, if indicated on the Drawings, shall be of the appropriate type and colour and to the approval of the Engineer.

6.16.3 Construction Methods

Construction, fabrication and installation of concrete kilometre posts shall be as shown on the Drawings.

6.16.4 Measurement

The quantity measured for payment shall be the actual number of concrete kilometre posts placed and accepted.

6.16.5 Payment

This work measured as provided above shall be paid for at the Contract rate for each monument and post. The price and payment shall be full compensation for furnishing and placing, including all materials, labour, equipment, tools, and incidentals necessary to complete the work.

Pay items shall be:

06/16/01	Concrete Kilometre Posts	Number

6.17 RCC PALISIDING

6.17.1 Description

This work shall consist of furnishing and placing RCC posts, precast planks and anchor arrangements, all in accordance with these Specifications and in conformity with the requirements on the Drawings or of other parts of the Contract Documents.

The RCC posts consist essentially of precast and driven "I" shaped concrete posts laterally supporting precast concrete planks.

6.17.2 Materials

The RCC posts shall conform to the requirements of Section 4.2.2.

The precast concrete planks shall be constructed in accordance with the details shown on the Drawings, and in accordance with Sections 5.1 and 5.2. Cement used shall be type 1.

6.17.3 Construction Methods

6.17.3.1 RCC Post

0All production and construction methods for RCC posts shall conform to Sections 4.2.3 and 4.2.4 except that load testing shall not normally be required.

6.17.3.2 Precast Planks

The precast planks shall be placed between the RCC posts as shown on the Drawings. The planks shall be excavated or driven down to the levels indicated on the Drawings or as otherwise directed. In this connection it may be necessary to clear up the bed to the prescribed level and make local excavations along the planks as they are lowered. The method of placing the planks shall be agreed with the Engineer.

6.17.4 Tolerances

The horizontal position of the RCC posts after being driven shall not deviate from the correct position more than +10 mm perpendicular to the line of the wall and +10 mm in the direction of the wall. The precast planks in between the piles are designed to allow for a longitudinal tolerance of RCC post position of +10 mm. If the Contractor during construction establishes that the above tolerance is too small, the Engineer may accept minor changes in the tolerance. Such changes will require corresponding changes in plank sizes.

6.17.5 Measurement

The unit of measurement shall be the linear metre of Palisiding works completed as per the drawing and accepted.

6.17.6 Payment

The work shall be measured as provided above shall be paid at the contract unit rate per linear metre. The rate shall constitute full compensation for all labour materials, equipment, driving, fitting, fixing and all related tools, hammers and other incidental equipment and works.

No payment shall be made for unauthorized or unsatisfactory works

06/17/01(a)	RCC Palisiding (4m post, 200mm X 200mm)	Lin. Metre
06/17/01(b)	RCC Palisiding (3m post, 150mm X 150mm)	Lin. Metre

FIDIC® Conditions of Contract for CONSTRUCTION

FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER

Guidance for The Preparation of
Particular Conditions

Guidance
for the Preparation of Particular Conditions

CONTENTS

INTRODUCTORY GUIDANCE NOTES 2

CONTRACT DATA 3

INTRODUCTION 8

NOTES ON THE PREPARATION OF TENDER DOCUMENTS 10

NOTES ON THE PREPARATION OF SPECIAL PROVISIONS 13

1	General Provisions	14
2	The Employer	18
3	The Engineer	20
4	The Contractor	22
5	Subcontracting	28
6	Staff and Labour	29
7	Plant, Materials and Workmanship	32
8	Commencement, Delays and Suspension	33
9	Tests on Completion	35
10	Employer's Taking Over	35
11	Defects after Taking Over	35
12	Measurement and Valuation	36
13	Variations and Adjustments	36
14	Contract Price and Payment	37
15	Termination by Employer	44
16	Suspension and Termination by Contractor	45
17	Care of the Works and Indemnities	45
18	Exceptional Events	46
19	Insurance	46
20	Employer's and Contractor's Claims	46
21	Disputes and Arbitration	47

ADVISORY NOTES TO USERS OF FIDIC CONTRACTS WHERE THE PROJECT IS TO INCLUDE BUILDING INFORMATION MODELLING SYSTEMS 53

ANNEXES FORMS OF SECURITY 56

Particular Conditions Part A – Contract Data

INTRODUCTORY GUIDANCE NOTES

These Introductory Guidance Notes are for use in completing the Contract Data and shall not form part of the Contract Data.

Certain Sub-Clauses in the General Conditions require that specific information is provided in the Contract Data.

The Employer should amend as appropriate and complete all data and should insert "Not Applicable" in the space next to any Sub-Clause which the Employer does not wish to use.

The Employer should insert "Tenderer to Complete" in the space next to any Sub-Clause which the Employer wishes Contract Data to be completed by the tenderers. Except where indicated "Tenderer to Complete" tenderers shall not amend the Contract Data as provided by the Employer.

All italicised text and any enclosing square brackets are for use in preparing the Contract Data and should be deleted from the final version of the Contract Data.

Failure by the Employer to provide the information and details required in the Contract Data could mean either that the documents forming the Contract are incomplete with vital information missing, or that the fall-back provisions to be found in some of the Sub-Clauses in the General Conditions will automatically take effect.

CONTRACT DATA

Sub-Clause	Data to be given	Data
1.1.19	where the Contract allows for Cost Plus Profit, percentage profit to be added to the Cost:	_____ %
1.1.27	Defects Notification Period (DNP):	_____ days
1.1.31	Employer's name and address:	_____ _____ _____ _____ _____ _____
1.1.35	Engineer's name and address:	_____ _____ _____ _____
1.1.85	Time for Completion:	_____ days
1.3 (a)(ii).....	agreed methods of electronic transmission:	_____ _____ _____ _____
1.3(d).....	address of Employer for communications:	_____ _____ _____ _____
1.3(d).....	address of Engineer for communications:	_____ _____ _____ _____ _____ _____
1.3(d).....	address of Contractor for communications:	_____ _____ _____ _____ _____ _____
1.4	Contract shall be governed by the law of:	_____ _____
1.4	ruling language:	_____ _____
1.4	language for communications:	_____ _____
1.8	number of additional paper copies of Contractor's Documents	_____
1.15	total liability of the Contractor to the Employer under or in connection with the Contract:	_____ (*sum*)
2.1	after receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within:	_____ Days
2.4	Employer's financial arrangements:	_____ _____ _____ _____
4.2	Performance Security (as percentages of the Accepted Contract Amount in Currencies): percent: ..... currency: ..... percent: ..... currency:	 _____ % _____ _____ _____ % _____ _____
4.7.2	period for notification of errors in the items of reference	_____ days

4.19.....	period of payment for temporary utilities	_____ days
4.20.....	number of additional paper copies of progress reports	_____
5.1(a).....	maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	_____ %
5.1(b).....	parts of the Works for which subcontracting is not permitted:.....	_____ _____ _____ _____
6.5.....	normal working hours on the Site.....	_____ _____
8.3.....	number of additional paper copies of programmes	_____
8.8.....	Delay Damages payable for each day of delay.....	_____
8.8.....	maximum amount of Delay Damages	_____
12.2	method of measurement:.....	_____ _____ _____ _____
12.3	percentage profit:.....	as stated under 1.1.19 above
13.4(b)(ii)....	percentage rate to be applied to Provisional Sums for overhead charges and profit.....	_____ %
14.2.....	total amount of Advance Payment (as a percentage of Accepted Contract Amount)	_____ %
14.2.....	currency or currencies of Advance Payment.....	_____ _____
14.2.3.....	percentage deductions for the repayment of the Advance Payment	_____ %
14.3.....	period of payment.....	_____ _____
14.3(b).....	number of additional paper copies of Statements	_____
14.3(iii)	percentage of retention.....	_____ %
14.3(iii)	limit of Retention Money (as a percentage of Accepted Contract Amount)	_____ %
14.5(b)(i)	Plant and Materials for payment when shipped.....	_____ _____ _____ _____
14.5(c)(i).....	Plant and Materials for payment when delivered to the Site	_____ _____

14.6.2 ..... 14.7(a).....	minimum amount of Interim Payment Certificate (IPC) period for payment of Advance Payment to the Contractor.....	_____ _____ _____ days
14.7(b)(i)	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.6 [*Interim Payment*]..	_____ days
14.7(b)(ii)....	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 [*Final Payment*]...	_____ days
14.7(c).....	period for the Employer to make final payment to the Contractor.....	_____ days
14.8	financing charges for delayed payment (percentage points above the average bank short–term lending rate as referred to under sub-paragraph (a)).....	_____ %
14.11.1(b)...	number of additional paper copies of draft Final Statement	_____
14.15	currencies for payment of Contract Price:	_____ _____ _____ _____ _____ _____
14.15(a)(i) ..	proportions or amounts of Local and Foreign Currencies are: Local..... Foreign	_____ _____ _____ _____
14.15(c).....	currencies and proportions for payment of Delay Damages	_____ _____ _____ _____ _____ _____
14.15(f).....	rates of exchange.....	_____ _____
17.2(d).....	forces of nature, the risks of which are allocated to the Contractor.....	_____ _____ _____ _____ _____ _____
19.1	permitted deductible limits: insurance required for the Works ..... insurance required for Goods..... insurance required for liability for breach of professional duty ..... insurance required against liability for fitness for purpose (if any is required)..... insurance required for injury to persons and damage to property ..... insurance required for injury to employees ..... other insurances required by Laws and by local practice: _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

19.2(1)(b) ...	additional amount to be insured (as a percentage of the replacement value, if less or more than 15%)	_____ %
19.2(1)(iv)...	list of Exceptional Risks which shall not be excluded from the insurance cover for the Works.....	_____ _____ _____ _____ _____ _____
19.2.2	extent of insurance required for Goods ..... amount of insurance required for goods	_____ _____ _____ _____
19.2.3(a).....	amount of insurance required for liability for breach of professional duty	
19.2.3(b).....	insurance required against liability for fitness for purpose	yes/no (*delete as appropriate*)
19.2.3	period of insurance required for liability for breach of professional duty	_____ _____
19.2.4	amount of insurance required for injury to persons and damage to property	
19.2.6	other insurances required by Laws and by local practice (give details)	_____ _____
21.1	time for appointment of DAAB	_____ _____
21.1	the DAAB shall comprise.....	_____ members
21.1	list of proposed members of DAAB - proposed by Employer ..... - proposed by Contractor.....	 1. _____ _____ 2. _____ _____ 3. _____ _____ 1. _____ _____ 2. _____ _____ 3. _____ _____
21.2	Appointing entity (official) for DAAB members	_____ _____ (*unless otherwise stated here, it shall be the president of fidic or a person appointed by the president*)

Definition of Sections (if any):

description of parts of the works that shall be designated a section for the purposes of the contract (sub-clause 1.1.73)	value: percentage* of accepted contract amount (sub-clause 14.9)	time for completion (sub-clause 1.1.84)	delay damages (sub-clause 8.8)

* These percentages shall also be applied to each half of the Retention Money under Sub-Clause 14.9.

Particular Conditions Part B – Special Provisions

INTRODUCTION

The terms of the Conditions of Contract for Construction have been prepared by the Fédération Internationale des Ingénieurs-Conseils (FIDIC) and are recommended for general use for the construction of building or engineering works, where tenders are invited on an international basis.

Modifications to the General Conditions may well be required to account for local legal requirements, particularly if they are to be used on domestic contracts.

Under the usual arrangements for this type of contract, the Contractor is responsible for the construction, in accordance with the design of the Employer, of building and/or engineering works. These Conditions allow for the possibility that the Contractor may be required to design a small proportion or a minor element of the Permanent Works, but they are not intended for use where significant design input by the Contractor is required or the Contractor is required to design a large proportion or any major elements of the Permanent Works. In this latter case, it is recommended that the Employer consider using FIDIC's Conditions of Contract for Plant and Design-Build, Second Edition 2017 (or, alternatively and if suitable for the circumstances of the project, FIDIC's Conditions of Contract for EPC/Turnkey Projects, Second Edition 2017).

The guidance hereafter is intended to assist drafters of the Special Provisions (Particular Conditions – Part B) by giving options for various sub-clauses where appropriate. In some cases example wording is included between lines, while in other instances only an aide-memoire is given.

FIDIC strongly recommends that the Employer, the Contractor and all drafters of the Special Provisions take all due regard of the five FIDIC Golden Principles:

GP1: The duties, rights, obligations, roles and responsibilities of all the Contract Participants must be generally as implied in the General Conditions, and appropriate to the requirements of the project.

GP2: The Particular Conditions must be drafted clearly and unambiguously.

GP3: The Particular Conditions must not change the balance of risk/reward allocation provided for in the General Conditions.

GP4: All time periods specified in the Contract for Contract Participants to perform their obligations must be of reasonable duration.

GP5: All formal disputes must be referred to a Dispute Avoidance/Adjudication Board (or a Dispute Adjudication Board, if applicable) for a provisionally binding decision as a condition precedent to arbitration.

These FIDIC golden principles are described and explained in the publication FIDIC's Golden Principles (http://http://fidic.org/bookshop †), and are necessary to ensure that modifications to the General Conditions:

- **are limited to those necessary for the particular features of the Site and the project, and necessary to comply with the applicable law;**
- **do not change the essential fair and balanced character of a FIDIC contract; and**

- **the Contract remains recognisable as a FIDIC contract.**

Before incorporating any new or changed sub-clauses, the wording must be carefully checked to ensure that it is wholly suitable for the particular circumstances. Unless it is considered suitable, example wording should be amended before use.

Where any amendments or additions are made to the General Conditions, great care must be taken to ensure that the wording does not unintentionally alter the meaning of other clauses in the Conditions of Contract, does not inadvertently change the obligations assigned to the Parties or the balance of risks shared between them and/or does not create any ambiguity or misunderstanding in the rest of the Contract documents.

Each time period stated in the General Conditions is what FIDIC believes is reasonable, realistic and achievable in the context of the obligation to which it refers, and reflects the appropriate balance between the interests of the Party required to perform the obligation, and the interests of the other Party whose rights are dependent on the performance of that obligation. If consideration is given to changing any such stated time period in the Special Provisions (Particular Conditions – Part B), care should be taken to ensure that the amended time period remains reasonable, realistic and achievable in the particular circumstances.

There are a number of Sub-Clauses in the General Conditions which require data to be provided by the Employer and/or the Contractor and inserted into the Contract Data (Particular Conditions – Part A). However, there are no Sub-Clauses in the General Conditions which require data or information to be included in the Special Provisions (Particular Conditions – Part B).

Provisions found in the Contract documents under Special Provisions (Particular Conditions – Part B) indicate that the General Conditions have been amended or supplemented.

In describing the Conditions of Contract in the tender documents, the following text can be used:

> "The Conditions of Contract comprise the "General Conditions", which form part of the "Conditions of Contract for Construction" Second Edition 2017 published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC), the Contract Data (Particular Conditions – Part A) and the following "Special Provisions" (Particular Conditions – Part B), which include amendments and additions to such General Conditions."

The provisions of the Special Provisions (Particular Conditions – Part B) will always over-rule and supersede the equivalent provisions in the General Conditions, and it is important that the changes are easily identifiable by using the same clause numbers and titles as appear in the General Conditions. Furthermore, it is necessary to add a statement in the tender documents for a contract that:

> "The provisions to be found in the Special Provisions (Particular Conditions – Part B) take precedence over the equivalent provisions found under the same Sub-Clause number(s) in the General Conditions, and the provisions of the Contract Data (Particular Conditions – Part A) take precedence over the Special Provisions (Particular Conditions – Part B)."

† Please Note: all web links referred to in these guidance notes are up-to-date as of the date of this publication but it is recommended that users of these guidance notes check online, at the time that they wish to reference the relevant document, for the most up-to-date version of the document.

NOTES ON THE PREPARATION OF TENDER DOCUMENTS

When preparing the tender documents and planning the tender process, Employers should read the publication FIDIC Procurement Procedures Guide 1st edition 2011 (http://fidic.org/books/fidic-procurement-procedures-guide-1st-ed-2011) which presents a systematic approach to the procurement of engineering and building works for projects of all sizes and complexity, and gives invaluable help and advice on the contents of the tender documents, and the procedures for receiving and evaluating tenders. This publication provides internationally acceptable, comprehensive, best practice procedures designed to increase the probability of receiving responsive, clear and competitive tenders using FIDIC forms of contract. FIDIC intends to update the FIDIC Procurement Procedures Guide (planned for publication at a later date) to make specific reference to these Conditions of Contract for Construction, Second Edition 2017.

The tender documents should be prepared by suitably qualified engineers who are familiar with the technical aspects of the required works and the particular requirements and contractual provisions of a construction project. Furthermore, a review by suitably-qualified lawyers is advisable.

The tender documents issued to tenderers should normally include the following:

- Letter of invitation to tender
- Instructions to Tenderers (including advice on any matters which the Employer wishes tenderers to include in their Tenders but which do not form part of the Specification and/or Drawings)
- Form of Letter of Tender and required appendices (if any)
- Conditions of Contract: General and Particular
- General information and data
- Technical information and data (including the data referred to in Sub-Clause 2.5 [Site Data and Items of Reference] of the General Conditions)
- the Specification
- the Drawings
- Schedules from the Employer
- details of schedules and other information required from tenderers
- required forms of agreement, securities and guarantees.

The publication FIDIC Procurement Procedures Guide referred to above provides useful guidance as to the content and format of each of the above.

For this type of contract where the Works are normally valued by measurement, the Bill of Quantities will usually be the most important Schedule. A Daywork Schedule may also be necessary to cover minor works to be executed at cost. In addition, each of the tenderers should receive the data referred to in Sub-Clause 2.5 [Site Data and Items of Reference], and the Instructions to Tenderers should advise them of any special matters which the Employer wishes them to take into account when pricing the Works but which are not to form part of the Contract.

When the Employer accepts the Letter of Tender, the Contract (which then comes into full force and effect) includes these completed Schedules.

The following Sub-Clauses make express reference to matters to be stated in the Specification and/or Drawings. However, it may also be necessary under other Sub-Clauses for the Employer to give specific information in the Specification (for example, under Sub-Clause 7.2 [Samples]).

1.8	Care and Supply of Documents
1.13	Compliance with Laws
2.1	Right of Access to the Site
2.5	Site Data and Items of Reference
2.6	Employer-Supplied Materials and Employer's Equipment
4.1	Contractor's General Obligations
4.4	Contractor's Documents
4.5	Training
4.6	Co-operation
4.8	Health and Safety Obligations
4.9	Quality Management and Compliance Verification Systems
4.16	Transport of Goods
4.18	Protection of the Environment
4.19	Temporary Utilities
4.20	Progress Reports
5.2	Nominated Subcontractors
6.1	Engagement of Staff and Labour
6.6	Facilities for Staff and Labour
6.7	Health and Safety of Personnel
6.12	Key Personnel
7.3	Inspection
7.4	Testing by the Contractor
7.8	Royalties
8.3	Programme
9.1	Contractor's Obligations
10.2	Taking Over Parts
11.11	Clearance of Site.

Many Sub-Clauses in the General Conditions make reference to data being contained in the Contract Data (Particular Conditions – Part A). This data must be provided in the tender documents, and these Conditions of Contract assume that all such data will be provided by the Employer, except as expressly noted in the example form of Contract Data included in this publication. If the Employer requires tenderers to provide any of the other information required in the Contract Data, the tender documents must make this clear.

If the Employer requires tenderers to provide additional data or information, a convenient way of doing this is to provide a suitably worded questionnaire with the tender documents.

The Instructions to Tenderers may need to specify any constraints on the completion of the Contract Data and/or Schedules, and/or specify the extent of other information which each tenderer is to include with his/her Tender. If each tenderer is to produce a tender security and/or a parent company guarantee, these requirements should be included in the Instructions to Tenderers: example forms are included at the end of this publication.

The Instructions to Tenderers may require the tenderer to provide information on the matters referred to in some or all of the following Sub-Clauses:

4.3 Contractor's Representative

6.12 Key Personnel

19 Insurance

It is important for the Parties to understand which of the documents included in the tender dossier, and which of the documents submitted by tenderers, will form part of the Contract and therefore have continuing effect. For example, the Instructions to Tenderers are not, by definition, a part of the Contract. They are simply instructions and information on the preparation and submission of the tender, and they should not contain anything of a binding or contractual nature.

Finally, when planning the overall programme for the project, Employers must remember to allow a realistic time for:

- tenderers to prepare and submit a responsive Tender (avoiding time that is either too short which can reduce competition and result in inadequate submittals, or too long which can be wasteful to all parties involved); and
- the review and evaluation of tenders and the award of the Contract to the successful tenderer. This will be the minimum time which tenderers should be asked to hold their tenders valid and open to acceptance.

Clause 1 General Provisions

Sub-Clause 1.1 Definitions

The opening words of Sub-Clause 1.1 mean that the definitions apply, not only to the Conditions of Contract, but to **all** the documents of the Contract. Therefore, the Employer should take care (particularly when drafting the Specification) and the Contractor should take care (particularly when drafting the documents of the Tender) to use terms in accordance with those as defined in the definitions.

Regarding the definition of "Base Date" under Sub-Clause 1.1.4, if the Employer makes significant data/information available to tenderers 28 days or less before the due date for submission of tenders, then it is recommended that the Employer consider extending that date so that such information is provided before the Base Date for the purposes of the Contract conditions (including Sub-Clause 2.5 [*Site Data and Items of Reference*] and Sub-Clause 4.12 [*Unforeseeable Physical Conditions*]).

The defined term "Site", under Sub-Clause 1.1.74, is used for a number of different purposes in the General Conditions (for example: insurances and security) and so, if it is anticipated that any item(s) of equipment, Plant, Materials and Temporary Works are to be located or stored in places other than where the Permanent Works are to be executed, it is recommended that

consideration be given to specifying such places in the Contract (by the Employer in the Specification and/or by the Contractor in the Tender).

In general, changes should not be made to the definitions as this could have serious consequences on the interpretation of the documents of the Contract, particularly the Conditions of Contract.

However, there are limited circumstances where it may be desirable to amend some of the definitions. For example:

1.1.4 the Base Date could be defined as a particular calendar date
1.1.42 one particular Foreign Currency may be required
1.1.52 a different currency may be required to be the contract Local Currency

Also, some of the defined terms in the General Conditions may not be appropriate and may need changing or developing.

For example, if the extent of the Site crosses the border between two countries, it is recommended that consideration be given to the following changes:

EXAMPLE 1.1.20

" "Country" means either xxxxx or yyyyy depending on the location to which the reference will apply."

EXAMPLE 1.1.52

" "Local Currency" means the currency of (*insert name of Country*) or (*insert name of Country*)."

Sub-Clause 1.1.82 "Tests after Completion"

If the Contract specifies that the Contractor shall design any part of the Permanent Works and if, after such part has been taken over, the Employer wishes to carry out Tests after Completion on that part, detailed requirements regarding these tests should be stated in the Specification.

The Specification should describe the tests the Employer will carry out to verify that the part designed by the Contractor fulfils the Employer's performance requirements, which requirements should also be stated in the Specification.

Further, it is recommended that consideration be given to including provisions in the Special Provisions that are based on those of Clause 12 in FIDIC's Conditions of Contract for Plant & Design-Build Projects, Second Edition 2017.

If it is necessary to introduce new terminology into the text of the Special Provisions, each term should be carefully and properly defined, using a clear Sub-Clause numbering system for the new/additional defined terms. It is recommended, that the numbering of new definitions does not interfere with the numbering as originally included in the General Conditions. For example:

EXAMPLE New definition B 1.1.x

" "Safety Regulations" means the Employer's safety regulations existing on the Site which the Contractor is required to follow."

In some jurisdictions, it may be advisable to add additional definitions to clarify certain terms/expressions which appear in the General Conditions but are not defined. A typical example might be:

EXAMPLE New definition B 1.1.'n'

" "Gross Negligence" means any act or omission of a party which is contrary to the most elementary rules of diligence which a conscientious employer or contractor would have observed in similar circumstances, and/or which show serious reckless disregard for the consequences of such an act or omission. It involves materially more want of care than mere inadvertence or simple negligence."

Sub-Clause 1.2 Interpretation

In relation to the meaning of "consent" under sub-paragraph (g), it should be noted that this does not mean "approve" or "approval" which, under some legal jurisdictions, may be interpreted as accepting or acceptance that the requested matter is wholly satisfactory - following which the requesting party may no longer have any responsibility or liability for it.

Sub-Clause 1.3 Notices and Other Communications

If Notices are only to be given in paper format by post, then consideration may be given to increasing the particular timescales for Notices in the Conditions of Contract to allow extra days for the Notice to be delivered to the recipient.

Sub-Clause 1.5 Priority of Documents

An order of precedence is usually necessary, in case a conflict is subsequently found between the documents of the Contract.

If the Specification is to comprise a number of documents, it may be useful to amend sub-paragraph (g) of this Sub-Clause 1.5 by adding an order of precedence between the documents of the Specification.

If no order of precedence of any of the documents of the Contract is to be prescribed, this Sub-Clause may be varied:

EXAMPLE Delete Sub-Clause 1.5 and substitute:

"The documents forming the Contract are to be taken as mutually explanatory of one another. If an ambiguity or discrepancy is found, the priority shall be such as may be accorded by the governing law. The Engineer has authority to issue any instruction which he/she considers necessary to resolve an ambiguity or discrepancy."

Sub-Clause 1.6 Contract Agreement

The form of the Contract Agreement should be included in the tender documents as an annex to the Special Provisions: an example form is included at the end of this publication (in the section "Sample Forms").

If lengthy tender negotiations were necessary, it is recommended that consideration be given to recording in the Contract Agreement: the Accepted Contract Amount, the Base Date and/or the Commencement Date.

Entry into a formal Contract Agreement may be mandatory under the applicable law. In such a case, the words "unless they agree otherwise" should be deleted from the text.

Sub-Clause 1.10 Employer's Use of Contractor's Documents

Additional provisions may be required if all rights to particular items of computer software (for example) are to be assigned to the Employer. These provisions should take account of the applicable law.

Sub-Clause 1.13 Compliance with Laws

In respect of sub-paragraphs (b) and (c) of this Sub-Clause, if (in addition to the provisions of Sub-Clause 4.18 [Protection of the Environment]) the applicable law requires the Contractor to apply for and/or comply with particular environmental permits, these permits should be stated in the Specification together with the Contractor's obligations associated with each permit.

Sub-Clause 1.14 Joint and Several Liability

If it is likely that one or more of the tenderers will be a Joint Venture, detailed requirements for the JV may need to be specified in addition to those listed in the definition of "JV Undertaking" under Sub-Clause 1.1.47. For example, it may be desirable for each member of the JV to produce a parent company guarantee: an example form is included at the end of this publication (in the section "Sample Forms").
These requirements should be included in the Instructions to Tenderers. Normally the Employer will wish the leader of the JV to be appointed at an early stage, providing a single point of contact thereafter, and will not wish to be involved in a dispute between the members of a JV.

The Employer should scrutinise the JV Undertaking carefully and, where relevant, check if the project's financing institution(s) has/have to give consent.

Sub-Clause 1.15 Limitation of Liability

If it is required that the limitation of each Party's liability to the other Party is to include certain "indirect or consequential loss or damage" and is also to take into account liabilities which are to be insured under Clause 19 [*Insurance*], the Contract Data and this Sub-Clause may be varied:

EXAMPLE

In the Contract Data, add the following:

" 1.15 Amount of Sum A: _____
Amount of Sum B: _____
Amount of Sum C: _____ "

Delete Sub-Clause 1.15 and substitute:

"Except as stated in this Sub-Clause, neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract.

The Contractor's liability to the Employer under or in connection with the Contract shall be limited as follows:

(a) for failure to comply with Sub-Clause 8.2 [*Time for Completion*], the limit shall be the maximum amount of Delay Damages stated in the Contract Data;

(b) for loss of profit, loss of any contract or loss of use of any part of the Permanent Works (after taking over under the Contract), caused by:

  (i) defects attributable to the Contractor, the limit shall be the sum A stated in the Contract Data;

  (ii) damage to the Works caused by the Contractor, the limit shall be the sum B stated in the Contract Data;

  (iii) damage caused by the Contractor to the Employer's property other than the Works, the limit shall be fifty percent (50%) of the sum B stated in the Contract Data; and

  (iv) any other matter attributable to the Contractor, the limit shall be fifty percent (50%) of the sum A stated in the Contract Data;

(c) for damage caused by the Contractor to the Works, the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.1 [*The Works*];

(d) for damage caused by the Contractor to the Employer's property other than the Works, the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.4 [*Injury to persons and damage to property*];

(e) for death or injury to the Employer's personnel or the Engineer's personnel by a cause attributable to the Contractor, the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.5 [*Injury to employees*];

(f) for the Contractor's indemnity to the Employer for third party claims under the first paragraph of Sub-Clause 17.4 [*Indemnities by Contractor*], there shall be no limit; and

(g) for the Contractor's indemnity to the Employer under the second paragraph of Sub-Clause 17.4 [*Indemnities by Contractor*], the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.3 [*Liability for breach of professional duty*];

(h) for all matters other than those described in sub-paragraphs (b) to (g) above and other than those under Sub-Clause 17.3 [*Intellectual and Industrial Property Rights*], the limit shall be the sum C stated in the Contract Data.

The Employer's liability to the Contractor under or in connection with the Contract shall be limited as follows:

(i) for loss of profit, loss of any contract or any other direct loss caused by termination of the contract under Sub-Clause 15.5 [*Termination for Employer's Convenience*] and Sub-Clause 16.2 [*Termination by Contractor*], the

limit shall be twenty percent (20%) of the Accepted Contract Amount;

(ii) for damage caused by the Employer or Employer's Personnel to the Temporary Works or Plant and Materials not included in the Permanent Works, the limit shall be thirty percent (30%) of the required value of cover of the insurance under Sub-Clause 19.2.1 [*The Works*];

(iii) for damage caused by the Employer or Employer's Personnel to the Contractor's Equipment, Materials, Plant and/or Temporary Works, the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.2 [*Goods*];

(iv) for death or injury to the Contractor's Personnel by a cause attributable to the Employer the limit shall be the required value of cover of the insurance under Sub-Clause 19.2.5 [*Injury to employees*];

(v) for the Employer's indemnity to the Contractor for third party claims under Sub-Clause 17.5 [*Indemnities by Employer*], there shall be no limit; and

(vi) for all matters other than those described in sub-paragraph (i) to (v) above and other than under Sub-Clause 17.3 [*Intellectual and Industrial Property Rights*], the limit shall be in accordance with Sub-Clause 14.14 [*Cessation of Employer's Liability*] as may be amended under Sub-Clause 21.4 [*Obtaining DAAB's Decision*], Sub-Clause 21.5 [*Amicable Settlement*] or Sub-Clause 21.6 [*Arbitration*].

This Sub-Clause shall not limit liability in any case of fraud, gross negligence, deliberate default or reckless misconduct by the defaulting Party."

Clause 2 The Employer

Sub-Clause 2.1 Right of Access to the Site

It may be necessary for the Contractor to have early access to the Site for the purposes of survey and sub-surface investigations. If so, the details of such early right of access should be stated in the Specification, including any restrictions on such access and whether or not it shall be exclusive to the Contractor.

If right of access to, and possession of, the Site cannot be granted by the Employer in the normal way, details should be stated in the Specification and appropriate amendments made to the first paragraph of this Sub-Clause and, if necessary, to the second paragraph.

Sub-Clause 2.3 Employer's Personnel and Other Contractors

The provisions concerning co-operation between contractors should be reflected in the Employer's contracts with any other contractors working on or near the Site.

Sub-Clause 2.6 Employer-Supplied Materials and Employer's Equipment

If Employer-Supplied Materials are listed in the Specification for the Contractor's use in the execution of the Works, the following provisions may be added:

EXAMPLE

After the last paragraph of Sub-Clause 2.6, add:

"The Employer shall supply to the Contractor the Employer-Supplied Materials listed in the Specification, at the time(s) stated in the Specification (if not stated, within the times that shall be required to enable the Contractor to proceed with execution of the Works in accordance with the Programme).
When made available by the Employer, the Contractor shall visually inspect the Employer-Supplied Materials and shall promptly give a Notice to the Engineer of any shortage, defect or default in them. Thereafter, the Contractor shall rectify such shortage, defect or default to the extent instructed by the Engineer. Such instruction shall be deemed to have been given under Sub-Clause 13.3.1 [*Variation by Instruction*].

After this visual inspection, the Employer-Supplied Materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody, and control shall not relieve the Employer of liability for any shortage, defect or default not apparent from a visual inspection."

In the last paragraph of Sub-Clause 17.1 [*Responsibility for Care of the Works*] after the two instances of "Goods" add

", Employer-Supplied Materials,".

If Employer's Equipment is listed in the Specification for the Contractor's use in the execution of the Works, the following provisions may be added:

EXAMPLE

After the last paragraph of Sub-Clause 2.6, add:

"The Employer shall make the Employer's Equipment listed in the Specification available to the Contractor at the time(s) stated in the Specification (if not stated, within the times that shall be required to enable the Contractor to proceed with execution of the Works in accordance with the Programme).

Unless expressly stated otherwise in the Specification, the Employer's Equipment shall be provided for the exclusive use of the Contractor.

When made available by the Employer, the Contractor shall visually inspect the Employer's Equipment and shall promptly give a Notice to the Engineer of any shortage, defect or default in them. Thereafter, the Contractor shall rectify such shortage, defect or default to the extent instructed by the Engineer. Such instruction shall be deemed to have been given under Sub-Clause 13.3.1 [*Variation by Instruction*].

The Contractor shall be responsible for the Employer's Equipment while it is under the Contractor's control and/or any of the Contractor's Personnel is operating it, driving it, directing it, using it, or in control of it.

The Contractor shall not remove from the Site any items of the Employer's Equipment without the consent of the Employer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel to or from the Site."

In the last paragraph of Sub-Clause 17.1 [*Responsibility for Care of the Works*] after the two instances of "Goods" add:

", Employer's Equipment",

Clause 3 The Engineer

Sub-Clause 3.1 The Engineer

It is recommended that the engineer who was appointed by the Employer to carry out the Employer's design of the Works is retained by the Employer to act as the Engineer under the Contract for services during construction of the Works.

In the appointment of the Engineer, it is recommended that the Employer and the Engineer use the form of agreement FIDIC Clients/Consultants Model Services Agreement fifth Edition, 2017 **(http://fidic.org/books/clientconsultant-model-services-agreement-5th-ed-2017-white-book)**.

Sub-Clause 3.2 Engineer's Duties and Authority

In performing the Engineer's duties and in exercising his/her authority under the Contract, the Engineer should take due regard of:

a) FIDIC's Code of Ethics for consulting engineers: http://fidic.org/about-fidic/fidic-policies/fidic-code-ethics†;

and

b) the duty to prevent corruption and bribery as described in the publications:

- FIDIC Guidelines for Integrity Management (FIM) in the consulting industry, Part 1- Policies and principles first edition, 2011 (http://fidic.org/books/integrity-management-system-fims-guidelines-1st-ed-2011-part1†) and
- FIDIC Guidelines for Integrity Management System in the Consulting Industry 1st Ed (2015) Part 2, FIMS Procedures (http://fidic.org/books/guidelines-integrity-management-system-consulting-industry-1st-ed-2015-part-2†).

If there are any requirements for Employer's consent, this Sub-Clause requires that these should be set out in the Special Provisions and so the following provisions should be added to this Sub-Clause:

EXAMPLE "The Engineer shall obtain the consent of the Employer before taking action under the following Sub-Clauses of these Conditions:

(a) Sub-Clause _____*
(b) Sub-Clause _____* "

* *[Insert Sub-Clause number (not Sub-Clause 3.7 [Agreement or Determination] – please see below) and describe the specific procedure to be followed by the Engineer, where appropriate].*

This list should be extended or reduced as necessary. If the obligation to obtain the Employer's consent only applies beyond certain limits, financial or otherwise, the example wording should be varied accordingly.
It should be noted that any such requirement shall not be applied to any action by the Engineer under Sub-Clause 3.7 [*Agreement or Determination*], as stated in Sub-Clause 3.2 [*Engineer's Duties and Authority*] of the General Conditions.

Sub-Clause 3.4 Delegation by the Engineer

The Engineer's assistants may include: design engineers, other construction professionals, technicians, inspectors and/or specialist independent engineers and/or inspectors appointed to monitor and review the execution of the Works (including inspecting and/or testing items of Plant and/or Materials).
If it is anticipated that the Engineer's assistants may not all be fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*], consideration should be given to amending this Sub-Clause:

EXAMPLE In the second paragraph of Sub-Clause 3.4, after "Sub-Clause 1.4 [*Law and Language*]" add the following:

"If any assistants are not fluent in this language the Engineer shall make competent interpreters available during all working hours, in a number sufficient for those assistants to properly perform their assigned duties and/or exercise their delegated authority."

Sub-Clause 3.5 Engineer's Instructions

If the applicable law prevents the Contractor from complying with any Engineer's instruction that may have an adverse effect on the health and safety of the Contractor's Personnel, sub-paragraph (b) of this Sub-Clause may be amended:

EXAMPLE At the end of sub-paragraph (b) of Sub-Clause 3.5, add the following:

"or will adversely affect the health and safety of the Contractor's Personnel".

If the Conditions of Contract are to allow for the giving of oral instructions by the Engineer, this Sub-Clause may be amended:

EXAMPLE At the end of Sub-Clause 3.5, add the following:

"If the Engineer or a delegated assistant:

(a) gives an oral instruction;

(b) receives a written confirmation of the instruction, from the Contractor, within two working days after giving the oral instruction; and

(c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation

then the Contractor's confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be)."

Sub-Clause 3.7 Agreement or Determination

The Engineer shall not delegate any of his/her duties under this Sub-Clause to the Engineer's Representative (if appointed) or to any assistant, as stated under Sub-Clause 3.4 [*Delegation by the Engineer*].

The opening words of this Sub-Clause state that the Engineer "shall act neutrally between the Parties" when carrying out his/her duties under this Sub-Clause and "shall not be deemed to act for the Employer". By these statements it is intended that, although the Engineer is appointed by the Employer and acts for the Employer in most other respects under the Contract, when acting under this Sub-Clause the Engineer treats both Parties even-handedly, in a fair-minded and unbiased manner.

Sub-Clause 3.8 Meetings

It may be useful to give information in the Specification of a planned timetable of meetings such as management meetings, site meetings, technical meetings, and progress meetings.

Clause 4 The Contractor

Sub-Clause 4.1 Contractor's General Obligations

In some projects there may be an item or items of Temporary Works for which the Contractor will not be fully responsible. For example, an Employer-designed temporary diversion of an existing road or waterway may be necessary to facilitate the Works. In this case, and in order for the second sentence of the third paragraph to apply ("Except to the extent specified in the Contract ..."), the item(s) of Temporary Works and the extent of the Employer's responsibility should be clearly stated in the Contract (by the Employer in the Specification, or by the Contractor in the Tender).

Sub-Clause 4.2 Performance Security

The acceptable form(s) of Performance Security should be included in the tender documents. Example forms are included at the end of this publication (in the section "Sample Forms"). They incorporate two sets of Uniform Rules published by the International Chamber of Commerce (the "ICC", which is based at 33-43 Avenue du Président Wilson, 75116 Paris, France), which also publishes guides to these Uniform Rules.

These example forms and the wording of the Sub-Clause may have to be amended to comply with applicable law.

EXAMPLE At the end of the first paragraph of Sub-Clause 4.2.1 [*Contractor's Obligations*], insert:

"If the Performance Security is in the form of a bank guarantee, it shall be issued either (i) by a bank located in the Country, or (ii) directly by a foreign bank to which the Employer gives consent. If the Performance Security is not in the form of a bank guarantee, it shall be issued by a financial entity registered, or licensed to do business, in the Country."

The example forms of Performance Security that are included at the end of this publication (in the section "Sample Forms") provide for the option to reduce the amount of the Performance

Security following issue of the Taking-Over Certificate for the whole of the Works under Clause 10. If neither of the example forms is to be used, consideration should be given to adding provisions for this option to Sub-Clause 4.2.1.

Sub-clause 4.3 Contractor's Representative

If the Contractor's Representative is known at the time of submission of the tender, the tenderer may propose that person in his/her tender. The tenderer may wish to propose alternatives, especially if the contract award seems likely to be delayed.

The "main engineering discipline applicable to the Works" in which the Contractor's Representative is required to be qualified, experienced and competent should be the engineering discipline of the Works which is of highest value proportionate to the value of the Works. If it is necessary to stipulate that the Contractor's Representative shall be qualified, experienced and competent in a particular engineering discipline in relation to the Works, the following amendment will need to be made to this Sub-Clause:

EXAMPLE In the second paragraph of Sub-Clause 4.3 delete "the main engineering discipline applicable to the Works" and replace with:

[Insert description of engineering discipline],

If it is necessary that the Contractor's Representative shall also be fluent in a particular language other than the language for communications defined in Sub-Clause 1.4 [*Law and Language*], the following amendment may be made:

EXAMPLE At the end of the second paragraph of Sub-Clause 4.3, add:

"The Contractor's Representative shall also be fluent in _____(*insert name of language*)."

If it is permissible that the Contractor's Representative is not fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*], consideration should be given to amending this Sub-Clause:

EXAMPLE Insert at the end of the second paragraph of Sub-Clause 4.3:

"If the Contractor's Representative is not fluent in this language the Contractor shall make competent interpreter(s) available during all working hours, sufficient for the Contractor's Representative to properly perform his/her duties and exercise his/her authority under the Contract."

If it is permissible that the Contractor's Representative's delegates are not all fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*], consideration should be given to amending this Sub-Clause:

EXAMPLE Insert at the end of the last paragraph of Sub-Clause 4.3:

"If any of these persons is not fluent in this language the Contractor shall make competent interpreters available during all working hours, in a number sufficient for those persons to properly perform their delegated powers, functions and/or authority."

Sub-clause 4.4 Contractor's Documents

Sub-Clause 4.4.1 Preparation and Review

It is important that the Specification should clearly specify which Contractor's Documents the Employer requires the Contractor to prepare, which may not necessarily include (for example) all the technical documents which the Contractor's Personnel will need in order to execute the Works.

Further, if there are Contractor's Documents that the Contractor must submit to the Engineer for review, it is important that they are clearly identified in the Specification.

If a different Review Period than that stated under Sub-Clause 4.4.1 is considered necessary, or different Review Periods are considered necessary for different (types of) Contractor's Documents, such different Review Period(s) should be clearly stated in the Specification.

Sub-Clause 4.4.3 Operation and Maintenance Manuals

If the Contractor is required to supply spare parts under the Contract, these should be detailed in the Specification, which should also specify the required guarantee period for these spare parts.

Sub-Clause 4.5 Training

If the Works include Plant that comprises (in whole or in part) new or innovative technology in the Country or at the Employer's location, it is recommended that the Parties consider including in the Contract provision for training (by the Employer in the Specification and/or by the Contractor in the Tender) of the Employer's Personnel at the location of another plant facility, or at a number of other plant facilities, that are similar in nature to the Works.

Sub-Clause 4.8 Health and Safety Obligations

If the Contractor is sharing occupation of the Site with others, it may not be appropriate for him/her to provide some of the listed items. In these circumstances:

- this Sub-Clause should be amended to specify exactly what health and safety obligations are the Contractor's under the Contract, and
- the health and safety obligations which are to be fulfilled by the Employer and/or others should be stated in the Specification

so that it is clear which Party is responsible for what in respect of the health and safety obligations for the Site and for the Works.

Sub-Clause 4.9.1 Quality Management System

In the performance of the Contractor's obligations under this Sub-Clause, it is recommended that the Contractor and the Engineer take due regard of the FIDIC publication Improving the Quality of Construction - a guide for actions, 2004 (http://fidic.org/books/improving-quality-construction-2004†).

If the Employer requires the Contractor to have a Quality Manager employed on the Site, such position should be stated in the Specification as one of the positions of Key Personnel.

If the Employer requires the Contractor to interface with others and/or with the Employer, the Specification should clearly describe all such interfaces and should specify the extent in which the Contractor shall allow for such interfaces in the QM System.

Sub-Clause 4.12 Unforeseeable Physical Conditions

In the case of a construction project which involves significant sub-surface works, it is recommended that the Employer consider the allocation of the risk of encountering adverse sub-surface conditions when the tender documents are being prepared.

If this risk is to be shared between the Parties, this Sub-Clause will need to be amended:

EXAMPLE In Sub-Clause 4.12.4 [*Delay and/or Cost*], delete the words "payment of such cost" and substitute with

"payment of ___ percent (___%) of such Cost (the balance of ___ percent (___%) shall be borne by the Contractor)."

In order to assist the Engineer in performing his duties under Sub-Clause 14.12.5 [*Agreement or Determination of Delay and/or Cost*] in the event that Unforeseeable physical conditions are encountered by the Contractor, the Employer may consider including the physical/geological/sub-surface conditions that are known at the Base Date in the Contract - in the form of a '"Baseline Report".

Sub-Clause 4.16 Transport of Goods

In some cases, the Contractor may be required to get permission prior to delivery of Goods to the Site. In such cases those Goods for which permission is required should be stated in the Specification, and the following wording may be added to this Sub-Clause:

EXAMPLE Insert at the end of Sub-Clause 4.16:

"The Contractor shall obtain the Engineer's permission prior to delivering to the Site any item of Goods which is identified in the Specification as requiring such permission. No such Goods shall be delivered without this permission, which shall not relieve the Contractor from any duty, obligation or responsibility under or in connection with the Contract."

Sub-Clause 4.17 Contractor's Equipment

If the Contractor is not to provide all the Contractor's Equipment necessary to execute the Works, the Employer's obligations should be specified: please see Sub-Clause 2.6 [*Employer-Supplied Materials and Employer's Equipment*] and the guidance notes for Sub-Clause 2.6 above.

If vesting of Contractor's Equipment to the Employer is required, and such vesting is consistent with the Laws of the Country, further paragraphs may be added to this Sub-Clause:

EXAMPLE At the end of Sub-Clause 4.17, add the following paragraphs:

"Each item of Contractor's Equipment shall become the property of the Employer (free from liens and other encumbrances) when it arrives on the Site.

This vesting of property from the Contractor to the Employer shall not:

(a) affect the responsibility or liability of the Employer under the Contract;

(b) prejudice the Contractor's right to exclusive use of all items of Contractor's Equipment for the purpose of the Works; and/or

(c) relieve the Contractor from any duty, obligation or responsibility to operate and maintain all items of Contractor's Equipment.

The property in each item of Contractor's Equipment shall be deemed to re-vest in the Contractor (free from liens and other encumbrances) when he/she is entitled to remove it from the Site or to receive the Taking-Over Certificate for the Works, whichever is the earlier."

Sub-Clause 4.18 Protection of the Environment

If the applicable environmental law requires the Contractor to prepare project-specific environmental management plans, for review by the Engineer and/or the Employer and approval by regulatory authorities, these plans should be clearly described in detail in the Specification together with the review/approval process associated with each plan.

Sub-Clause 4.19 Temporary Utilities

If services are to be available on the Site for the Contractor to use, details of such services should be stated in the Specification, including a description of each utility, the capacity of each utility that is available for the Contractor's use, its location and the price per unit of consumption.

Sub-Clause 4.21 Security of the Site

If the Contractor is sharing occupation of the Site with others, it may not be appropriate for the Contractor to be responsible for its security. In these circumstances, it is recommended that:

a) this Sub-Clause should be amended to specify exactly what security obligations are the Contractor's under the Contract,

and

b) the security obligations which are to be fulfilled by the Employer and/or others should be stated in the Specification

so that it is clear which Party is responsible for what in respect of the security of the Site.

Sub-Clause 4.22 Contractor's Operations on Site

If the Contractor is sharing occupation of the Site with others, it is recommended that this Sub-Clause is amended by identifying and allocating responsibility for clearance and removal from the Site of any wreckage, rubbish, hazardous waste, temporary works and surplus material.

Additional Sub-Clause Milestones

If the Employer wishes to have certain parts of the Works completed within certain times but does not wish to take over such parts when completed (as distinct from the parts of the Works which the Employer wishes to take over after completion, which should be defined as Sections in the Contract Data), such parts of the Works should be clearly described in the Specification as 'Milestones' and it is recommended that the following provisions are added to the Contract Data and to the Conditions of Contract:

EXAMPLE PROVISIONS FOR MILESTONES

In the Contract Data, add the following:
"4.24..... Definition of Milestones:

Description of a part of the Plant or of the Works that shall be designated a Milestone for the purposes of the Contract	Time for Completion	Delay Damages (as a percentage of final Contract Price per day of delay)
	_____ days	__ %
	_____ days	__ %
	_____ days	__ %
	_____ days	__ %

Maximum amount of Delay Damages for Milestones (percent of final Contract Price) ..... _____ %. "

Insert two new definitions under Sub-Clause 1.1:

" "**Milestone**" means a part of the Plant and/or a part of the Works stated in the Contract Data (if any), and described in detail in the Specification as a Milestone, which is to be completed by the time for completion stated in Sub-Clause 4.24 [Milestone Works] but is not to be taken over by the Employer after completion.

"**Milestone Certificate**" means the certificate issued by the Engineer under Sub-Clause 4.24 [*Milestones*]. "

Add new Sub-Clause 4.24...Milestones

"If no Milestones are specified in the Contract Data, this Sub-Clause shall not apply.

The Contractor shall complete the works of each Milestone (including all work which is stated in the Specification as being required for the Milestone to be considered complete) within the time for completion of the Milestone, as stated in the Contract Data, calculated from the Commencement Date.

The Contractor shall include, in the initial programme and each revised programme, under sub-paragraph (a) of Sub-Clause 8.3 [Programme], the time for completion for each Milestone.
Sub-paragraph (d) of Sub-Clause 8.4 [Advance Warning] and Sub-Clause 8.5 [Extension of the Time for Completion] shall apply to each Milestone, such that "Time for Completion" under Sub-Clause 8.5 shall be read as the time for completion of a Milestone under this Sub-Clause.

The Contractor may apply, by Notice to the Engineer, for a Milestone Certificate not earlier than 14 days before the works of a Milestone will, in the Contractor's opinion, be complete. The Engineer shall, within 28 days after receiving the Contractor's Notice:

(a) issue the Milestone Certificate to the Contractor, stating the date on which the works of the Milestone were completed in accordance with the Contract, except for any minor outstanding work and defects (as shall be listed in the Milestone Certificate); or

(b) reject the application, giving reasons and specifying the work required to be done and defects required to be remedied by the Contractor to enable the Milestone Certificate to be issued.

The Contractor shall then complete the work referred to in sub-paragraph (b) of this Sub-Clause before issuing a further Notice of application under this Sub-Clause.

If the Engineer fails either to issue the Milestone Certificate or to reject the Contractor's application within the above period of 28 days, and if the works of a Milestone are complete in accordance with the Contract, the Milestone Certificate shall be deemed to have been issued on the date which is 14 days after the date stated in the Contractor's Notice of application.

If Delay Damages for a Milestone are stated in the Contract Data, and if the Contractor fails to complete the works of the Milestone within the time for completion of the Milestone (with any extension under this Sub-Clause):

(i) the Contractor shall, subject to Sub-Clause 20.1 [Claims], pay Delay Damages to the Employer for this default;

(ii) such Delay Damages shall be the amount stated in the Contract Data, for every day which shall elapse between the time for completion for the Milestone (with any extension under this Sub-Clause) and the date stated in the Milestone Certificate;

(iii) these Delay Damages shall be the only damages due from the Contractor for such default; and

(iii) the total amount of Delay Damages for all Milestones shall not exceed the maximum amount stated in the Contract Data (this shall not limit the Contractor's liability for Delay Damages in any case of fraud, gross negligence, deliberate default or reckless misconduct by the Contractor)."

If certain payment(s) to the Contractor is/are to be made on completion of each Milestone, such payment(s) should be specified in a Schedule of Payments in the Contract and consideration should be given to amending Sub-Clause 14.4 [*Schedule of Payments*] to make express reference to the Milestone payments.

Clause 5 Subcontracting

Sub-Clause 5.1 Subcontractors

It may be appropriate and/or desirable, taking account of the circumstances and locality of the project, to encourage the Contractor to employ local contractors in the execution of the Work:

EXAMPLE At the end of the second paragraph of Sub-Clause 5.1, add:

"The Contractor shall give reasonable opportunity to contractors from the Country to tender for subcontracts for the Works, and shall use reasonable endeavours to employ such contractors as Subcontractors."

If no consent by the Engineer to Subcontractors is required, the last three paragraphs of this Sub-Clause may be deleted. If less consent by the Engineer to Subcontractors is preferable, this Sub-Clause may be amended:

EXAMPLE After sub-paragraph (ii) of Sub-Clause 5.1, add:

"or

(iii) a Subcontractor where the value of his/her subcontract is less than one percent (1%) of the Accepted Contract Amount."

If the Engineer's consent is required to the suppliers of certain Materials, this Sub-Clause may be amended:

EXAMPLE At the end of the third paragraph of Sub-Clause 5.1, add:

"However, the Engineer's prior consent shall be required for the suppliers of the following Materials:

_____,
_____"

(*insert details: for example, specific manufactured or prefabricated items of Materials*)

If the Employer requires that all the Contractor's subcontracts should provide for assignment of the subcontract to the Employer in the event that Sub-Clause 15.2 [Termination for Contractor's Default] applies, the following amendment will need to be made to this Sub-Clause:

EXAMPLE Insert at the end of the last paragraph of Sub-Clause 5.1:

"All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under sub-paragraph (a) of Sub-Clause 15.2.3 [After Termination]."

If the Employer requires that the Contractor assigns the benefit of the relevant subcontract in the event that a Subcontractor's obligations continue after expiry of the DNP relating to that Subcontractor's work, the following amendment will need to be made to this Sub-Clause:

EXAMPLE Insert at the end of the last paragraph of Sub-Clause 5.1:

"If a Subcontractor's obligations to the Contractor extend beyond the expiry date of the DNP which is applicable to the Subcontractor's work and if the Contractor receives an instruction from the Engineer to do so not less than 7 days before this expiry date, the Contractor shall assign the benefit of such obligations to the Employer. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for work carried out by the Subcontractor after the assignment takes effect."

Sub-Clause 5.2 Nominated Subcontractors

Normally the Contractor will select and employ subcontractor(s), (subject to any constraints stated in the Contract), but this Sub-Clause provides for the situation where the Employer may wish to select a particular subcontractor or subcontractors to be employed by the Contractor in the execution of the Works.

If this is the case, it is recommended that the Employer names the particular subcontractor(s) in the Specification so that tenderers are aware of this requirement before submitting their tenders - although this Sub-Clause also makes provision for the Engineer to instruct the Contractor to employ a subcontractor or subcontractors selected by the Employer after contract award.
It should be noted that:

a) once the Contractor has employed a subcontractor who has been nominated by the Employer, the second paragraph of Sub-Clause 5.1 [*Subcontractors*] applies; and

b) sub-paragraph (b) of Sub-Clause 13.4 [Provisional Sums] should provide for payment to the Contractor for works or services to be purchased by the Contractor from a nominated Subcontractor.

If the Employer anticipates that a Subcontractor is to be instructed under Sub-Clause 13.3 [Variation Procedure] but is not to be a nominated Subcontractor, this Sub-Clause should be amended describing the particular circumstances.

Clause 6 Staff and Labour

Sub-Clause 6.3 Recruitment of Persons

It may be necessary to review and revise this Sub-Clause (or delete it in its entirety) if the relevant labour Laws applicable to the Contractor's Personnel and/or the Employer's Personnel do not permit any restriction on the right of any worker to seek other positions.

Sub-Clause 6.6 Facilities for Staff and Labour

If the Employer plans to make any facilities and/or accommodation (for example, office accommodation) available for the Contractor's occupation and/or use, the Employer's obligations to do so and details of such facilities and/or accommodation should be stated in the Specification. See also the guidance under Clause 17 [*Care of the Works and Indemnities*] below for the suggested additional sub-clause in respect of responsibility for care of such facilities and/or accommodation.

Sub-Clause 6.8 Contractor's Superintendence

If it is permissible that the Contractor's superintending staff are not all fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*], then consideration should be given to amending this Sub-Clause:

EXAMPLE Insert at the end of sub-paragraph (a) of Sub-Clause 6.8:

"or, if not, the Contractor shall make competent interpreters available during all working hours, in a number sufficient for those persons to properly perform their superintendence duties."

If it is necessary to stipulate that the Contractor's superintending staff shall be fluent in a particular language, the following sentence should be added.

EXAMPLE Insert at the end of Sub-Clause 6.8:

"A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of

[*Insert name of language*],

or the Contractor shall make interpreters available on Site during all working hours in a number deemed sufficient by the Engineer."

Sub-Clause 6.12 Key Personnel

If it is permissible that all Key Personnel are not fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*], then consideration should be given to amending this Sub-Clause:

EXAMPLE Insert at the end of the last paragraph of Sub-Clause 6.12:

"If any of the Key Personnel are not fluent in this language the Contractor shall make competent interpreter(s) available during all working hours, sufficient for that person to properly perform his/her duties under the Contract."

Additional Sub-Clauses

It may be necessary, appropriate and/or desirable to include additional sub-clauses to take account of the circumstances and locality of the Site:

EXAMPLE SUB-CLAUSE FOR FOREIGN PERSONNEL

"The Contractor may bring into the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer shall, if requested by the Contractor, use all reasonable endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial."

EXAMPLE SUB-CLAUSE FOR SUPPLY OF FOODSTUFFS

"The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract."

EXAMPLE SUB-CLAUSE FOR SUPPLY OF WATER

"The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel."

EXAMPLE SUB-CLAUSE FOR MEASURES AGAINST INSECT AND PEST NUISANCE

"The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide."

EXAMPLE SUB-CLAUSE FOR ALCOHOLIC LIQUOR OR DRUGS

"The Contractor shall not, other than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereto by the Contractor's Personnel."

EXAMPLE SUB-CLAUSE FOR ARMS AND AMMUNITION

"The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow the Contractor's Personnel to do so."

EXAMPLE SUB-CLAUSE FOR FESTIVALS AND RELIGIOUS CUSTOMS

"The Contractor shall respect the Country's recognised festivals, days of rest and religious or other customs."

EXAMPLE SUB-CLAUSE FOR FUNERAL ARRANGEMENTS

"The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of the

Contractor's local employees who may die while engaged upon the Works."

EXAMPLE SUB-CLAUSE FOR FORCED LABOUR

"The Contractor shall not employ forced labour, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements."

EXAMPLE SUB-CLAUSE FOR CHILD LABOUR

"The Contractor shall not employ children (any natural persons under the age of eighteen years) in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labour Laws of the Country have provisions for employment of minors, the Contractor shall follow those Laws applicable to the Contractor."

EXAMPLE SUB-CLAUSE FOR EMPLOYMENT RECORDS OF WORKERS

"The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarised on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [*Contractor's Records*]."

EXAMPLE SUB-CLAUSE FOR WORKERS' ORGANISATIONS

"In countries where the relevant labour Laws recognise workers' rights to form and to join workers' organisations of their choosing without interference and to bargain collectively, the Contractor shall comply with such Laws. Where the relevant labour Laws substantially restrict workers' organisations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. In either case described above, and where the relevant labour Laws are silent, the Contractor shall not discourage the Contractor's Personnel from forming or joining workers' organisations of their choosing or from bargaining collectively, and shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organisations and bargain collectively. The Contractor shall engage with such workers' representatives. Workers' organisations are expected to fairly represent the workers in the workforce."

EXAMPLE SUB-CLAUSE FOR NON-DISCRIMINATION AND EQUAL OPPORTUNITY

"The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where the relevant labour Laws provide for non-discrimination in employment, the Contractor shall comply with such Laws. When the relevant labour Laws are silent on non-discrimination in employment, the Contractor shall meet the requirements under this Sub-Clause. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination."

Clause 7 Plant, Materials and Workmanship

Sub-Clause 7.7 Ownership of Plant and Materials

If the Contractor is to provide high-value items of Plant and/or Materials under the Contract, consideration may be given to amending this Sub-Clause:

EXAMPLE

Insert at the end of Sub-Clause 7.7:

"No Plant and/or Materials that is the property of the Employer shall be removed from the Site. If it becomes necessary to:

(i) remove any item of such Plant from the Site for the purposes of repair, the Contractor shall give a Notice, with reasons, to the Engineer requesting consent to remove the defective or damaged item off the Site. This Notice shall clearly identify the item of defective or damaged Plant, and shall give details of: the defect or damage to be repaired; the place to which defective or damaged item of Plant is to be taken for repair; the transportation to be used (and insurance cover for such transportation); the proposed inspections and testing off the Site; and the planned duration required before the repaired item of Plant shall be returned to the Site. The Contractor shall also provide any further details that the Employer may reasonably require; or

(ii). replace any item(s) of such Plant and/or Materials, the Contractor shall give a Notice, with reasons, to the Engineer clearly identifying the item(s) of Plant and/or Materials to be replaced, and giving details of the due date of delivery to the Site of the replacement item(s).

Where any item of Plant and/or Materials has become the property of the Employer under this Sub-Clause before it has been delivered to the Site, the Contractor shall ensure that such an item is not moved except for its delivery to the Site.

The Contractor shall indemnify and hold the Employer harmless against and from the consequences of any defect in title or encumbrance or charge (except

8

arrangements, instrumentation, etc.

If the Works are to be tested and taken over in Sections, it is strongly recommended that consideration is given to testing requirements in the Specification that take due account of the effect of other parts of the Works being incomplete.

For less complex projects, the Employer may consider simplifying the testing requirements under this Sub-Clause.

Clause 10 Employer's Taking Over

Sub-Clause 10.1 Taking Over the Works and Sections

If the Works are to be completed and taken over in stages it is important that each stage is defined as a Section in the Contract Data. Precise geographical definitions are advisable, and the Contract Data should include a table to also define for each Section:

- the relevant percentage for release of Retention Money,
- the Time for Completion, and
- the applicable Delay Damages.

An example form of such table is shown in the example form of Contract Data included in this publication.

Clause 11 Defects after Taking Over

Sub-Clause 11.3 Extension of Defects Notification Period

Depending on the complexity of the project and the nature of the Works, the Employer may consider amending the period of "two years" stated at the end of the first paragraph of this Sub-Clause to be a longer or a shorter period.

Sub-Clause 11.10 Unfulfilled Obligations

It may be necessary to review the effect of this Sub-Clause in relation to the period of liability imposed by the applicable law.
In particular, the second paragraph of this Sub-Clause may require amending to take account of the applicable law.

Additional Sub-Clause

If the Works include the Plant that comprises (in whole or in part) new or innovative technology in the Country or at the Employer's location, consideration may be given to including in the Specification a requirement for the Contractor to provide supervisory assistance to the Employer's permanent operating personnel in the operation and maintenance of the Plant during the DNP of the Works.

EXAMPLE SUB-CLAUSE FOR SUPERVISORY ASSISTANCE DURING DNP

"The Contractor shall provide supervisory assistance to the Employer during the DNP for the Works. Such supervisory assistance shall be as described in the Specification for the purpose of supporting the Employer's operation and maintenance of the Plant for the period of [*insert number of months*] after the Date of Completion."

Clause 12 Measurement and Valuation

Sub-Clause 12.1 Works to be Measured

If any part of the Permanent Works is to be measured according to records of its construction, this part should be identified, and the records to be made should be stated in the Specification. If the Contractor is to be responsible for any such records, this should be specified in the Contract (by the Employer in the Specification or by the Contractor in the Tender).

Clause 13 Variations and Adjustments

Variations can be initiated by any of three ways:

a) the Contractor may initiate his own proposals under Sub-Clause 13.2 [*Value Engineering*], which are intended to benefit both Parties;

b) the Engineer may instruct Variations under Sub-Clause 13.3.1 [*Variation by Instruction*]; or

c) the Engineer may request a proposal from the Contractor under Sub-Clause 13.3.2 [*Variation by Request for Proposal*].

Sub-Clause 13.4 Provisional Sums

Provisional Sums may be required for parts of the Works which are not required to be priced at the risk of the Contractor. For example, a Provisional Sum may be necessary to cover goods or services which the Employer wishes to select after award of the Contract, or to deal with a major uncertainty regarding sub-surface conditions. It is essential to define the scope of each Provisional Sum (it is recommended that this be included in a Schedule prepared by the Employer), since the amount of each Provisional Sum corresponding to the defined scope will then be excluded from the other elements of the Accepted Contract Amount.

Sub-Clause 13.7 Adjustments for Changes in Cost

The provision for adjustments under this Sub-Clause may be required if it would be unreasonable for the Contractor to bear the risk of escalating costs due to inflation.

If the amounts payable to the Contractor are to be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, for this Sub-Clause to apply it is important that a Schedule (or Schedules) of cost indexation is (are) included in the Contract and that such Schedule(s) include a formula or formulae for calculation of the applicable adjustment under this Sub-Clause.

It is recommended that the Employer be advised by a professional with experience in construction costs and the inflationary effect on construction costs when preparing the contents of the Schedule(s) of cost indexation.

SCHEDULE OF COST INDEXATION: EXAMPLE FORMULA FOR ADJUSTMENT FOR CHANGE IN COST

$$Pn = a + b\frac{Ln}{Lo} + c\frac{En}{Eo} + d\frac{Mn}{Mo} + \ldots\ldots$$

where:
"Pn" 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;

"a" is a fixed coefficient, 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, such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

(*particular care should be taken in the calculation of the weightings/coefficients ("a", "b", "c", ...), the total of which must not exceed unity*)

"Ln", "En", "Mn", ... are the current cost indices or reference prices (stated in the Schedule of cost indexation) 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

"Lo", "Eo", "Mo", ... 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.

The weightings (coefficients) for each of the factors of cost stated in the following table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

Table(s) of adjustment data for payments each month/[*YEAR*] (delete as appropriate) in ..... (currency)

Coefficient; scope of index	Country of origin; currency of index	Source of index; Title/definition	Value on stated date(s)* Value .... Date
a= 0.10 Fixe			
d			
b= ____Labour			
c=			
d=			
e=			

* These values and dates confirm the definition of each index, but do not define Base Date indices

Clause 14 Contract Price and Payment

The procedures and timing for making payments under this Clause 14 should be checked to ensure that they are acceptable to both the Employer and any financing institution the Employer may be using to fund the project.

Sub-Clause 14.1 The Contract Price

When writing the Special Provisions, consideration should be given to the amount and timing of payment(s) to the Contractor. A positive cash-flow is clearly of benefit to the Contractor, and tenderers will take account of the interim payment procedures when preparing their tenders.

Cost-plus contracts, under which the actual Cost is determined and Cost Plus Profit is paid to the Contractor, are unusual and only used when (for reasons of urgency or otherwise) the Employer is willing to accept the risks involved. If the Contractor is to be paid Cost Plus Profit, Clause 12 should be replaced by provisions describing the method of determining the Cost and the Contract Price. As a result, the provisions in the General Conditions which entitle the Contractor to payment of additional Cost will generally be of no effect.

Additional Sub-Clauses may be required to cover any exceptions to the provisions set out in Sub-Clause 14.1, and any other matters relating to payment.

Lump sum contracts may be suitable if the tender documents include details which are sufficiently complete for construction and for significant Variations to be unlikely. From the information supplied in the tender documents, the Contractor can prepare any other details necessary, and construct the Works, without having to refer back to the Engineer for clarification or further information. However, as noted in the Introduction above, if significant design input by the Contractor is required, it is recommended that the Employer consider using FIDIC's Conditions of Contract for Plant and Design-Build, Second Edition 2017 (or, alternatively and if suitable for the circumstances of the project, FIDIC's Conditions of Contract for EPC/Turnkey Projects, Second Edition 2017).

For a lump sum contract, the tender documents should include a schedule of payments (see Sub-Clause 14.4 [*Schedule of Payments*]).

EXAMPLE PROVISIONS FOR A LUMP SUM CONTRACT

Delete the second paragraph of Sub-Clause 8.5 [*Extension of Time for Completion*].

Delete Clause 12 [*Measurement and Valuation*].

Under Sub-Clause 13.3.1 [*Variation by Instruction*]:
- in sub-paragraph (c) delete the words "by valuing the Variation in accordance with Clause 12 [*Measurement and Valuation*], with supporting particulars (which shall include identification of any estimated quantities and, if the Contractor incurs or will incur Cost as a result of any necessary modification to the Time for Completion, shall show the additional payment (if any) to which the Contractor considers that the Contractor is entitled)" and replace with:

"with supporting particulars. Whenever the omission of any work forms part (or all) of a Variation, and if:

- the Contractor has incurred or will incur cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount; and
- the omission of the work has resulted or will result in this sum not forming part of the Contract Price

this cost may be included in the Contractor's proposal (and, if so, shall be clearly identified). If the Parties have agreed to the omission of any work which is to be carried out by others, the Contractor's proposal may also include the amount of any loss of profit and other losses and damages suffered (or to be suffered) by the Contractor as a result of the omission"; and

- in sub-paragraph (ii): delete the words "(including valuation of the Variation in accordance with Clause 12 [*Measurement and Valuation*] using measured quantities of the varied work)" and replace with: "and the Schedule of Payments (if any)".

Delete sub-paragraph (a) of Sub-Clause 14.1 and replace with:
"(a) the Contract Price shall be the lump sum Accepted Contract Amount and be subject to adjustments in accordance with the Contract;".

Delete sub-paragraph (c) of Sub-Clause 14.1 and replace with:
"(c) any quantities which may be set out in a Schedule are estimated quantities and are not to be taken as the actual and correct quantities of the Works which the Contractor is required to execute; and".

If the Contractor is not required to pay import duties on Goods imported by the Contractor into the Country, an additional Sub-Clause should be added and sub-paragraph (b) of Sub-Clause 14.1 [*The Contract Price*] of the General Conditions should be amended accordingly:

EXAMPLE SUB-CLAUSE FOR EXEMPTION FROM DUTIES

"All Goods imported by the Contractor into the Country shall be exempt from customs and other import duties, if the Employer's prior written approval is obtained for import. The Employer shall endorse the necessary exemption documents prepared by the Contractor for presentation in order to clear the Goods through Customs, and shall also provide the following exemption documents:

(*describe the necessary documents, which the Contractor will be unable to prepare*)

If exemption is not then granted, the customs duties payable and paid shall be reimbursed by the Employer.

All imported Goods, which are not incorporated in or expended in connection with the Works, shall be exported on completion of the Contract.

If not exported, the Goods will be assessed for duties as applicable to the Goods involved in accordance with the Laws of the Country.

However, exemption may not be available for:

(a) Goods which are similar to those locally produced, unless they are not available in sufficient quantities or are of a different standard to that which is necessary for the Works; and

(b) any element of duty or tax inherent in the price of goods or services procured in the Country, which shall be deemed to be included in the Accepted Contract Amount.

Port dues, quay dues and, except as set out above, any element of tax or duty inherent in the price of goods or services shall be deemed to be included in the Accepted Contract Amount."

If expatriate staff are exempted from paying local income tax, a suitable Sub-Clause should be added and sub-paragraph (b) of Sub-Clause 14.1 [*The Contract Price*] of the General Conditions should be amended accordingly. However, advice should be sought from a qualified tax expert before drafting any such additional Sub-Clause.

EXAMPLE SUB-CLAUSE FOR EXEMPTION FROM TAXES

"Expatriate (foreign) personnel shall not be liable for income tax levied in the Country on earnings paid in any foreign currency, or for income tax levied on subsistence, rentals and similar services directly furnished by the Contractor to Contractor's Personnel, or for allowances in lieu. If any Contractor's Personnel have part of their earnings paid in the Country in a foreign currency, they may export (after the conclusion of their term of service on the Works) any balance remaining of their earnings paid in foreign currencies.

The Employer shall seek exemption for the purposes of this Sub-Clause. If it is not granted, the relevant taxes paid shall be reimbursed by the Employer."

Sub-Clause 14.2 Advance Payment

When writing the Particular Conditions, consideration should be given to the benefits of the Employer making an advance payment to the Contractor. Unless this Sub-Clause is not to apply, the advance payment and the currencies in which it is to be paid must be specified in the Contract Data. The rate of deduction for the repayments should be checked to ensure that repayment is achieved before the Contractor's completion of the Works. The typical figures in sub-paragraphs (a) and (b) of Sub-Clause 14.2.3 [*Repayment of Advance Payment*] of the General Conditions are based on the assumption that the advance payment is less than 22% of the Accepted Contract Amount.

The acceptable form of Advance Payment Guarantee should be included in the tender documents, annexed to the Particular Conditions: an example form is included at the end of this publication (in the section "Sample Forms").

If the Employer wishes to provide the advance payment in instalments, the Contract Data and this Sub-Clause will need to be amended.

EXAMPLE The Contract Data:

- delete the words "14.2 ..... Amount of Advance Payment (percent of Accepted Contract Amount): ....." and replace with:
  "14.2 .....Total Advance Payment ___% of the Accepted Contract Amount
  14.2 .....Number and timing of instalments: _____".

- delete the words "14.2 ..... Currencies of payment if different to the currencies quoted in the Contract ....." and replace with:

  "14.2 .....Currencies and proportions ..... ___% in _____
  ___% in _____".

Delete the second sentence of the second paragraph of Sub-Clause 14.2 and replace with:

> "The total amount of the advance payment, the number and timing of instalments, and the applicable currencies and proportions shall be as stated in the Contract Data.".

Sub-Clause 14.2.1 [*Advance Payment Guarantee*]:

- delete the words "equal to the advance payment" from the first sentence and replace with: "equal to the total amount of the advance payment".
- in the second paragraph before "the advance payment has been repaid" add the words: "the total amount of".

- in the third paragraph before "the advance payment has not been repaid" add the words: "the total amount of".

- in sub-paragraph (a) before "the advance payment has been repaid" add the words: "the total amount of".

- in the last sentence, before "the advance payment" add the words: "the first instalment of".

Sub-Clause 14.2.2 [*Advance Payment Certificate*]:
- in the first sentence before "the advance payment" add the words: "the first instalment of".

- delete sub-paragraph (b) replace with: "(b) the Engineer has received a copy of the Contractor's application for the first instalment of the advance payment".

- at the end of this Sub-Clause add the following wording: "Thereafter, the Engineer shall issue an Advance Payment Certificate for each subsequent instalment of the advance payment, which the Contractor is entitled to under the Contract, within 14 days after the Engineer has received the Contractor's application (in the form of a Statement) for that instalment of advance payment."

Sub-Clause 14.2.3 [*Repayment of Advance Payment*]:
- in the last sentence before "the advance payment has not been repaid" add the words: "the total amount of".

Sub-Clause 14.4 Schedule of Payments

The General Conditions contains provisions for interim payments to the Contractor, which may be based on a Schedule of Payments. If another basis is to be used for determining interim valuations, details should be added in the Special Provisions.

If payments are to be specified in a Schedule of Payments, the "minimum amount of interim certificates" may be omitted from the Contract Data, and consideration may be given to the Schedule of Payments being in one of the following forms:

a) an amount, or percentage of the estimated final Contract Price, for each month (or other period) during the Time for Completion (but this can prove unreasonable if the Contractor's progress differs significantly from the expectation on which the Schedule was based); or

b) amounts based on the actual progress achieved by the Contractor in executing the Works, which necessitates careful definition of the payment milestones (but disagreements may arise when the work required for a payment milestone is nearly achieved but the balance of the work, albeit minor, cannot be completed until some months later).

The figures inserted by a tenderer in the Schedule of Payments may be compared with his/her tender programme (if any), in order to assess whether they are reasonably consistent with each other.

Sub-Clause 14.7 Payment

Periods for payment should be long enough for the Employer to meet, but not so long as to prejudice the Contractor's positive cash-flow.
If the country or countries of payment need to be specified, details may be included in a Schedule.

Sub-Clause 14.8 Delayed Payment

As an alternative to the second paragraph of this Sub-Clause, consideration may be given to the payment of the Contractor's actual financing Costs, taking account of local financing arrangements.

Sub-Clause 14.9 Release of Retention Money

If part of the Retention Money is to be released and substituted by an appropriate guarantee, an additional Sub-Clause may be added. The acceptable form(s) of guarantee should be included in the tender documents, annexed to the Particular Conditions: an example form is included at the end of this publication (in the section "Sample Forms"). Also, a limit of Retention Money should be stated in the Contract Data.

EXAMPLE SUB-CLAUSE FOR RELEASE OF RETENTION

When the Retention Money has reached three-fifths (60%) of the limit of Retention Money stated in the Contract Data, after the Employer has received the guarantee referred to below the Engineer shall certify and the Employer shall make payment of half (50%) of the limit of Retention Money to the Contractor.

The Contractor shall obtain (at the Contractor's cost) a guarantee in amounts and currencies equal to half (50%) of the limit of Retention Money stated in the Contract Data, and shall submit it to the Employer with a copy to the Engineer. This guarantee shall be issued by an entity and from within a country (or other jurisdiction) to which the

Employer gives consent, and shall be based on the sample form included in the tender documents or on another form agreed by the Employer (but such consent and/or agreement shall not relieve the Contractor from any obligation under this Sub-Clause).

The Contractor shall ensure that the guarantee is valid and enforceable until the Contractor has executed the Works, as specified for the Performance Security in Sub-Clause 4.2.1. If the terms of the guarantee specify an expiry date, and the Contractor has not so executed the Works by the date 28 days before the expiry date, the Contractor shall extend the validity of the guarantee.

The release of Retention Money under this Sub-Clause shall be in lieu of the release of the second half of the Retention Money under the second paragraph of Sub-Clause 14.9 [*Release of Retention Money*].

Sub-Clause 14.15 Currencies of Payment

If all payments are to be made in Local Currency, this currency must be named in the Letter of Tender, and this Sub-Clause may be replaced:

EXAMPLE SUB-CLAUSE FOR A SINGLE CURRENCY CONTRACT

All payments made in accordance with the Contract shall be in Local Currency. The Local Currency payments shall be fully convertible, except those for local costs. The percentage attributed to local costs shall be as stated in the Contract Data.

Financing Arrangements

For major contracts in some markets, there may be a need to secure finance from entities such as aid agencies, development banks, export credit agencies, or other international financing institutions. If financing is to be procured from any of these sources, the Special Provisions may need to incorporate the financing institution's special requirements. The exact wording will depend on the relevant institution, so reference will need to be made to the institution to ascertain its requirements, and to seek approval of the draft tender documents.

These requirements may include tendering procedures which need to be adopted in order to render the eventual contract eligible for financing, and/or additional Sub-Clauses which may need to be incorporated into the Special Provisions. The following examples indicate some of the topics which the institution's requirements may cover:

- prohibition from discrimination against the shipping companies of any one country;
- ensuring that the Contract is subject to a widely-accepted neutral law;
- provision for arbitration under recognised international rules and at a neutral location;
- giving the Contractor the right to suspend/terminate in the event of default under the financing arrangements;
- restricting the right to reject Plant;
- specifying the payments due in the event of termination;

- specifying that the Contract does not become effective until certain conditions precedent have been satisfied, including pre-disbursement conditions for the financing arrangements; and
- obliging the Employer to make payments from his own resources if, for any reason, the funds under the financing arrangements are insufficient to meet the payments due to the Contractor, whether due to a default under the financing arrangements or otherwise.

The financing institution may wish the Contract to include references to the financing arrangements, especially if funding from more than one source is to be arranged to finance different elements of supply. It is not unusual for the Special Provisions to include particular provisions identifying different categories of Works and specifying the documents to be presented to the relevant financing institution to obtain payment. If the financing institution's requirements are not met, it may be difficult (or even impossible) to secure suitable financing for the project, and/or the institution may decline to provide finance for part or all of the Contract.

Where the financing is not tied to the export of goods and services from any particular country but is simply provided by commercial banks lending to the Employer, those banks may wish to satisfy themselves regarding the extent of the Contractor's rights under the Contract.

Alternatively, the Contractor may be prepared to initiate financing arrangements for the Contract and retain responsibility for them, although the Contractor would probably be unable or unwilling to provide finance from the Contractor's own resources. The Contractor's financing bank's requirements are then likely to affect the Contractor during contract negotiations. For example, the financing bank may require the Employer to make interim payments, although a large proportion of the Contract Price might be withheld until the Works are complete. Since the Contractor would then have to arrange financing to cover the shortfall between the payments and the Contractor's outgoings, the Contractor (and the financing bank) would probably require some form of security from the Employer, guaranteeing payment when due.

It may be appropriate for the Employer, when preparing the tender documents, to anticipate the latter requirement by undertaking to provide a guarantee for the element of payment which the Contractor is to receive when the Works are complete. The acceptable form(s) of guarantee should be included in the tender documents, annexed to the Particular Conditions: an example form is included at the end of this publication (in the section "Sample Forms"). The following Sub-Clause may be added.

EXAMPLE SUB-CLAUSE FOR CONTRACTOR FINANCE

"The Employer shall obtain (at the Employer's cost) a payment guarantee in the amount and currencies, and provided by an entity, as stated in the Contract Data. The Employer shall deliver the guarantee to the Contractor within 28 days after both Parties have entered into the Contract Agreement. The guarantee shall be in the form annexed to these Special Provisions, or in another form acceptable to the Contractor. Unless and until the Contractor receives the guarantee, the Engineer shall not give the notice under Sub-Clause 8.1 [*Commencement of Works*].

The guarantee shall be returned to the Employer at the earliest of the following dates:

(a) when the Contractor has been paid the Accepted Contract Amount;

(b) when obligations under the guarantee expire or have been discharged; or

(c) when the Employer has performed all obligations under the Contract."

Clause 15 Termination by Employer

Sub-Clause 15.2 Termination for Contractor's Default

Before inviting tenders, the Employer should verify that the wording of this Sub-Clause, and each anticipated ground for termination, is consistent with the law governing the Contract.

Sub-Clause 15.2.1 Notice

Sub-paragraph (h) in this Sub-Clause is intended to include situations, where the Contractor or any of the Contractor's employees, agents, Subcontractors or Contractor's Personnel gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward for showing or forbearing to show favour or disfavour to any person in relation to the Contract. However, this is not intended to include lawful inducements and rewards by the Contractor to the Contractor's Personnel.

Sub-Clause 15.2.3 After termination

If the Employer has made available any Employer-Supplied Materials and/or Employer's Equipment in accordance with Sub-Clause 2.6, consideration should be given to an additional sub-paragraph under this Sub-Clause:

EXAMPLE Insert the following new sub-paragraph at the end of sub-paragraph (b) of Sub-Clause 15.2.3:

"(iv) all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 [*Employer-Supplied Materials and Employer's Equipment*], and".

Sub-Clause 15.5 Termination for Employer's Convenience

In many jurisdictions under the applicable law it may not be permissible for the Employer to terminate the Contract for convenience (termination of the Contract only being permitted in the event of default on the part of the Contractor and, thereafter, arranging an equitable, non-discriminatory and transparent procurement process to select a replacement contractor).
Therefore, before inviting tenders the Employer should verify that the wording of this Sub-Clause is consistent with the law governing the Contract.

Clause 16 Suspension and Termination by Contractor

Sub-Clause 16.2 Termination by Contractor

Before inviting tenders, the Employer should verify that the wording of this Sub-Clause is consistent with the law governing the Contract.

Sub-Clause 16.2.1 Notice

Sub-paragraph (j) in this Sub-Clause is intended to include situations, where the Employer or any of the Employer's employees, agents or Employer's Personnel gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward for showing or forbearing to show favour or disfavour to any person in relation to the Contract. However, this is not intended to include lawful inducements and rewards by the Employer to the Employer's Personnel.

Sub-Clause 16.3 Contractor's Obligations After termination

If the Employer has made available any Employer-Supplied Materials and/or Employer's Equipment in accordance with Sub-Clause 2.6, consideration should be given to amending this Sub-Clause:

EXAMPLE Delete sub-paragraph (c) in Sub-Clause 16.3 and replace with:

"(c) deliver to the Engineer all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 [*Employer-Supplied Materials and Employer's Equipment*]; and

(d) remove all other Goods from the Site, except as necessary for safety, and leave the Site."

Clause 17 Care of the Works and Indemnities

Sub-Clause 17.4 Indemnities by Contractor

In respect of the Contractor's obligation to indemnify under the second paragraph of this Sub-Clause, it should be noted that this applies only to the extent, if any, that the Contractor is required to carry out any design of the Permanent Works under the Contract. If this is the case:

a) as this liability is not excluded under the first paragraph of Sub-Clause 1.15 [*Limitation of Liability*], the Contractor has no liability for any indirect or consequential loss or damage suffered by the Employer as a result of any negligence by the Contractor in designing the Works to be fit for purpose;

b) as this liability is not excluded under the second paragraph of Sub-Clause 1.15 [*Limitation of Liability*], it falls within the Contractor's limitation of liability under Sub-Clause 1.15; and

c) this liability may be covered by the insurance to be taken out by the Contractor under Sub-Clause 19.2.3 [*Liability for breach of professional duty*], in which case a statement to this effect should be included in the Contract Data.

Additional Sub-Clause

If the Contractor is to be allowed to use and/or occupy any of the Employer's facilities and/or accommodation temporarily during the Contract, it is recommended that an additional sub-clause be added to Clause 17 to cover the responsibility for care of such facilities and/or accommodation:

EXAMPLE SUB-CLAUSE FOR CONTRACTOR'S USE OF EMPLOYER'S FACILITIES/ACCOMMODATION

"The Contractor shall take full responsibility for the care of the items of the Employer's facilities and/or accommodation listed below, from the

date of use and/or occupation by the Contractor until the date on which such use and/or occupation is re-vested in the Employer.

[*List of items and details*]

If any loss or damage happens to any of the above items during a time when the Contractor is responsible for its care, arising from any cause other than a cause for which the Employer is responsible or liable, the Contractor shall promptly rectify the loss or damage at the Contractor's risk and cost."

Clause 18 Exceptional Events

Sub-Clause 18.1 Exceptional Events

In respect of sub-paragraph (f) of this Sub-Clause, it should be noted that any event of "exceptionally adverse climatic conditions" is excluded from the definition of what constitutes an Exceptional Event. While this means that there is no right for either Party to suspend the Works in the case of an event of "exceptionally adverse climatic conditions", if this type of event has the effect of delaying completion and taking-over of the Works or Section the Contractor shall be entitled to EOT under sub-paragraph (c) of Sub-Clause 8.5 [*Extension of Time*].

Clause 19 Insurance

If the Employer wishes to change the insurance provisions of this Clause – for example by providing some of the insurance cover under the Employer's own policy(ies) – it will be necessary to review and revise the relevant Sub-Clause(s) under this Clause 19.

If this is the case, it is strongly recommended that:

a) the tender documents include details of such insurances as an annex to the Special Provisions so that tenderers can estimate what other insurances they may wish to have for their own protection. The details should include the conditions of insurance, limits, exceptions and deductibles; preferably in the form of a copy of each insurance policy; and

b) the Employer is advised by a professional with extensive experience in construction insurance and liability in the preparation of the wording of the revised sub-clauses. If the insurance provisions are changed without due care and attention, there is a risk that the Employer will inadvertently carry liabilities for which the Employer is neither prepared nor covered by insurance.

Clause 20 Employer's and Contractor's Claims

Sub-Clause 20.1 Claims

In respect of any Claim under sub-paragraph (c) of this Sub-Clause, it should be noted that "another entitlement or relief …or the execution of the Works" may include such matters as:

- interpretation of a provision of the Contract,
- rectification of an ambiguity or discrepancy found in the Contract documents,
- a declaration in favour of the claiming Party,
- access to the Site or to places where the Works are being (or to be) carried out, and/or

- any other matter of entitlement under the Conditions of Contract or in connection with, or arising out of, the Contract that does not involve payment by one Party to the other Party and/or EOT and/or extension of the DNP.

Consideration may be given to replacing the words "within a reasonable time" in the last paragraph of this Sub-Clause by a specified time period.

Clause 21 Disputes and Arbitration

Sub-Clause 21.1 Constitution of the DAAB

It is generally accepted that construction projects depend for their success on the avoidance of Disputes between the Employer and the Contractor and, if Disputes do arise, the timely resolution of such Disputes.

Therefore, the Contract should include the provisions under Clause 21 which, while not discouraging the Parties from reaching their own agreement on Disputes as the Works proceed, allow them to bring contentious matters to an independent and impartial dispute avoidance/adjudication board ("DAAB") for resolution.

The provisions of this Sub-Clause are intended to provide for the appointment of the DAAB, and FIDIC strongly recommends that the DAAB be appointed, as a 'standing DAAB'
– that is, a DAAB that is appointed at the start of the Contract who visits the Site on a regular basis and remains in place for the duration of the Contract to assist the Parties:

a) in the avoidance of Disputes,

and

b) in the 'real-time' resolution of Disputes if and when they arise

to achieve a successful project.

It is for this reason that, under the first paragraph of this Sub-Clause, the Parties are under a joint obligation to appoint the member(s) of the DAAB within 28 days after the Contractor receives the Letter of Acceptance if no other time is stated in the Contract Data. That said, it is preferable that the member(s) of the DAAB are appointed before the Letter of Acceptance is issued.
At an early stage in the Employer's planning of the project, consideration should be given as to whether a sole-member DAAB or a three-member DAAB is preferable for a particular project, taking account of its size, duration and the fields of expertise which will be involved.

This Sub-Clause provides for two alternative arrangements for the DAAB:

- a sole-member DAAB of one natural person, who has entered into a tripartite agreement with both Parties;

or

- a three-member DAAB of three natural persons, each of whom has entered into a tripartite agreement with both Parties.

The tripartite agreement above is referred to as the *DAAB Agreement* under the Conditions of Contract. It is recommended that the form of this agreement be one of the two alternative example forms included at the end of this publication (in the section "Sample Forms"), as appropriate to the arrangement adopted.

It should be noted that both forms of the DAAB Agreement incorporate (by reference) the *General Conditions of Dispute Avoidance/Adjudication Agreement* with its Annex *DAAB Procedural Rules*, which are included as the Appendix to the General Conditions in this publication.

Under either of these alternative forms of DAAB Agreement, each natural person of the DAAB is referred to as a *DAAB Member*.

A very important factor in the success of the dispute avoidance/adjudication procedure is the Parties' confidence in the agreed individual(s) who will serve on the DAAB. Therefore, it is essential that candidates for this position are not imposed by either Party on the other Party. The appointment of the DAAB is facilitated by the provision in the Contract Data for each Party to name potential DAAB Members. It is important that the Employer and the Contractor each avail himself/herself, of the opportunity at the tender stage of the Contract to name potential DAAB members in the Contract Data.

The Contract Data includes two lists for potential DAAB Members to be named: one for the Employer to list three names, the other for the Contractor to list three names. This ensures that both Parties have equal opportunity to put forward (the same number of) names for potential DAAB Members, and so avoid any question that DAAB Member(s) may be imposed on one Party by the other Party.

This provides a total of six potential DAAB Members from which the sole member or three members (as the case may be) can be selected by the Parties. If it is considered necessary to have a wider selection of DAAB Member(s) to choose from, then provision may be made for longer lists in the Contract Data for both the Contractor and the Employer to name (the same number of) additional DAAB Members.

If the Parties cannot agree on any DAAB member, Sub-Clause 21.2 [*Failure to Appoint DAAB Member(s)*] applies and the selection and appointment of the DAAB member(s) should be made by a wholly impartial entity with an understanding of the nature and purpose of a DAAB. The President of FIDIC is prepared to perform this role if this authority has been delegated in accordance with the example wording in the Contract Data. FIDIC maintains a list of approved and experienced adjudicators for this specific purpose: *The FIDIC President's List of Approved Dispute Adjudicators* (http://fidic.org/president-list†).

If no potential DAAB members' names are given in the Contract Data, consideration should be given to stating a time period in the Contract Data that is greater than the default period of 28 days stated in the first paragraph of this Sub-Clause.

The period of 224 days stated in sub-paragraph (i) of this Sub-Clause has been arrived at by taking account of certain time allowances, as follows:

date of termination + 28 days to give a Notice of Claim under Sub-Clause 20.2.1 [*Notice of Claim*]

+ 84 days to submit detailed particulars for the Claim under Sub-Clause 20.2.4 [*Fully detailed Claim*]

+ 84 days for the Engineer's agreement/determination of the Claim under Sub-Clause 3.7 [*Agreement or Determination*]

+ 28 days for a NOD under Sub-Clause 3.7 [*Agreement or Determination*]

= 224 days after the date of termination.

As noted above, FIDIC strongly recommends that the DAAB be appointed at the start of the Contract and remain in place for the duration of the Contract. However, as an alternative to the 'standing DAAB' envisaged under this Sub-Clause, the Parties may prefer the dispute board to be appointed on an 'ad-hoc' basis. In such case, the dispute board would be appointed when a Dispute arises, its appointment would be limited to resolution of the Dispute, it would have no role to play in the avoidance of Disputes between the Parties, and its appointment would cease when it had given its decision on that Dispute. Should a new Dispute arise, a new ad-hoc DAAB would be appointed. Given that such a dispute board would have no role in dispute avoidance, it is more correctly referred to as a "Dispute Adjudication Board" or "DAB". If the Parties wish to provide for an 'ad-hoc DAB', rather than the recommended 'standing DAAB', then the following amendments will be needed:

EXAMPLE

Delete the definitions under Sub-Clause 1.1.22 and 1.1.23 and replace with:
" "Dispute Adjudication Board" or "DAB" means the person or three persons (as the case may be) so named in the Contract, or appointed under Clause 21."

and replace all references in the Conditions of Contract to "DAAB" with "DAB".

Sub-Clause 21.1, plus the Appendix *General Conditions of Dispute Avoidance/Adjudication Agreement* with its Annex DAAB Procedural Rules, should be amended to comply with the wording contained in the corresponding provisions of FIDIC's Conditions of Contract for Plant and Design-Build, First Edition 1999.

Delete Sub-Clause 21.3 [*Avoidance of Disputes*];

in the first paragraph of Sub-Clause 21.4 [*Obtaining DAAB's Decision*]:

- after the words "If a Dispute arises between the Parties then, " add:

  "after a DAB has been appointed";
- delete the words "(whether or not any informal discussions have been held under Sub-Clause 21.3 [*Avoidance of Disputes*])"; and

delete sub-paragraph (a) of Sub-Clause 21.4.1 [*Reference of a Dispute to the DAAB*].

To facilitate the appointment of the member(s) of an 'ad-hoc DAB', it is important that the Employer and the Contractor each avail themselves of the opportunity at the tender stage of the Contract to name three potential members in the Contract Data.

Sub-Clause 21.5 Amicable Settlement

In circumstances where the DAAB has given its decision but one or both Parties is/are dissatisfied with the decision, the provisions of this Sub-Clause are intended to encourage the Parties to settle a Dispute amicably, without the need for arbitration.

Rather than considering the 28 day period stated in this Sub-Clause as a 'cooling-off period', FIDIC recommends that the Parties avail themselves of this opportunity to actively engage with each other with a view to settling their Dispute.

Such active engagement may be by, for example:

- direct negotiation by senior executives from each of the Parties;
- mediation (please see below);
- expert determination (using, for example, the Expert Rules published by the International Chamber of Commerce (the "ICC", which is based at 33-43 Avenue du Président Wilson, 75116 Paris, France) https://iccwbo.org/publication/icc-expert-rules-english-version/ †);
- or other form of alternative dispute resolution that is not as formal, time-consuming and costly as arbitration.

In this regard, it is recommended that consideration be given by the Parties to agree to a longer time period than the period of 28 days stated in this Sub-Clause in an effort to arrive at an amicable settlement procedure chosen by the Parties.

Amicable settlement procedures typically depend for their success on the consensual involvement of both Parties, on confidentiality and on both Parties' acceptance of the particular procedure. Therefore, while it is recommended that both Parties engage actively to settle the Dispute amicably, neither Party should seek to impose the procedure on the other Party.

If the Parties wish to adopt a mediation procedure in their attempt to settle the Dispute amicably, then consideration may be given to the Mediation Rules, 2017 published by the International Chamber of Commerce (the "ICC", which is based at 33-43 Avenue du Président Wilson, 75116 Paris, France) https://iccwbo.org/dispute-resolution-services/mediation/mediation-rules/ †

or, alternatively, to the following mediation rules:

EXAMPLE

MEDIATION RULES

Appointment of Mediator

If the Parties are unable to agree on the choice of an independent and impartial mediator, or if the chosen mediator is unable or unwilling to act, then either Party may immediately apply to the appointing entity or official named in the Contract Data to appoint a mediator.

Once the mediator has been appointed, the Dispute shall immediately be referred to the mediator by the Parties or by either Party.

Obligations of the Parties

In addition to the Parties' obligations as set out in the provisions that follow below, during the mediation process the Parties shall engage with the mediator and with each other in co-operation, in a timely manner and in good faith.

Agreement of the Mediation Timetable

The mediator shall, within 7 days of his/her appointment, or other period as may be proposed by the mediator and agreed by both Parties, consult with the Parties to agree a timetable for the exchange of any relevant information, the date/time/venue of the mediation meeting, and the procedure to be adopted for the negotiations. The agreement of the timetable shall have regard to the period stated under Sub-Clause 21.5 [*Amicable Settlement*] of the Conditions of Contract or as may be amended by the agreement of the Parties.

Confidentiality

The Parties' negotiations facilitated by the mediator shall be conducted on a strictly private and confidential basis. Neither Party shall disclose to any third party any detail of the mediation process, including but not limited to: the fact of the mediation, the identity of the mediator, any matter discussed during the mediation process, any information or document exchanged with the mediator, any negotiations during the mediation meeting and/or the outcome of the mediation.

The mediation, and/or any negotiations taking place during the mediation meeting, shall not be referred to by either Party in any concurrent or subsequent proceedings, unless such negotiations conclude with a written legally binding agreement.

Written Agreement to be Binding

If the Parties accept the mediator's recommendations, or otherwise reach agreement on the settlement of the Dispute, such agreement shall be recorded in writing and, once signed by the designated representative(s) of both Parties, shall be binding on the Parties.

Mediator's Opinion

If no agreement is reached by the Parties after negotiations have been facilitated by the mediator, either Party may invite the mediator to provide to both Parties a non-binding opinion in writing. Such opinion shall not be used in evidence in any concurrent or subsequent proceedings.

Costs of Mediation

The Parties will bear their own costs of participating in the mediation, including but not limited to the costs of preparing and submitting evidence to the mediator and attending the mediation meeting.

Each Party shall be responsible for paying one-half of the remuneration of the mediator (and, if the mediator has been appointed by the appointing entity or official named in the Contract Data, the remuneration of such appointing entity or official).

However, if the mediator finds that a Party has initiated the mediation, or has engaged in the mediation, in a frivolous or vexatious manner, then the mediator shall have the power to order that Party to pay the reasonable costs of the other Party for preparing for and attending the mediation meeting. If these costs cannot be agreed, they will be assessed by the mediator, whose assessment shall be binding on the Parties.

Sub-Clause 21.6 **Arbitration**

The Contract should include provisions for the resolution by international arbitration of any Dispute which is not settled amicably by the Parties. In international contracts, international commercial arbitration has numerous advantages over litigation in national courts and is likely to be more acceptable to the Parties.

Careful consideration should be given to ensuring that the international arbitration rules that are chosen are compatible with the provisions of Clause 21 and with the other elements to be set out in the Contract Data. The Arbitration Rules published by the International Chamber of Commerce (the "ICC", which is based at 33-43 Avenue du Président Wilson, 75116 Paris, France) https://iccwbo.org/dispute-resolution-services/arbitration/rules-of-arbitration/† are frequently incorporated by reference in international contracts.
It is important that the Parties agree on the number of arbitrators and the language of arbitration. In the absence of specific stipulations as to the number of arbitrators and the place of arbitration in the Contract, the International Court of Arbitration of the ICC will decide these matters.

If the arbitration rules published by the United Nations Commission on International Trade Law ("UNCITRAL" which is based at the Vienna International Centre, A-1400 Vienna, Austria) http://www.uncitral.org/pdf/english/texts/arbitration/arb-rules-revised/arb-rules-revised-2010-e.pdf† or other non-ICC arbitration rules are preferred, it may be necessary to designate, in the Contract Data, an institution to appoint the arbitrators or to administer the arbitration, unless the institution is named (and their role specified) in the arbitration rules. It may also be necessary to ensure, before so designating an institution in the Contract Data, that the institution is prepared to appoint or administer.
For major projects tendered internationally, it is desirable that the place of arbitration be situated in a country other than that of the Employer or Contractor. This country should have a modern and liberal arbitration law and should have ratified a bilateral or multilateral convention (such as the 1958 New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards), or both, that would facilitate the enforcement of an arbitral award in the states of the Parties.

It may be considered desirable in some cases for other Parties to be joined into any arbitration between the Parties or for two or more pending arbitrations to be consolidated, thereby creating a multi-party arbitration. While the ICC Arbitration Rules address multi-party arbitration, such arbitration may in some cases be feasible only if the parties have included multi-party arbitration clauses in their contracts. Such clauses require skilful drafting, and usually need to be prepared on a case-by-case basis

It is not unusual that the arbitration of a complex dispute is concluded sometime after performance of the Contractor's obligations under the Contract has been completed, in which case it may not be fair and reasonable in the circumstances for any arbitral award which requires the payment of an amount by one Party to the other Party to be in the currencies of payment and in the proportions provided for under Sub-Clause 14.15 [*Currencies of Payment*]. For example, the Contractor may no longer have any need for local currency after completion of the Works; or the local currency may have declined in value in the interim or be a 'blocked currency' that, consequently, cannot be removed from the country concerned.

Advisory Notes to Users of FIDIC Contracts Where the Project is to Include Building Information Modelling Systems

Building Information Modelling (BIM), is a process which is changing many elements of the design profession, the construction industry and, possibly, even the operation and maintenance of a facility.

BIM is one of the digital data technologies used in all aspects of project planning, investigation, design, construction and operation. Digital data technologies include systems for: data acquisition; document management; design and process management; estimating, planning, and scheduling; contract management; performance management; and building information modelling.

BIM has varying degrees of complexity ranging from rather isolated use of computer aided design tools to full sharing of models and information by the entire project team. Currently, BIM is more often used and better understood in developed countries, many of which are encouraging or even mandating its use to improve quality, accuracy and delivery times for projects as well as to provide cost savings. BIM has the potential to dramatically improve productivity in the construction industry and reduce operational costs of facilities as well.

BIM is not a set of contract conditions; it is a mechanism to provide an environment where all parties have access to information relevant to their role in the design and construction of a project. Wherever possible, a combined (sometimes called federated or collaborative) model is developed for all parties to share, even if, as is often the case, various designers have used different computer aided design programs to develop their respective designs. Drawings and specifications are held in a common database accessible to everyone. These can be used for clash detection, coordination of designs, communication of changes, and construction sequencing.

Coordination of goals and effort is essential and is generally achieved by a BIM Protocol and a BIM Execution Plan, both key documents to access and understand work in this environment. A designer needs to understand and work to the Levels of Design (or Detail) (LOD) that will be spelled out in these documents to ensure that there is sufficient detail at each level to allow all designs to progress efficiently and avoid unnecessary changes.

BIM is founded on a team approach and successful projects utilising BIM encourage collaboration. FIDIC contracts are designed to be fair to all parties and are considered suitable for use with projects featuring the use of BIM - providing that the parties recognise the difference in approach and use the contract appropriately. This starts with proper planning and, unless an employer has appropriate expertise in house, they are well advised to retain an engineer who is appropriately qualified to assist them in the solicitation of interest, proposals, selection and negotiation of contracts with the selected project team. Legal advice is also necessary, of course, especially during the latter steps. The request for proposal (RFP) must clearly outline what the client's (employer's) expectations of the consultant are. The expectations should focus on the specific BIM goals and benefits desired. If properly developed, the RFP will help the proposers be responsive and the employer select the consultant (or in the case of a design build project, the project team) best qualified to deliver the desired BIM outcome. This process will in turn help all parties develop appropriate contract terms and conditions. Ideally the selection process would use FIDIC's Quality Based Selection (QBS) guideline.

It should be noted that the improved quality of information in projects utilising BIM can result in a significant reduction in variations. It is worth thinking about how the traditional roles of Contractor and Employer fit into this structure. In general, BIM is well suited for integrated project delivery, including Design Build and especially Design Build Operate projects where early proactive involvement of the design engineer, contractor and employer are essential. If advanced levels of BIM are anticipated for the project, the possibility of adding operation and maintenance elements of the constructed facility might be considered.

For advanced levels of BIM where fully open sharing of information is required, a qualified individual needs to be assigned the duty of managing the combined model. This should be separate from the project manager's role to ensure clear delineation of project responsibilities. This may require special outsourcing, if such skills are not available from the employer or engineer. Managing the BIM elements of a project may also involve risks that are beyond the normal coverage of professional indemnity (PI) insurance policies. Specialist advice should be sought from PI insurers if there is any doubt on coverage for this role. The competence and responsibilities of this position need to be understood and should include experience in data back-up and integrity, continuity planning and cyber security.

All parties involved in a project utilising BIM should take special care in checking their assigned scope and contract to ensure that they are aware of their BIM related responsibilities. The risks that FIDIC has identified in working in a BIM environment arise from these key features:

- misunderstanding of scope of services
- use of data for an inappropriate purpose and reliance on inappropriate data
- ineffective information, document or data management
- cyber security and responsibility for "holding" the models or data
- definition of deliverables, approval, and delivery

To manage these and other digital technology related risks, the consultant is encouraged to clearly define adequately their proposed services, addressing such issues as:

- the systems and versions or releases they propose and the management processes they will adopt
- access rights and limitations of the client, other consultants and contractors
- reliance other parties in the project may place on data in the digital environment
- limitations in terms of uptime and access and potential exclusion of liability for downtime
- potential exclusion of liability in the event of cyber attack
- potential exclusion or limitations on professional liability in respect of the actions of others
- access to the current and previous issues of the combined model and to the complete audit trail of changes to the model

At the completion of the project the model may need to be brought up to as-built status. This involves not only the drawing elements but also the embedded data. Experience shows that this is a significant effort, so responsibilities for completing this task should be clear and appropriate allowances provided.

The process for the delivery of contractual notices should be checked to determine if this will be through the common data environment or by more traditional means.

If sub-contractors are to be utilised, they should be bound by the BIM Protocol and Execution Plan.

The dispute resolution processes in the agreement should be appropriate, considering the collaborative nature of the BIM process. Professionals with engineering, construction and legal expertise should be consulted in this regard.

Legal counsel should review the contract to ensure that it does not create an unintended joint venture which may be a risk in some jurisdictions.

If there is a fitness for purpose clause, make sure that it is clear who is responsible for ensuring compliance and how responsibility for rectification is spread between participants.
Make sure that audit trails for modifications to the composite or federated model are controlled by a process which can generate an audit trail that is preserved during and after completion. The audit trail should be accessible by appropriate parties during and after project completion.
Given that there will be many parties involved in the design and construction effort, ensure that there are appropriate limits of liability in place for each participant and for the project as a whole.

For construction or building projects involving BIM, in addition to considering the general principles as introduced above, the following (non-exhaustive) list of Sub-Clauses of the General Conditions of Contract for Construction [©FIDIC 2017 Second Edition] should be thoroughly reviewed when drafting the Particular Conditions:

Sub-Clause No.	**Sub-Clause Title**
1.1	Definitions
1.3	Notices and Other Communications
1.5	Priority of Documents
1.10	Employer's Use of Contractor's Documents
1.11	Contractor's Use of Employer's Documents
1.15	Limitation of Liability
2.3	Employer's Personnel and Other Contractors
2.5	Site Data and Items of Reference
3.2	Engineer's Duties and Authority
4.1	Contractor's General Obligations
4.4	Contractor's Documents
4.6	Co-operation
4.7	Setting Out
4.9	Quality Management and Compliance Verification Systems
4.20	Progress Reports
6.8	Contractor's Superintendence
6.10	Contractor's Records
8.3	Programme
9.1	Contractor's Obligations (Tests on Completion)
13.3	Variation Procedure

17.3 _____ Intellectual and Industrial Property Rights

17.4 _____ Indemnities by Contractor

17.5 _____ Indemnities by Employer

17.6 _____ Shared Indemnities

19.2.6 _____ Other insurances required by Laws and by local practice

FIDIC intends to publish a "Technology Guideline" and a "Definition of Scope Guideline Specific to BIM" with the aim of providing further detailed support. These documents are under preparation and expected to be released shortly after the publication of the updates of the 1999 suite of FIDIC contract forms.

Annexes FORMS OF SECURITIES

Acceptable form(s) of security should be included in the tender documents: for Annex A and/or B, in the Instructions to Tenderers; and for Annexes C to G, annexed to the Particular Conditions. The following example forms, which (except for Annex A) incorporate Uniform Rules published by the International Chamber of Commerce (the "ICC", which is based at 33-43 Avenue du Président Wilson, 75116 Paris, France, www.iccwbo.org), need to be carefully reviewed against, and may have to be amended to comply with, applicable law. Although the ICC publishes guides to these Uniform Rules, legal advice should be taken before the securities are written. Note that the guaranteed amounts should be quoted in all the currencies, as specified in the Contract, in which the guarantor pays the beneficiary.

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Annex A EXAMPLE FORM OF PARENT COMPANY GUARANTEE

Name of Contract/Contract No.:_____ _____

Name and address of Employer: _____ _____

_____ (together with successors and assigns).

We have been informed that _____ (hereinafter called the "Contractor") is submitting an offer for such Contract in response to your invitation, and that the conditions of your invitation require his/her offer to be supported by a parent company guarantee.

In consideration of you, the Employer, awarding the Contract to the Contractor, we (name of parent company) irrevocably and unconditionally guarantee to you, as a primary obligation, the due performance of all the Contractor's obligations and liabilities under the Contract, including the Contractor's compliance with all its terms and conditions according to their true intent and meaning.

If the Contractor fails to so perform his/her obligations and liabilities and comply with the Contract, we will indemnify the Employer against and from all damages, losses and expenses (including legal fees and expenses) which arise from any such failure for which the Contractor is liable to the Employer under the Contract.

This guarantee shall come into full force and effect when the Contract comes into full force and effect. If the Contract does not come into full force and effect within a year of the date of this guarantee, or if you demonstrate that you do not intend to enter into the Contract with the Contractor, this guarantee shall be void and ineffective. This guarantee shall continue in full force and effect until all the Contractor's obligations and liabilities under the Contract have been discharged, when this guarantee shall expire and shall be returned to us, and our liability hereunder shall be discharged absolutely.

This guarantee shall apply and be supplemental to the Contract as amended or varied by the Employer and the Contractor from time to time. We hereby authorise them to agree any such amendment or variation, the due performance of which and compliance with which by the Contractor are likewise guaranteed hereunder. Our obligations and liabilities under this guarantee shall not be discharged by any allowance of time or other indulgence whatsoever by the Employer to the Contractor, or by any variation or suspension of the works to be executed under the Contract, or by any amendments to the Contract or to the constitution of the Contractor or the Employer, or by any other matters, whether with or without our knowledge or consent.

This guarantee shall be governed by the law of the same country (or other jurisdiction) as that which governs the Contract and any dispute under this guarantee shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with such Rules. We confirm that the benefit of this guarantee may be assigned subject only to the provisions for assignment of the Contract.

SIGNED by: _____ SIGNED by[1]:_____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

_____ _____ _____ _____

(position in the company) *(position in the company)*

Date:

(1) Whether one or more signatories for the parent company are required will depend on the parent company and/or applicable law.

Annex B EXAMPLE FORM OF TENDER SECURITY

Guarantee No.: _____ [*insert guarantee reference number*]

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

Name of Contract/Contract No.:_____ [*insert reference number or other information identifying the contract with regard to which the tender is submitted*]

The Beneficiary (the "Employer"): _____ ____ [*insert name and address of the Beneficiary*]

We have been informed that _____ [*insert name and address of the Tenderer*] (hereinafter called the "Applicant") is submitting an offer for such Contract in response to your invitation, and that the conditions of your invitation (the "Conditions of Invitation", which are set out in a document entitled Instructions to Tenderers) require his/her offer to be supported by a tender security.

At the request of the Applicant, we _____ [*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] upon receipt by us of your demand in writing and your written statement (in the demand) that:

(a) the Applicant has, without your agreement, withdrawn his/her offer after the latest time specified for its submission and before the expiry of its period of validity, or

(b) the Applicant has refused to accept the correction of errors in his/her offer in accordance with such Conditions of Invitation, or

(c) you awarded the Contract to the Applicant and he/she has failed to comply with Sub-Clause 1.6 of the Conditions of Contract, or

(d) you awarded the Contract to the Applicant and he/she has failed to comply with Sub-Clause 4.2.1 of the Conditions of Contract.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office [insert address of office] on or before _____ [*insert the date 35 days after the expiry of the validity of the Letter of Tender*], when this guarantee shall expire.

The party liable for the payment of any charges: _____
_____ [*insert the name of the party*].

This guarantee shall be governed by the laws of _____ [*insert the law governing the guarantee*], and shall be subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

SIGNED by: _____ SIGNED by[1]:_____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Date: _____

(1) Whether one or more signatories for the bank are required will depend on the bank and/or applicable law.

Annex C EXAMPLE FORM OF PERFORMANCE SECURITY - DEMAND GUARANTEE

Guarantee No.: _____ [*insert guarantee reference number*]

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

Name of Contract/Contract No.: _____ [*insert reference number or other information identifying the contract between the Applicant and the Beneficiary on which the guarantee is based*]

The Beneficiary (the "Employer"): _____ _____
_____ ___ [*insert name and address of the Beneficiary*]

We have been informed that _____ [*insert name and address of the Contractor*] (hereinafter called the "Applicant") is your Contractor under such Contract, which requires him/her to obtain a Performance Security.

At the request of the Applicant, we _____ [*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] (the "Guaranteed Amount") upon receipt by us of your demand in writing and your written statement indicating in what respect the Applicant is in breach of its obligations under the Contract.

[*Following receipt by us of an authenticated copy of the Taking-Over Certificate for the whole of the Works under clause 10 of the Conditions of Contract, the Guaranteed Amount shall be reduced by _____ % and we shall promptly notify you that we have received such certificate and have reduced the Guaranteed Amount accordingly.*] (1)

Following receipt by us of an authenticated copy of a statement issued by _____
_____ [*insert name and address of the Engineer under the Contract*] that, pursuant to Sub-Clause 4.2.1 of the Conditions of Contract, variations or adjustments under Clause 13 of the Conditions of Contract have resulted in an accumulative increase or decrease of the Contract Price by more than twenty percent (20%) of the Accepted Contract Amount, and that therefore the Guaranteed Amount should be adjusted by the percentage specified in the statement equal to the accumulative increase or decrease, respectively, we shall promptly inform you that we have received such statement and have adjusted the Guaranteed Amount accordingly. In the case of a request for a decrease of the amount of the Performance Security, the above statement shall be accompanied by your written consent to such decrease.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office [insert address of office] on or before _____ (*insert the date 70 days after the expected expiry of the Defects Notification Period for the Works*) (the "Expiry Date"), when this guarantee shall expire.

The party liable for the payment of any charges: [*insert the name of the party*].

This guarantee shall be governed by the laws of _____ [*insert the law governing the guarantee*], and shall be subject to the Uniform Rules for Demand Guarantees, (URDG) 2010 Revision, ICC Publication No. 758.

SIGNED by: _____ SIGNED by[2]: _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Date: _____

[1] When drafting the tender documents, the writer should ascertain whether to include the optional text, shown in parentheses [ ].

[2] Whether one or more signatories for the bank are required will depend on the bank and/or applicable law.

Annex D EXAMPLE FORM OF PERFORMANCE SECURITY - SURETY BOND

Name of Contract/Contract No.: _____ _____

Name and address of Beneficiary (the "Employer"): _____

_____ _____

We have been informed that _____ [*insert name of the Contractor*] (hereinafter called the "Principal") is your contractor under such Contract, which requires him/her to obtain a Performance Security.

By this Bond, _____ _____

_____ _____ [*insert name and address of contractor*]

(who is your Contractor under such Contract) as Principal and: _____

_____ [*insert name and address of Guarantor*] as Guarantor are irrevocably held and firmly bound to the Beneficiary in the total amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] (the "Bond Amount") for the due performance of all such Principal's obligations and liabilities under the above named Contract.

[Such Bond Amount shall be reduced by _____ % upon the issue of the Taking-Over Certificate for the whole of the Works under Clause 10 of the Conditions of Contract.](1)

This Bond shall become effective on the Commencement Date defined in the Contract.

Upon Default by the Principal to perform any contractual obligation, or upon the occurrence of any of the events and circumstances listed in Sub-Clause 15.2.1 of the Conditions of Contract, the Guarantor shall satisfy and discharge the damages sustained by the Beneficiary due to such Default, event or circumstances.(2) However, the total liability of the Guarantor shall not exceed the Bond Amount.

The obligations and liabilities of the Guarantor shall not be discharged by any allowance of time or other indulgence whatsoever by the Beneficiary to the Principal, or by any variation or suspension of the Works to be executed under the Contract, or by any amendments to the Contract or to the constitution of the Principal or the Beneficiary, or by any other matters, whether with or without the knowledge or consent of the Guarantor.

Any claim under this Bond must be received by the Guarantor on or before _____ [*insert the date six months after the expected expiry of the Defects Notification Period for the Works*] (the "Expiry Date"), when this Bond shall expire and shall be returned to the Guarantor.

The benefit of this Bond may be assigned subject to the provisions for assignment of the Contract, and subject to the receipt by the Guarantor of evidence of full compliance with such provisions.

This Bond shall be governed by the law of _____ [*insert the law governing the bond*] being the same country (or other jurisdiction) as that which governs the Contract. This Bond incorporates and shall be subject to the Uniform Rules for Contract Bonds, published as number 524 by the International Chamber of Commerce, and words used in this Bond shall bear the meanings set out in such Rules.

Whereas this Bond has been issued by the Principal and the Guarantor on _____ [*date*]

Signatures for and on behalf of the Principal(3):

_____ _____ _____ _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Signatures for and on behalf of the Guarantor[4]:

_____ _____ _____ _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

[1] When writing the tender documents, the writer should ascertain whether to include the optional text, shown in parentheses [ ].

[2] Insert: [and shall not be entitled to perform the Principal's obligations under the Contract.]
Or: [or at the option of the Guarantor (to be exercised in writing within 42 days of receiving the claim specifying such Default) perform the Principal's obligations under the Contract.]

[3] Whether one or more signatories for the Principal are required will depend on the Principal and/or applicable law.

[4] Whether one or more signatories for the Guarantor are required will depend on the Guarantor and/or applicable law.

Annex E EXAMPLE FORM OF ADVANCE PAYMENT GUARANTEE

Guarantee No.: _____ _____ [*insert guarantee reference number*]

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

Name of Contract/Contract No.: _____ _____
_____ [*insert reference number or other information identifying the contract between the Applicant and the Beneficiary on which the guarantee is based*]

The Beneficiary (the "Employer"): _____ _____
_____ ____ [*insert name and address of the Beneficiary*]

We have been informed that _____ _____
_____ [*insert name and address of the Contractor*] (hereinafter called the "Applicant") is your Contractor under such Contract and wishes to receive an advance payment, for which the Contract requires him/her to obtain a guarantee.

At the request of the Applicant, we _____ [*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] (the "Guaranteed Amount") upon receipt by us of your demand in writing and your written statement that:

(a) the Applicant has failed to repay the advance payment in accordance with the Conditions of Contract, and

(b) the amount of the advance payment which the Applicant has failed to repay.

This guarantee shall become effective upon receipt [of the first instalment] of the advance payment by the Applicant. The Guaranteed Amount shall be reduced by the amounts of the advance payment repaid to you, as evidenced by interim payment certificates issued under Sub-Clause 14.6 of the Conditions of Contract. Following receipt of a copy of each interim payment certificate, we shall promptly notify you of the revised Guaranteed Amount accordingly.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office [insert address of office] on or before _____ [*insert the date 70 days after the expected expiry of the Time for Completion*] (the "Expiry Date"), when this guarantee shall expire.

The party liable for the payment of any charges: _____[*insert the name of the party*].

This guarantee shall be governed by the laws of _____[*insert the law governing the guarantee*], and shall be subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

Signed by:_____ Signed by[1]: _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Date: _____

(1) Whether one or more signatories for the bank are required will depend on the bank and/or applicable law.

Annex F EXAMPLE FORM OF RETENTION MONEY GUARANTEE

Guarantee No.: _____ _____ [*insert guarantee reference number*]

The Guarantor: _____ _____

_____ [*insert name and address of place of issue, unless indicated in the letterhead*]

Name of Contract/Contract No.: _____ _____

_____ [*insert reference number or other information identifying the contract between the Applicant and the Beneficiary on which the guarantee is based*]

The Beneficiary (the "Employer"): _____ _____

_____ [*insert name and address of the Beneficiary*]

We have been informed that _____ _____

_____ [*insert name and address of the Contractor*] (hereinafter called the "Applicant") is your Contractor under such Contract and wishes to receive an early payment of [part of] the retention money, for which the Contract requires him/her to obtain a guarantee.

At the request of the Applicant, we _____ [*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] (the "Guaranteed Amount") upon receipt by us of your demand in writing and your written statement that the Applicant has failed to carry out his/her obligation(s) to rectify the following defect(s) for which he/she is responsible under the Contract [*state the nature of the defect(s)*].

At any time, our liability under this guarantee shall not exceed the total amount of retention money released to the Applicant by you, as evidenced by interim payment certificates issued under Sub-Clause 14.6 of the Conditions of Contract with a copy being submitted to us.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office [insert address of office] on or before _____ [*insert the date 70 days after the expected expiry of the Defects Notification Period for the Works*], (the "Expiry Date"), when this guarantee shall expire.

We have been informed that the Beneficiary may require the Applicant to extend this guarantee if the Performance Certificate under the Contract has not been issued by the date 28 days prior to such Expiry Date. We undertake to pay you the Guaranteed Amount upon receipt by us, within such period of 28 days, of your demand in writing and your written statement that the Performance Certificate has not been issued, for reasons attributable to the Applicant, and that this guarantee has not been extended.

The party liable for the payment of any charges: _____[*insert the name of the party*].

This guarantee shall be governed by the laws of _____ [*insert the law governing the guarantee*] and shall be subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

Signed by:_____ Signed by[1]: _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Date: _____

(1) Whether one or more signatories for the bank are required will depend on the bank and/or applicable law.

Annex G EXAMPLE FORM OF PAYMENT GUARANTEE BY EMPLOYER

Guarantee No.: _____ _____ [insert guarantee reference number]

The Guarantor: _____ _____

_____ [*insert name and address of place of issue, unless indicated in the letterhead*]

Name of Contract/Contract No.: _____ _____

_____ [*insert reference number or other information identifying the contract between the Applicant and the Beneficiary on which the guarantee is based*]

The Beneficiary (the "Contractor"): _____ _____

_____ [*insert name and address of the Beneficiary*]

We have been informed that _____ _____

_____ [*insert name and address of the Employer*] (hereinafter called the "Applicant") is required to obtain a bank guarantee.

At the request of the Applicant, we _____ [*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Contractor, any sum or sums not exceeding in total the amount of _____ [*insert in figures and words the maximum amount payable and the currency in which it is payable*] upon receipt by us of your demand in writing and your written statement that:

(a) in respect of a payment due under the Contract, the Applicant has failed to make payment in full by the date fourteen days after the expiry of the period specified in the Contract as that within which such payment should have been made, and

(b) the amount(s) which the Applicant has failed to pay.

Any demand for payment must be accompanied by a copy of _____ [*insert list of documents evidencing entitlement to payment and the language in which these documents are to be submitted*], in respect of which the Applicant has failed to make payment in full.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office [address of office] on or before _____ [*insert the date six months after the expected expiry of the Defects Notification Period for the Works*] when this guarantee shall expire.

The party liable for the payment of any charges: _____[*insert the name of the party*].

This guarantee shall be governed by the laws of _____ [*insert the law governing the guarantee*] and shall be subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

Signed by:_____ Signed by[1]: _____

(signature) *(signature)*

_____ _____ _____ _____

(name) *(name)*

Date: _____

(1) Whether one or more signatories for the bank are required will depend on the bank and/or applicable law.

FIDIC® Conditions of Contract for CONSTRUCTION

FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER

Forms of Letter of Tender, Letter of Acceptance, Contract Agreement and Dispute Adjudication Avoidance Agreement

LETTER OF TENDER

NAME OF CONTRACT:

TO:

We have examined the Conditions of Contract, Specification, Drawings, Schedules including the Bill of Quantities, the Contract Data and Addenda Nos _____ for the above-named Contract and the words and expressions used herein shall have the meanings assigned to them in the Conditions of Contract. We offer to execute and complete the Works and remedy any defects therein, in conformity with this Tender which includes all these documents, for the sum of

_____

[*currency and amount in figures*]

_____

[*currency and amount in words*]

or such other amount as may be determined in accordance with the Contract.

We agree to abide by this Tender until _____ [*date*] and it shall remain binding upon us and may be accepted at any time before that date.

If this offer is accepted, we will provide the specified Performance Security, commence the Works as soon as is reasonably practicable after the Commencement Date, and complete the Works in accordance with the above-named documents within the Time for Completion.

Unless and until a Contract Agreement is prepared and executed this Letter of Tender, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest or any tender you may receive.

Signature _____ _____in the capacity of _____

duly authorised to sign tenders for and on behalf of _____

Address: _____ _____

Date: _____

LETTER OF ACCEPTANCE •

NAME OF CONTRACT:_____ _____

CONTRACT NUMBER: _____ _____

TO:____ _____ _____

Date: __ _____ _____

Your Reference:_____ _____

Our Reference: _____ _____

We thank you for your Tender dated _____ for the execution and completion of the Works comprising the above-named Contract and remedying of defects therein, all in conformity with the terms and conditions contained in the Contract.

We have pleasure in accepting your Tender for the Accepted Contract Amount of:

_____ _____ _____
[*currency and amount in figures*]

_____ _____ _____
[*currency and amount in words*]

In consideration of you properly and truly performing the Contract, we agree to pay you the Accepted Contract Amount or such other sums to which you may become entitled under the terms of the Contract, at such times and as prescribed by the Contract.

We acknowledge that this Letter of Acceptance creates a binding Contract between us, and we undertake to fulfil all our obligations and duties in accordance with the terms of this Contract.

Signed by: _____ _____(signature)

For and behalf of:_____ _____

Date: __ _____ _____

_____ _____ _____

• Memoranda (if any) to be annexed [*see Sub-Clause 1.1.51*]

CONTRACT AGREEMENT

This Agreement made the _____ day of _____ _____
Between _____ of _____ (hereinafter called "the Employer") of the one part,
and _____ of _____ (hereinafter called "the Contractor") of the other part

Whereas the Employer desires that the Works known as _____ [name and number of the Contract] should be executed by the Contractor, and has accepted a Tender 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 Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement:
   (a) The Letter of Acceptance dated
   (b) The Letter of Tender dated
   (c) The Addenda Nos _____
   (d) The Conditions of Contract
   (e) The Specification
   (f) The Drawings
   (g) The Schedules and
   (h) The JV Undertaking.*

   * [*if the Contractor constitutes an unincorporated JV, otherwise delete*]

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein, in conformity 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 at the times and in the manner prescribed by the Contract.

In Witness whereof the parties hereto have caused this Agreement to be executed the day and year first before written in accordance with their respective laws.

SIGNED by: _____	SIGNED by: _____
for and on behalf of the Employer in the presence of	for and on behalf of the Contractor in the presence of
Witness: _____	Witness: _____
Name: _____	Name: _____

Address: _____ Address: _____

Date:___ _____ Date: __ _____

DISPUTE AVOIDANCE/ADJUDICATION AGREEMENT

[*All italicised text and any text within square brackets (except sub-clause headings) in this form of agreement is for use in preparing the form and should be deleted from the final product*].

Name and details of the Contract _____ _____
_____ _____ _____

This Agreement made the _____day of _____ [*month*], _____ [*year*], between

Name and contact details of the Employer ____ _____ (name)
____ _____(*address*)
____ _____ (*telephone*)
____ _____(*email/other contact details*);

Name and contact details of the Contractor____ _____ (*name*)
____ _____(*address*)
____ _____ (*telephone*)
____ _____(*email/other contact details*);

and

Name and contact details of the DAAB Member _____ (*name*)
____ _____(*address*)
____ _____ (*telephone*)
____ _____(*email/other contact details*);

("**DAA Agreement**")

Whereas:

A. the Employer and the Contractor have entered (or intend to enter) into the Contract;

B. under the Contract, the "**DAAB**" or "**Dispute Avoidance/Adjudication Board**" means the sole member or three members (as stated in the Contract Data of the Contract) so named in the Contract, or appointed under Sub-Clause 21.1 [Constitution of the DAAB] or Sub-Clause 21.2 [Failure to Appoint DAAB Members] of the Conditions of Contract;

C. the Employer and the Contractor desire jointly to appoint the above-named DAAB Member to act on the DAAB as:

   (a) the sole member of the DAAB, and where this is the case, all references to the "Other Members" do not apply; or

   (b) one of three members/chairman [delete the one which is not applicable] of the DAAB and, where this is the case, the other two persons are:

_____ _____ *(name)*	_____ _____ *(name)*
_____ _____ *(address)*	_____ _____ *(address)*
_____ _____*(telephone)*	_____ _____*(telephone)*

_____ _____ *(email/ other contact details)*	_____ _____ *(email/ other contact details)*

the "**Other Members**"; and

D. the DAAB Member accepts this appointment.

The Employer, Contractor and DAAB Member jointly agree as follows:

1. The conditions of this DAA Agreement comprise:
   (a) Clause 21 [Disputes and Arbitration] of the Conditions of Contract, and any other provisions of the Contract that are applicable to the DAAB's Activities; and
   (b) the "General Conditions of Dispute Avoidance/Adjudication Agreement", which is appended to the General Conditions of the "Conditions of Contract for Construction" Second Edition 2017 published by FIDIC ("GCs"), as amended and/or added to by the following provisions.

2. [Details of amendments to the GCs, if any. For example:
   In the procedural rules annexed to the GCs, Rule _ is deleted and replaced by: " ... "]

3. The DAAB Member shall be paid in accordance with Clause 9 of the GCs. The currency of payment shall be _____.

   In respect of Sub-Clauses 9.1 and 9.2 of the GCs, the amounts of the DAAB Member's monthly fee and daily fee shall be:
   monthly fee _____ per month, and
   daily fee of _____ per day
   (or as otherwise set under Sub-Clause 9.3 of the GCs).

4. In consideration of the above fees, and other payments to be made to the DAAB Member in accordance with the GCs, the DAAB Member undertakes to act as DAAB Member in accordance with the terms of this DAA Agreement.

5. The Employer and the Contractor shall be jointly and severally liable for the DAAB Member's fees and other payments to be made to the DAAB Member in accordance with the GCs.

6. This DAA Agreement shall be governed by the law of _____ (if not stated, the law that governs the Contract under Sub-Clause 1.4 of the Conditions of Contract).

SIGNED by: _____	SIGNED by: _____	SIGNED by: _____
Print name: _____	Print name: _____	the DAAB Member
Title: _____	Title: _____	Title: _____

9

for and on behalf of the Employer	for and on behalf of the Contractor	
in the presence of	in the presence of	in the presence of
Witness: _____	Witness:_____	Witness: _____
Name:_____	Name: _____	Name:_____
Address: _____	Address: _____	Address: _____
_____	_____	_____
Date:_____	Date: _____	Date:_____

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Bangladesh Economic Zones Authority (BEZA)

Project Name :- Bangladesh Economic Zones Development Project (Mirsarai - EZ)
Design and Supervision of Infrastructure Works

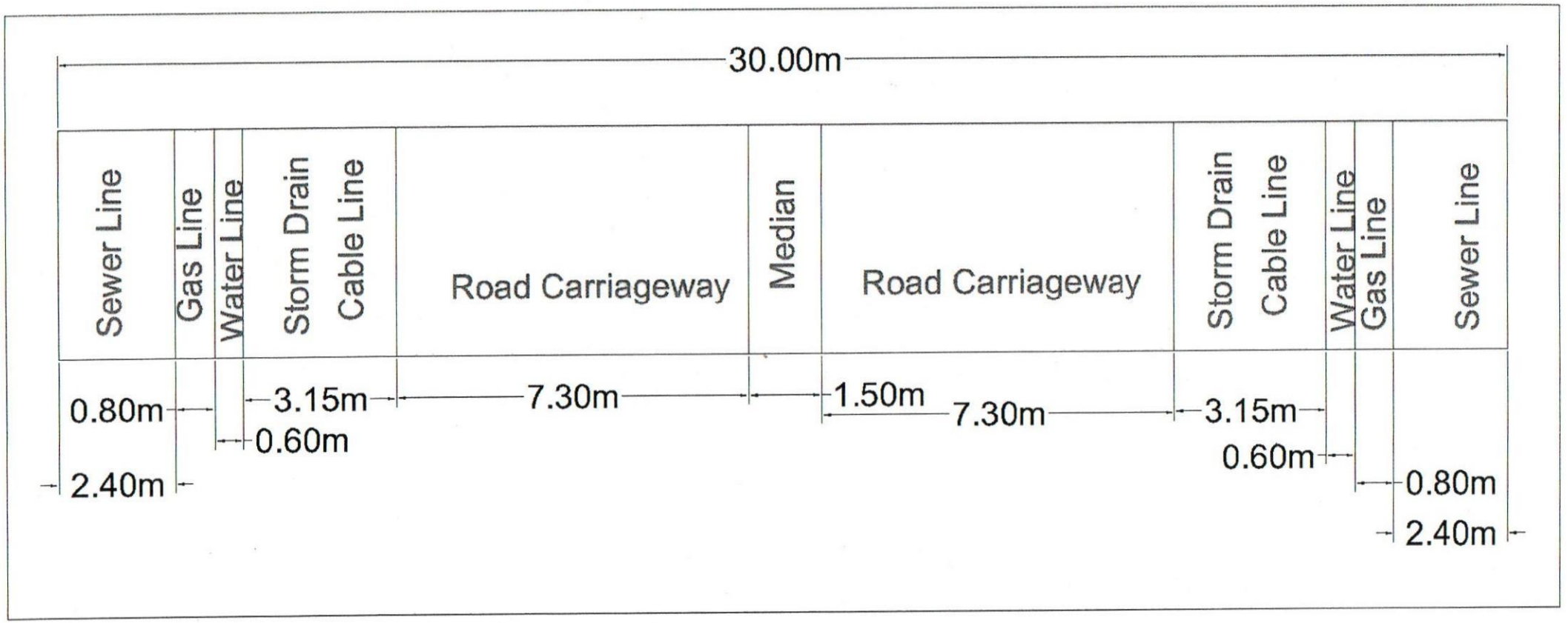
Package Name :- Construction of Storm water RCC Drains, Zone - 2B

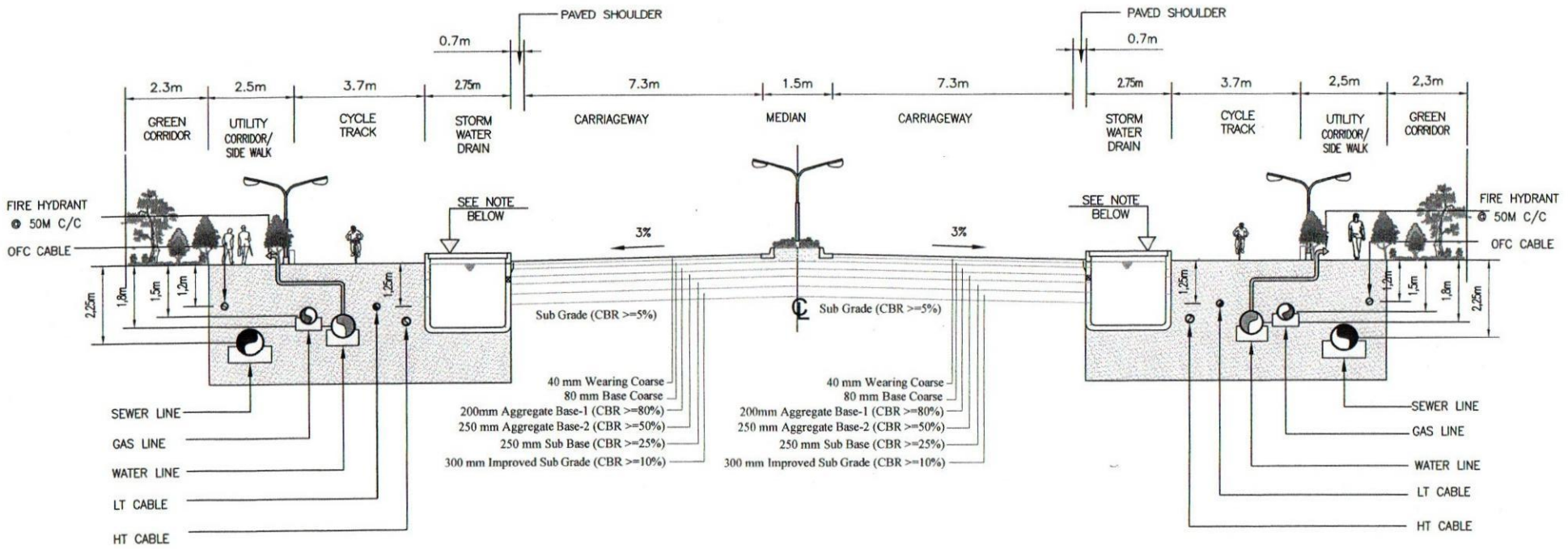
Package No. WD2-BSMSN-BEZA

NOVEMBER 2020

Prepared By :-

Joint Venture of Aarvee - BETS (JV)
Transaction Advisory Services Firm for
Design and Supervision of Infrastructure Works
(Package No. WD2-BSMSN-BEZA)-Bangladesh
Economic Zones Authority (BEZA)

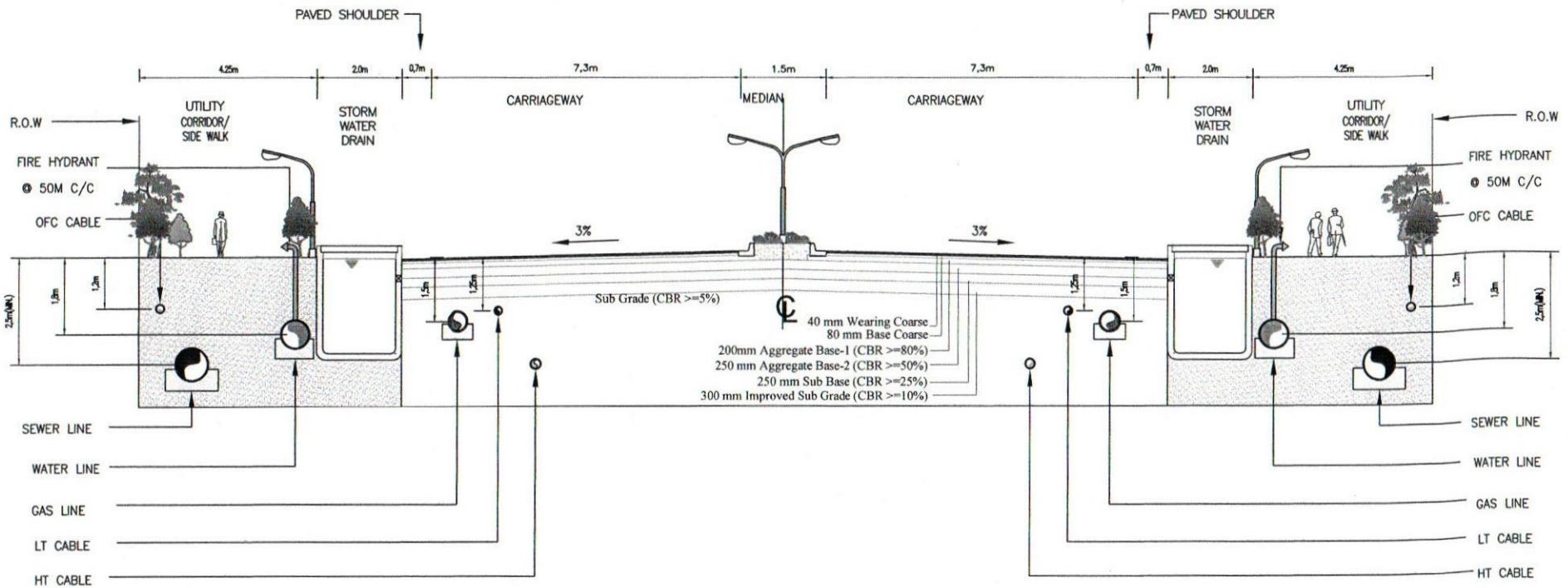

30.00m
Sewer Line
Gas Line
Water Line
Storm Drain
Cable Line
Road Carriageway
Median
Road Carriageway
Storm Drain
Cable Line
Water Line
Gas Line
Sewer Line
0.80m
2.40m
3.15m
0.60m
7.30m
1.50m
7.30m
3.15m
0.60m
0.80m
2.40m



CROSS SECTION OF SUB-ARTERIAL TYPE ROAD
(40m ROW)

NOTE:- 20mm Overley After Every 5-6 Years of Wearing Coarse.

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	Bangladesh Economic Zones Development Project (Phase-1), Mirsaral EZ	TAS Firm, RPMC (BEZA-S-103)	Farida Yesmin CAD Operator	Subrata Kumar Sarkar Office Engineer	Md. Marajul Islam Road Design Engineer	Gazi Mohammad Mohsin Team Leader	BEZA	NO	REVISION	DATE	TYPICAL CROSS SECTION OF BC ROAD
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : TYPICAL CROSS-SECTION OF BC ROAD PAVEMENT	May,2019						01			Sheet No: S-03
								02			
								03			
								04			
								05			



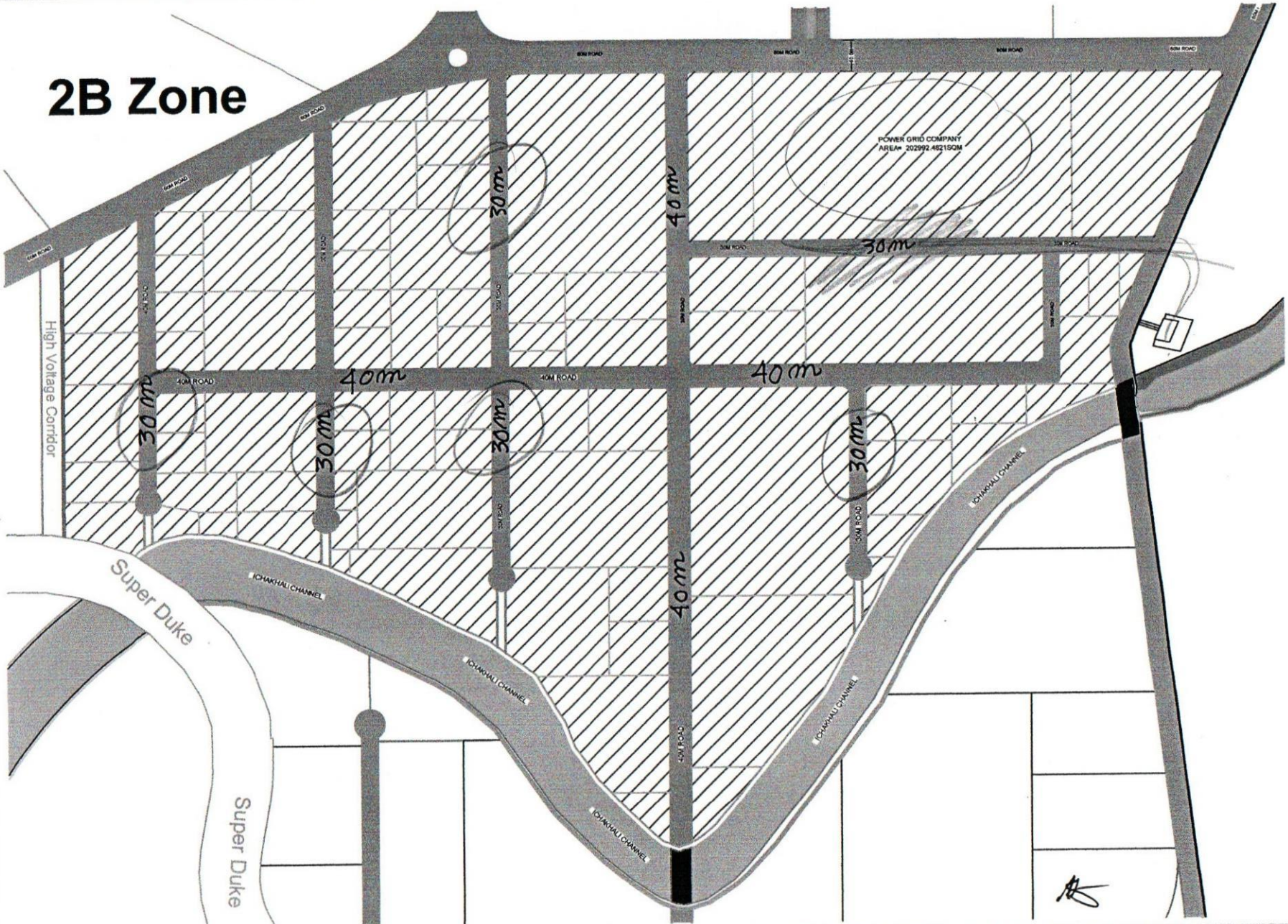
CROSS SECTION OF SUB-ARTERIAL TYPE ROAD

(30m WIDTH)

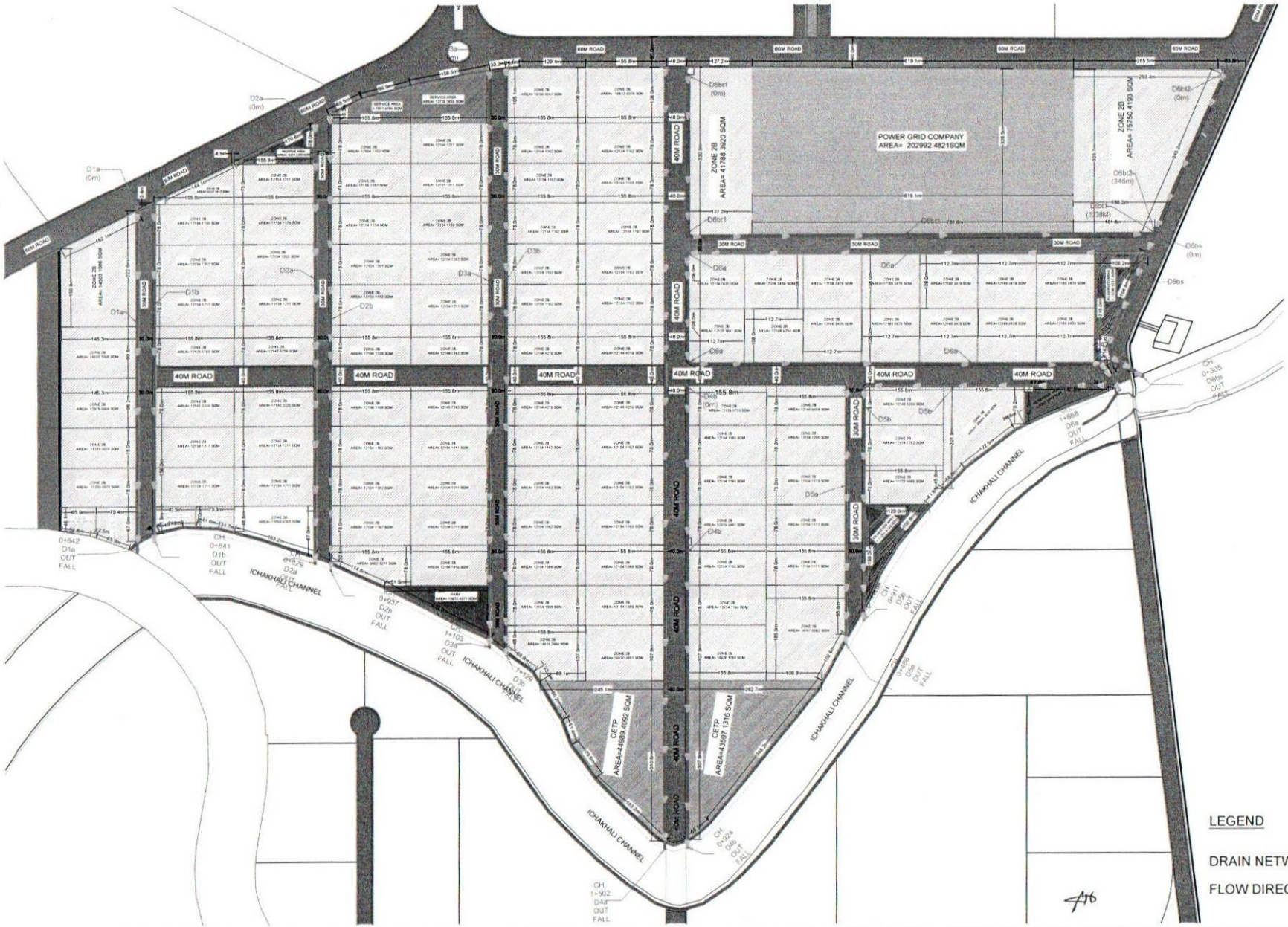
NOTE:- 20mm Overley After Every 5-6 Years of Wearing Coarse.

CLIENT: BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	PROJECT NAME : Bangladesh Economic Zones Development Project (Phase-1), Mirsarai EZ	SUBMITTED BY: TAS Firm, RPMC (BEZA-S-103)	DRAWN BY: Farida Yesmin CAD Operator	DRAWING CHECKED BY: Subrata Kumar Sarkar Office Engineer	DESIGNED BY: Md. Marajul Islam Road Design Engineer	CHECKED BY: Gazi Mohammad Mohsin Team Leader	APPROVED BY: BEZA	REVISION: NO / REVISION / DATE: 01, 02, 03, 04, 05
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : TYPICAL CROSS-SECTION OF BC ROAD PAVEMENT	May,2019						DRAWING STATUS: TYPICAL CROSS SECTION OF BC ROAD; Sheet No: S-02

2B Zone



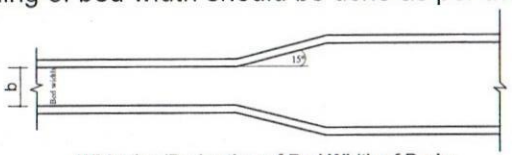
CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	ROAD LAYOUT, ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) BEZA - CS - 2211	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Md. Merajul Islam Road Design Engr.	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : ROAD LAYOUT	NOVEMBER, 2020						01			Sheet No: N-01
								02			
								03			
								04			
								05			



CLIENT	PROJECT NAME	SUBMITTED BY	DRAWN BY	DRAWING CHECKED BY	DESIGNED BY	CHECKED BY	APPROVED BY	REVISION	DRAWING STATUS
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO / REVISION / DATE: 01, 02, 03, 04, 05	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: Storm Drainage Network	NOVEMBER, 2020							Sheet No: N-01

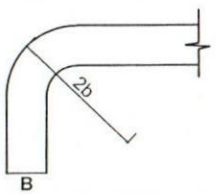
GENERAL NOTES:

1. 28 days cylinder strength of 1:1.5:3 concrete should not be less than 25 MPa.
2. 28 days cylinder strength of 1:3:6 concrete shall not be less than 10 MPa.
3. Yield strength of reinforcement bar shall not be less than fy(ReH)= 400 MPa.
4. Clear cover of reinforcement
   a) Base slab - 75 mm
   b) Vertical wall- 75 mm
   c) Top slab- 40 mm
5. 75 mm thick Lean Cement concrete (1:3:6) may be provided over sand filling.
6. All reinforcement bar is deformed billet bar and no hook shall be provided.
7. C.C. blocks (75 mm x 75 mm) of required thickness to be provided for the required clear cover.
8. Only Steel shuttering should to be used and those should be cleaned properly before reuse.
9. Vibrator should be used for compaction of concrete.
10. Cement grouting must be used at all construction joints.
11. All dimensions are in mm unless otherwise stated.
12. Weep hole 50mm Ø @ 3000 c/c along the long direction.
13. Widening of bed width should be done as per the following drawing.

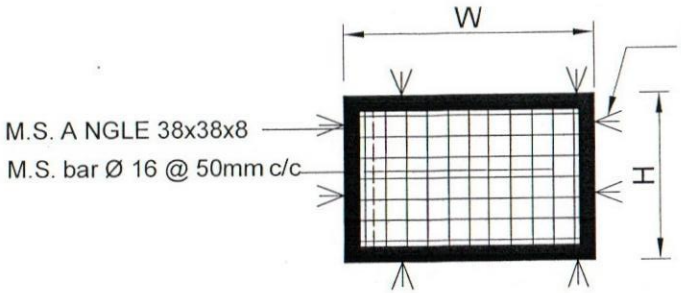


Widening/Reduction of Bed Width of Drain

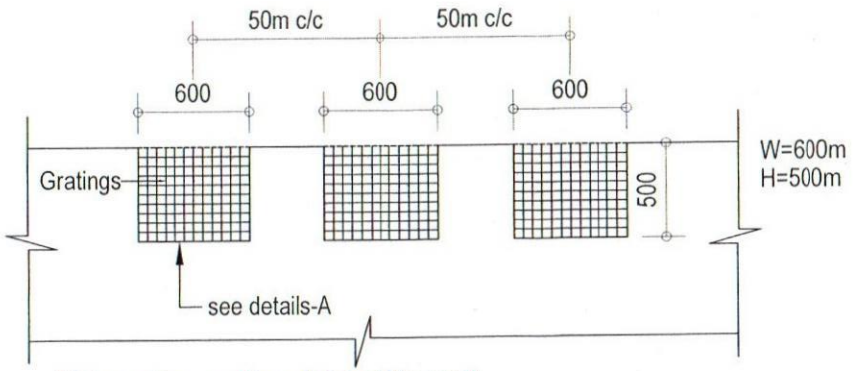
14. Change in alignment of route of drain show follow the drawing below.



15. Fillets of 0.25B X 0.25B (B is the clear width of Drain) may be provided in the Drains.
16. A typical design of outfall is given below

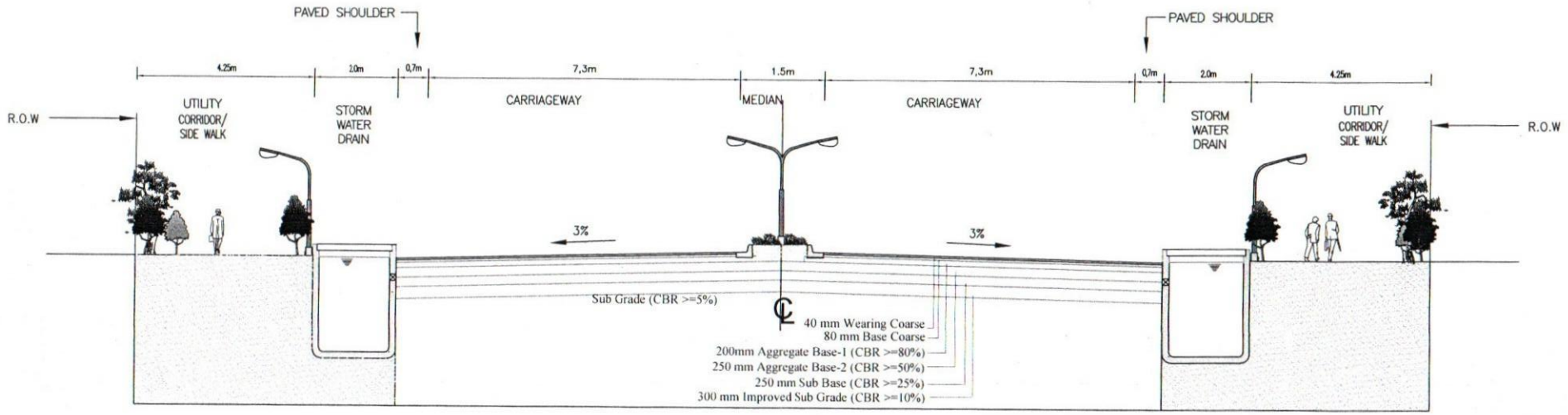


Horizontal Grating Section
50m interval or as directed
by the Engineer
Detail-A



Water entry opening at top of the wall

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : GENERAL NOTES	NOVEMBER, 2020						01			Sheet No: G-01
								02			
								03			
								04			
								05			

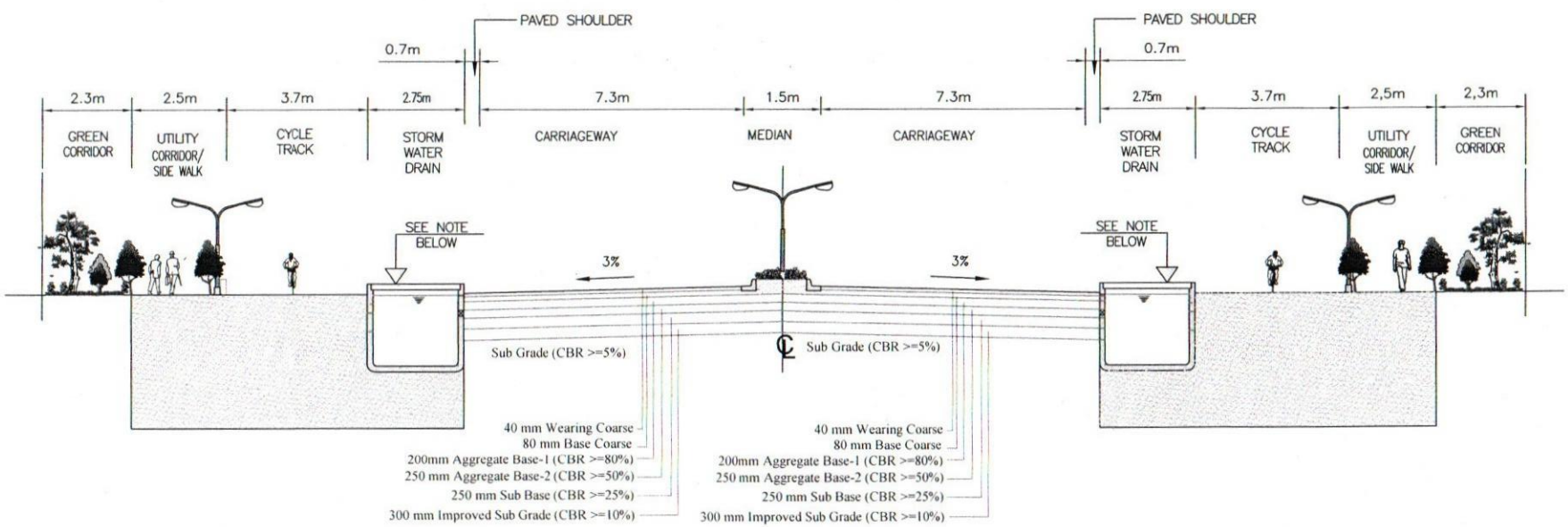


CROSS SECTION OF SUB-ARTERIAL TYPE ROAD

(30m WIDTH)

NOTE:- 20mm Overley After Every 5-6 Years of Wearing Coarse.

CLIENT	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	Bangladesh Economic Zones Development Project (Phase-1), Mirsarai EZ	TAS Firm, RPMC (BEZA-S-103)	Farida Yesmin CAD Operator	Subrata Kumar Sarkar Office Engineer	Md. Marajul Islam Road Design Engineer	Gazi Mohammad Mohsin Team Leader	BEZA	NO	REVISION	DATE	TYPICAL CROSS SECTION OF BC ROAD
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : TYPICAL CROSS-SECTION OF BC ROAD PAVEMENT	May,2019						01			Sheet No: S-02
								02			
								03			
								04			
								05			



CROSS SECTION OF SUB-ARTERIAL TYPE ROAD
(40m ROW)

NOTE:- 20mm Overley After Every 5-6 Years of Wearing Coarse.

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	Bangladesh Economic Zones Development Project (Phase-1), Mirsarai EZ	TAS Firm, RPMC (BEZA-S-103)	Farida Yesmin CAD Operator	Subrata Kumar Sarkar Office Engineer	Md. Marajul Islam Road Design Engineer	Gazi Mohammad Mohsin Team Leader	BEZA	NO	REVISION	DATE	TYPICAL CROSS SECTION OF BC ROAD
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : TYPICAL CROSS-SECTION OF BC ROAD PAVEMENT	May,2019						01			Sheet No: S-03
								02			
								03			
								04			
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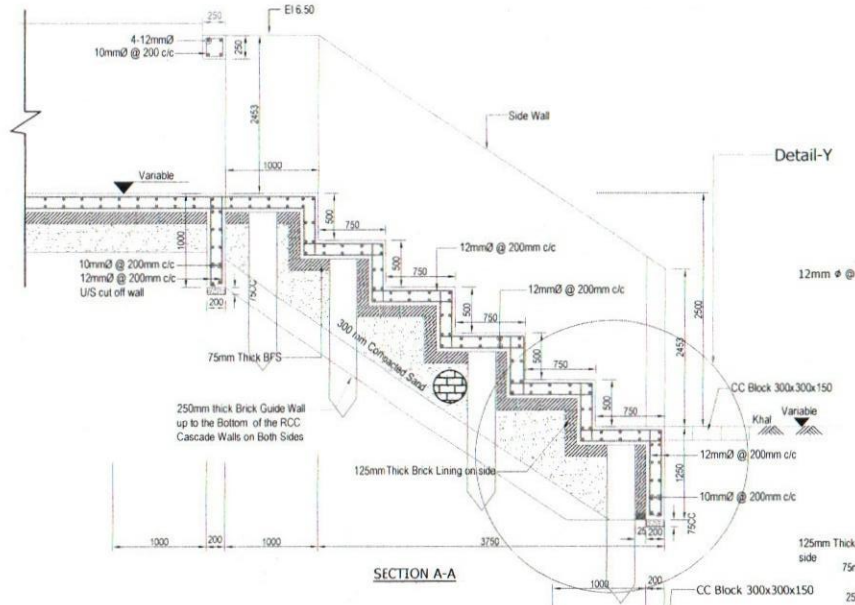
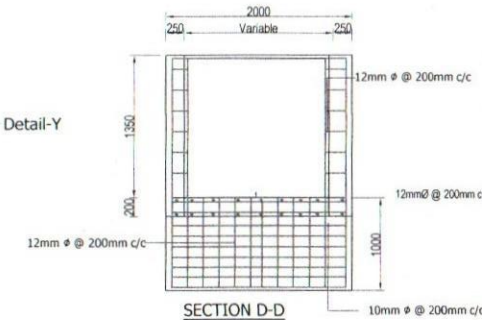


SECTION A-A



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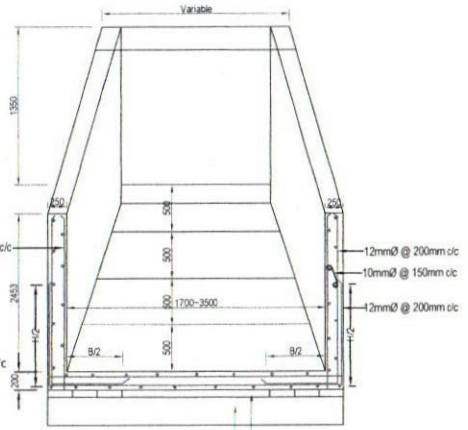
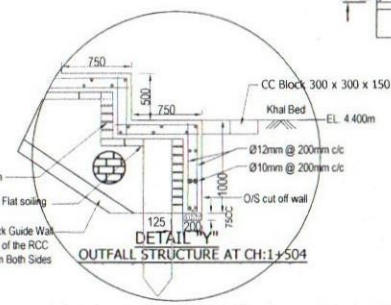
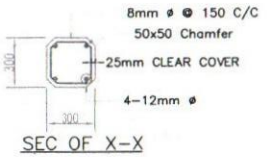


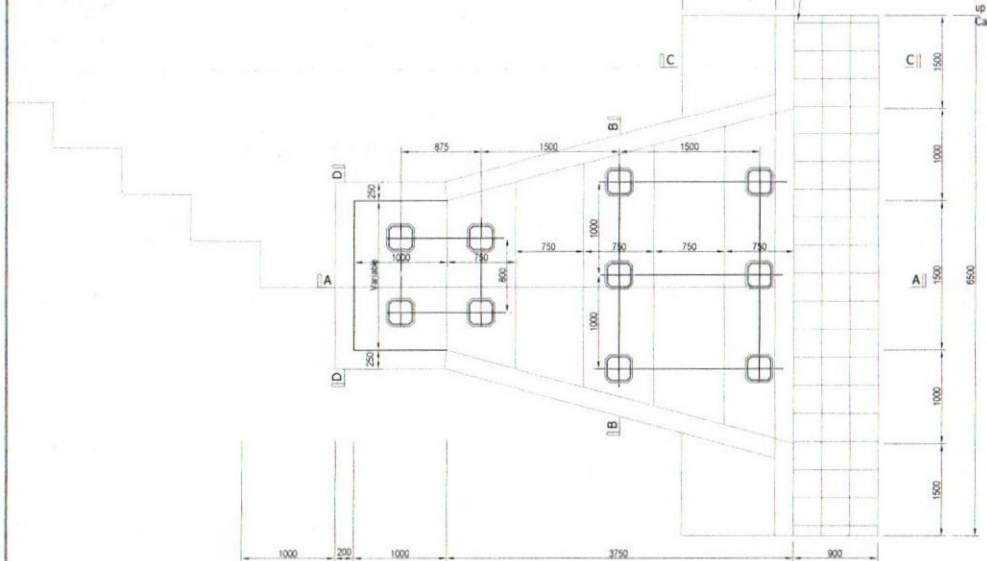
SECTION B-B



DETAIL
OUTFALL STRUCTURE AT CH:1+504

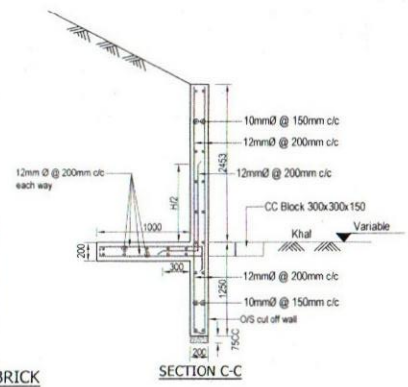


SEC OF X-X

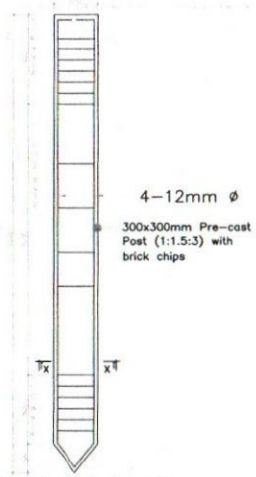


PLAN OF OUTFALL

X-SECTION OF BRICK GUIDE WALL

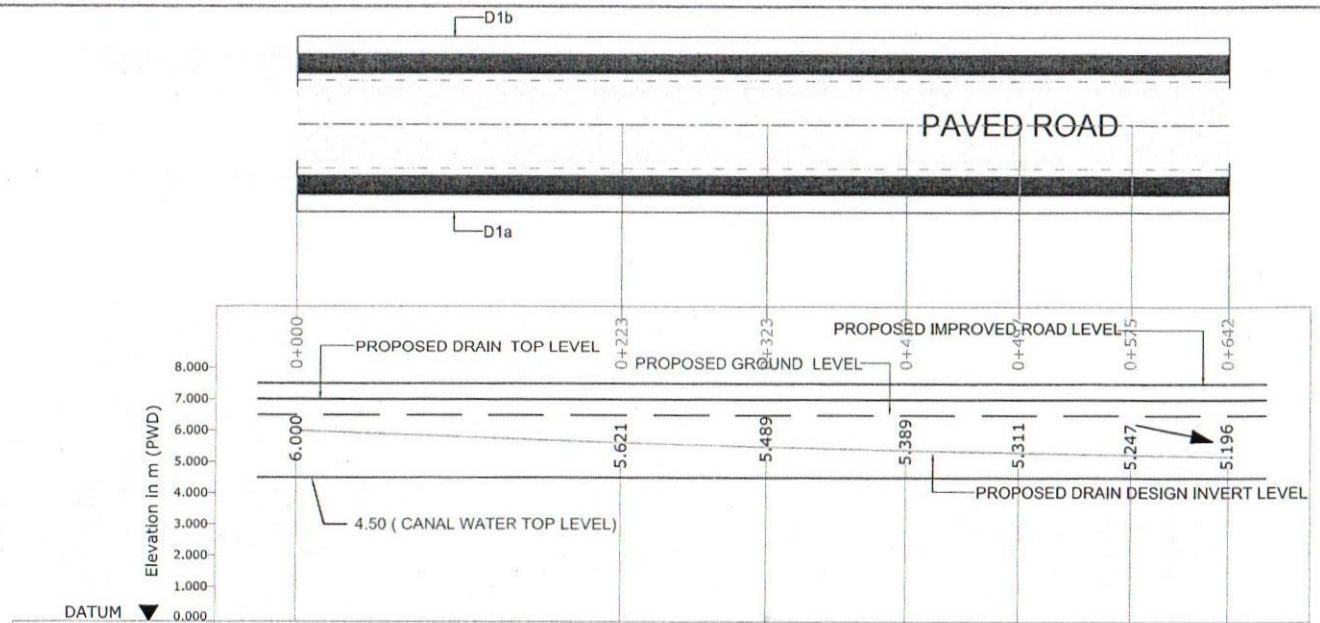


SECTION C-C



Reinf. Details of 5.00m Long RCC Post

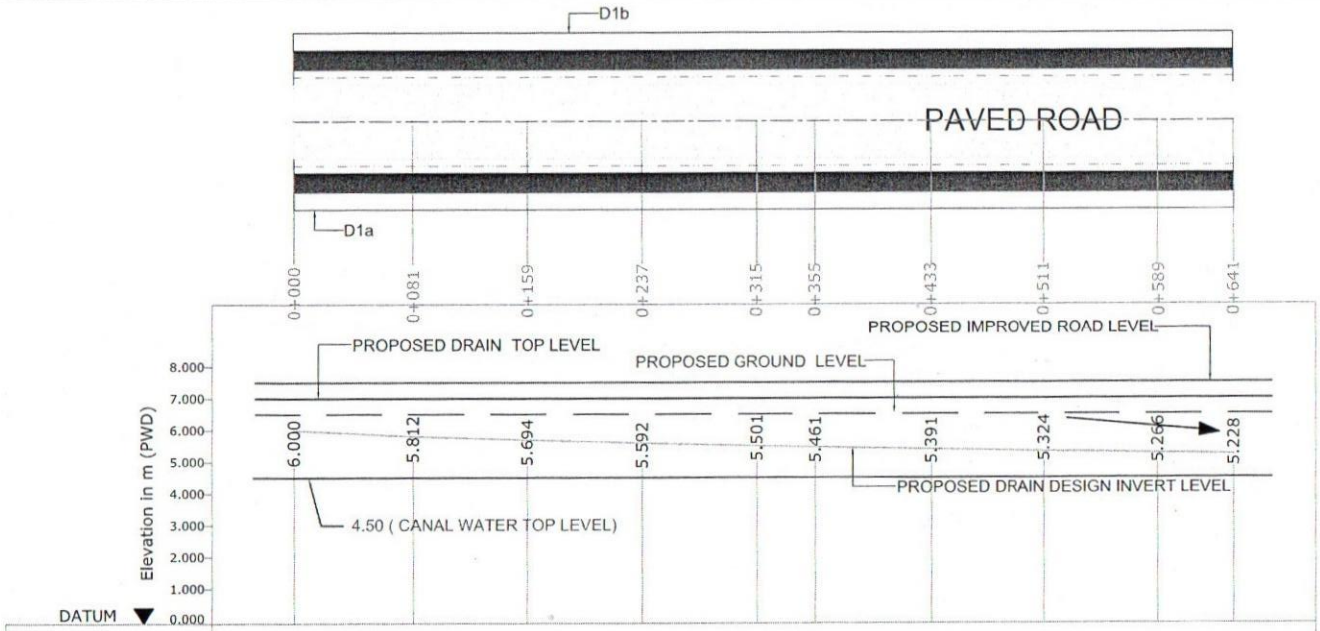
CLIENT	PROJECT NAME	SUBMITTED BY	DRAWN BY	DRAWING CHECKED BY	DESIGNED BY	CHECKED BY	APPROVED BY	REVISION			DRAWING STATUS
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2- BSMSN- BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: OUT FALL DETAILS OF STORM WATER RCC DRAIN (Typical)	NOVEMBER, 2020						01			Sheet No: O2B-01
								02			
								03			
								04			
								05			



SLOPE								
DRAIN BED WIDTH (mm)	800		1000		1200			
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	
DRAIN INVERT LEVEL(m)	6.000	5.621	5.489	5.389	5.311	5.247	5.196	
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	
CHAINAGE (m)	0+000	0+223	0+323	0+419	0+497	0+575	0+642	
Description of route (m)							Outfall	

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D1a

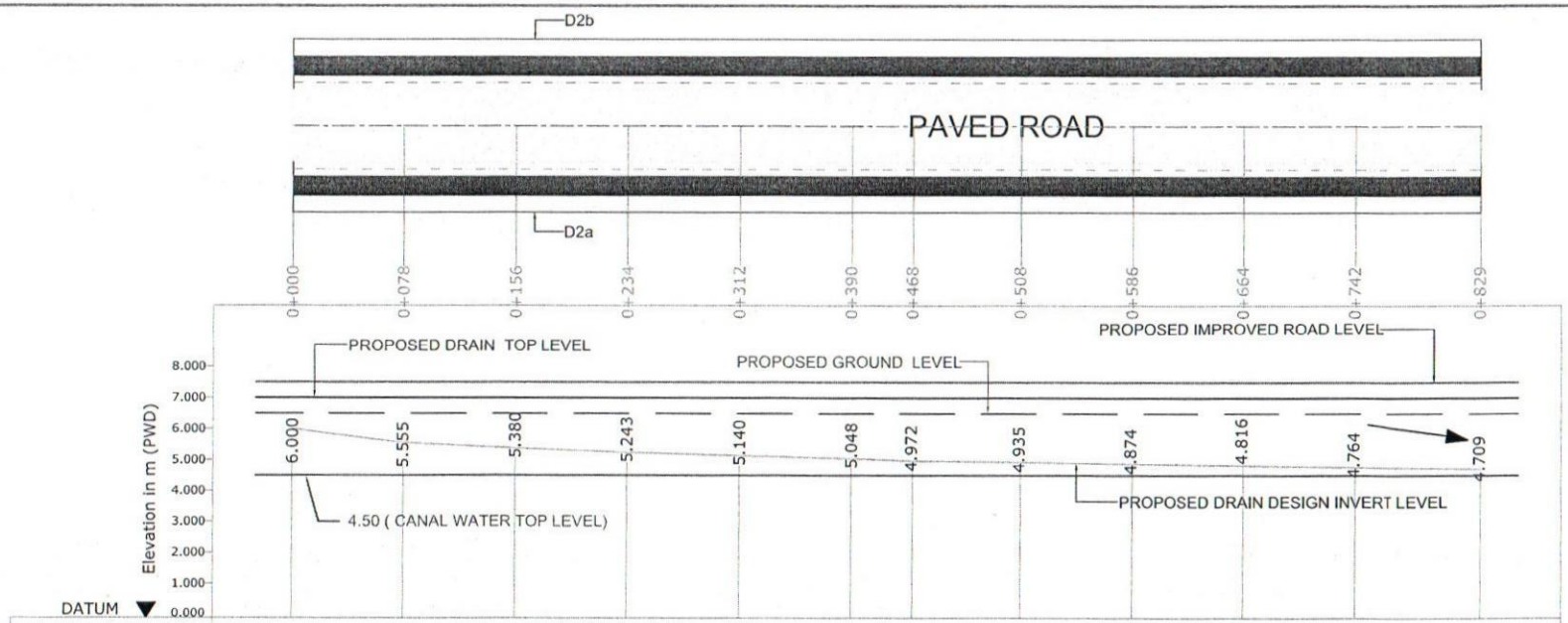
CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D1a	NOVEMBER, 2020						01			SHEET NO: D1a - 01
								02			
								03			
								04			
								05			



SLOPE										
DRAIN BED WIDTH (mm)	600	800			1000			1200		
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.812	5.694	5.592	5.501	5.461	5.391	5.324	5.256	5.228
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+081	0+159	0+237	0+315	0+355	0+433	0+511	0+589	0+641
Description of route (m)					Road Crossing					Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D1b

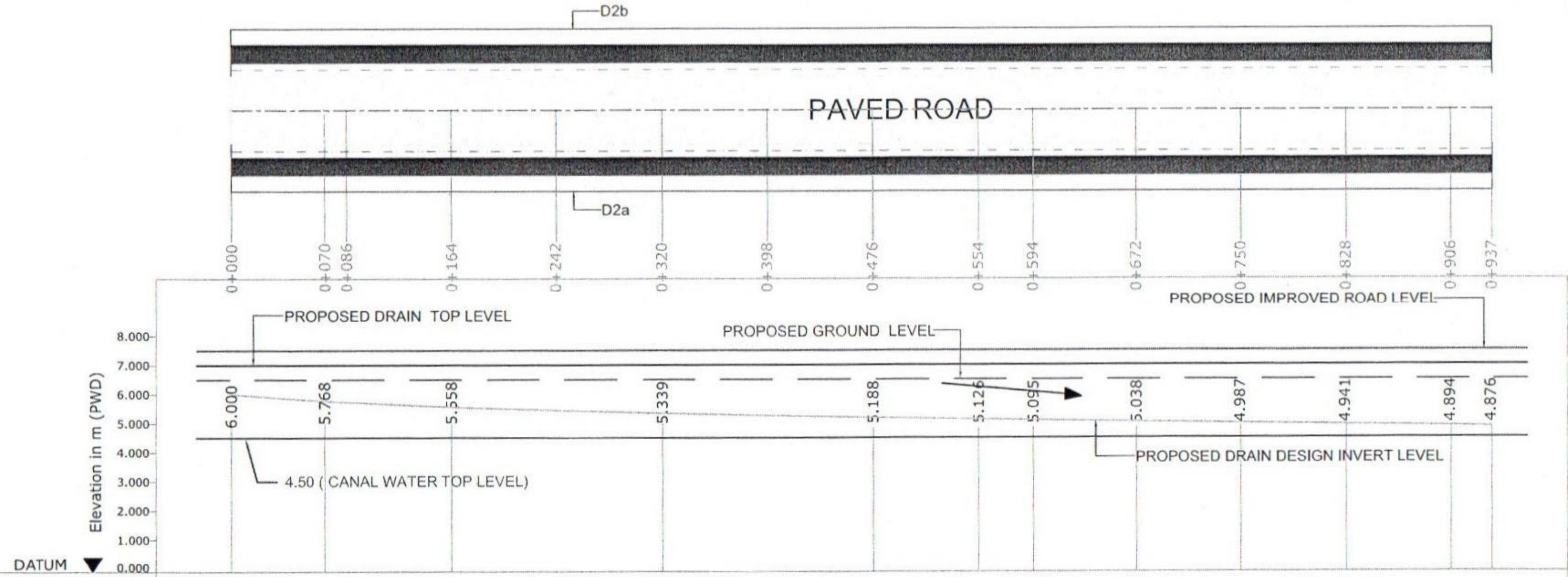
CLIENT	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D1b	NOVEMBER, 2020						01			Sheet No: D1b - 02



SLOPE												
DRAIN BED WIDTH (mm)	600		800		1000		1200		1400			
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.555	5.380	5.243	5.140	5.048	4.972	4.935	4.874	4.816	4.764	4.709
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+078	0+156	0+234	0+312	0+390	0+468	0+508	0+586	0+664	0+742	0+829
Description of route (m)							Road Crossing					Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D2a

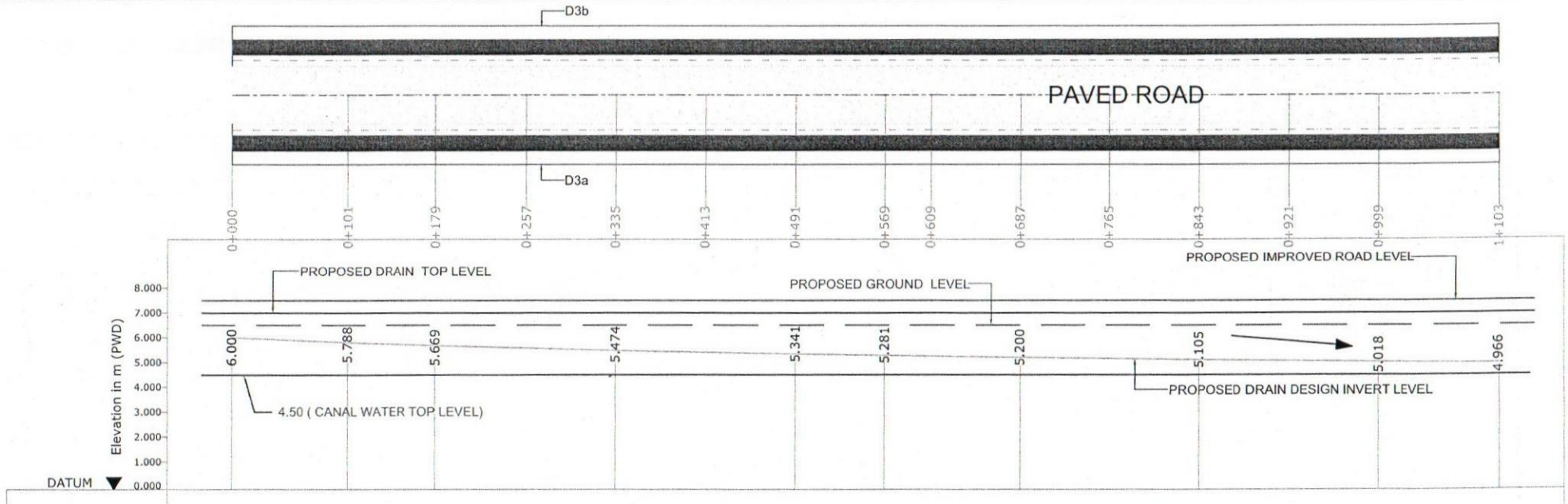
CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:		DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO.	REVISION / DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D2a	NOVEMBER, 2020						01		SHEET NO: D2a - 03
								02		
								03		
								04		
								05		



SLOPE															
DRAIN BED WIDTH (mm)		600			1000				1200			1400			
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.768		5.558		5.339		5.188	5.126	5.095	5.038	4.987	4.941	4.894	4.876
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+070	0+086	0+164	0+242	0+320	0+398	0+476	0+554	0+594	0+672	0+750	0+828	0+906	0+937
Description of route (m)									Road Crossing						Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D2b

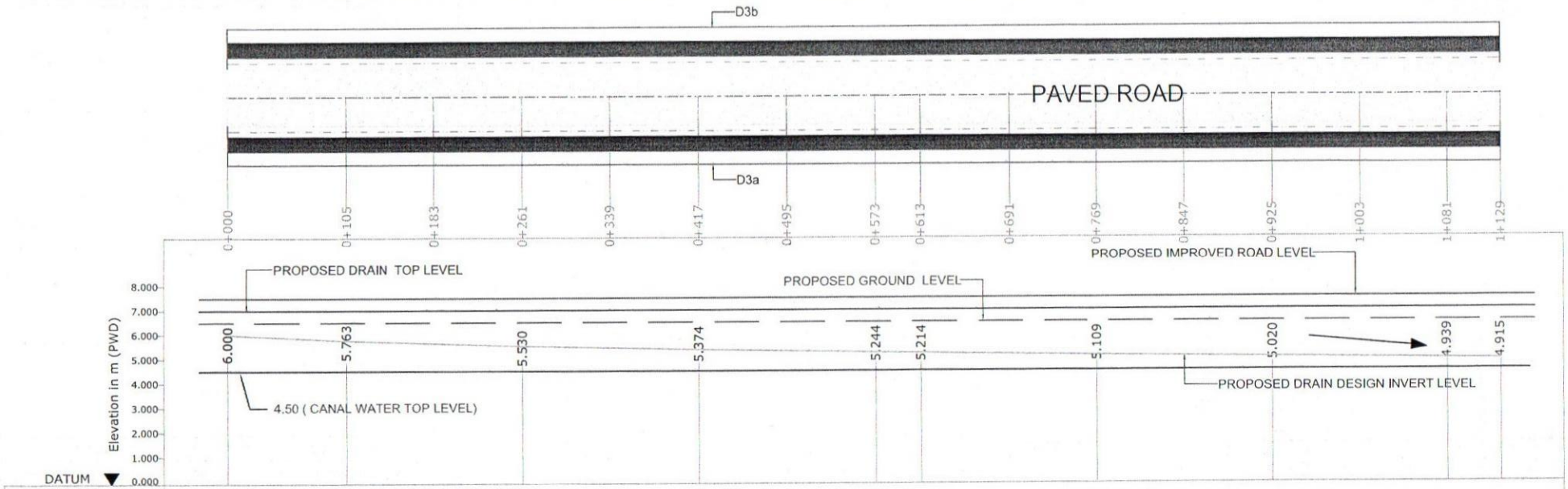
CLIENT:	PROJECT NAME:	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISIONS	DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO / REVISION / DATE: 01, 02, 03, 04, 05	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D2b	NOVEMBER, 2020							Sheet No: D2b - 04



SLOPE															
DRAIN BED WIDTH (mm)	800				1200				1400				1600		
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.788	5.669		5.474		5.341	5.281		5.200		5.105		5.018	4.966
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+101	0+179	0+257	0+335	0+413	0+491	0+569	0+609	0+687	0+765	0+843	0+921	0+999	1+103
Description of route (m)								Road Crossing							Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D3a

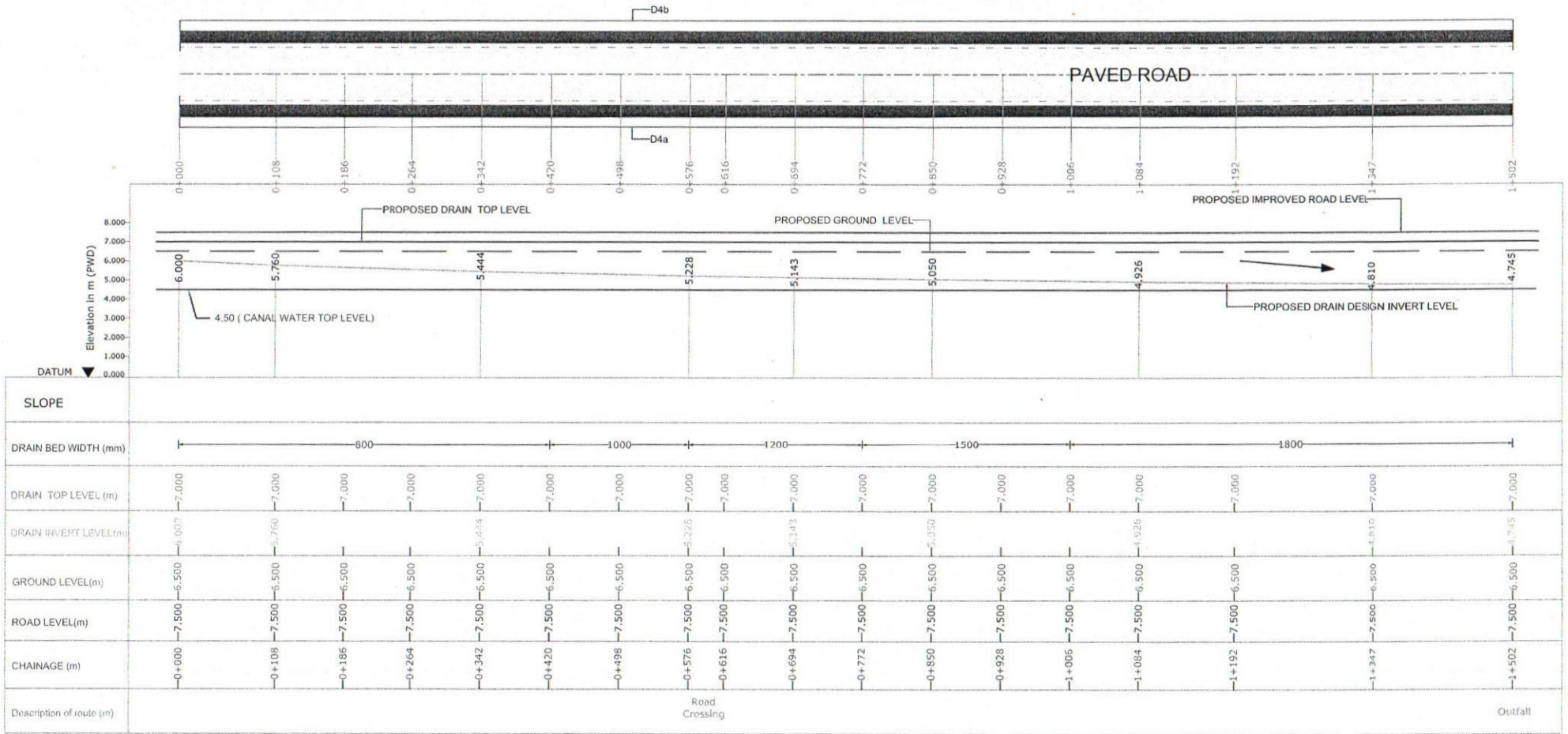
CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D3a	NOVEMBER, 2020						01			Sheet No. D3a - 05
								02			
								03			
								04			
								05			



SLOPE																							
DRAIN BED WIDTH (mm)	600						1000						1200				1400						1600
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.763		5.530		5.374			5.244	5.214		5.109			5.020			4.939	4.915				
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+105	0+183	0+261	0+339	0+417	0+495	0+573	0+613	0+691	0+769	0+847	0+925	1+003	1+081	1+129							
Description of route (m)								Road Crossing															Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D3b

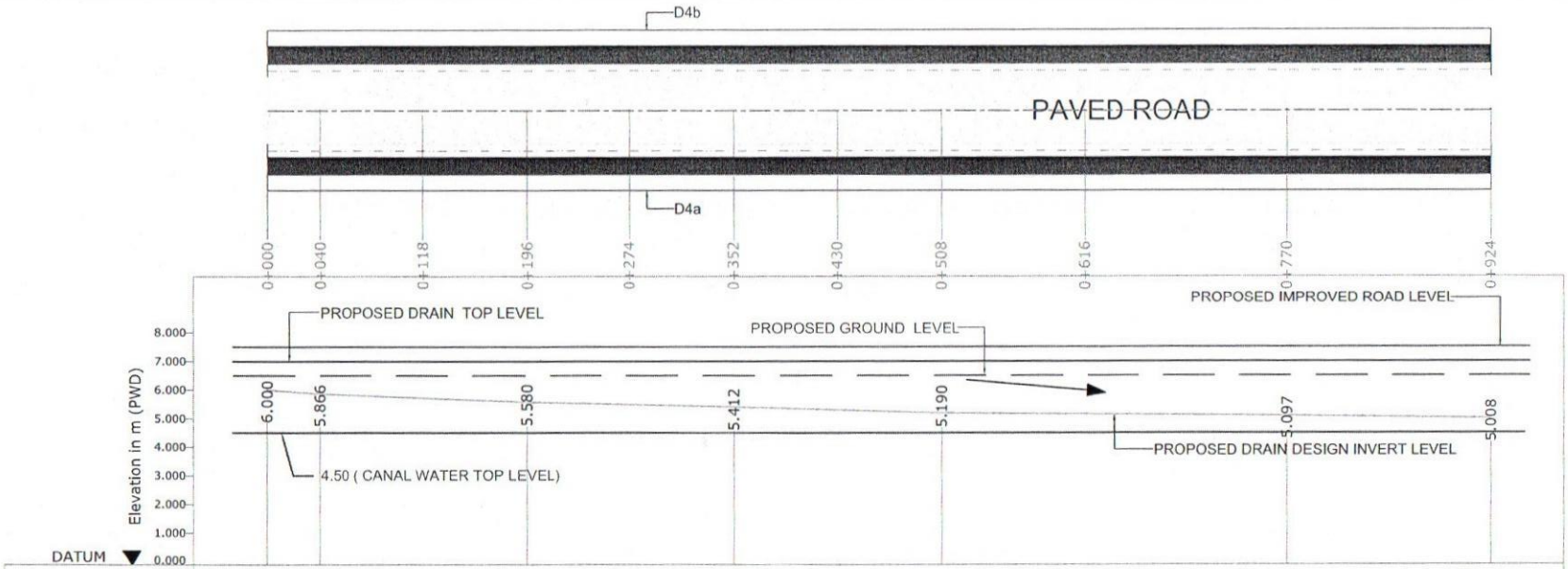
CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION			DRAWING STATUS
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D3b	NOVEMBER, 2020						01			Sheet No. D3b - 06



PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D4a

A6

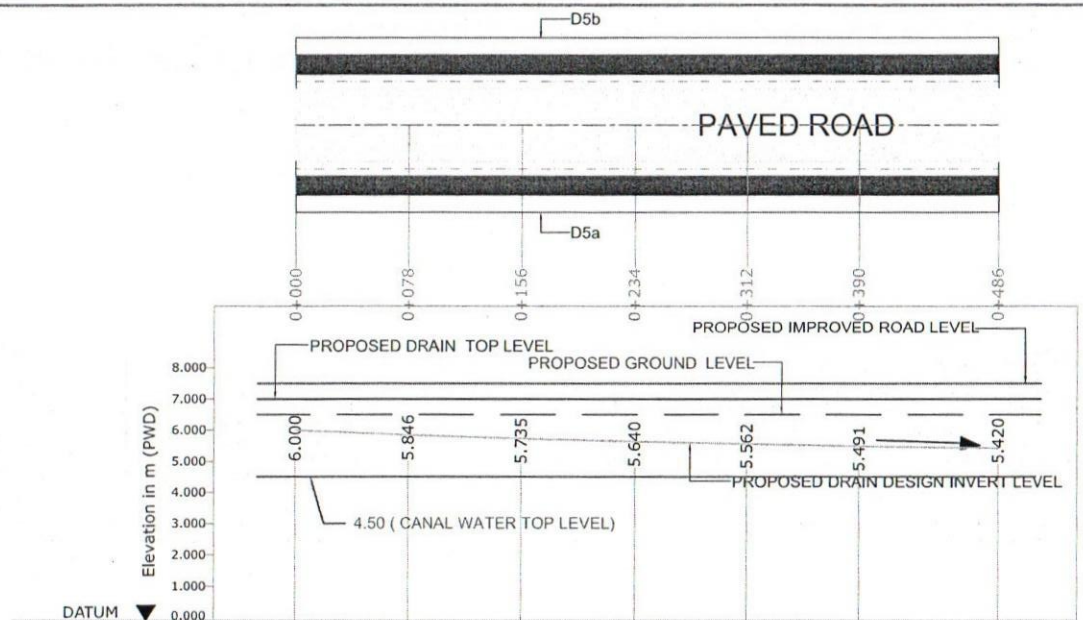
CLIENT:	PROJECT NAME:	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:		DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO / REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D4a	NOVEMBER, 2020						01 / 02 / 03 / 04 / 05		Sheet No: D4a - 07



SLOPE											
DRAIN BED WIDTH (mm)	600		1000					1400			
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.866		5.580		5.412		5.190		5.097	5.008
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+040	0+118	0+196	0+274	0+352	0+430	0+508	0+616	0+770	0+924
Description of route (m)	Road Crossing										Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D4b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D4b	NOVEMBER, 2020						01			SHEET NO: D4b - 08
								02			
								03			
								04			
								05			



SLOPE							
DRAIN BED WIDTH (mm)	600	800	1000	1200			
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	6.000	5.846	5.735	5.640	5.562	5.491	5.420
GROUND LEVEL(m)	6.500	6.500	6.500	6.500	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500	7.500	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+078	0+156	0+234	0+312	0+390	0+486
Description of route (m)							Outfall

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D5a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D5a	NOVEMBER, 2020						01			DRAWING NO. D5a - 09
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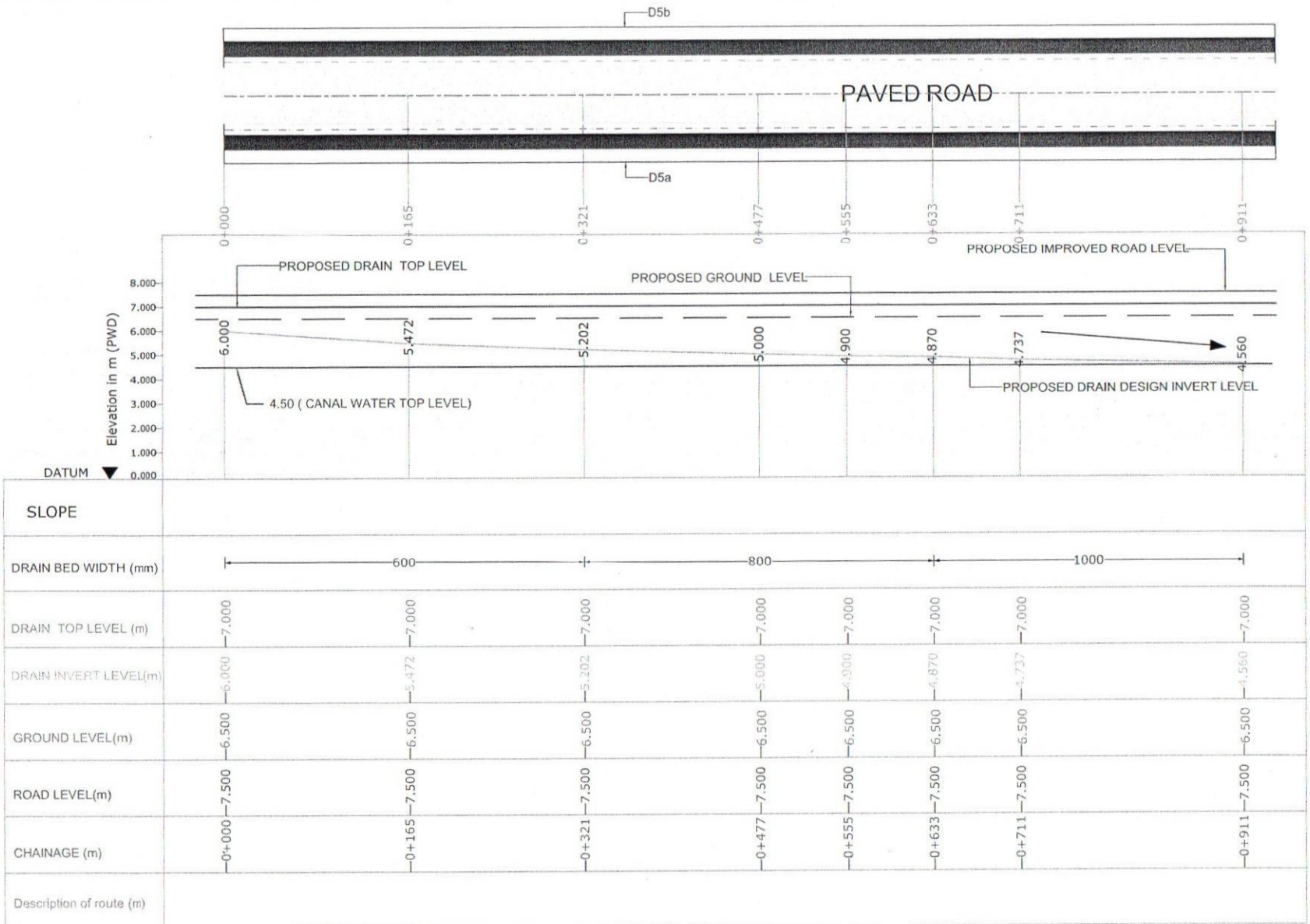
								03			
								04			
								05			



PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D5b

CLIENT:	PROJECT NAME:	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE: LONG PROFILE OF RCC DRAIN,D5b	NOVEMBER, 2020						01			SHEET NO: D5b - 10
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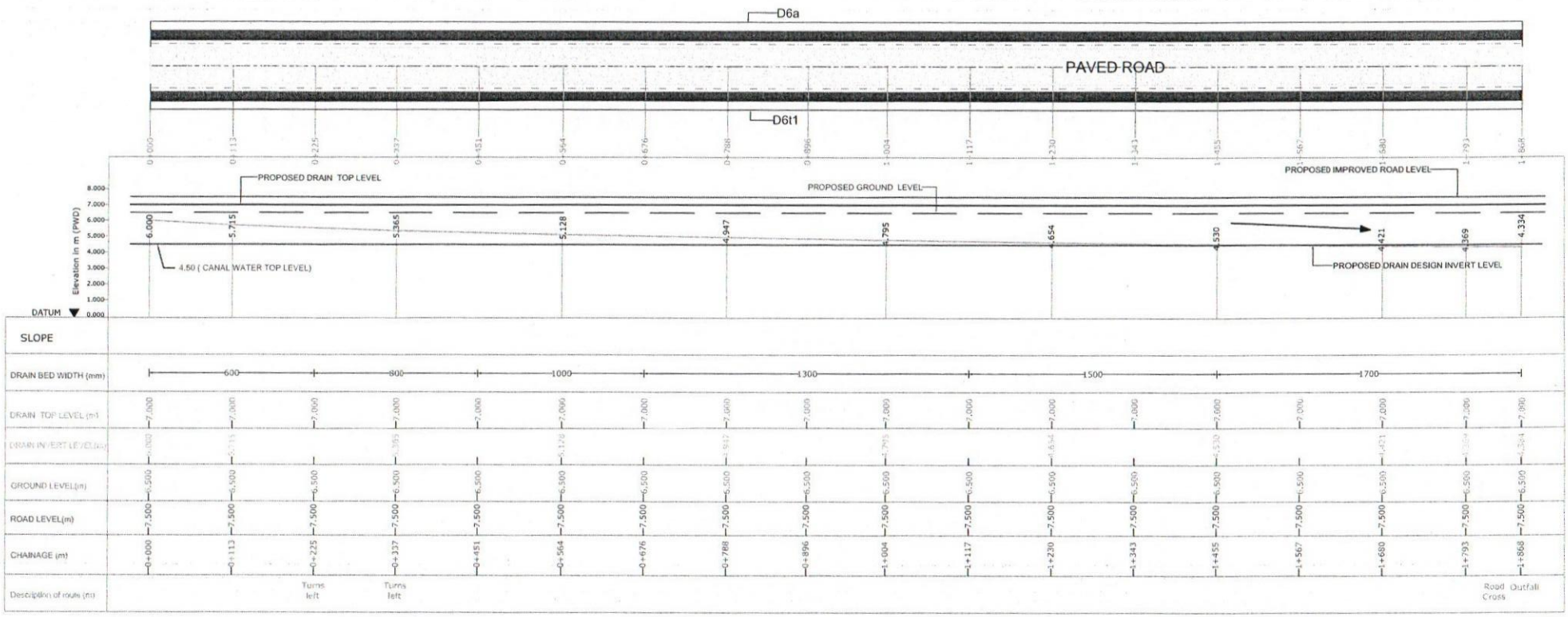

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D6a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D6a	NOVEMBER, 2020						01			Sheet No: D6a - 11
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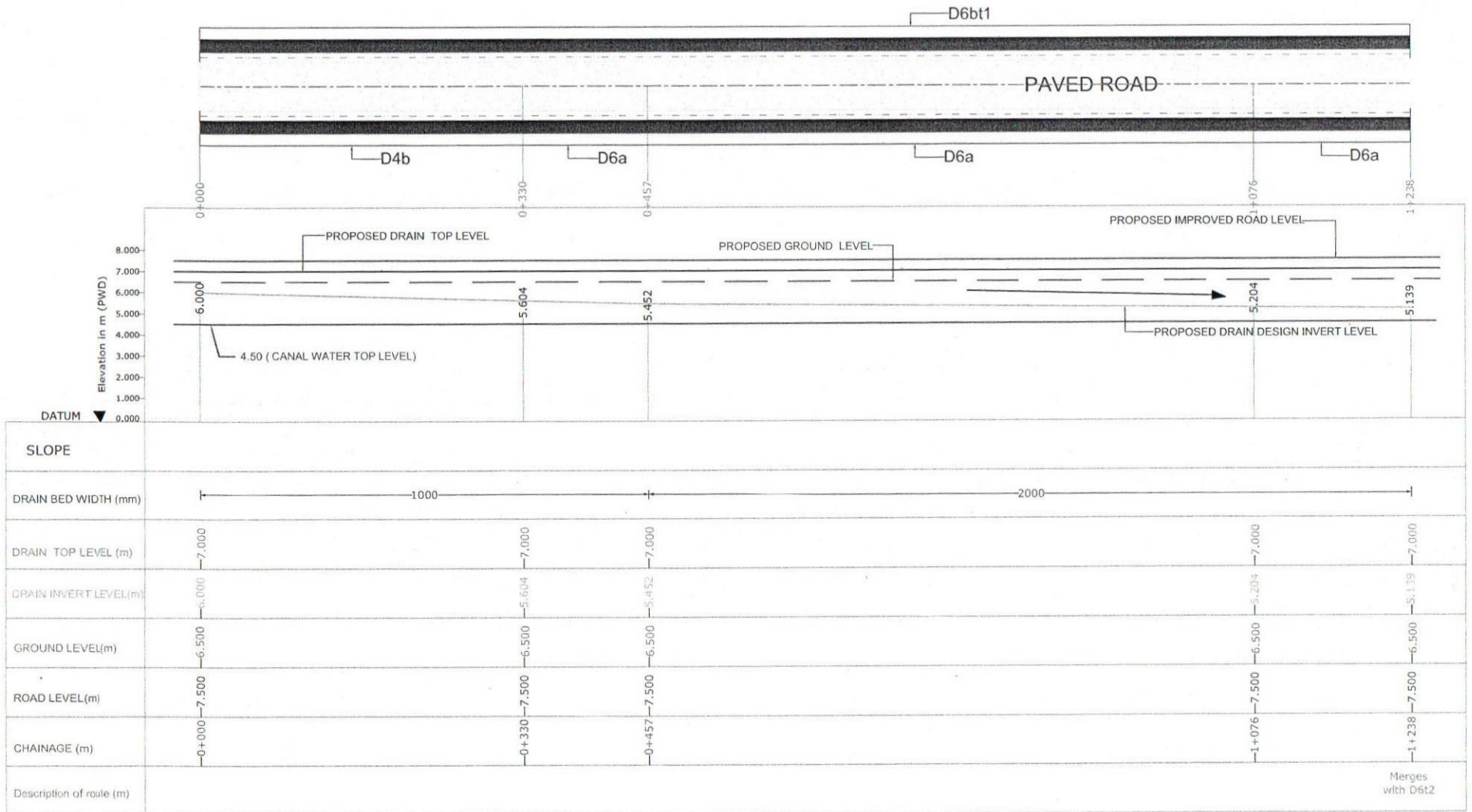

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D6bt1

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D6bt1	NOVEMBER, 2020						01			SHEET NO: D6bt1 - 12
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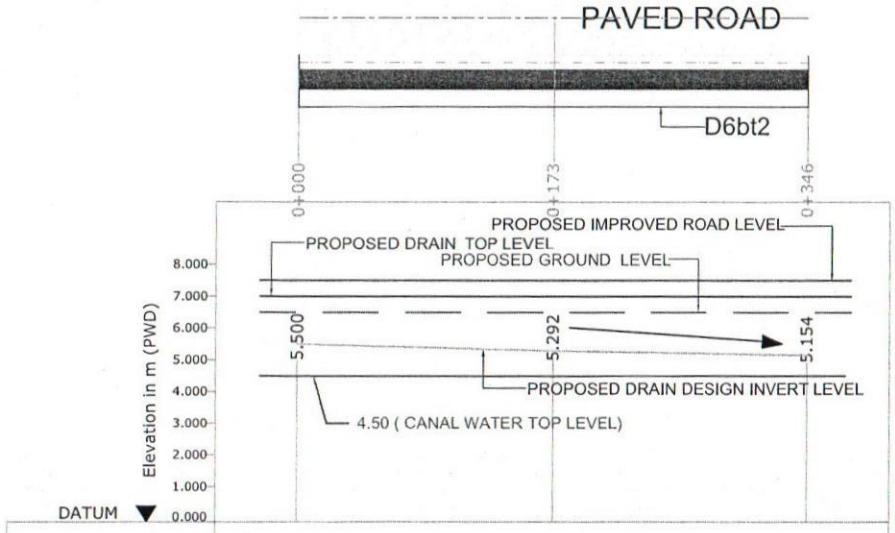

SLOPE			
DRAIN BED WIDTH (mm)	900	1200	
DRAIN TOP LEVEL (m)	7.000	7.000	7.000
DRAIN INVERT LEVEL(m)	5.500	5.292	5.154
GROUND LEVEL(m)	6.500	6.500	6.500
ROAD LEVEL(m)	7.500	7.500	7.500
CHAINAGE (m)	0+000	0+173	0+346
Description of route (m)			Merges with D6t1

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D6bt2

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D6bt2	NOVEMBER, 2020						01			Sheet No: D6bt2 - 13
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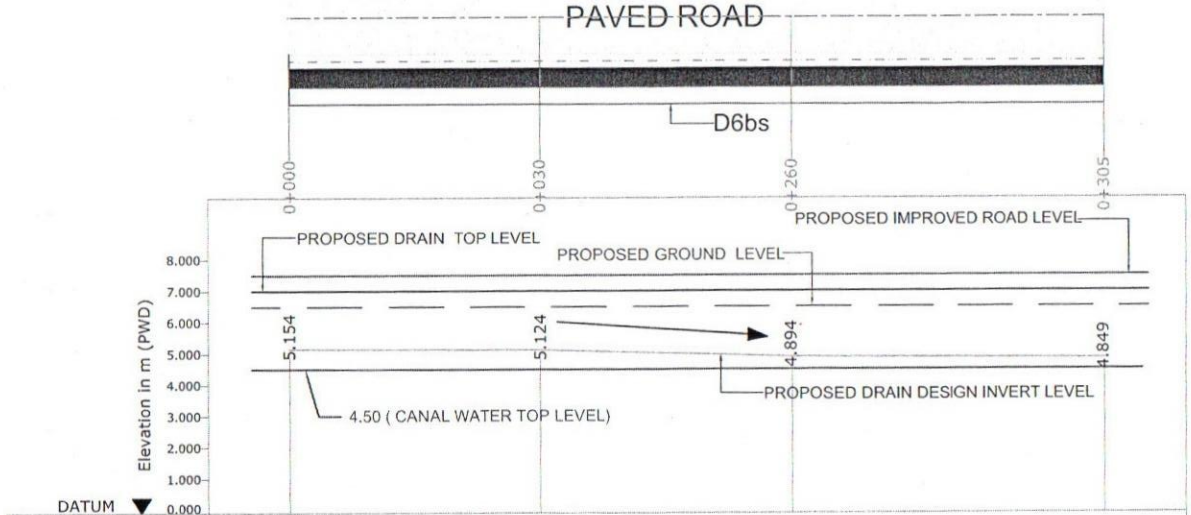
								03			
								04			
								05			



SLOPE									
DRAIN BED WIDTH (mm)	1900								
DRAIN TOP LEVEL (m)	7.000	7.000	7.000	7.000					
DRAIN INVERT LEVEL(m)	5.154	5.124	4.894	4.849					
GROUND LEVEL(m)	6.500	6.500	6.500	6.500					
ROAD LEVEL(m)	7.500	7.500	7.500	7.500					
CHAINAGE (m)	0+000	0+030	0+260	0+305					
Description of route (m)	Merging of D6b1 & D6b2	Road Crossing					Road Crossing	Outfall	

PLAN & LONGITUDINAL PROFILE OF RCC DRAIN D6bs

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Md Zillur Rahman CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : LONG PROFILE OF RCC DRAIN,D6bs	NOVEMBER, 2020						01			SHEET NO: D6bs - 14
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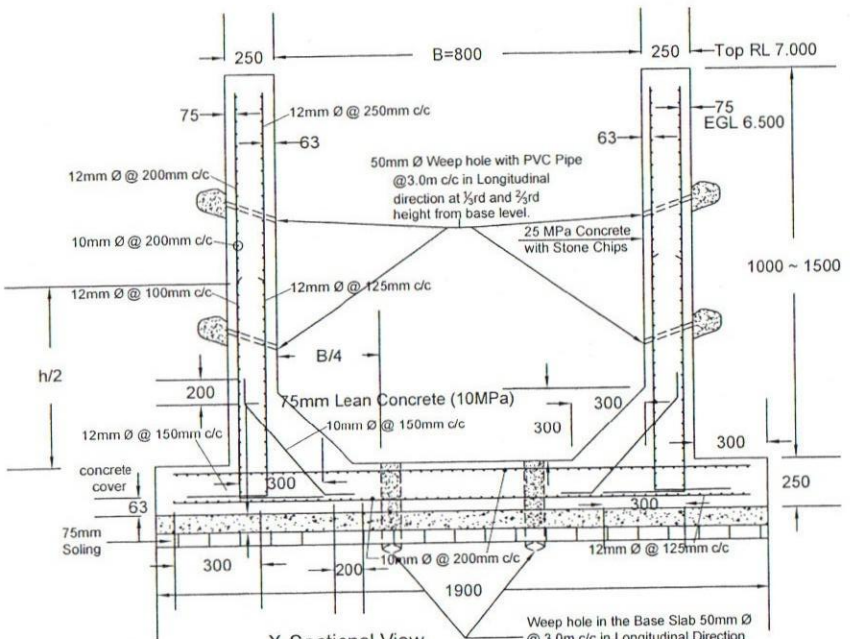
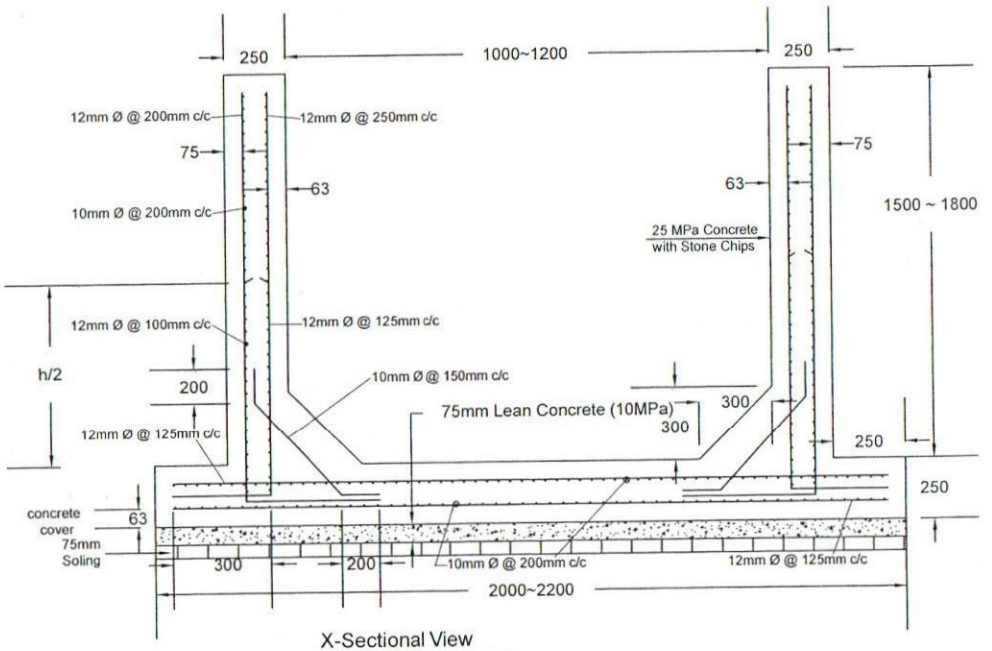


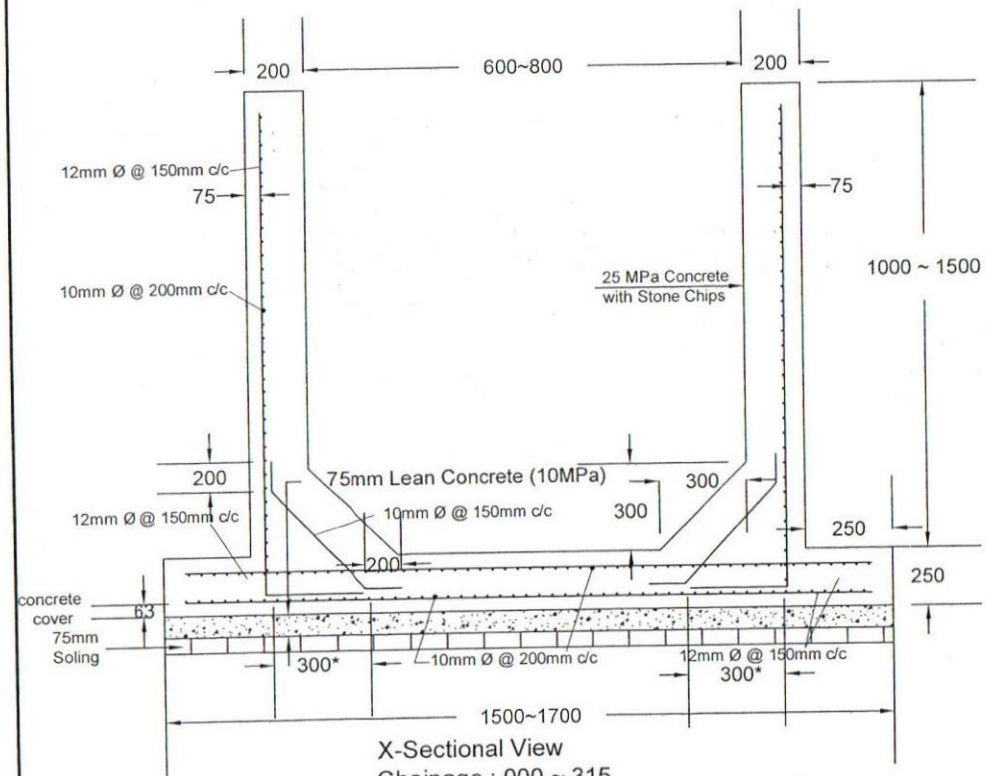
X-Sectional View
Chainage : 0+000 ~0+ 323
Drain - D1a



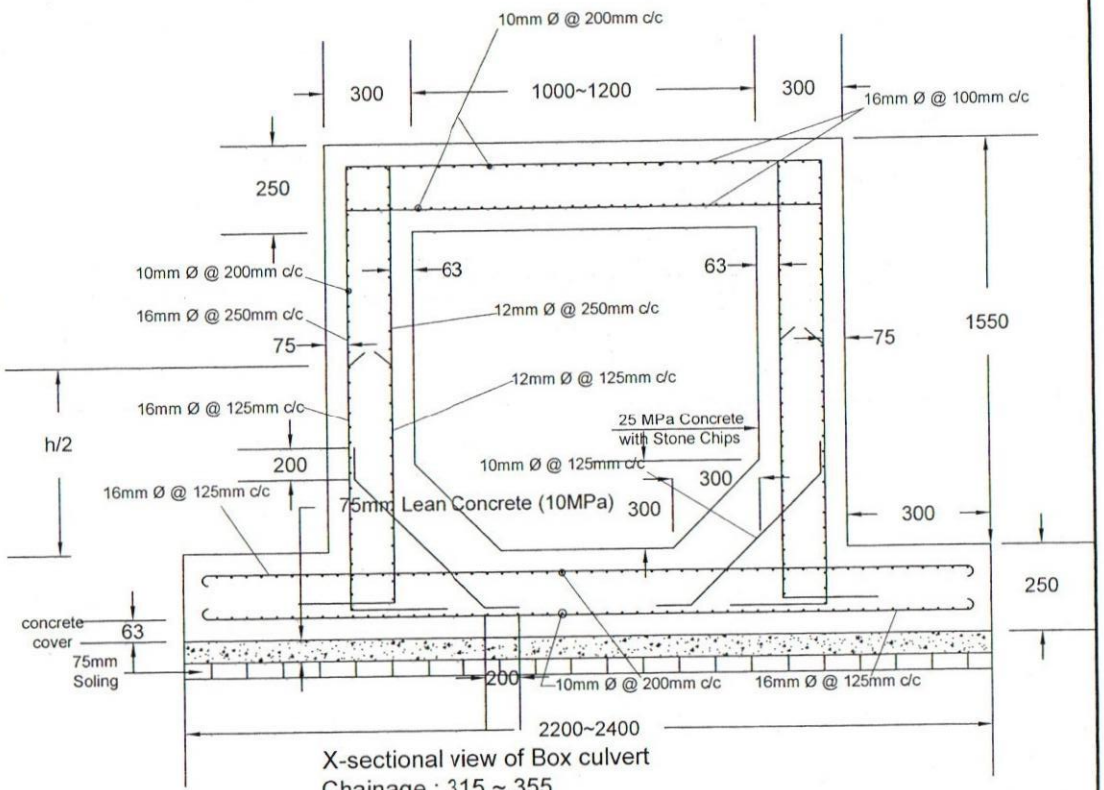
X-Sectional View
Chainage : 323 ~ 642
Drain - D1a

Not to Scale

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
								01			
								02			Sheet No:
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D1a	NOVEMBER, 2020						03			D1a - 01
								04			
								05			



X-Sectional View
Chainage : 000 ~ 315
Drain - D1b



X-sectional view of Box culvert
Chainage : 315 ~ 355
Drain - D1b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D1b	NOVEMBER, 2020						01			Sheet No: D1b - 02
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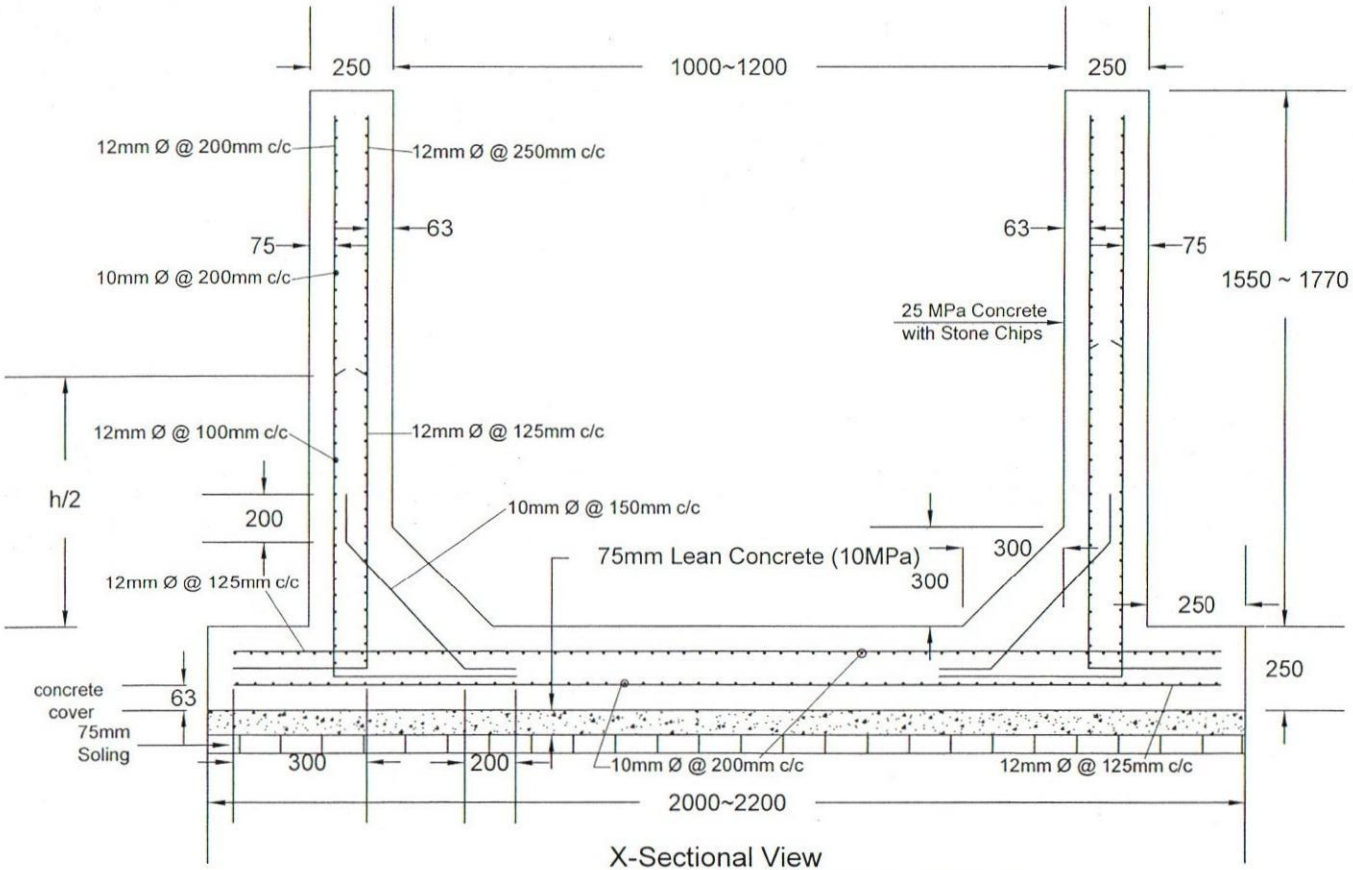

X-Sectional View
Chainage : 355 ~ 641 (outfall)-01
Drain - D1b

Not to Scale

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D1b	NOVEMBER, 2020						01			Sheet No: D1b - 03
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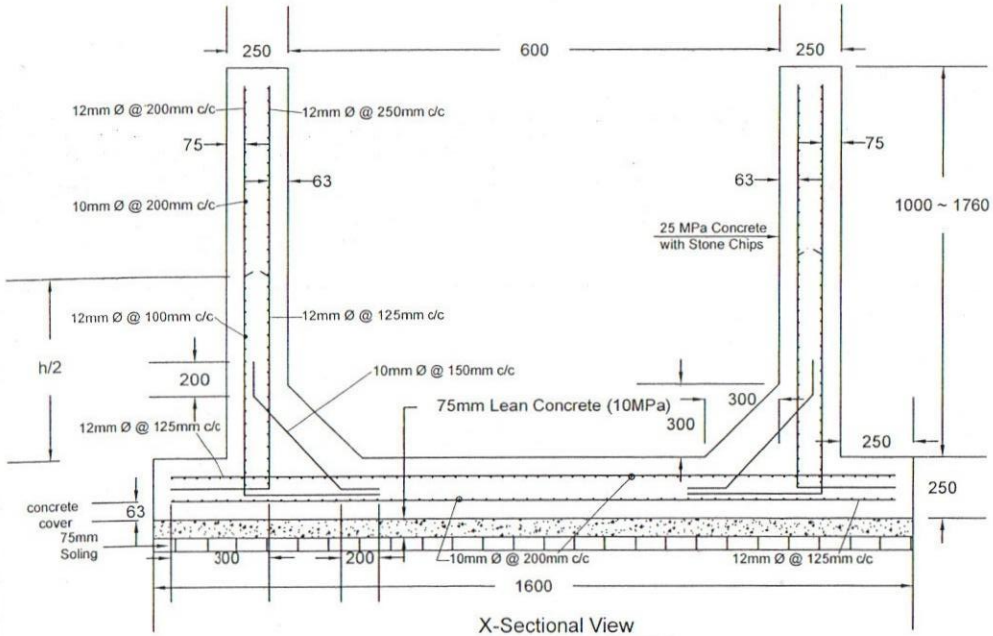
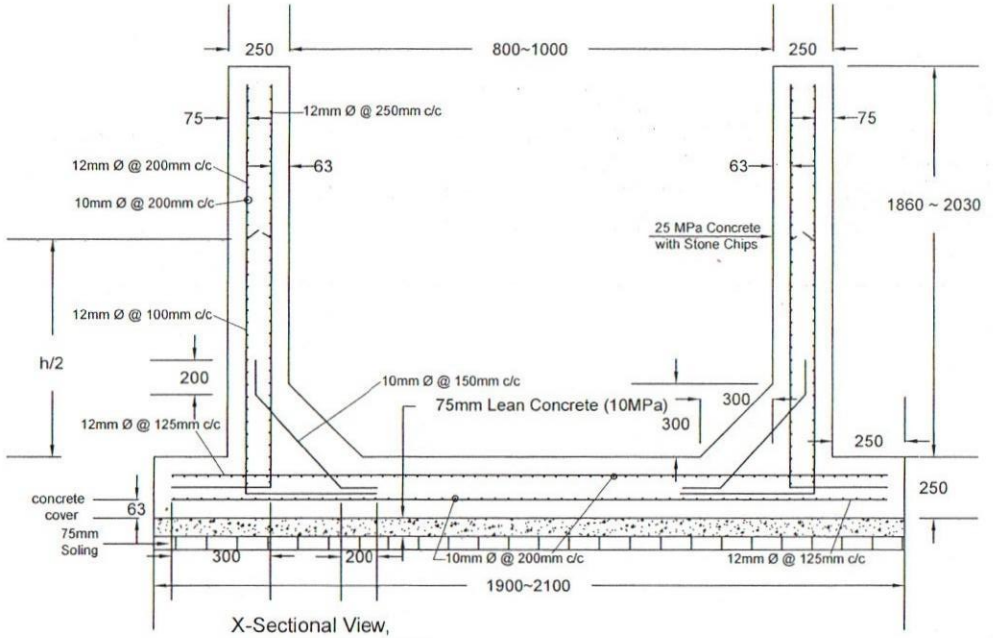


X-Sectional View
Chainage : 000 ~ 234
Drain - D2a



X-Sectional View,
Chainage : 234 ~ 468
Drain - D2a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D2a	NOVEMBER, 2020						01			Sheet No: D2a - 04
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								03			
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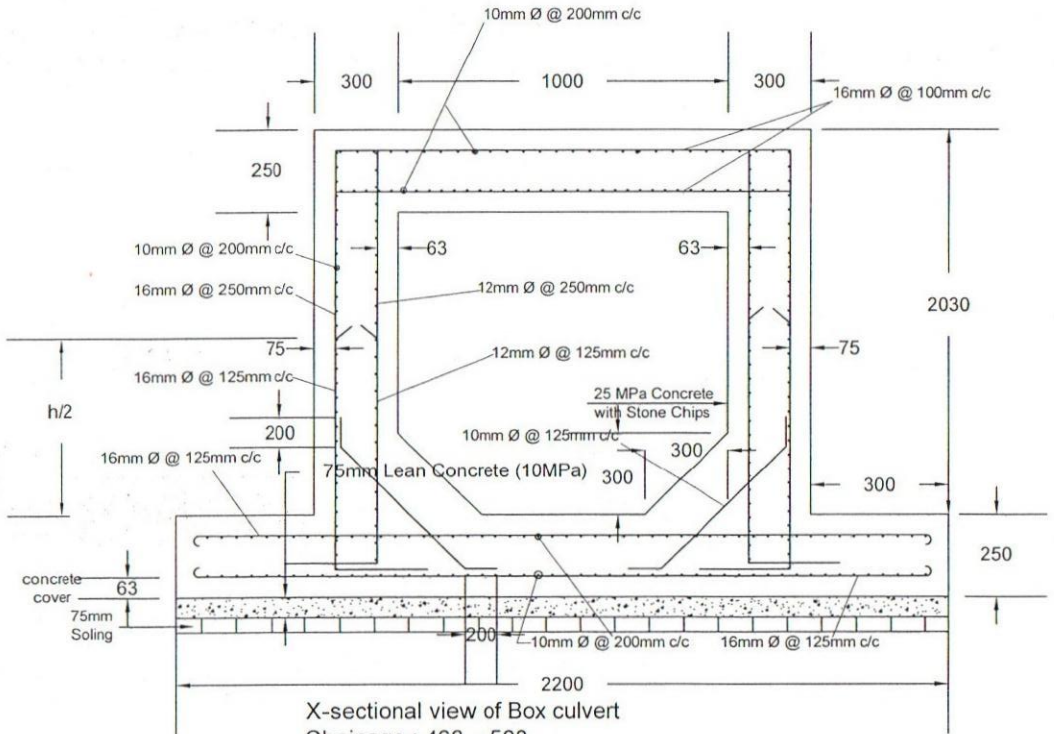
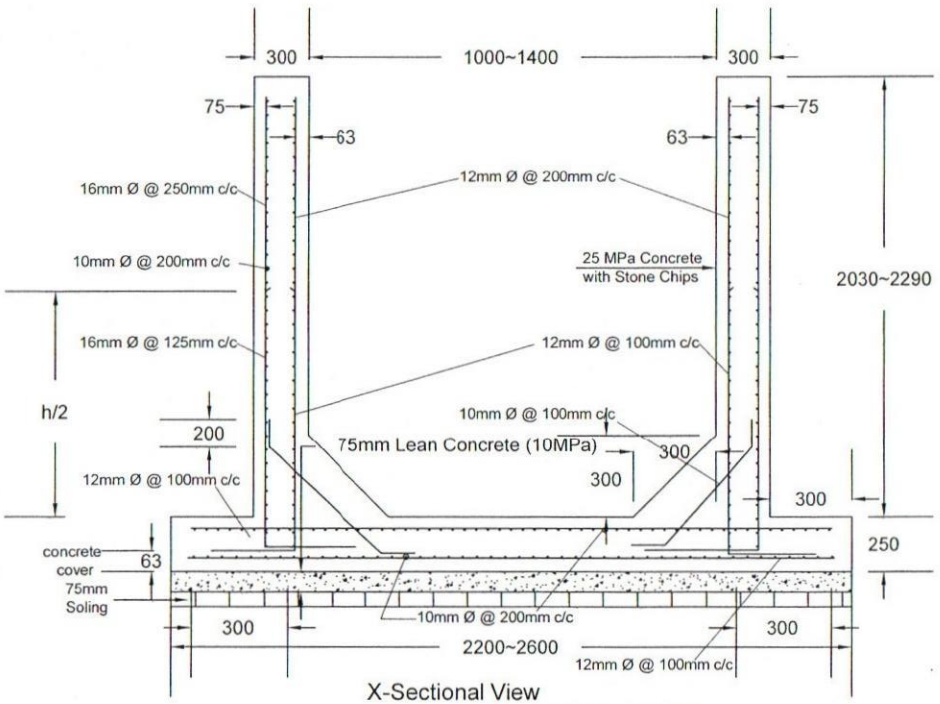


X-sectional view of Box culvert
Chainage : 468 ~ 508
Drain - D2a



X-Sectional View
Chainage : 508 ~ 829 (outfall)-02
Drain - D2a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D2a	NOVEMBER, 2020						01			Sheet No: D2a - 05
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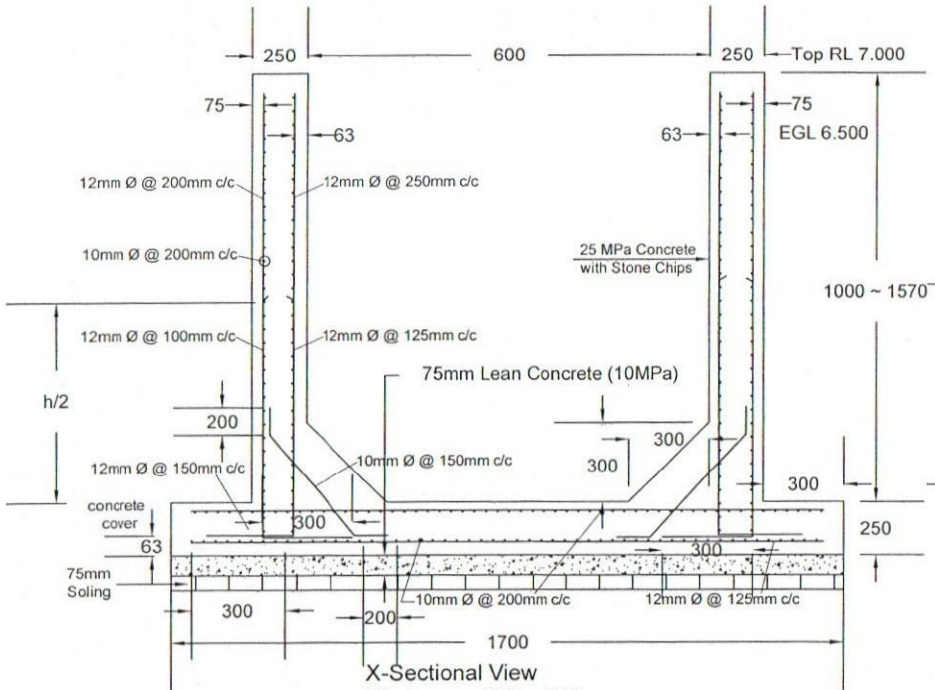
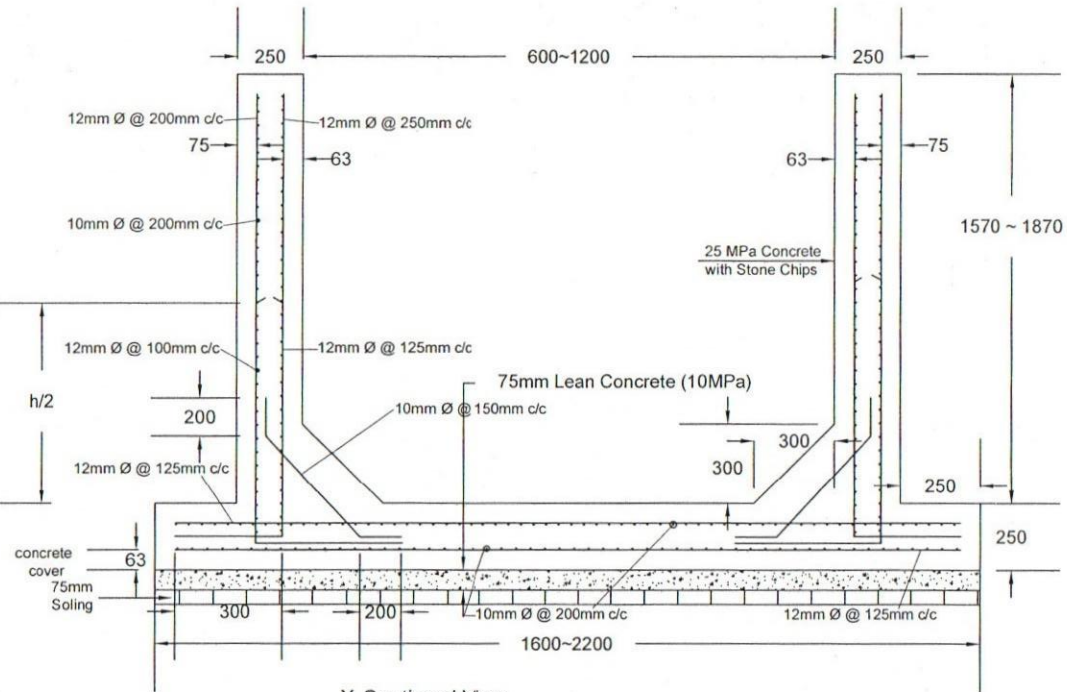


X-Sectional View
Chainage : 000 ~ 242
Drain - D2b



X-Sectional View
Chainage : 242 ~ 554
Drain - D2b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D2b	NOVEMBER, 2020						01			Sheet No: D2b - 06
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								03			
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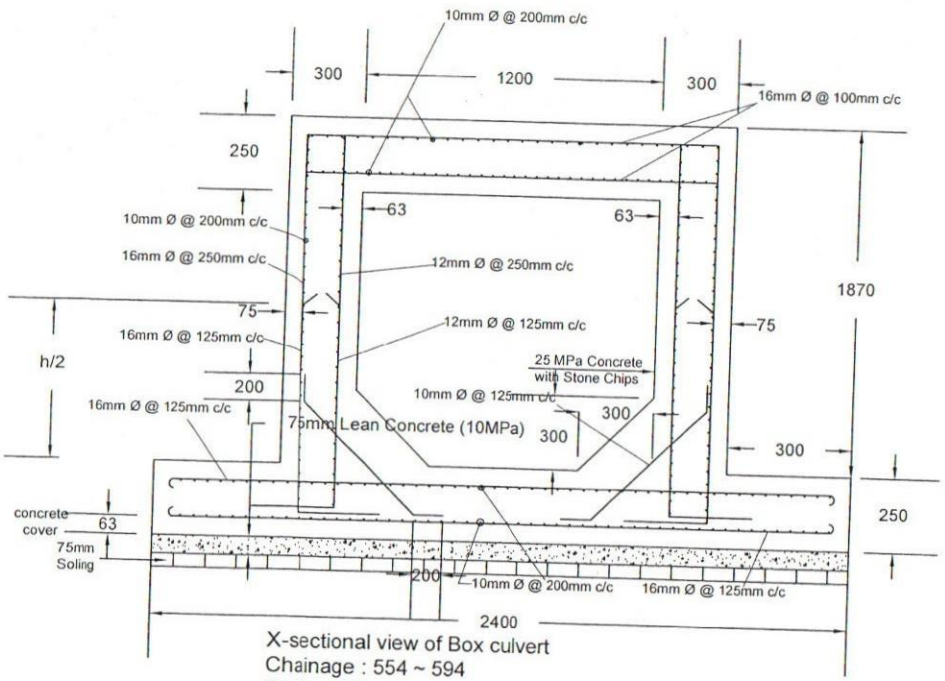
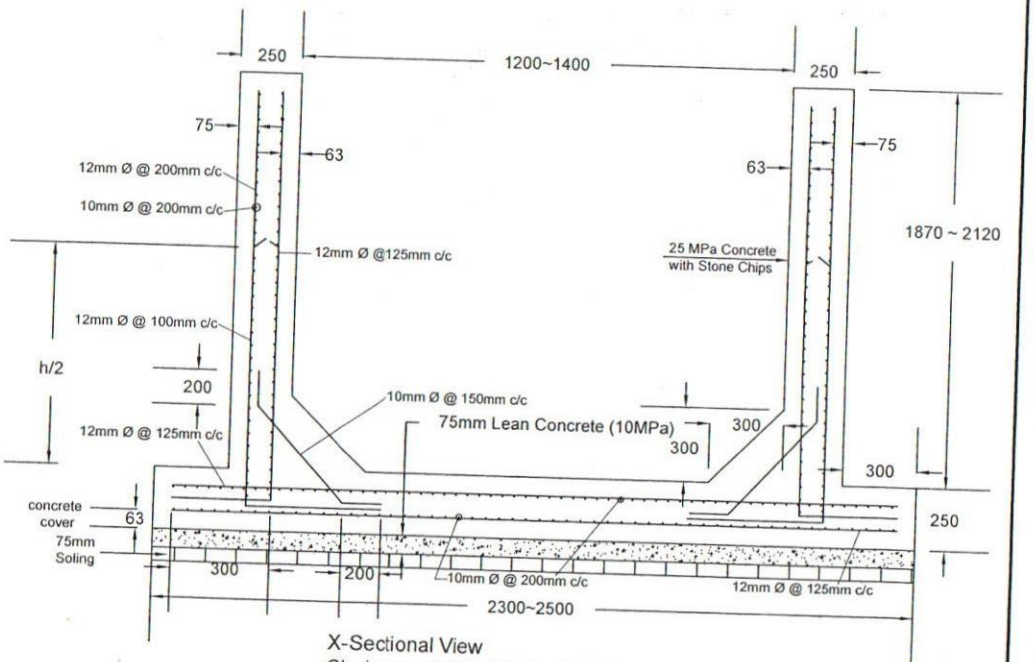


X-sectional view of Box culvert
Chainage : 554 ~ 594
Drain - D2b



X-Sectional View
Chainage : 594 ~ 937 (outfall)-03
Drain - D2b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D2b	NOVEMBER, 2020						01			Sheet No: D2b - 07
								02			
								03			
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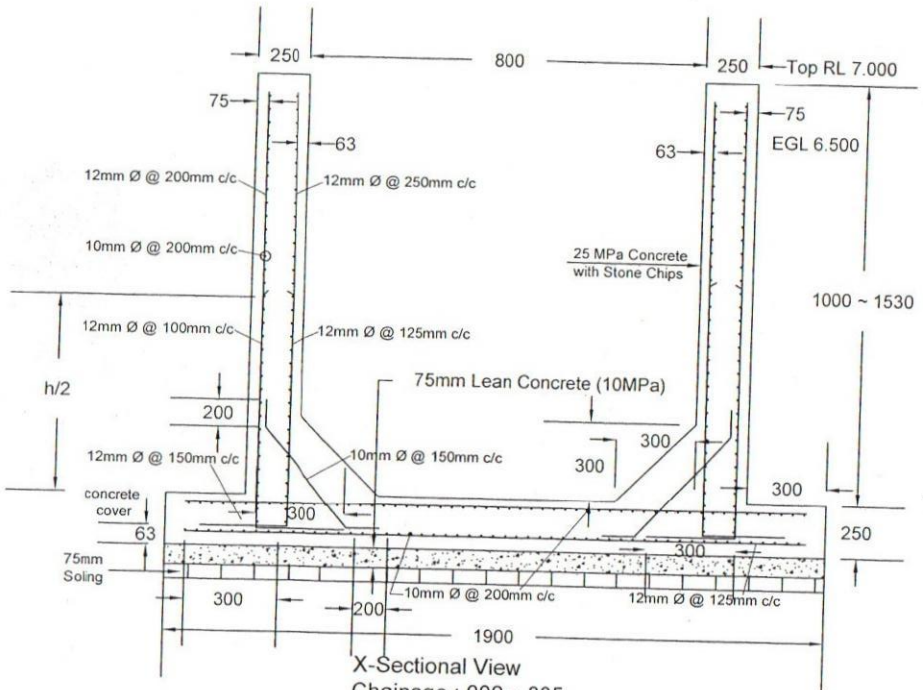
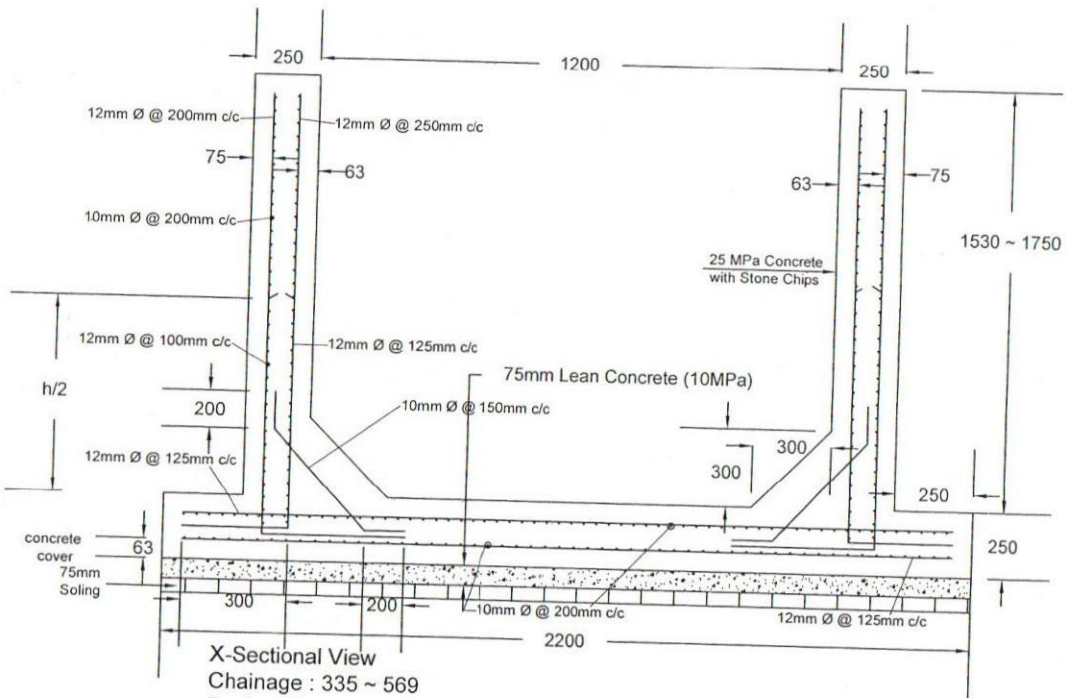


X-Sectional View
Chainage : 000 ~ 335
Drain - D3a



X-Sectional View
Chainage : 335 ~ 569
Drain - D3a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D3a	NOVEMBER, 2020						01			Sheet No: D3a - 08
								02			
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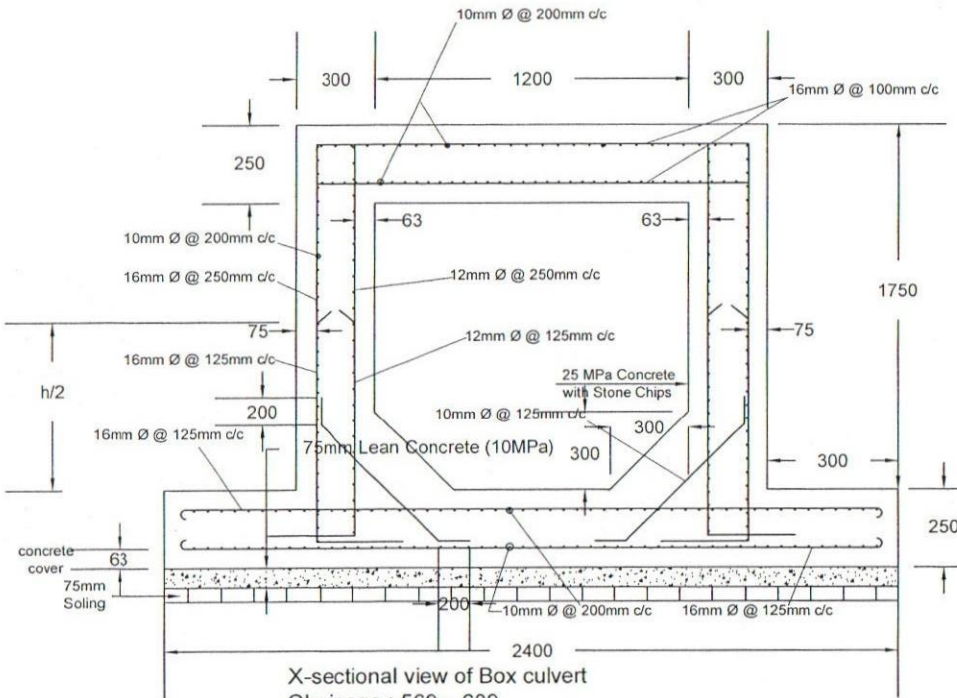
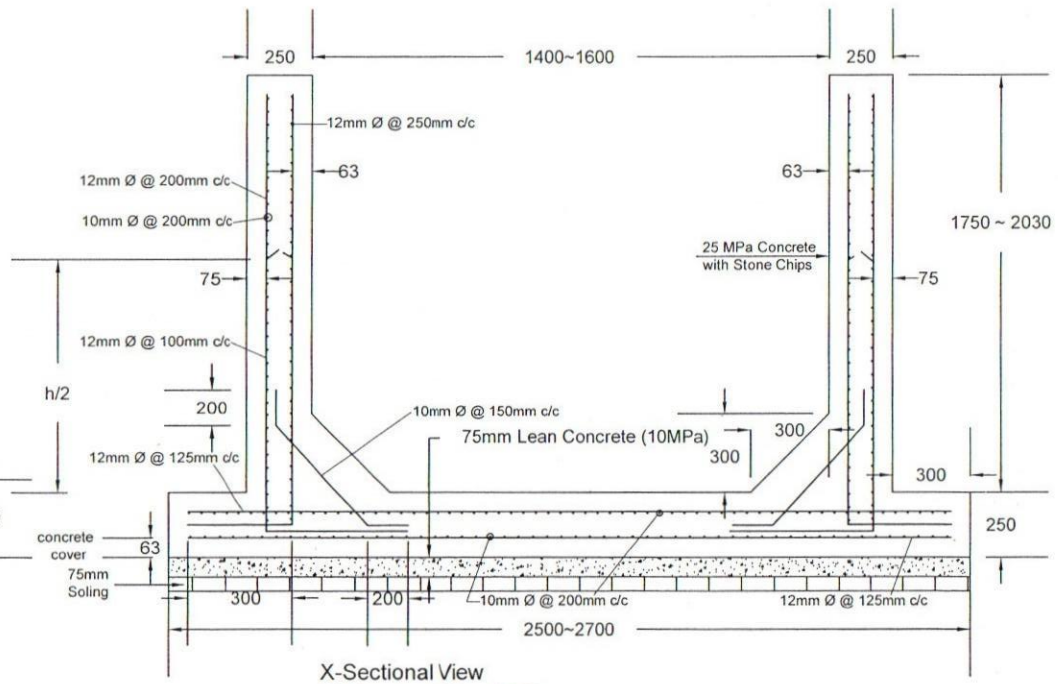


X-sectional view of Box culvert
Chainage : 569 ~ 609
Drain - D3a



X-Sectional View
Chainage : 609 ~ 1103
Drain - D3a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D3a	NOVEMBER, 2020						01			Sheet No: D3a - 09
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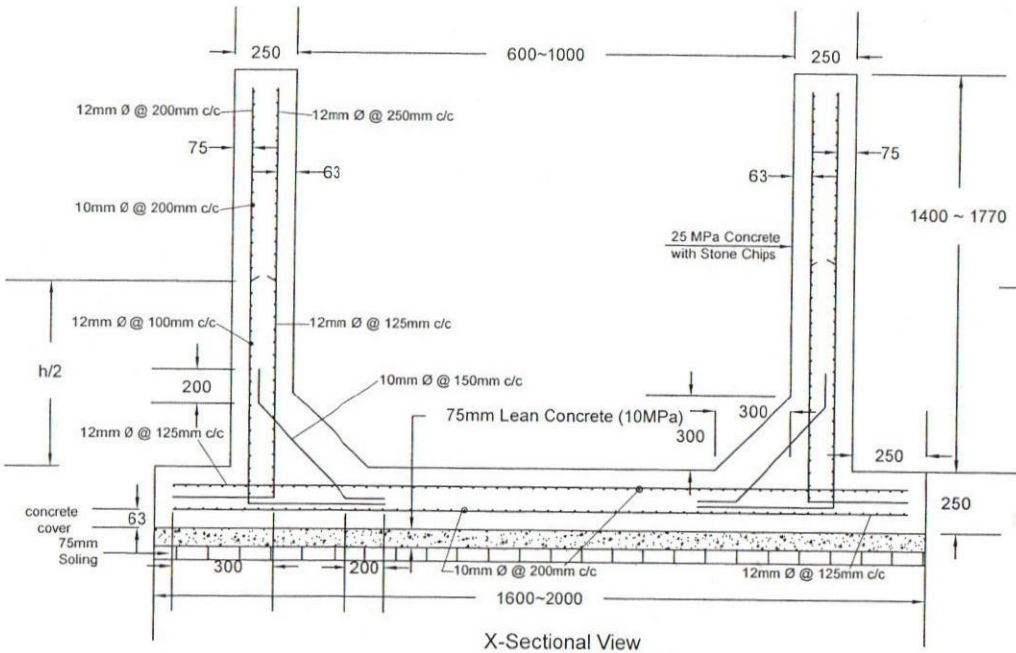
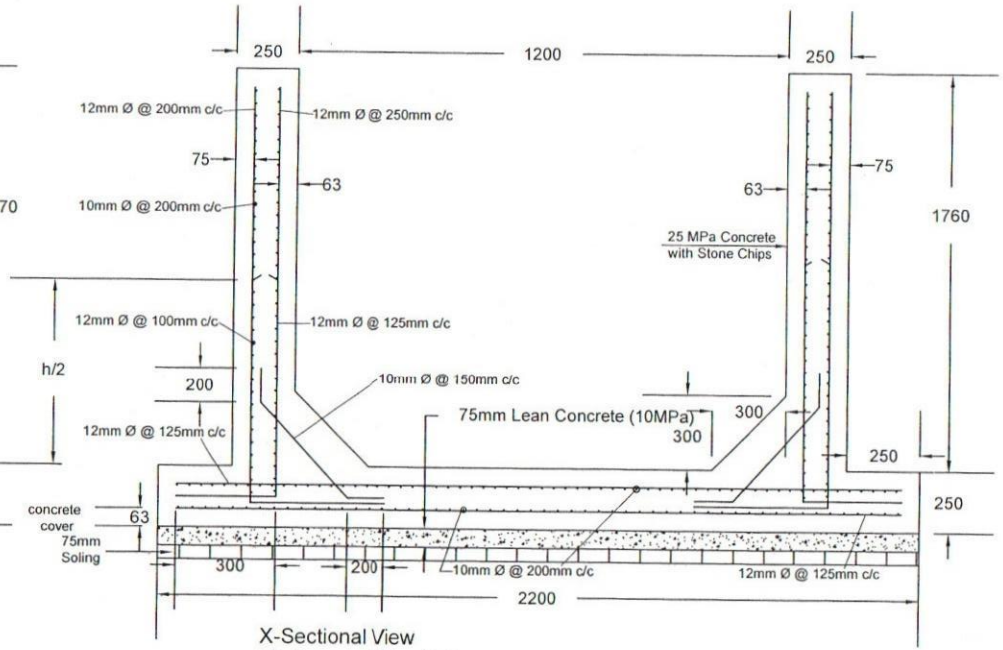


X-Sectional View
Chainage : 00 ~ 495
Drain - D3b



X-Sectional View
Chainage : 495 ~ 573
Drain - D3b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D3b	NOVEMBER, 2020						01			Sheet No: D3b - 10
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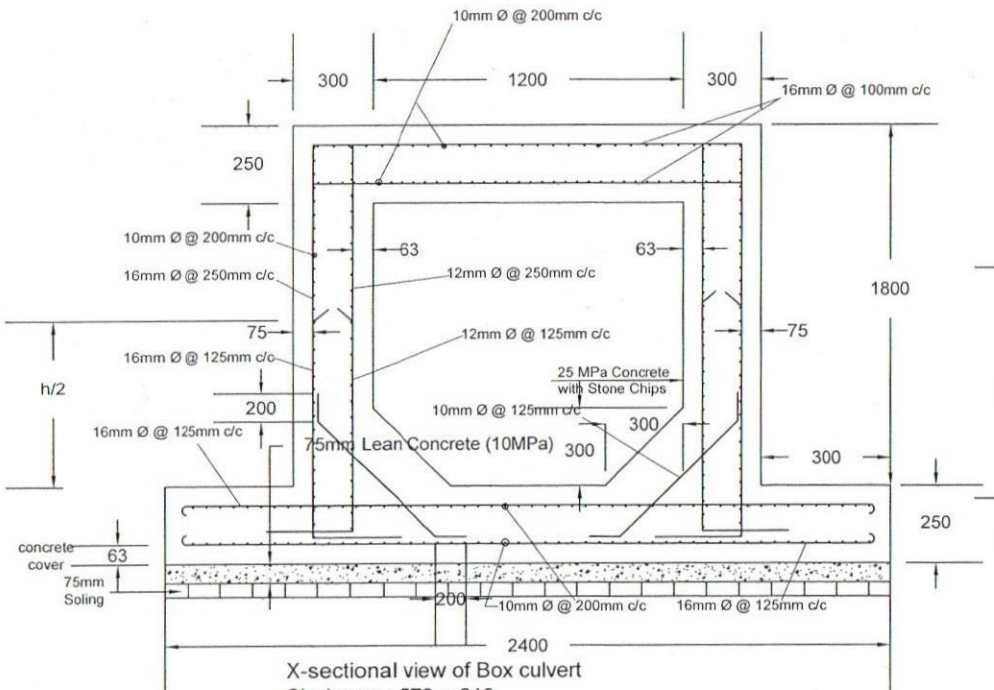
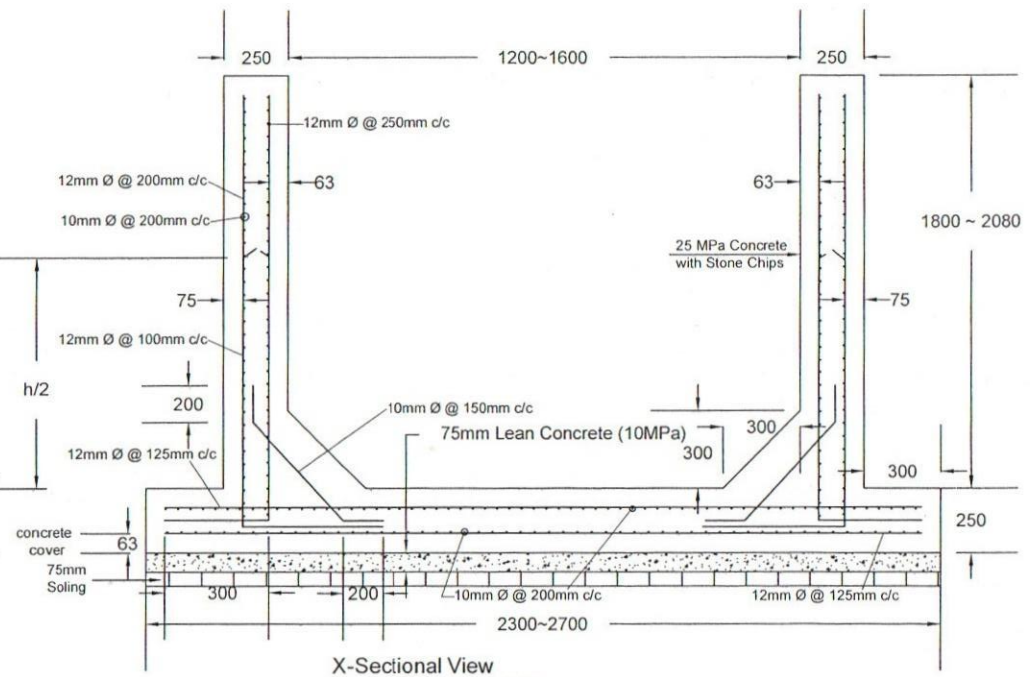
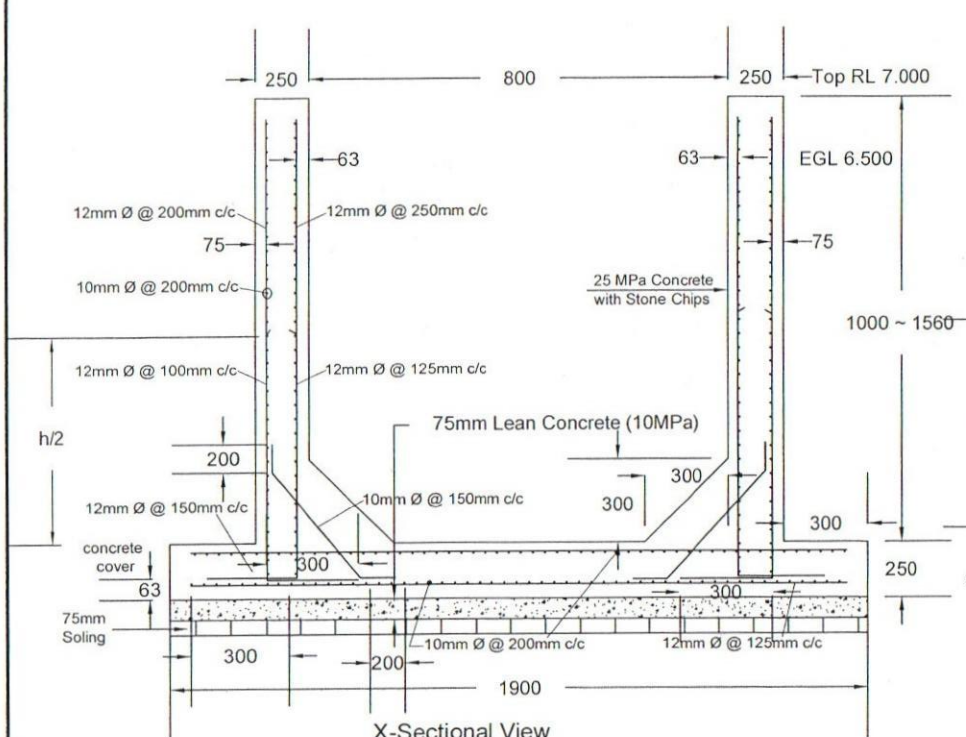


X-sectional view of Box culvert
Chainage : 573 ~ 613
Drain - D3b

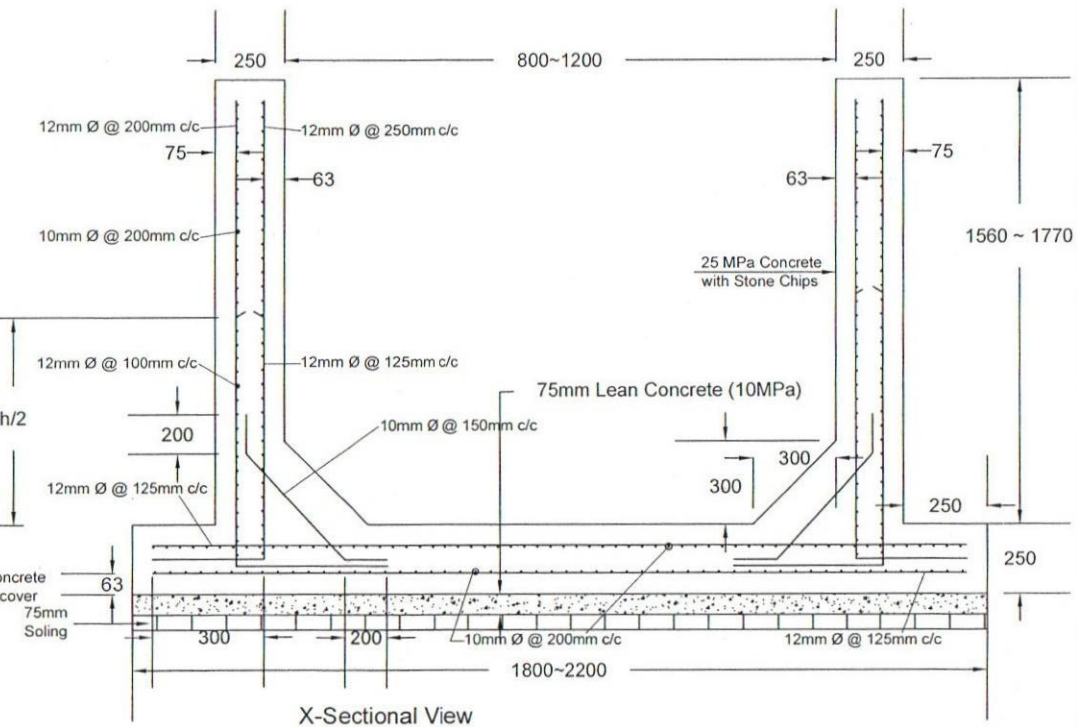


X-Sectional View
Chainage : 613 ~ 1129
Drain - D3b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D3b	NOVEMBER, 2020						01 02 03 04 05			Sheet No: D3b - 11



X-Sectional View
Chainage : 00 ~ 342
Drain - D4a



X-Sectional View
Chainage : 342 ~ 576
Drain - D4a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
								01			
								02			Sheet No:
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D4a	NOVEMBER, 2020						03			D4a - 12
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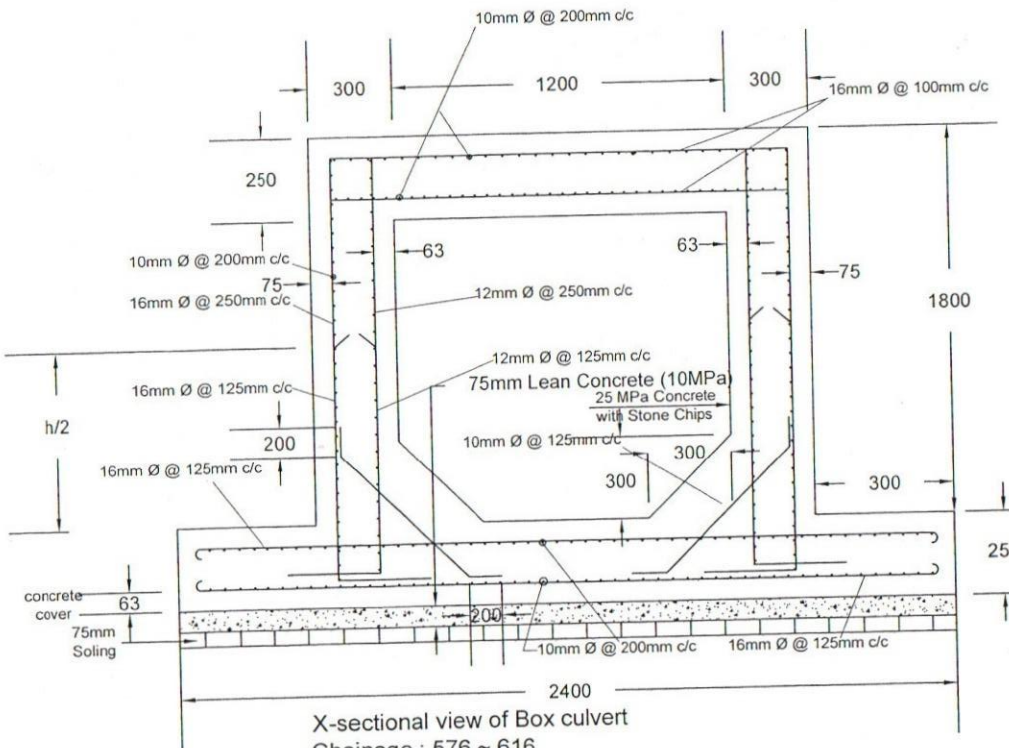
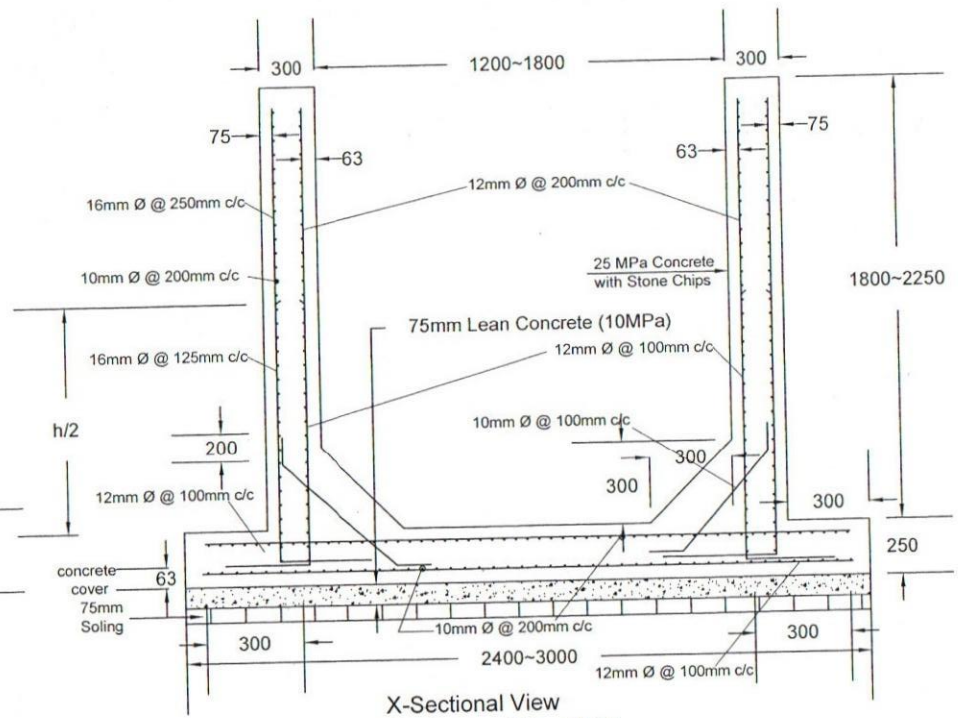
								05			



X-sectional view of Box culvert
Chainage : 576 ~ 616
Drain - D4a



X-Sectional View
Chainage : 616 ~ 1502
Drain - D4a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D4a	NOVEMBER, 2020						01			Sheet No: D4a - 13
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								03			
								04			
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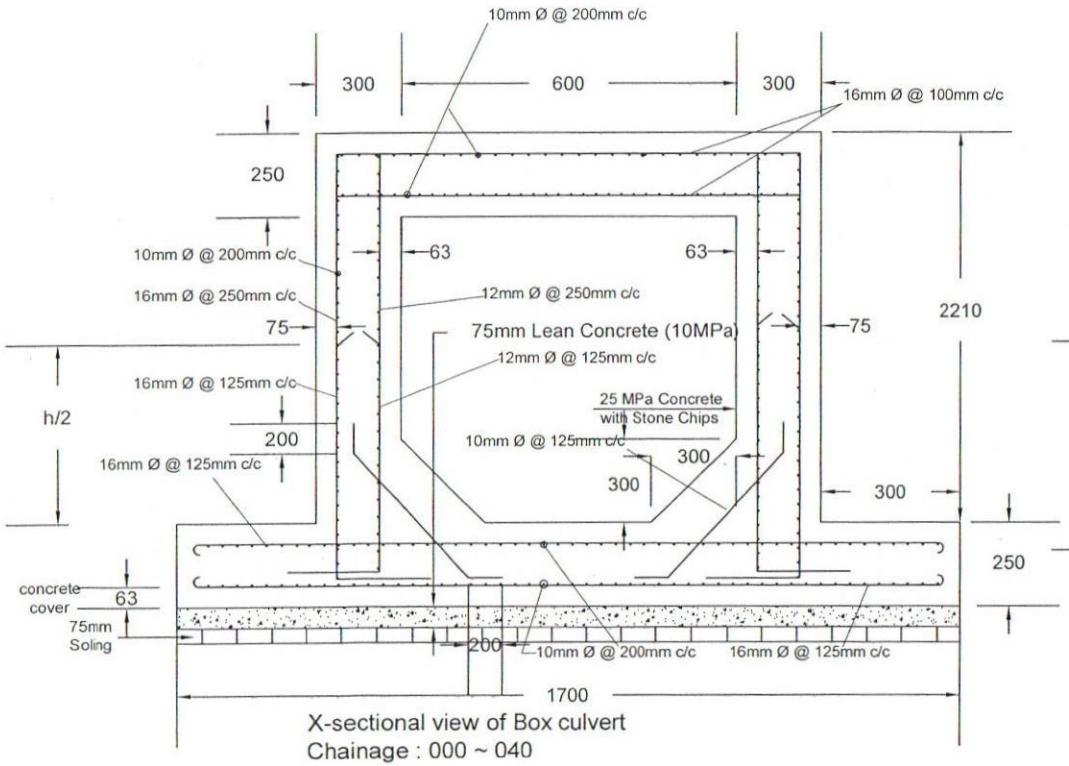
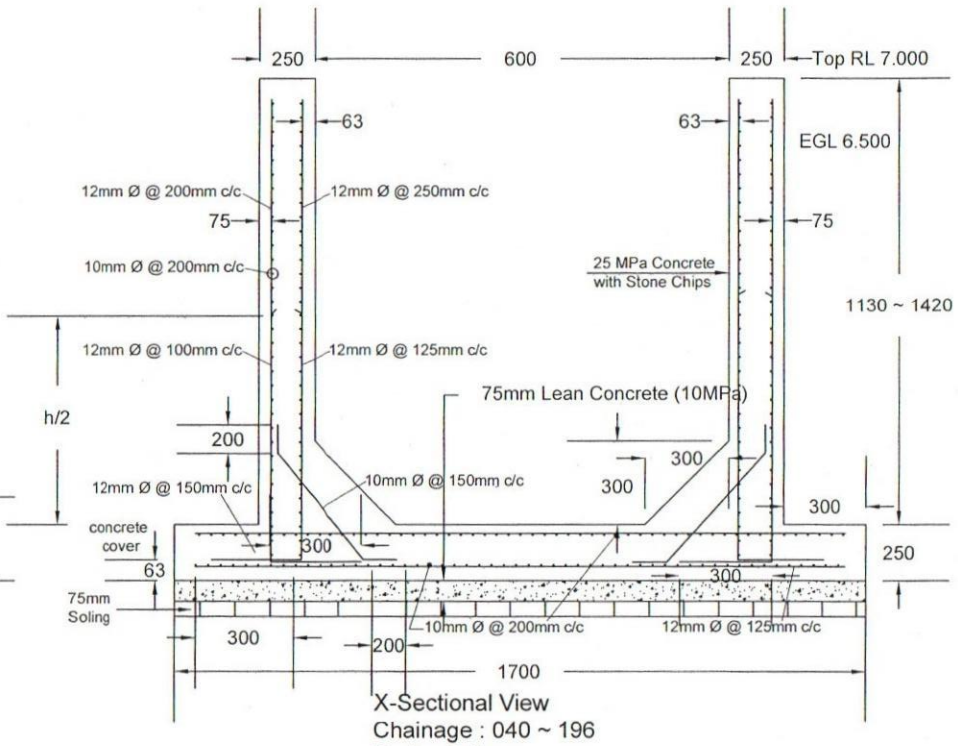


X-sectional view of Box culvert
Chainage : 000 ~ 040
Drain - D4b



X-Sectional View
Chainage : 040 ~ 196
Drain - D4b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D4b	NOVEMBER, 2020						01			Sheet No: D4b - 14
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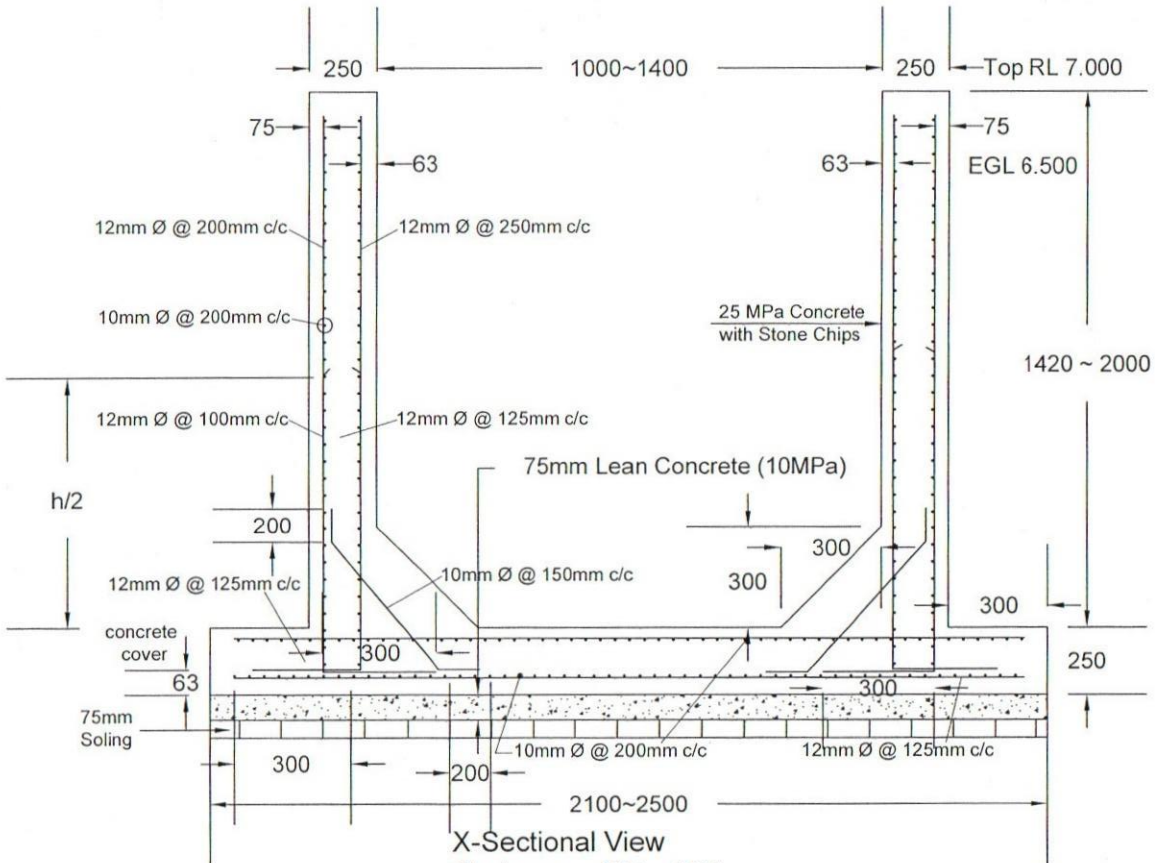

X-Sectional View
Chainage : 196 ~ 924
Drain - D4b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D4b	NOVEMBER, 2020						01			Sheet No: D4b - 15
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								03			
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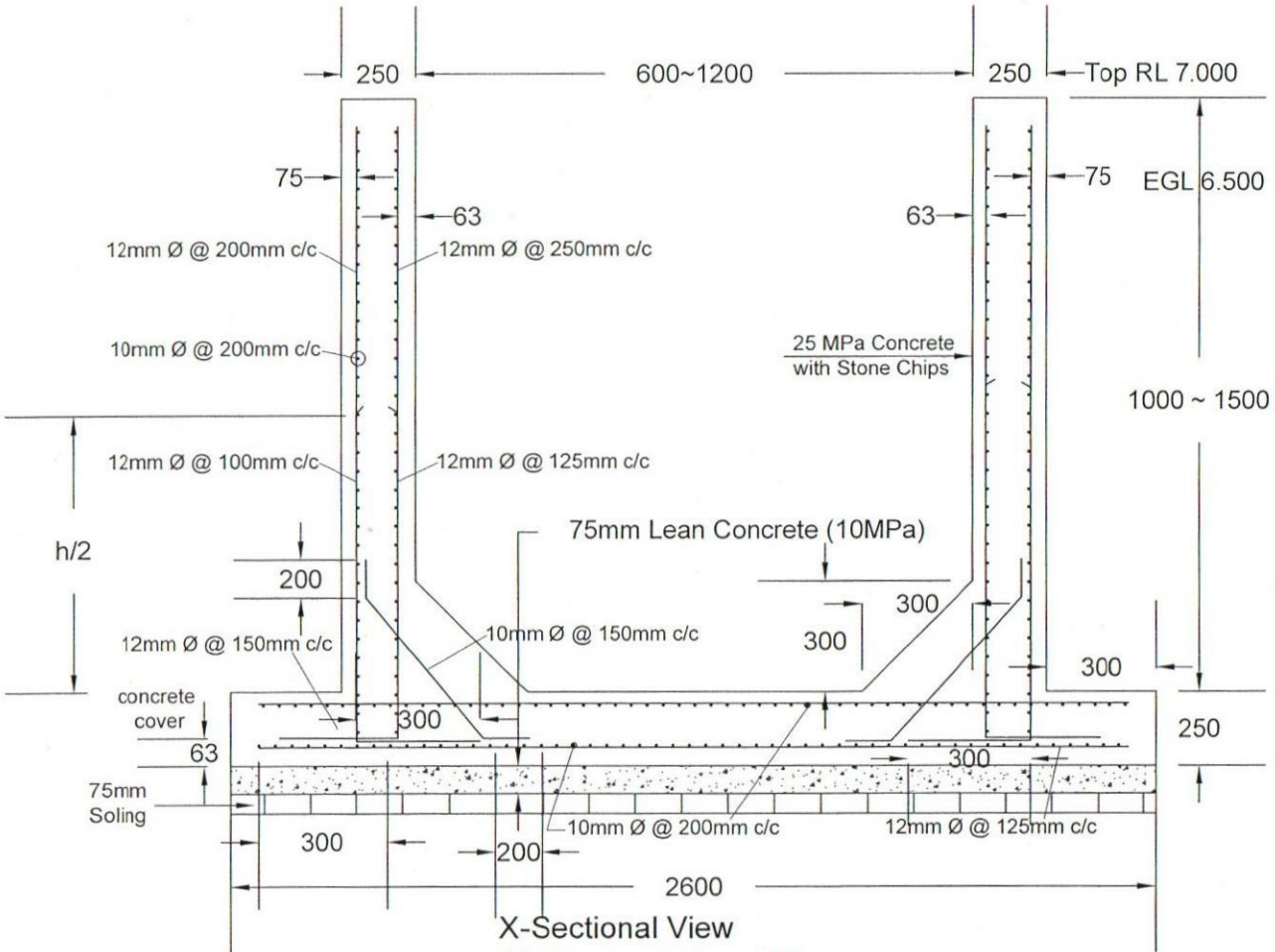
								05			



X-Sectional View
Chainage : 000 ~ 486
Drain - D5a *Placed alternate both direction

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D5a	NOVEMBER, 2020						01			Sheet No: D5a - 16
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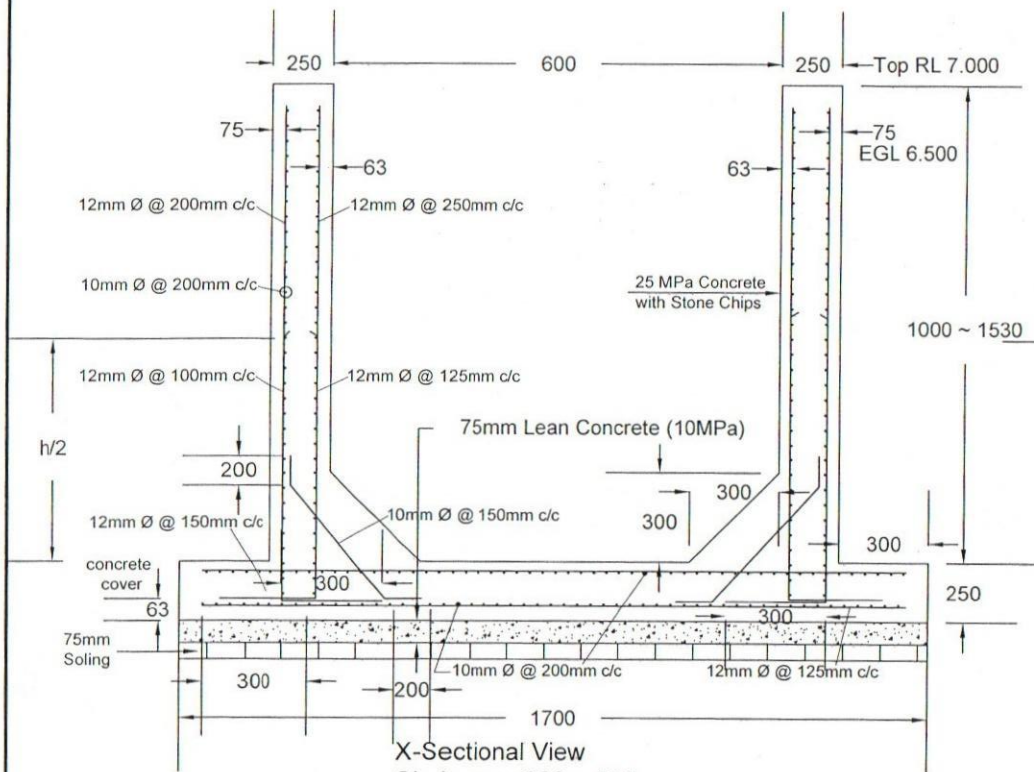
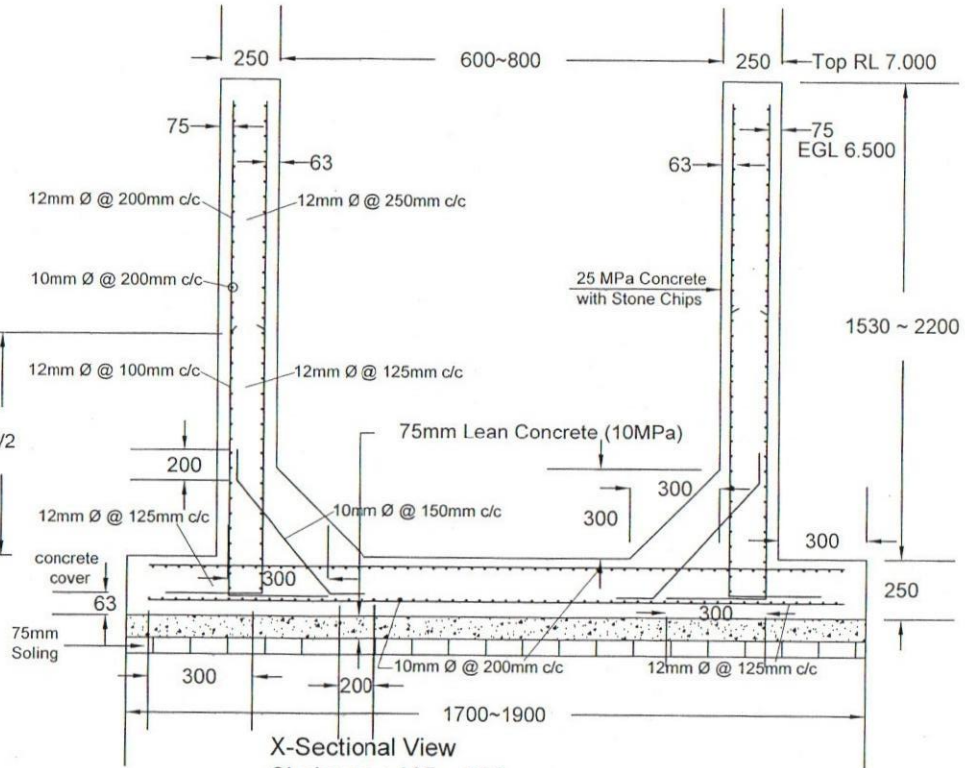


X-Sectional View
Chainage : 000 ~ 165
Drain - D5b



X-Sectional View
Chainage : 165 ~ 633
Drain - D5b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D5b	NOVEMBER, 2020						01			Sheet No: D5b - 17
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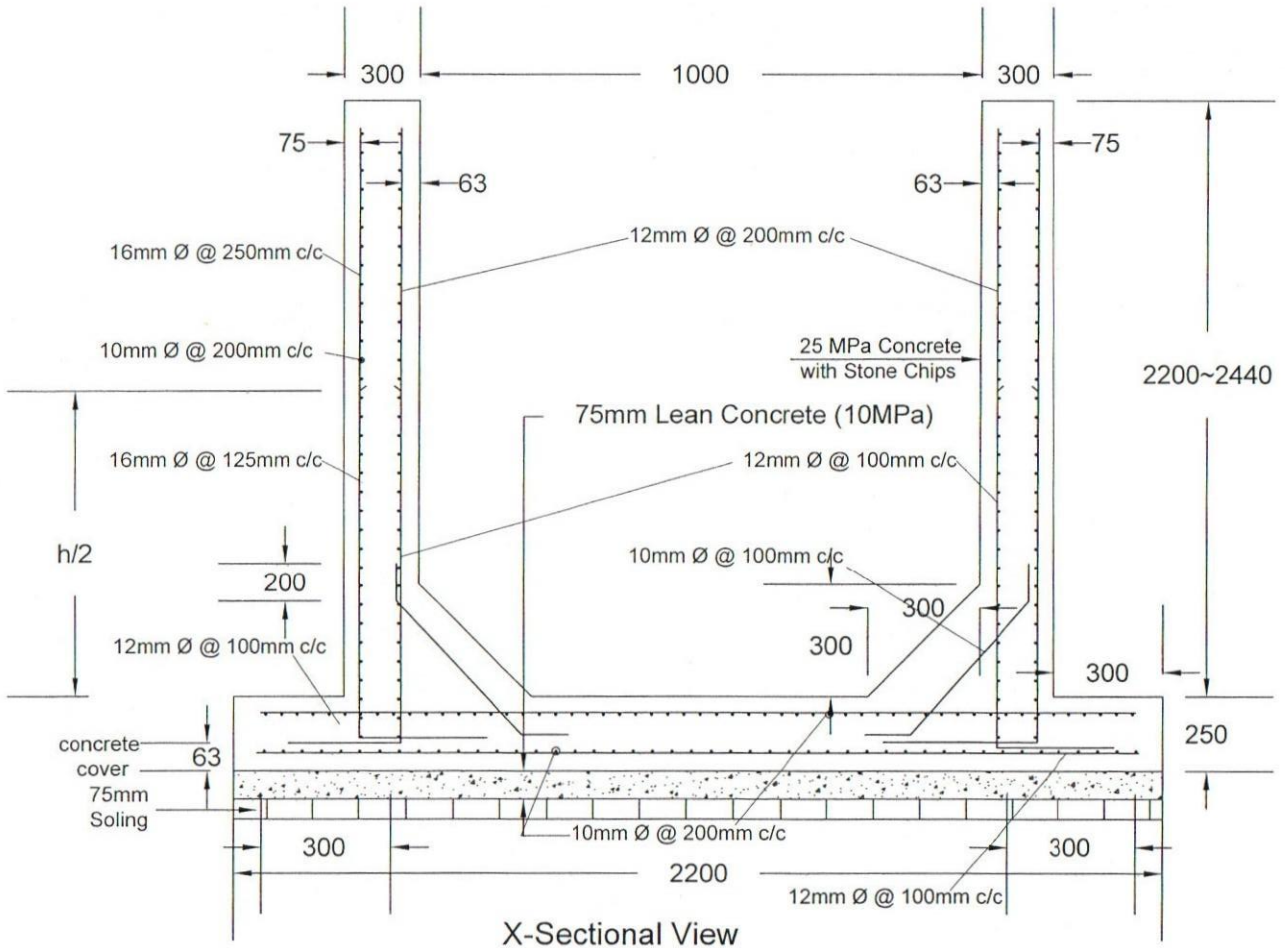

X-Sectional View
Chainage : 633 ~ 911
Drain - D5b

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D5b	NOVEMBER, 2020						01			Sheet No: D5b - 18
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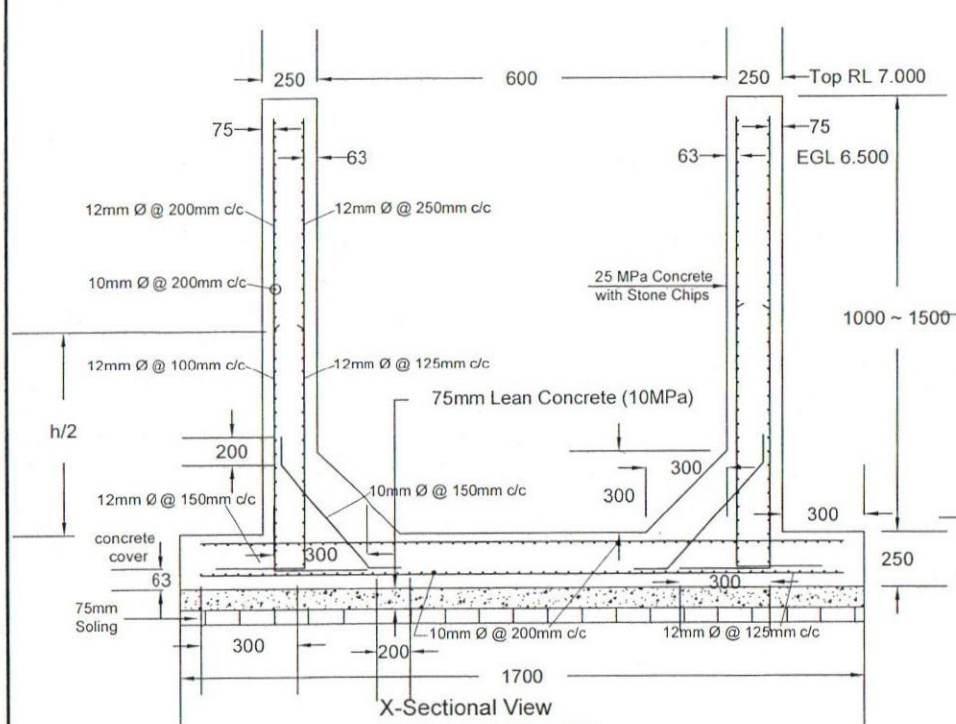
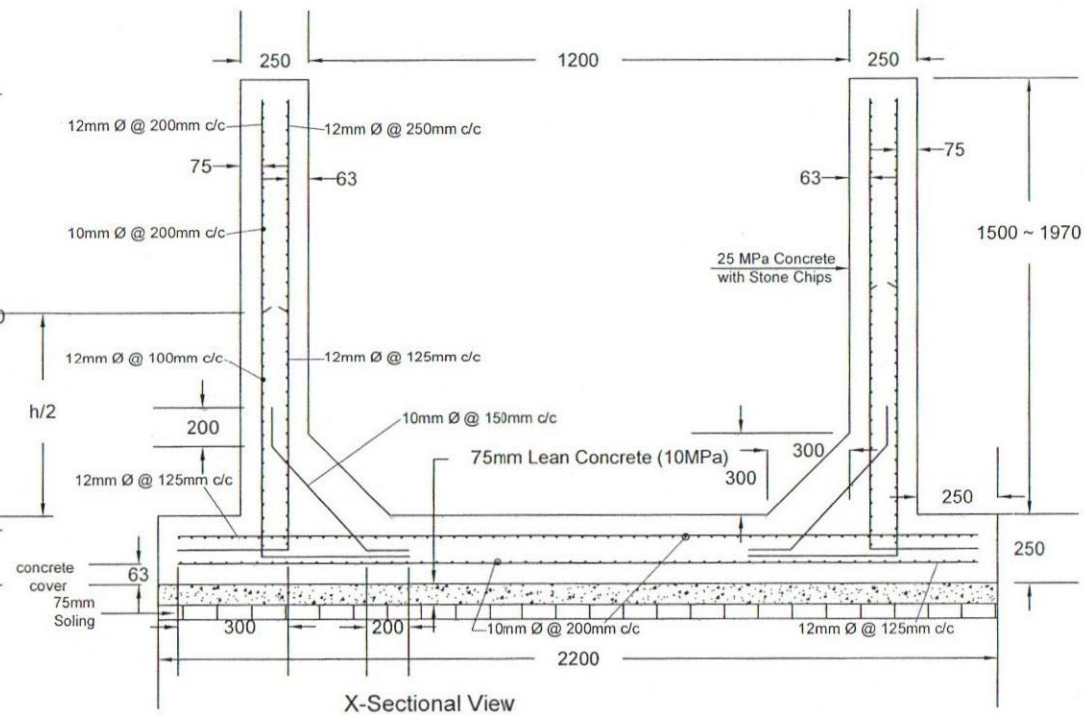


X-Sectional View
Chainage : 000 ~ 225
Drain - D6a



X-Sectional View
Chainage : 225 ~ 675
Drain - D6a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6a	NOVEMBER, 2020						01			Sheet No: D6a - 19
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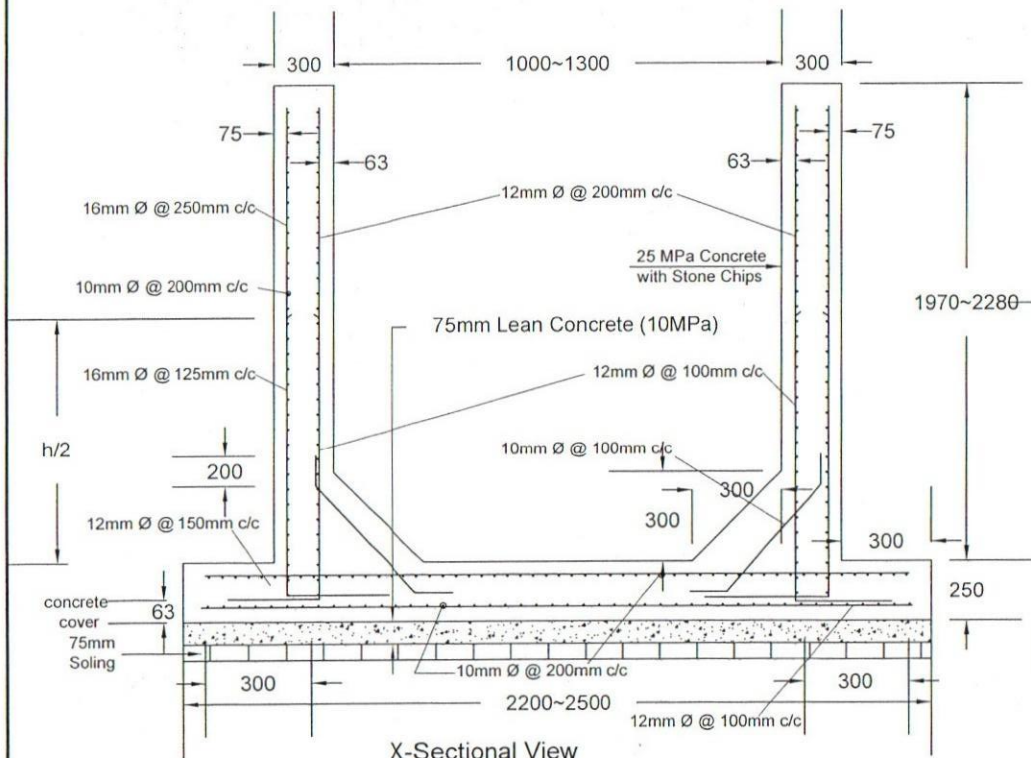
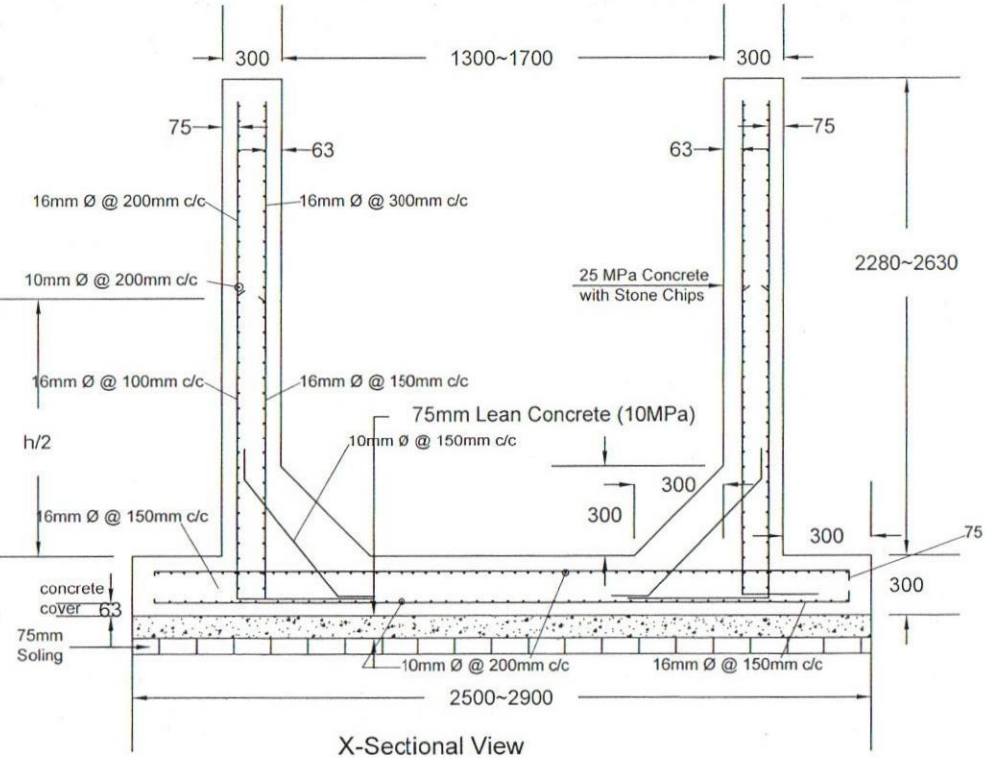
								05			



X-Sectional View
Chainage : 675 ~ 1117
Drain - D6a



X-Sectional View
Chainage : 1117 ~ 1793
Drain - D6a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6a	NOVEMBER, 2020						01			Sheet No: D6a - 20
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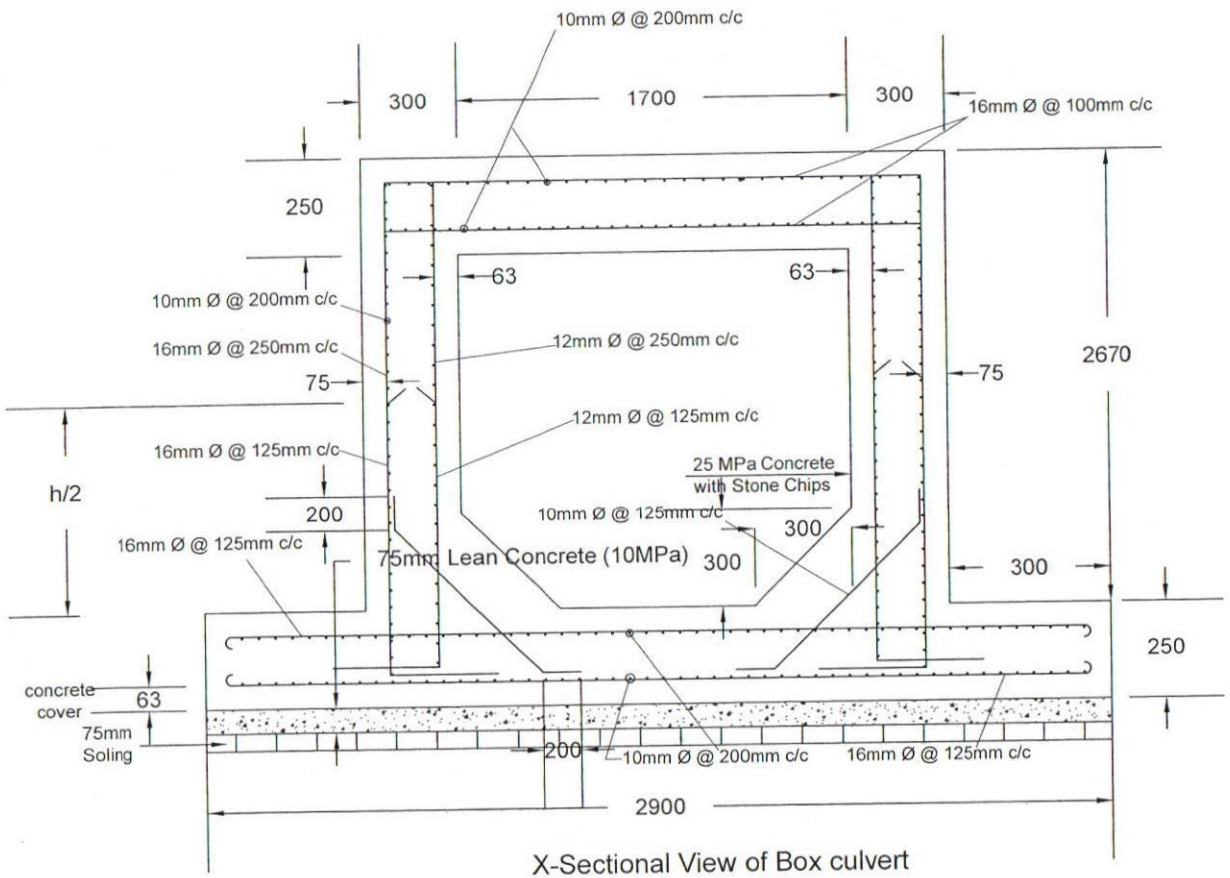

X-Sectional View of Box culvert
Chainage : 1793 ~ 1868
Drain : D6a

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
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								02			Sheet No:
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6a	NOVEMBER, 2020						03			D6a - 21
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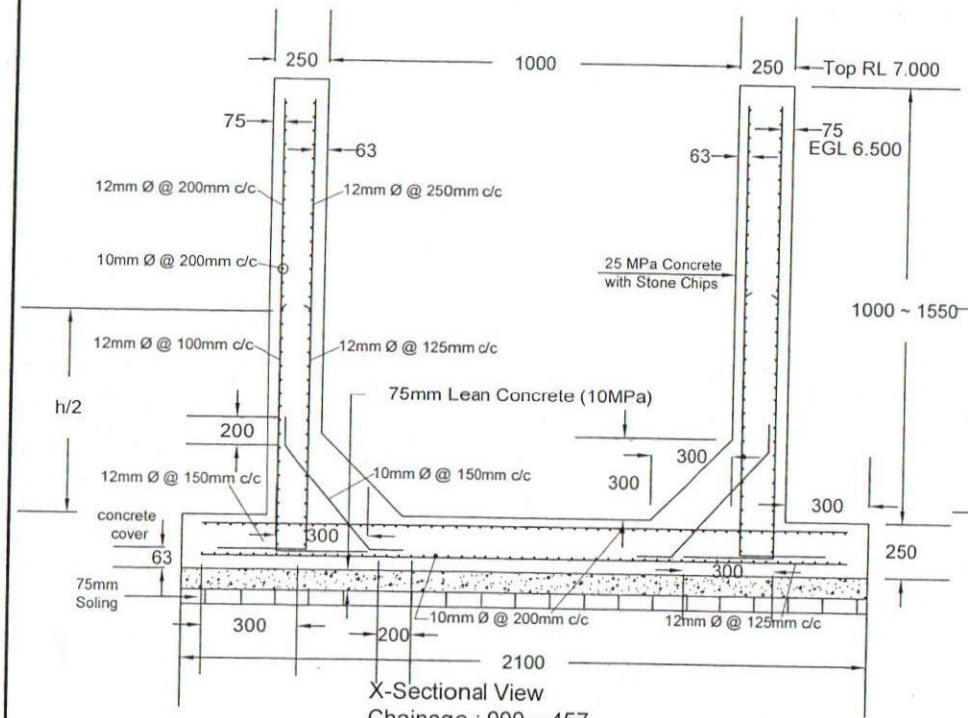
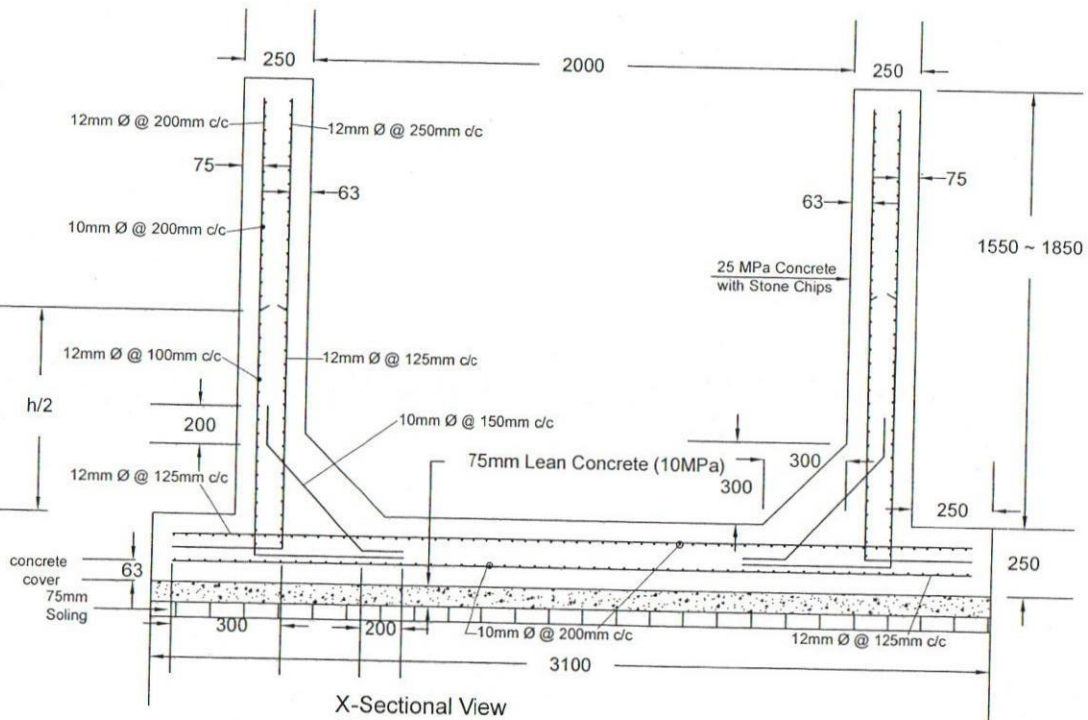
								05			



X-Sectional View
Chainage : 000 ~ 457
Drain - D6bt1 *Placed alternate both direction



X-Sectional View
Chainage : 457 ~ 1238
Drain - D6bt1

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6bt1	NOVEMBER, 2020						01			Sheet No: D6bt1 - 22
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								03			
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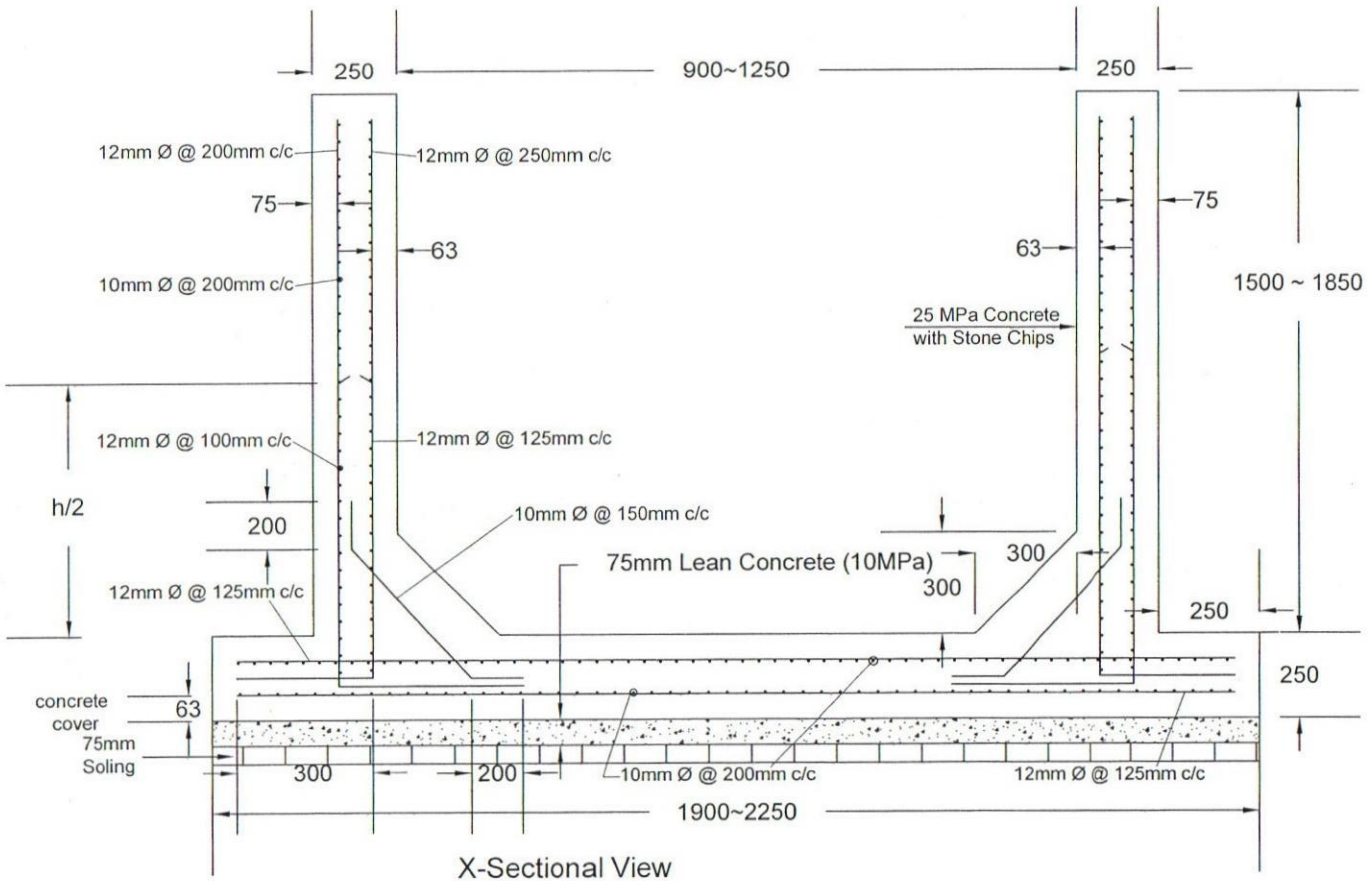

X-Sectional View
Chainage : 00 ~ 346
Drain - D6bt2

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6bt2	NOVEMBER, 2020						01			Sheet No: D6bt2 - 23
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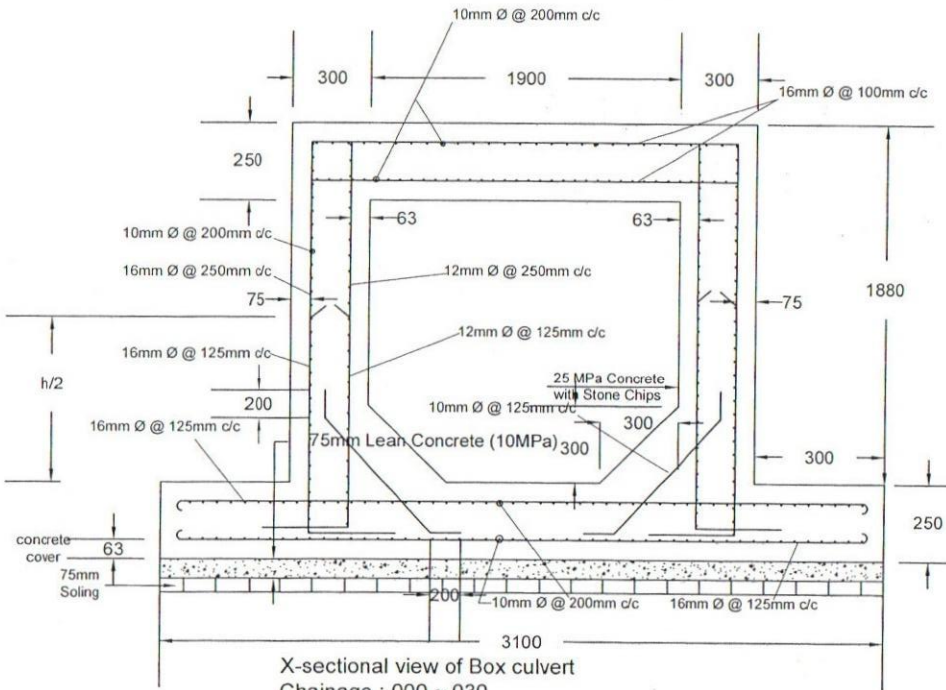
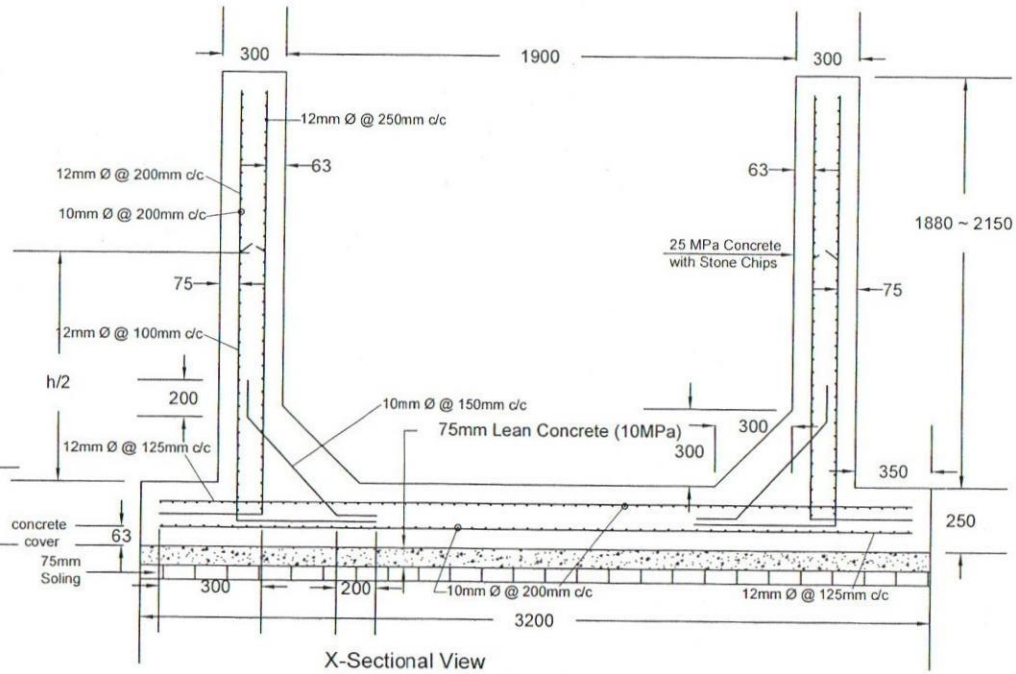
								04			
								05			



X-sectional view of Box culvert
Chainage : 000 ~ 030
Drain - D6bs



X-Sectional View
Chainage : 030 ~ 305 (outfall)-04
Drain - D6bs

CLIENT:	PROJECT NAME :	SUBMITTED BY:	DRAWN BY:	DRAWING CHECKED BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	REVISION:			DRAWING STATUS:
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)	STORM WATER DRAINAGE WORKS ZONE-2B, MIRSARAI, CHATTOGRAM.	Aarvee - BETS (JV) WD2-BSMSN-BEZA	Tanin Ahmed CAD operator	Subrata Kumar Sarkar Office Engineer	Mohammad Mofazzal Hoque Water Supply & Drainage Expert	Dr.V.G. Hiremath Team Leader	BEZA	NO	REVISION	DATE	FOR CNSTRUCTION
BANGLADESH ECONOMIC ZONES DEVELOPMENT PROJECT (PHASE-1)	DRAWING TITLE : X-Sectional View,Drain D6bs	NOVEMBER, 2020						01			Sheet No: D6bs -24
								02			
								03			
								04			
								05			