BIDDING DOCUMENTS

FOR

RENOVATION, MODERNIZATION AND UPGRADATION OF UMIAM-UMTRU STAGE - III HYDRO ELECTRIC POWER PROJECT

PACKAGE II

[Civil & Hydro Mechanical Works]

Volume – I (Parts – 1 & 2)

Bidding Procedure & Works Requirements

EMPLOYER: MEGHALAYA POWER GENERATION CORPORATION LIMITED

COUNTRY: INDIA

PROJECT: UMIAM - UMTRU STAGE III HEPP

LOAN NO. : ID-P 271

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Invitation for Bids

Date	: 07-06-2024
IFB No.	: MePGCL/CE/C/HP&HC/T-33(C)/Pt-I/2024/96 Dated 07-06-2024
Employer	: Meghalaya Power Generation Corporation Limited.(MePGCL)
Country	: INDIA
JICA Loan No.	: *ID-P 271*
Project Name	: Renovation and Modernisation of Umiam -Umtru Stage III Hydroelectric Power Station
Contract Name	: Renovation work of Hydro Mechanical and Civil Facilities for Umaim -Umtru Stage III HE Power Station.

1. The President of India has received a loan from the Japan International Cooperation Agency (JICA) towards the cost of *Renovation and Modernisation of Umiam-Umtru Stage III Hydroelectric Power Station* and intends to apply part of the proceeds towards payments under the contract for Renovation work of Hydro Mechanical and Civil facilities for Umiam – Umtru Stage III HE Power Station.

2. The Meghalaya Power Generation Corporation Limited now invites sealed Bids from eligible Bidders for the renovation work of existing civil and hydromechanical facilities mainly consisting of removal of silt / debris from inside the Link Tunnel and at its exit into the Nongmahir Forebay including disposal of silt into a designated disposal area , repair of concrete lining inside the Link Tunnel and the Head Race Tunnel including cement grouting inside the tunnels, internal and external painting of penstocks including repair of expansion joints, renovation including replacement of worn out parts of vertical lift Intake gate and trash rack , draft tube gates, PRV gates including replacement of their hoists / lifting mechanism, strengthening of turbo – generator foundations of the power station for the new loading if required , painting of the power station, renovation of fire fighting system and sanitary fittings of the power station and other civil works such as renovation of operational buildings and staff quarters , renovation / reconstruction of approach roads to various facilities , etc. to have effect on life time extension and reduction of generation loss.

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

4. Interested Bidders may obtain further information from and inspect the Bidding Document during office hours at the office of :

   Chief Engineer(C) , HP&HC,

   Meghalaya Power Generation Corporation Limited. (MePGCL),

   Lumjingshai, Short Round Road ,Shillong. Meghalaya 793001

   [10.00 am to 5pm]

   [*Ph. No.: 0364-2590113*] Email: cehphc.mepgcl@gmail.com

5. The Bidding Document may be purchased by interested Bidders on the submission of a written application to the address above and upon payment of a non-refundable fee of **INR 10000.00 (Rupees Ten Thousand Only)** or by downloading the document from the MeECL website (**www.meecl.nic.in**). Those who download the bid document from the website will have to enclose the fee in the technical bid envelope while submitting their bids , failing which their bids will be rejected . The method of payment will be in the form of Demand Draft drawn in favour of **MeECL Principal Account** payable at SBI , Shillong. The documents will be sent by Post/Courier to those who purchase the bid documents through written application.

6. Bids must be delivered to the address above on or before [*14.00 Hrs*] on [*08-07-2024*] and must be

accompanied by a security of **INR 95 Lakh (Rupees Ninety Five Lakh) only**

7. Bids will be opened in the presence of Bidders' representatives who choose to attend at the place as specified in the Bidding Document.

Chief Engineer (C),

HP&HC,

Meghalaya Power Generation Corporation Limited (MePGCL)

Lumjingshai , Short Round Road,

SHILLONG – *793001*, Meghalaya.

[Ph. No.:0364-2590113]
Email: **cehphc.mepgcl@gmail.com**

SBD for Procurement of Works

Invitation for Bids (IFB)

A form of "Invitation for Bids" is provided at the beginning of this SBD (Works).

PART 1 – BIDDING PROCEDURES

Option A – Two-Envelope Bidding (alternative Section I and II to be used for Two-Envelope bidding procedure)

Section I. Instructions to Bidders (ITB)

This Section specifies the procedures to be followed by the Bidders when preparing and submitting their technical and price Bids. It also provides information on the opening and evaluation of Bids and on the award of the Contract. **Section I contains provisions that are to be used without modification.**

Section II. Bid Data Sheet (BDS)

This Section contains information and provisions that are specific to each procurement and that supplement Section I, Instructions to Bidders.

Option B – One-Envelope Bidding (alternative Section I and II to be used for One-Envelope bidding procedure)

Section I. Instructions to Bidders (ITB)

This Section specifies the procedures to be followed by the Bidders when preparing and submitting their Bids. It also provides information on the opening and evaluation of Bids and on the award of the Contract. **Section I contains provisions that are to be used without modification.**

Section II. Bid Data Sheet (BDS)

This Section contains information and provisions that are specific to each procurement and that supplement Section I, Instructions to Bidders. Section III, Section IV and Section V below are to be used either with **Option A –Two- Envelope Bidding** or with **Option B – One-Envelope Bidding.**

Section III. Evaluation and Qualification Criteria (EQC)

This Section specifies the criteria to determine the lowest evaluated Bid and the qualifications of the Bidder to perform the Contract. Two alternative Sections III, Evaluation and Qualification Criteria are provided to address the possibility of having or not having prequalification of the Bidders, conducted prior to the bidding process.

Section IV. Bidding Forms

This Section includes the forms which are to be completed by the Bidders and submitted as part of their Bids.

Section V. Eligible Source Countries of Japanese ODA Loans

This Section contains information and provisions as to the Eligible Source Countries applicable for the Bidders, and for the goods and services to be supplied under the Contract, as included in the Loan Agreement with JICA.

PART 2 – WORKS REQUIREMENTS

Section VI. Works Requirements

This Section contains Scope of Work, Technical Specification and the Drawings that describe the Works to be procured, the site data and the supplementary information.

PART 3 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section VII. General Conditions (GC)

This Section contains the general clauses to be applied in all contracts. **The text of the clauses in this Section shall not be modified.**

Section VIII. Particular Conditions (PC)

This Section consists of Part A, Contract Data, which contains data specific to each contract, and Part B, Specific Provisions, which contains provisions specific to each contract. The contents of this Section supplement the General Conditions.

Section IX. Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for performance security, advance payment security and the retention money security, when required, shall only be completed by the successful Bidder after award of the Contract.

Bidding Procedure

Documents Structure

I. Bidding Document

Issued by Employer

Section I	-	Instructions to Bidders (ITB)
Section II	-	Bid Data Sheet (BDS)
Section III	-	Evaluation and Qualification Criteria (EQC)
Section IV	-	Bidding Forms
Section V	-	Eligible Source Countries of Japanese ODA Loans
Section VI	-	Works Requirements
Section VII	-	General Conditions (GC)
Section VIII	-	Particular Conditions (PC)
Section IX	-	Contract Forms

II. The Bid

Submitted by Bidder

Two-Envelope Bidding

<u>Technical Bid</u>

(a) Letter of Technical Bid, in accordance with ITB 12.1.

(b) Bid Security, in accordance with ITB 19.

(c) Power of Attorney, authorizing the signatory of the Bids to commit the Bidder, in accordance with ITB 20.2 and ITB 20.3.
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(d) Copy of the JV Agreement, or Letter of Intent to enter into a JV including a draft agreement in the case of a Bid submitted by a JV in accordance with ITB 4.1.

(e) Documentary evidence in accordance with ITB 17 establishing the Bidder's eligibility and qualifications to perform the Contract if its Bid is accepted.

(f) Technical Proposal in accordance with ITB 16.

(g) Acknowledgement of Compliance with the Guidelines for Procurement under Japanese ODA Loans (Form ACK), which shall be signed and dated by the Bidder's authorized representative.

(h) Any other document required in BDS 11.2(g).

Price Bid

(a) Letter of Price Bid, in accordance with ITB 12.1;

(b) Completed Schedules in accordance with ITB12.1 and ITB 14, including priced Bill of Quantities, and completed Schedule of Adjustment Data (if any required in accordance with ITB 14.5) but excluding any Schedule(s) required in ITB 11.2.

(c) Any other document required in BDS 11.3(c).

III. Contract Documents **Issued by Employer & submitted by Bidder** **Two-Envelope Bidding**
(a) Contract Agreement. (b) Letter of Acceptance. (c) Letter of Technical Bid. (d) Letter of Price Bid. (e) Addenda, if any. (f) Particular Conditions – Part A. (g) Particular Conditions – Part B. (h) General Conditions. (i) Specification. (j) Drawings (k) Completed Schedules. (l) Acknowledgment of Compliance with Guidelines for Procurement under Japanese ODA Loans. (m) Any other document forming part of the Contract.

Invitation for Bids: Without Prequalification

PART 1 – BIDDING PROCEDURES

OPTION A: TWO-ENVELOPE BIDDING

Section I : Instructions to Bidders

A. General

1. Scope of Bid

1.1 In connection with the Invitation for Bids **specified in Section II, Bid Data Sheet (BDS)**, the Employer as **specified in the BDS** located in the Country, as **specified in the BDS**, issues this Bidding Document (hereinafter referred to as "Bidding Document") for the procurement of Works as specified in Section VI, Works Requirements.

The name of the Project and the name of the Contract are **specified in the BDS**.

Bids may also be invited for multiple lots of the Project, as **specified in the BDS**. Bids may be submitted either for individual lots or for multiple lots in any combination.

1.2 Throughout this Bidding Document:

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

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

(c) "day" means calendar day;

(d) "firm" means a private entity, a state-owned enterprise or institution; and

"Joint Venture" or "JV" means any combination of two or more firms in the form of a joint venture, consortium, association or other unincorporated grouping under an existing agreement or with the intention to enter into such an agreement supported by a formal Letter of Intent

2. Source of Funds

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

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

2.3 The above Loan Agreement will cover only a part of the project cost. As for the remaining portion, the Borrower, the Project Executing Agency and the Employer will take appropriate measures for finance through other sources **specified in the BDS**

3. Corrupt and Fraudulent Practices

3 . 1 It is JICA's policy to require that the Bidders and the Contractors, as well as the Borrowers, the Project Executing Agencies and the Employers, under contracts funded with Japanese ODA Loans

and other Japanese ODA, to observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, JICA:

a. will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.

b. will recognize a Bidder or Contractor as ineligible, for a period determined by JICA, to be awarded a contract funded with Japanese ODA Loans if it at any time determines that the Bidder or the Contractor has engaged in any corrupt or fraudulent practice in competing for, or in executing, another contract funded with Japanese ODA Loans or other Japanese ODA. The list of ineligible firms and individuals is available at the electronic address **specified in the BDS**.

c. will recognize a Contractor as ineligible to be awarded a contract funded with Japanese ODA Loans if the Contractor or subcontractor, who has a direct contract with the Contractor, is debarred under the cross debarment decisions by the Multilateral Development Banks. Such period of ineligibility shall not exceed three (3) years from (and including) the date on which the cross debarment is imposed.

"Cross debarment decisions by the Multilateral Development Banks" is a corporate sanction in accordance with the agreement among the African Development Bank Group, Asian Development Bank, European Bank for Reconstruction and Development.

Inter-American Development Bank Group and the World Bank Group signed on 9 April 2010 (as amended from time to time). JICA will recognize the World Bank Group's debarment of which period exceeds one year, imposed after 19 July 2010, the date on which the World Bank Group started cross debarment, as "cross debarment decisions by the Multilateral Development Banks." The list of debarred firms and individuals is available at the electronic address **specified in the BDS**.

JICA will recognize a Bidder or Contractor as ineligible to be awarded a contract funded with Japanese ODA Loans if the Bidder or Contractor is debarred by the World Bank Group for the period starting from the date of the Invitation for Bid, if prequalification has not been conducted, or the date of the Advertisement for Prequalification, if prequalification has been conducted, up to the signing of the contract, unless (i) such debarment period does not exceed one year, or (ii) three (3) years have passed since such debarment decision.

If it is revealed that the Contractor was ineligible to be awarded a contract according to above, JICA will, in principle, impose sanctions against the Contractor.

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

3.2 If the Employer determines, based on reasonable evidence, that any Bidder has engaged in any corrupt or fraudulent practice, the Employer may disqualify such Bidder after notifying the grounds of such disqualification.

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

4. Eligible Bidders

4.1 The Bidder may be a single firm or a JV. In the case of a JV

(a) all members shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms.

(b) The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.

A Bid submitted by a JV shall include a copy of the JV Agreement entered into by all members. Alternatively, a formal letter of intent to enter into a JV 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. The JV Agreement or the proposed JV Agreement, as the case may be, shall indicate at least the part(s) of the Works to be executed by each member.

4.2 The Bidder shall not have a conflict of interest. The Bidder shall be disqualified under any of the circumstances set forth below, where it is determined to have a conflict of interest throughout the bidding/selection process and/or the execution of the Contract unless the conflict has been resolved in a manner acceptable to JICA.

(a) A firm shall be disqualified from providing goods or non- consulting services resulting from or directly related to consulting services for the preparation or implementation of a project that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm. This provision does not apply to the various firms (consultants, contractors, or suppliers) only due to the reason that those firms together are performing the Contractor's obligations under a turnkey or design and build contract.

(b) A firm that has a close business relationship with a professional personnel of the Borrower (or the Project Executing Agency, or the Employer), who are directly or indirectly involved in any part of: (i) the preparation of the Prequalification Document (if any prepared) and/or the Bidding Document for the Contract, (ii) the prequalification evaluation (if any conducted) and/or the Bid evaluation, or (iii) the supervision of such contract, shall be disqualified.

Based on the "One Bid Per Bidder" principle, which is to ensure fair competition, a firm and any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm shall not be allowed to submit more than one Bid, either individually as a single firm or as a member of a JV. A firm (including its affiliate), if acting in the capacity of a subcontractor in one Bid, may participate in other Bids, only in that capacity.

(c) A firm having any other form of conflict of interest other than (a)

through (c) above shall also be disqualified.

4.3 The Bidder shall meet the requirements as to eligibility of the Bidders as specified in Section V, Eligible Source Countries of Japanese ODA Loans.

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

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

The Bidder shall provide such evidence of its continued eligibility satisfactory to the Employer, as the Employer shall reasonably request

5. Eligible Goods and Services

5.1 The goods and services comprising the Works to be supplied under the Contract and financed by JICA shall meet the requirements specified in Section V, Eligible Source Countries of Japanese ODA Loans.

B. Contents of Bidding Document

6. Sections of Bidding Document

6 . 1 The Bidding Document consists of Parts 1, 2, and 3, which include all the Sections specified below, and which should be read in conjunction with any addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures

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

PART 2 Works Requirements

- Section VI. Works Requirements

PART 3 Conditions of Contract and Contract Forms

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

6.2 The Invitation for Bids 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. The information or documentation shall be complete, accurate, current, and verifiable

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

7.1 The 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 on the Employer's 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 and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

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

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

7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than seven (7) days before the meeting.

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

8. Amendment of Bidding Document

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

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the

Bidding Document from the Employer in accordance with ITB 6.3. If so **specified in the BDS**, the Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.

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

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

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

11. Documents Comprising the Bid

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

11.2 The Technical Bid shall comprise the following:

(a) Letter of Technical Bid, in accordance with ITB 12.1;

(b) Bid Security, in accordance with ITB 19;

(c) Power of Attorney, authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2 and ITB 20.3;

(d) copy of the JV Agreement, or Letter of Intent to enter into a JV including a draft agreement in the case of a Bid submitted by a JV in accordance with ITB 4.1;

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

(f) Technical Proposal in accordance with ITB 16;

(g) Acknowledgement of Compliance with the Guidelines for Procurement under Japanese ODA Loans (Form ACK), which shall be signed and dated by the Bidder's authorized representative; and

(h) any other document required in the BDS.

11.3 The Price Bid shall comprise the following:

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

(b) Completed Schedules in accordance with ITB 12.1 and ITB 14, including priced Bill of Quantities, and completed Schedule of Adjustment Data (if any required in accordance with ITB 14.5) but

excluding any Schedule(s) required in ITB 11.2.

(c) any other document required in the BDS.

12. Letter of Bid and Schedules

12.1 The Bidder shall complete the Letters of Technical Bid and Price Bid and the Schedules, including the Bill of Quantities, and the Schedule of Adjustment Data (only if required in ITB 14.5), 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. All blank spaces shall be filled in with the information requested.

13. Alternatives to the Bid Requirements and Alternative Bids

13.1 **If so specified in the BDS**, alternative times for completion will be permitted, and the method of evaluating different times for completion shall be as specified in Section III, Evaluation and Qualification Criteria.

13.2 **If so specified in the BDS**, alternative Bids will be permitted, and the Bidders, wishing to offer technical alternatives to the Bid requirements, may in addition to the substantially responsive Bid (hereinafter referred to as "Base Bid"), submit an alternative Bid. The alternative Bid shall be complete with all information necessary for a complete evaluation of the alternative by the Employer including drawings, design calculations, technical specifications, breakdown of prices, proposed construction methodology and other relevant details.

Only the alternative Bids, if any, submitted by the Bidder whose Base Bid is determined to be the lowest evaluated Bid under ITB 36.1 shall be considered by the Employer

14. Bid Prices and Discounts

14.1 The prices and discounts (including any price reduction) quoted by the Bidder in the Letter of Price Bid and in the Bill of Quantities shall conform to the requirements specified below 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 and/or prices for other items in the Bill of Quantities and will not be paid for separately by the Employer.

14.2 For the purpose of evaluation, any item against which no rate or price is entered by the Bidder shall be assumed to be not included in the Bid. However provided that the Bid is determined to be substantially responsive notwithstanding this omission, the average price of the item quoted by the substantially responsive Bidders will be added to the Bid Price and the total cost of the Bid so determined will be used for price comparison.

14.3 The price to be quoted in the Letter of Price Bid, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the Bid.

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

14.5 Unless otherwise specified in the BDS and the 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/or weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Employer may require the Bidder to justify its proposed indices and weightings.

14.6 If so specified in BDS 1.1, Bids are being invited for multiple lots. The Bidders wishing to offer any discounts (including price reduction) for the award of more than one lot shall specify in their Letter of Price Bid, discounts applicable to such award. Discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all lots are opened at the same time.

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

14.8 The exact amounts of the Provisional Sums shall be indicated in the completed Bill of Quantities in the following manner:

(a) The exact amounts and currencies of the Specified Provisional Sums and contingency allowance, if any, shall be **as specified in the BDS**.

(b) The amount of the Provisional Sum, if any, for the Daywork shall be derived by the Bidder (by entering rates and/or prices in the Schedule of Daywork Rates in the Bill of Quantities) and indicated in the Summary of the completed Bill of Quantities.

14.9 The Bidder shall be aware of the provisions stated in Sub- Clauses 1.1.4.10, 13.5 and 13.6 of the Conditions of Contract

15. Currencies of Bid and Payment

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

15.2 The Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data are reasonable

16. Technical Proposal and Subcontractors

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

16.2 Unless otherwise stated in the BDS, the Employer does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Employer (nominated Subcontractors).

The Bidder may propose to subcontract any of the key activities indicated in Section III, Evaluation Qualification Criteria 2.4.2 (b). In such a case,

(a) the Bidder may list one or more subcontractor(s) against any of the

key activities aforementioned and summation of the subcontractors' qualifications against each of criteria for key activities is accepted;

(b) the Bidder shall clearly identify the proposed subcontractor(s) in Forms ELI-3 and EXP-2(b) in Section IV, Bidding Forms and submit the Schedule of Subcontractors, as part of its Technical Proposal, listing out all subcontractors so proposed; and

(c) substitution of the proposed subcontractor(s) shall not be allowed after the Bid submission deadline date prescribed by the Employer in accordance with ITB 22.1.

If the prequalification process was conducted prior to the bidding process, the Bidder shall name and list out in the Schedule of Subcontractors, the same subcontractor(s) whose experience in the key activities was evaluated in the prequalification, except only for such changes as are explicitly approved by the Employer in accordance with ITB 17.2

17. Documents Establishing the Qualifications of the Bidder

17.1 In accordance with Section III, Evaluation and Qualification Criteria,

(a) if the prequalification process was conducted prior to the bidding process, the Bidder shall provide in the corresponding information sheets included in Section IV, Bidding Forms, updated information on any assessed aspect to establish that the Bidder continues to meet the criteria used at the time of prequalification, and

(b) if the prequalification process was not conducted prior to the bidding process, the Bidder shall provide the information requested in the corresponding information sheets included in Section IV, Bidding Forms.

The aforementioned Evaluation and Qualification Criteria contains, among other things, the requirements as to eligibility specified in ITB 4.

17.2 Any change in the structure or formation of the Bidder after being prequalified and invited to bid (including, in the case of a JV, any change in the structure or formation of any member thereto) shall be subject to the written approval of the Employer prior to the deadline for submission of Bids. Such approval shall be denied if:

(a) such change has not taken place by the free choice of the firms involved;

(b) as a consequence of the change, the Bidder no longer substantially meets the qualification criteria set forth in the Prequalification Document; or

(c) in the opinion of the Employer, the change may result in a substantial reduction in competition.

Any such change should be submitted to the Employer not later than twenty-eight (28) days before the Bid submission deadline

18. Period of Validity of Bids

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

18.2 In exceptional circumstances, prior to the expiration of the Bid validity period, the Employer may request the Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. The Bid Security shall also be extended for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 18.3.

18.3 If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity period, 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.

In any case, Bid evaluation shall be based on the Bid Price without taking into consideration the effect of the adjustment indicated in the above paragraph

19. Bid Security

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

19.2 The Bid Security shall be at the Bidder's option, 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 standby letter of credit;

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

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

from a reputable source. If the unconditional guarantee is issued by a non-bank financial institution located outside the Employer's Country, the issuing financial institution shall have a correspondent financial institution located in the Employer's Country to make it enforceable. In the case of a bank guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Employer prior to Bid submission. In either case, the form must include the complete name of the Bidder. The Bid Security shall be valid for twenty-eight (28) days beyond the original validity period of the Bid, or beyond any period of extension if requested under ITB 18.2.

19.3 Any Bid not accompanied by a substantially responsive Bid Security shall be rejected by the Employer as non-responsive.

19.4 The Bid Security of all Bidders who have been rejected on the grounds of their Technical Bids being substantially non- responsive to the requirements of the Bidding Document, shall be returned as promptly as possible upon the Employer's notification of such rejection pursuant to ITB 25.8.

The Bid Security of all unsuccessful Bidders (other than those referred in the above paragraph) shall be returned as promptly as

possible upon the successful Bidder's signing the Contract and furnishing the Performance Security pursuant to ITB 41.

19.5 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security.

19.6 The Bid Security may be forfeited:

(a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, or any extension thereto provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 40; or

(ii) furnish a Performance Security in accordance with ITB 41.

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

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the documents as described in ITB 11 and clearly mark them "TECHNICAL BID – ORIGINAL" and "PRICE BID – ORIGINAL", as appropriate. Alternative Bids, if permitted in accordance with ITB 13.2, shall be clearly marked "ALTERNATIVE BID – ORIGINAL".

In addition, the Bidder shall submit copies of the Technical and Price Bids, in the number specified in the BDS and clearly mark each of them "TECHNICAL BID – COPY", "PRICE BID – COPY" and "ALTERNATIVE BID – COPY", as appropriate.

In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 The original 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 be in the form of a Power of Attorney included in the Technical Bid. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.

20.3 A bid submitted by a JV shall be signed by an authorized representative of the JV accompanied by a Power of Attorney from each member of the JV giving that authorized representative the power to sign on their behalf and legally bind them all. Such power shall also be given by a person duly authorized to do so on behalf of each member evidenced by a Power of Attorney.

20.4 Any interlineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

20.5 The Bidders shall clearly mark "CONFIDENTIAL" any information which they regard as confidential to their business. Such information may include proprietary information, trade secrets, or commercial or financially sensitive information.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

21.1 The Bidder shall enclose:

(a) in a sealed envelope, duly marked as "TECHNICAL BID – ORIGINAL", all documents comprising the Technical Bid, as described in ITB 11.2;

(b) in a sealed envelope, duly marked as "PRICE BID – ORIGINAL", all documents comprising the Price Bid, as described in ITB 11.3;

(c) in sealed envelopes, duly marked as "TECHNICAL BID – COPY", all required copies of the Technical Bid, sequentially numbered;

(d) in sealed envelopes, duly marked as "PRICE BID – COPY", all required copies of the Price Bid, sequentially numbered; and

(e) if alternative Bids are permitted in accordance with ITB 13.2, and if relevant:

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

(ii) in the envelope marked "ALTERNATIVE BID – COPY", all required copies of the alternative Bid, sequentially numbered.

These envelopes (inner envelopes) containing the original and the copies shall then be enclosed in one single envelope (outer envelope).

21.2 The inner and outer envelopes shall be:

(a) clearly marked with the name and address of the Bidder;

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

(c) clearly marked with the specific identification of this bidding process specified in BDS 1.1.

21.3 The outer envelopes and the inner envelopes containing the Technical Bid shall be clearly marked with a warning "NOT TO BE OPENED BEFORE THE TIME AND AND DATE FOR THE OPENING OF TECHNICAL BID", in accordance with ITB 25.1.

21.4 The inner envelopes containing the Price Bid shall be clearly marked with a warning "NOT TO BE OPENED UNTIL ADVISED BY THE EMPLOYER", in accordance with ITB 25.7.

21.5 The inner envelopes containing the alternative Bids, if any, shall be clearly marked with a warning "NOT TO BE OPENED UNTIL ADVISED BY THE EMPLOYER", in accordance with ITB 13.2.

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

22. Deadline for Submission of Bids

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

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

23. Late Bids

23.1 The Employer shall not consider any Bid that arrives after the

deadline for submission of Bids, in accordance with ITB 22. Any Bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder

24. Withdrawal, Substitution, and Modification of Bids

24.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – after it has been submitted and prior to the deadline for submission of Bids, by sending a written notice, duly signed by an authorized representative, and shall include a copy of the Power of Attorney in accordance with ITB 20.2 and ITB 20.3. 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 outer envelopes shall be clearly marked "WITHDRAWAL", "SUBSTITUTION", "MODIFICATION", and

(b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 22.

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

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

25. Bid Opening

25.1 Except in the cases specified in ITB 23 and ITB 24, the Employer shall publicly open and read out in accordance with ITB 25.5 all Technical Bids received by the deadline, at the date, time and place **specified in the BDS**, in the presence of the Bidders' designated representatives and anyone who choose to attend. The Price Bids will remain unopened and will be held in custody of the Employer until the time of their opening to be specified in accordance with ITB 25.7. Alternative Bids, if any, shall remain unopened in accordance with ITB 13.2.

If the Technical Bid and the Price Bid are submitted together in one envelope, the Employer may reject the entire Bid.

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

25.3 Next, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing Substitution Technical Bid and/or Substitution Price Bid shall be exchanged with the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened and read out. Substitution Price Bid will remain unopened in accordance with ITB 25.1. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at the

opening of Technical Bids.

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

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

(a) the name of the Bidder;

(b) whether there is a withdrawal, substitution, or modification;

(c) whether there is an alternative Bid without opening its envelope;

(d) the presence or absence of a Bid Security; and

(e) any other details as the Employer may consider appropriate.

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

25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum:

(a) the name of the Bidder;

(b) whether there is a withdrawal, substitution, or modification;

(c) whether there is an alternative Bid; and

(d) the presence or absence of a Bid Security.

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

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

25.8 The Employer will notify, in writing, the Bidders who have been rejected on the grounds of their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and/or who have been determined as being disqualified for award, and return their Price Bids unopened together with the Bid Security.

25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids and who were determined as being qualified for award, in the presence of the Bidders' representatives who choose to attend at the address, date

and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

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

(a) the name of the Bidder;

(b) whether there is a withdrawal, substitution or modification;

(c) the total Bid Price, including any discounts and alternative Bids; and in the case of bidding for multiple lots, the total price for each lot together with the sum of the total prices for all lots including any discounts; and

(d) any other details as the Employer may consider appropriate.

Only Price Bids and Price Bid discounts read out and recorded at the opening of Price Bids shall be considered for evaluation. The Employer shall neither discuss the merit of any Price Bid nor reject any Price Bid at the Price Bids opening.

25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum:

(a) the name of the Bidder; and

(b) the total Bid Price; including any discounts and alternative Bids; and in the case of bidding for multiple lots, the total price for each lot together with the total price for all lots including any discounts.

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 who submitted Bids in time, and to JICA

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 the Bidders or any other persons not officially concerned with the bidding process until information on Contract award is communicated to all Bidders in accordance with ITB 39

The use by any Bidder of confidential information related to this bidding process may result in the rejection of its Bid.

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

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

27. Clarification of Bids

27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid, giving a reasonable time for a response. Any

clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid, including any voluntary increase or decrease in the prices, shall be sought, offered, or permitted, except to confirm the correction of arithmetical errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33.

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

28. Deviations, Reservations, and Omissions

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

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

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

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

29. Preliminary Examination of Technical Bids

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

29.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the Bid shall be rejected.

(a) Letter of Technical Bid;

(b) Power of Attorney to commit the Bidder;

(c) Bid Security; and

(d) Technical Proposal in accordance with ITB 16.

30. Qualification of the Bidders

30.1 The Bidders shall substantially meet or exceed the specified qualification requirements. The Employer shall determine to its satisfaction whether the Bidders meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria, during the evaluation of Technical Bids. However, if the prequalification process was carried out prior to the bidding process, the Employer may carry out the assessment of the qualification criteria specified in Section III, Evaluation and Qualification Criteria, only for the Bidder who submitted the lowest evaluated and substantially responsive Bid.

30.2 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. For the purposes of this determination, only the qualification of the legal entity(ies) comprising the Bidder shall be considered. In particular, the qualifications of affiliated entities (such as the parent company(ies), group companies, subsidiaries or other affiliates)

shall not be considered unless they are parties to the Bidder under a JV in accordance with ITB 4.1 or as subcontractors to be employed in accordance with ITB 16.2 for the key activities listed in Section III Evaluation and Qualification Criteria 2.4.2(b).

30.3 The Employer reserves the right to waiver minor (nonmaterial) deviations in the qualification criteria if they do not materially affect the technical capability and financial resources of the Bidder to perform the contract.

30.4 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.

If the assessment of the Bidder's qualification was conducted only for the lowest evaluated Bidder, in accordance with ITB 30.1, and the result of such assessment is negative, the Employer shall proceed to the next lowest evaluated Bid to make a similar determination.

30.5 The subcontractors proposed by the Bidder in its Bid shall meet the eligibility requirements of ITB 4.

Furthermore, the subcontractor proposed in accordance with ITB 16.2 who does not meet the corresponding criteria for the key activities specified in Evaluation and Qualification Criteria 2.4.2(b) shall be disqualified.

31. Determination of Responsiveness of Technical Bids

31.1 The Employer's determination of a Technical Bid's responsiveness is to be based on the contents of the Technical Bid itself, as defined in ITB 11.2.

31.2 For the purposes of this determination, a substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would

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

(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

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

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

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

32. Nonmaterial Nonconformities

32.1 Provided that a Technical Bid is substantially responsive, the Employer may waive any nonconformities (deviation, reservation

or omission) in the Technical Bid.

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

32.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify quantifiable non Evaluate 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. Adjustment to the rates and prices of the Bill of Quantities shall be made in accordance with ITB 14.2.

33. Correction of Arithmetical Errors

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

(a) where 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) where 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) where there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to

(a) and (b) above.

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

34. Conversion to Single Currency

34.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as **specified in the BDS**. The Employer will convert the amounts in various currencies in which the Bid Price, corrected pursuant to ITB 33, is denominated to the single currency identified above at the selling rates established for similar transactions by the authority **specified in the BDS** and on the date **stipulated in the BDS**.

35. Evaluation of Price Bids

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

(a) the Bid Price, excluding the Specified Provisional Sums and contingency allowance, if any in the Grand Summary of the Bill of Quantities, but including the Provisional Sum for Daywork when priced competitively;

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

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

(d) the additional evaluation factors specified in Section III, Evaluation and Qualification Criteria;

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 32.3; and

(f) converting the amount resulting from applying (a) to € above, if relevant, to a single currency in accordance with ITB 34.

35.2 If price adjustment is allowed in accordance with ITB 14.5, 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.

35.3 In the case of bidding for multiple lots, the lowest evaluated price of the lot(s) shall be determined as specified in Section III, Evaluation and Qualification Criteria.

36. Comparison of Bids

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

36.2 If the Bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the Performance Security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

36.3 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.

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.

For the purposes of this ITB 36.3, 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 to perform the Contract for the offered Bid Price.

37. Employer's Right to Accept Any Bid, and to Reject

37.1 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

Any or All Bids

Contract award, without thereby incurring any liability to the Bidders. In case of annulment, all Bids submitted and specifically, Bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

38. Award Criteria

38.1 Subject to ITB 37.1, the Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated Bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

39. Notification of Award

39.1 Prior to the expiration of the period of Bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification letter (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called "the Accepted Contract Amount").

39.2 After a contract has been determined to be eligible for financing under Japanese ODA Loans, the following information may be made public by JICA:

(a) name of each Bidder who submitted a Bid;

(b) Bid Prices as read out at Bid Opening;

(c) name and address of the successful Bidder; and

(d) signing date and amount of the contract.

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

40. Signing of Contract

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

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

41. Performance Security

41.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the Conditions of Contract, subject to ITB 36.2 using for that purpose the Performance Security Form included in Section IX, 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'sbCountry.

41.2 Failure of the successful Bidder to submit the above- mentioned Performance Security or sign the Contract shall constitute

sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose Bid is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

42. Notification to Unsuccessful Bidders and Debriefing

42.1 As promptly as possible upon the successful Bidder signing the Contract and furnishing the Performance Security pursuant to ITB 41, the Employer shall notify all unsuccessful Bidders of the results of the bidding.

42.2 After receipt of the Employer's notification pursuant to ITB42.1 above, the unsuccessful Bidders (including those rejected on the grounds of their Technical Bids not being substantially responsive) may request in writing to the Employer a debriefing seeking an explanation of the grounds on which their Bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who requests a debriefing in accordance with this Clause

Section II : Bid Data Sheet

Bid Data Sheet

A. General	
ITB 1.1	The number of the Invitation for Bids is: MePGCL/CE/C/HP&HC/T-33(C)/Pt-I/2024/96 Dated 07-06-2024 The Employer is: Meghalaya Power Generation Corporation Limited.(MePGCL) located in *India*. The Project is: Renovation and Modernisation of Umiam-Umtru Stage III Hydro Electric Power Station (2X30MW) The name of the Contract is: Renovation work of Hydro Mechanical and Civil facilities of Umiam-Umtru Stage III Power Station.
ITB 2.1	The Borrower is: The President of India. The number of the JICA Loan Agreement is: ID-P 271 The amount of the Japanese ODA Loan is: *5497Million Yen* The signed date of the Loan Agreement is: 29th October, 2018.
ITB 2.2	The applicable Guidelines for Procurement under Japanese ODA Loans are those published in *: April 2012, .*
ITB 2.3	The other sources of finance are: State Government of Meghalaya
ITB 3.1(b)	The list of ineligible firms and individuals is available at the JICA's website: www.jica.go.jp/english/our_work/compliance.
ITB 3.1 (c)	The list of debarred firms and individuals is available at the World Bank's website: www.worldbank.org/debarr.
ITB 4.5	This bidding is not subject to Prequalification
B. Bidding Document	
ITB 7.1	For **clarification purposes** only, the Employer's address is: Attention: Chief Engineer (C), HP&HC, Meghalaya Power Generation Corporation Limited.(MePGCL), Lumjingshai , Short Round Road, Shillong , Meghalaya. Pin Code: 793001 Email:cehphc.mepgcl@gmail.com Responses to any request for clarification, *"will"* be published on the Employer's web page indicated below. Web Page: www.meecl.nic.in

ITB 7.4	A Pre-bid meeting *"will"* take place at the following date, time and place: Date : 24-06-2024 Time : 15:00 Hrs. Place : MeECL Conference Hall , Lumjingshai , Short Round Road , Shillong, Meghalaya -793001 A site visit conducted by the Employer will not be organized ,The bidders shall conduct site visit(s) as per their convenience prior to pre bid meeting seeking due permission from employer.

ITB 8.2	Addenda, if any, will be published on the Employer's web page.www.meecl.nic.in
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: ENGLISH
ITB 11.2 (h)	The Bidder shall submit the following additional documents in its Technical Bid: (a) Documentary evidence establishing, in accordance with Section III EQC, that the Works carried out earlier by the Bidder meet the minimum requirements of the Bidding Documents .
ITB 13.1	Alternative times for completion *will not be* permitted.
ITB 13.2	Alternative Bids *will not be* permitted.
ITB 14.5	The prices quoted by the Bidder shall: *"be adjustable"; consequently, the Bidder is required to furnish the total amount for each index component* *and weightings for the price adjustment formulae in the Schedule of* *Adjustment Data"*, as appropriate.
ITB 14.7	All duties, taxes and levies are payable by the Contractor.

<table>
<tr><td>ITB 14.8</td><td>The Amount and Currency of the Specified Provisional Sum shall be as follows:
<table>
<tr><th>Item No.</th><th>Description</th><th>Local currency</th></tr>
<tr><td>1</td><td>Renumeration of DB Member</td><td>Rs.9.50 lakh (Rupees Nine Lakh Fifty Thousand) only</td></tr>
</table></td></tr>
<tr><td>ITB 15.1</td><td>Since Local Competitive Bidding is adopted and all inputs are expected to be from within the borrower’s country, the currency(ies) of the Bid shall be as described below:
(a) the inputs to the Works shall be quoted by the bidder in Indian Rupees (INR), referred to as “the local currency”, to [two] decimal place(s).</td></tr>
<tr><td>ITB 16.2</td><td>At this time the Employer “does not intend”, to execute certain specific parts of the Works</td></tr>
</table>

<table>
<tr><td></td><td>by subcontractors (i.e.: nominated Subcontractors) selected in advance.</td></tr>
<tr><td>ITB 18.1</td><td>The Bid validity period shall be 120days.</td></tr>
<tr><td>ITB 18.3 (a)</td><td>This BDS 18.3(a) is not applicable..</td></tr>
</table>

ITB 19.1	The amount and currency of the Bid Security shall be **INR 95 Lakh (Rupees Ninety Five Lakh) only**
ITB 19.2 (d)	Other types of acceptable securities: Fixed Deposit Receipt pledged in favour of the employer from a Nationalised / reputed bank .
ITB 20.1	In addition to the original of the Bid, the number of copies is: Two
D. Submission and Opening of Bids	
ITB 22.1	For **Bid submission purposes** only, the Employer's address is: Attention: Chief Engineer (C) , HP&HC , Meghalaya Power Generation Corporation Limited. (Me PGCL) Lumjingshai, Short Round Road . Shillong – 793001, Meghalaya . The deadline for Bid submission is: Date: 08- 07- 2024 Time: 14: 00 Hours IST
ITB 25.1	The Technical Bid opening shall take place at the MeECL Conference Hall , Lumjingshai , Short Round Road., Shillong - 793001, Meghalaya . Date: 08-07-2024] Time 15: 00 Hrs. IST

SECTION III. EVALUATION AND QUALIFICATION CRITERIA

(OPTION II: WITHOUT PREQUALIFICATION)

Evaluation and Qualification Criteria

(Without Prequalification)

1. Evaluation

1.1 Evaluation of Technical Bid

The evaluation of the Technical Bids consists of the following:

(a) assessment of the qualification of the Bidder to perform the Contract satisfactorily, in accordance with ITB 30. The qualification criteria for the purpose of this assessment have been described in detail under item 2 (*Qualification*) below.

(b) determination of the substantial responsiveness of the Technical Bid in accordance with ITB 31. The evaluation criteria for the purpose of this determination have been described herein under.

Determination of the substantial responsiveness of the Technical Bid includes, among other things, an assessment of the adequacy of the Bidder's Technical Proposal, during which the Bidder's technical capacity to complete the Works will be assessed in terms of the following. Based on such assessment, the Employer will determine whether the Technical Proposal is substantially responsive to the requirements stipulated in Section VI, Work's Requirements.

(i) mobilization of key construction equipment and personnel for the execution of the Works.

(ii) adequately supervising and controlling the execution of the Works by the appropriate allocation of staff.

(iii) planning and scheduling of all work activities in such a manner that the Works will be completed on time and meet with all Contract requirements.

(iv) execution of the Works fully in accordance with all Contract requirements including but not limited to work methods, material sourcing, etc.

(v) carrying out all operations for the execution of the Works safely and in an environmental friendly manner

1.1.1 Personnel

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

No.	Position	Minimum Number of Years	
		Similar Positions	Total Work Experience
1	Construction Manager(Civil)	5	8
2	Engineer (Civil)	3	6
3	EHS Officer	3	5
4	Construction Manager (Mech) for HM Works	5	8
5	Engineer(Mech)for HM work	3	6
…			

Alternative candidates for key positions shall not be evaluated.

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

1.1.1 Construction Equipment

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

No.	Equipment Type and Required Performance Characteristics	Minimum Requirement (Number of Units)
1	Concrete Mixer 10 / 7 cft or above	02
2	Concrete Pump with all fittings	01
3	DG set 200 kva capacity	01
4	Mechanical Ventilation System for tunnel	01
5	Air Compressor 250 cfm or above	01
6	Dumper/Tippers 15 T capacity or above	04
7	Dewatering pump 25 hp or above (Diesel / Electric)	02
8	Road Roller 8 T or above	01

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

1.1.2 Other Evaluation Criteria

"N/A".

……

……

1.2 Evaluation of Price Bid

In addition to the criteria listed in ITB 35.1 (a) – (c), € and (f), the following criteria shall apply:

1.2.1 Other Evaluation Criteria (ITB 35.1(d))

N/A

……

……

1.2.2 Award Criteria for Multiple Lots (ITB 35.3)

"N/A".

1.3 Alternative Times for Completion (ITB 13.1)

Time for Completion of the Works shall be:**730 days (24 Months)**

No credit will be given for earlier Completion

2. Qualification

(I) Qualification of the Bidder but not of that of Bidder's Affiliate

It is the legal entity or entities comprising the Bidder (which is/are party to the Bidder under a JV or as subcontractors to be employed for the key activities listed in this Section), and not the Bidder's parent company(ies), group companies, subsidiaries, or other affiliates, that must satisfy the qualification criteria.

(II) Exchange Rate for Qualification Criteria

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

(a) For turnover or financial data required for each year – Exchange rate prevailing on the last day

of the respective calendar or fiscal year, as applicable.

(b) Value of single contract – Exchange rate prevailing on the date of the contract.

Exchange rates shall be taken from the publicly available source **identified in BDS 34.1** or, in case such rates are not available in the source identified above, any other publicly available source acceptable to the Employer. Any error in determining the exchange rates may be corrected by the Employer.

(III) Qualification Criteria for Award of Multiple Lots

N/A

2.1 Eligibility

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.1.1	Nationality	Nationality in accordance with ITB 4.3	Must meet requirement	N/A	Must meet requirement	N/A	Forms ELI –1 and 2(i) with attachments
2.1.2	Conflict of Interest	No conflicts of interest in ITB 4.2	Must meet requirement	N/A	Must meet requirement **(ii)**	N/A	Letter of Technical Bid
2.1.3	JICA Ineligibility	Not having been declared ineligible by JICA, as described in ITB 4.4	Must meet requirement	N/A	Must meet requirement **(ii)**	N/A	Letter of Technical Bid Form ACK

Notes for the Bidders
(i) ELI -2 is required only if the Bidder is a JV.
(ii) This requirement also applies to subcontractors if proposed by the Bidder under 2.4.2(b) below.

2.2 Historical Contract Non-Performance and Litigation

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.2.1	History of Non-Performing Contracts	Non-performance of a contract**(i)** did not occur as a result of contractor's default since 1st January 2021.	Must meet requirement **(ii)**	N/A	Must meet requirement **(ii)**	N/A	Form CON
2.2.2	Pending Litigation	Bidder's financial position and prospective long-term profitability still sound according to criteria established in 2.3.1 below and assuming that all pending litigation will be resolved against the Bidder.	Must meet requirement **(ii)**	N/A	Must meet requirement **(ii)**	N/A	Form CON
2.2.3	Litigation History	No consistent history of court orders(iii) against the Bidder since 1st January 2021.	Must meet requirement **(ii)**	N/A	Must meet requirement **(ii)**	N/A	Form CON

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	

Notes for the Bidders

(i) Non-performance, as decided by the Employer, shall include all contracts:

(a) where non-performance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and

(b) that were so challenged but fully settled against the contractor.

Non-performance shall not include contracts where Employer's decision was overruled by the dispute resolution mechanism. Moreover, non- performance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

(ii) This requirement also applies to contracts executed by the Bidder as a JV member.

The Bidder shall provide accurate information on the related Bidding Form about any litigation resulting from contracts completed or ongoing under its execution over the last three (3) years. A consistent history of court orders against the Bidder or any member of a joint venture may result in failure of the Bid.

2.3 Financial Situation and Capabilities

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.3.1	Financial Performance	The financial statements for the last Five years(05) shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability. As the minimum requirement, the Bidder's net worth calculated as the difference between total assets and total liabilities should be positive.	Must meet requirement	N/A	Must meet requirement	N/A	Form FIN –1 with attachments

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.3.2	Average Annual Turnover	Minimum average annual turnover of **Rs. 15 Crore (Rupees Fifteen Crore) only** calculated as total certified payments received for contracts in progress and/ or completed, within the last eight (8) years, divided by eight (8) years.	Must meet requirement	Must meet requirement	Must meet 25% of the requirement	Must meet 40% of the requirement	Form FIN –2
2.3.3	**Financial Capabilities**	The Bidder shall demonstrate, to the satisfaction of the Employer that it currently (as of the Bid submission deadline), has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as **Rs. 3.50 Crore (Rupees Three crore fifty lakh) only** for the subject contract(s) net of the Bidder's all other commitments, both current and future.	Must meet requirement	Must meet requirement	N/A	N/A	Form FIN –3 and FIN –4

2.4 Experience

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.4.1	General Experience	Continuous experience under construction contracts in the role of prime contractor(i) (single firm or JV member) or subcontractor between 1st January 2021 and the Bid submission deadline.	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP –1

No.	Factor	Requirement	Single Firm	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	One Member	
2.4.2	Specific Experience	(a) A minimum number of **one (01)** similar contract, each of minimum value of **Rs. 10 Crore (Rupees Ten Crore)**(ii) that have been satisfactorily completed(iii) as a prime contractor(i) (single entity or JV member)(iv) between 1st January2010 and Bid submission deadline. The similarity of the contracts shall be based on the following: [Construction or Repair of concrete lined tunnel conveying water costing not less than Rs.10 Crore (Rupees Ten Crore) only]	Must meet requirement	Must meet requirement (v)	Must meet requirement (v)	N/A	Form EXP –2(a) with attachment
		(b) For the above or other contracts completed and under implementation as prime contractor**(i)** (single entity or JV member) or subcontractor**(vi)** between 1st January2010 and Bid submission deadline, a minimum experience in the following key activities successfully completed(iii)[(1)Construction or Repair of concrete lining in tunnels with not less than 1000 cum of concrete lining (2) Supply and Installation or Renovation of at least one Fixed Wheel Vertical Lift Gate of minimum size 3.00 m x 3.00 m in hydropower or water resources projects]	Must meet requirement [can be a specialist subcontractor for key activity at Sl..No. (2)]	Must meet requirement [can be a specialist subcontractor for key activity at Sl. No. (2)]	N/A	N/A	Form ELI –3 Form EXP –2(b) with attachment Schedule of Subcontractors

Notes for the Bidders

(i) For the purposes of this criterion, a 'management contractor' is also considered as a prime contractor. A firm which takes on the role of contract management is referred herein as 'management contractor'. A management contractor does not normally perform directly the construction work(s) associated with the contract. Rather, it manages the work of other (sub) contractors while bearing full responsibility and risk for price, quality, and timely performance of the work contract.

(ii) Summation of number of small value contracts (less than the value specified under requirement) to meet the overall requirement will not be accepted.

(iii) Completion shall be evidenced by submission of end-user certificates such as Taking-over Certificates and Completion Certificates as required to be submitted as attachment to Form EXP-2(a) or Form EXP-2(b) of Section IV, Bidding Forms.

(iv) For contracts under which the Bidder participated as a JV member, only the Bidder's share, by value, shall be considered to meet this requirement.

(v) In case of a 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.

(vi) For contracts under which the Bidder participated as a JV member or subcontractor, only the Bidder's share, by value and role, shall be considered to meet this requirement.

Section IV. Bidding Forms

Section IV. Bidding Forms

The forms included in this section shall be completed by the Bidder in accordance with guidance and instructions provided in this section and other sections of the Bidding Document, and submitted as part of its Bid (in the case of One-Envelope Bidding) or its Technical and Price Bids (in the case of Two-Envelope Bidding) as indicated in the table below:

The Bid Submitted by Bidder

Two-Envelope Bidding
<u>Technical Bid</u> (a) **Letter of Technical Bid**, in accordance with ITB 12.1. (b) **Bid Security**, in accordance with ITB 19. (c) Power of Attorney, authorizing the signatory of the Bids to commit the Bidder, in accordance with ITB 20.2 and ITB 20.3. (d) Copy of the JV Agreement, or Letter of Intent to enter into a JV including a draft agreement in the case of a Bid submitted by a JV in accordance with ITB 4.1. (e) Documentary evidence in accordance with ITB 17 establishing the Bidder's eligibility and qualifications to perform the Contract if its Bid is accepted. **i. Form ELI -1: Bidder Information Form.** **ii. Form ELI -2: JV Member Information Form.** **iii. Form ELI -3: Subcontractor Information Form.** **iv. Form CON: Historical Contract Non-Performance and Litigation.** **v. Form FIN -1: Financial Situation.** **vi. Form FIN -2: Average Annual Turnover.** **vii. Form FIN -3: Financial Resources.** **viii. Form FIN -4: Current Contract Commitments.** ix. **Form EXP -1: General Construction Experience.** * x. **Form EXP -2(a): Specific Construction Experience.** * **xi. Form EXP -2(b): Construction Experience in Key Activities. *** (f) Technical Proposal in accordance with ITB 16. **i. Site Organization.** **ii. Method Statement.**

Two-Envelope Bidding

iii. Mobilization Schedule.

iv. Construction Schedule.

v. Health and Safety Plan.

vi. Environmental Plan.

vii. Schedule of Subcontractors.

viii. Form PER -1: Proposed Personnel.

ix. Form PER -2: Resume of Proposed Personnel.

x. Form EQU: Construction Equipment.

(g) **Acknowledgement of Compliance with the Guidelines for Procurement under Japanese ODA Loans (Form ACK)** which shall be signed and dated by the Bidder's authorized representative.

(h) Any other document required in BDS 11.2(h).

Price Bid

(a) **Letter of Price Bid**, in accordance with ITB 12.1.

(b) Completed Schedules in accordance with ITB 12.1 and 14, including priced **Bill of Quantities**, and completed **Schedule of Adjustment Data**, (if any required to be submitted under ITB 14.5) but excluding any Schedule(s), required in BDS 11.2.

(c) Any other document required in BDS 11.3 (c).

<Option A: Two-Envelope Bidding>

[*Prepare this Letter of Technical Bid on stationery with its letterhead clearly showing the Bidder's complete name and business address.*]

Letter of Technical Bid

Date	: [*insert date of Bid submission*]
IFB No.	: [*insert Invitation for Bid number*]
Project	: [*insert name of Project*]
Contract	: [*insert name of Contract*]

To: [*insert full name of Employer*]

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Document, including addenda issued in accordance with Instructions to Bidders (ITB) 8. [*insert the number and issuing date of each addendum*];

(b) We, including subcontractors meet the eligibility requirements in accordance with ITB 4 and ITB 5;

(c) We, including subcontractors have no conflict of interest in accordance with ITB 4;

(d) We offer to execute in conformity with the Bidding Document the following Works: [*insert a brief description of the Works*];

(e) Our Bid shall be valid for a period of [*specify the number of calendar days*] days from the date fixed for the Bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) We are not participating, as a Bidder or as a subcontractor, in more than one Bid in this bidding process in accordance with ITB 4.2€; and

(g) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud or corruption.

Name of the Bidder1 [*insert name of the Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder2 [*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*]

Notes for the Bidders

1. In the case of a Bid submitted by a Joint Venture, specify the name of the Joint Venture as Bidder.
2. Person signing the Bid shall have the Power of Attorney given by the Bidder to be included in the Technical Bid.

<Option A: Two-Envelope Bidding>

[*Prepare this Letter of Technical Bid on stationery with its letterhead clearly showing the Bidder's complete name and business address.*]

Letter of Price Bid

Date	: [*insert date of Bid submission*]
IFB No.	: [*insert Invitation for Bid number*]
Project	: [*insert name of Project*]
Contract	: [*insert name of Contract*]

To: [*insert full name of Employer*]

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Document, including addenda issued in accordance with Instructions to Bidders (ITB) 8. [*insert the number and issuing date of each addendum*];

(b) We offer to execute in conformity with the Bidding Document and Technical Bid the following Works: [*insert a brief description of the Works*];

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

[*In case of only one lot, insert the total Bid Price in words and figures, indicating the amounts in the respective currencies.*]

[*In case of multiple lots, insert:*

(i) the total price of each lot; and

(ii) the sum of the total prices of all lots];

indicating the amounts in the respective currencies.];

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

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

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

(e) Our Bid shall be valid for a period of [specify the number of calendar days] days from the date fixed for the Bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) If our Bid is accepted, we commit to obtain a Performance Security in accordance with the Bidding Document;

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

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

Name of the Bidder1 [*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*]

Notes for the Bidders

1. In the case of a Bid submitted by a Joint Venture, specify the name of the Joint Venture as Bidder.

Schedule of Adjustment Data

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Table A. Local Currency

(i)	(ii)	(iii)	(iv)		(v)	(vi)
Index Code	**Index Description**	**Source of Index**	**Base Cost Index3**		**Total Amount1 (Each Index)**	**Bidder's proposed weighting2**
			Value	**Date**		
-	Non-adjustable	—	—	—		a: 0.20
M_1	Wholesale Price Index for Cement.	Office of Economic Adviser, MOC & I , Govt. of India				b: 0.10 to 0.25
M_2	Wholesale Price Index for Mild Steel.	-do-				c: 0.15 to 0.30
M_3	Wholesale Price Index for Fuel (HSD).	-do-				d: 0.15 to 0.45
L	Consumer Price Index for Industrial workers.	Labour Bureau ,MoL&E,Govt. of India				e: 0.075 to 0.20
		Total				**1.00**

Notes for the Bidders

1. The Bidder shall fill in column (v), the Total Amount of each index component (i.e.: labour, material, equipment, etc as stated in column (ii)) quoted in the local currency.

   The Total Amount of the relevant "*Non-adjustable*" component shall also be indicated in the corresponding cell.

2. The Bidder shall specify a value within the ranges given by the Employer in 'b', 'c', 'd' and 'e' of column (vi), so that the total weighting equals 1.00.

3. The Values and the Dates of the Base Cost Index(ices) will be provided by the Employer prior to contract signing.

Bill of Quantities

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the General and Particular Conditions of Contract, Specification, 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 payment shall be made based on the actual quantities of the work executed in accordance with the Contract.
3. The rates and prices in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all costs for construction plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.
4. A rate or price shall be entered against each item in the Bill of Quantities, irrespective of whether quantities are stated or not. Items against which no rate or price is entered in the priced Bill of Quantities shall be deemed to be covered by the rates or prices entered for other items therein, and will not be paid for separately.
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 included in the rates or prices entered for the related items of work.
6. General requirements, directions and/or descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. Relevant sections of the Contract documents shall be referred 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-Clause 13.5 or Sub-Clause 13.6 of the General Conditions of Contract, as applicable. Notwithstanding the above, the Provisional Sum for the cost of the DB shall require no prior instruction of the Engineer.
8. No Contractor's overhead charges or profit shall be included or payable on the Provisional Sum for the cost of the DB.
9. The method of measurement of completed work for payment shall be in accordance with [IS 1200 (relevant parts) and SP 27 : 1987]
10. Any unit rates and/or prices quoted in the Bill of Quantities in:

(a) [Indian Rupees] there shall be [two] decimal places below zero.

Any price(s) resulting from computations (such as unit price multiplied by quantity) shall be rounded down to the nearest decimal place(s) as indicated for each relevant currency above.

11. Where there are any items of work provided in the Bills of Quantities for complying with requirements of sub-clauses 6.1 through 6.24 of the General Conditions of Contract, payment for such items are made only by monthly instalments upon the Contractor's compliance with all contract requirement with respect of that item, for each month, to the satisfaction of the Engineer.

B. Work Items

1. The Bill of Quantities contains the following part Bills, Schedules and the Summary:

General Items & Civil Works :

Bill No. 1 - General Items

Bill No. 2 – Nongmahir Dyke and Reservoir

Bill No. 3 – Barbed Wire Fencing around dykes

Bill No. 4 – Construction of V- notch

Etc.

Bill No. 35 Land Reclamation

Bill No. 37 – Provision of Automatic Rain Gauge , Monitoring Instruments , etc.

Daywork Schedule

Hydromechanical Works :

Bill No. 1 – Schedule of unit rates for repair and renovation of fixed wheel vertical lift Intake Gate (Face – III) and replacement of trash rack.

Bill No. 2 - Schedule of unit rates for repair and renovation of fixed wheel vertical lift Draft Tube Gates

Bill No. 3 - Schedule of unit rates for repair and renovation of fixed wheel vertical lift PRV Gates

Schedule of Specified Provisional Sums; and Grand Summary.

2. The Bill of Quantities shall be priced in the currency(ies) specified below.

(a) Indian Rupees INR(Indian Rupees)

Bill No. 1: General Items

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
101	Security of the Site.	month	24		
102	Health and Safety management.	month	24		
103	Environmental Protection.	month	24		
104	Establishment and removal of Facilities for Contractor's Personnel.	lumpsum	lumpsum		
105	Maintenance of Facilities for Contractor's Personnel.	month	24		
106	Establishment and Removal of office for use of Engineer - in - charge	No.	1		
107	Maintenance of office for use of the Engineer– in - charge	month	24		
108	Establishment and removal of access road.	lumpsum	lumpsum		
109	Maintenance of access roads.	month	24		
110	Inauguration of renovated Power Station	lumpsum	lumpsum		
111	-etc.-				
Total for Bill No. 1 (carried forward to Grand Summary, p._____)					

Bill No. 2: Nongmahir Dykes and Reservoir

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Spillway:				
201	Demolishing cement concrete including disposal of material within 50m lead as per direction of Engineer-in-charge	m^3	18		
202	Providing and laying in position machine batched and machine mixed design mix M-30grade cement concrete for RCC work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, but including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge	m^3	18		
	Dykes (Main Dyke, Dyke-1 to Dyke-5)				
203	Providing and laying dry rubble flooring complete as per drawing and specifications.	m^3	275		
204	Labour for stone pitching with scattered one man size boulders not less than 25cm x 25cm x 30cm including filling the interstices with spolis and carriage of stones complete as directed.	m^3	785		

Total for Bill No. 2 (carried forward to Grand Summary, p.....)	

Bill No. 3: Barbed wire fencing with RCC post along the Periphery of the Dykes covering upstream and downstream with MS Gate for security purposes

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
301	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classificationof soils. a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	m^3	78		
302	Earthwork in filling (excluding rock) in trenches, plinth, sides of foundation, etc in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering. i) With available excavated earth	m^3	10		
303	Providing, laying, spreading and compacting local material in block or large discrete particles, such as Kankar, Laterite, Dhandla, etc. below footings for levelling course.	m^3	2		
304	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed and specified including	m^3	15		

	dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). b) 1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)				
305	Supplying, fitting and fixing in position reinforcement bars up to3 m lift , conforming to relevant I.S. Code for R.C.C. work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) b).High Yield Strength Deformed bars or Tor Bars	Quintal	62		
306	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer- in-charge for foundations, footings, bases of columns, etc. for mass concrete (using steel).	m^2	17		
307	Centering and shuttering includlng struttlng, propplng etc. and removal of form for all heights complete and as directed by Engineer- in-charge. For Columns, Pillars, Piers, Abutments, Posts and struts (using steel).	m^2	785		
308	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centerjng, shuttering, finishing and reinforcement- All works up to	m^3	80		

	plinth level. a) M15 or Prop.1 :2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size)				
309	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centerjng, shuttering, finishing and reinforcement- All works upto plinth level. M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stoneaggregate 20 mm nominal size)	m^3	62		
310	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, fillets, columns, pillars, posts and struts etc. above plinth level up to 3 m lift , excluding cost of centering, shuttering, finishing and reinforcement. M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stone aggregate 20 mm nominal size)	m^3	4		
311	Steel work welded in built up sections/framed work including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel, etc. as required. b) ln gratings, frames, guard bar, ladder, railings, brackets, gates and similar works.	kg	627		
312	Applying priming coat with ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanized iron/ steel works	m^2	21		
313	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade: New work (two or more coats) over and including	m^2	33		

	water thinnable priming coat with cement primer				
314	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete on steel work	m^2	21		
315	Fencing with RCC post placed at required distance, embedded in cement concrete blocks, every 15th post, last but one end post and corner post shall be strutted on both sides and end post one side only, provided with horizontal lines and two diagonals of barbed wire between the two posts fitted and fixed with G.I. staples on wooden plugs or G.I. binding wire tied to 6 mm bar nibs fixed while casting the post (cost of R.C.C. posts, struts, earth work and concrete to be paid for separately):- Payment to be made per metre cost of total length of barbed wire used.	m	22100		
316	15 mm cement plaster on rough side of single or half brick wall of mix: a) 1 :4 (1 cement: 4 coarse sand)	m^2	800		
317	White washing with lime to give an even shade: a) New work (three or more coats)	m^2	770		
Total for Bill No. 3 (carried forward to Grand Summary, p.……)					

Bill No. 4: Construction of V notch at the toe of Main Dyke including steps and footpath for approach.

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
401	Earthwork in excavation for structures as per drawing and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto a lead of 50 m dressing of sides and bottom and backfilling in trenches with excavated suitable material. A. Ordinary soil i) Upto 3m depth without dewatering	m^3	570		
402	Providing laying, spreading and compacting local material in block or large discrete particles, such as Kankar, Laterite, Dhandla, etc. to water bound macadam specifications including spreading in uniform thickness, hand packing, rolling with three wheeled 80-100 kN static roller in stages to proper grade and camber, applying and brooming requisite type of screening/binding materials to fill up the interstices of laid material, watering and compacting to the required density as per Technical Specifications .	m^3	330		
403	Providing concrete for plain cement concrete in open foundations complete as per drawing and Technical	m^3	168		

	Specifications : P.C.C. grade M15 Nominal Mix 1:3:6				
404	Stone masonry work in cement mortar in foundation complete as per drawing and Technical Specifications: Coursed rubble masonry (1st sort) in cement mortar 1:6	m^3	378		
405	Providing and laying reinforced cement concrete complete **including** centering and shuttering but excluding reinforcement as per drawings and Technical Specifications : R.C.C. grade M20 (1 : 2 : 4 Nominal Mix)	m^3	5		
406	Providing 12 mm thick cement plastering in cement mortar 1 : 2, 1 : 3 and 1 : 4 including cleaning the surface, curing and cariage of all materials complete as per Technical Specification. Proportion 1:3	m^2	495		
407	Providing and fixing G.I. pipes 50 mm diameter nominal bore complete with G.I. fittings and clamps, cutting and making good the walls etc.	m	5		
Total for Bill No. 4 (carried forward to Grand Summary, p.....)					

Bill No.5: Surge shaft

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Providing barbed wire fencing with RCC post along the Periphery of Surge shaft including providing MS grill gate for security purposes :				
501	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	m^3	12		
502	Earthwork in filling (excluding rock) in trenches, plinth, sides of foundation etc in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering . With available excavated earth.	m^3	4		
503	Providing laying, spreading and compacting local material in block or large discrete particles, such as Kankar, Laterite, Dhandla, etc. below footings for levelling course.	m^3	1		
504	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed	m^3	2		

	and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). b) 1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size).				
505	Supplying, fitting and fixing in position reinforcement bars up to lst floor level, conforming to relevant I.S. Code for RCC work/ a.a. walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) a) With High Yield Strength Deformed bars or Tor steel	Quintal	6		
506	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge. Foundations, footings, bases of columns, etc. (using steel).	m^2	5		
507	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge. For Columns, Pillars, Piers, Abutments, Posts and struts (using steel).	m^2	68		
508	Providing and laying in position specified grade of reinforced cement concrete,	m^3	6		

	excluding the cost of centering, shuttering, finishing and reinforcement- All work up to plinth level. a) M15 or Prop.1 :2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size)				
509	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement- All work up to plinth level. M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stone aggregate 20 mm nominal size)	m^3	2		
510	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, fillets, columns, pillars, posts and struts etc. above plinth level up to first floor level, excluding cost of centering, shuttering, finishing and reinforcement. M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stone aggregate 20 mm nominal size)	m^3	1		
511	Steel work welded in built up sections/framed work including cutting, hoisting, fixing in position and applying a priming coat Of approved steel primer using structural steel ,etc. as required. b) ln gratings, frames, guard bar, ladder, railings, brackets, gates and similar works.	kg	156		
512	Applying priming coat: With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	m^2	9		

513	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade: New work (two or more coats) over and including water thinnable priming coat with cement primer	m^2	9		
514	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete. On steel work.	m^2	9		
515	Fencing with RCC post placed at required distance, embedded in cement concrete blocks, every 15th post, last but one end post and corner post shall be strutted on both sides and end post one side only, provided with horizontal lines and two diagonals of barbed wire between the two posts fitted and fixed with G.I. staples on wooden plugs or G.I. binding wire tied to 6 mm bar nibs fixed while casting the post (cost Of R.C.C. posts, struts, earth work and concrete to be paid for separately):- Payment to be made per metre cost of total length of barbed wire used.	m	1724		
516	15 mm cement plaster on rough side of single or half brick wall of mix: a 1 :4 (1 cement: 4 coarse sand)	m^2	69		
517	White washing with lime to give an even shade: a New work (three or more coats)	m^2	60		
Total for Bill No. 5 (carried forward to Grand Summary, p.)					

Bill No.6: Link & Head Race Tunnels

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Bunds in front of LinkTunnel and HRT Intakes & Link Tunnel Exit :				
601	Earth work in filling with riverbed material or locally available materials in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer and watering with carriage upto 5 km				
	b) With burrowed earth carriage upto 5 Km	m^3	1500		
	M20 PCC 30 cm thick on Upstream face of bunds :				
602	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge. For Columns, Pillars, Piers, Abutments, Posts and struts, walls , etc. (using steel).	m^2	400		
603	Providing and laying M20 Plain Cement Concrete 30 cm thick in retaining walls, etc. and all works above plinth level, excluding the cost of centering and shuttering but including carriage of cement , aggregates and other materials upto the work site. .	m^3	200		

	Removal of bund after completion of works :				
604	Dismantling of bund by mechanical means including removal of debris and its disposal into a designated dumping area upto 4 km lead. i) Concrete ii) Soil	 m^3 m^3	 200 1500		
605	Cleaning of debris/silt from inside the Link Tunnel (including installation of ventilation system in the tunnel) and from its exit at the Nongmahir Forebay by mechanical means and disposal of the debris/silt into a designated dumping area upto 4 km lead.	m^3	15000		
606	Dewatering inside and outside of Link and Head Race Tunnels to keep the working area dry.	hp - hour	75000		
	Repair Works of Conduit Channel with M20 concrete :				
607	Providing and laying M20 cement concrete with 20 mm nominal size coarse aggregates in retaining walls, etc. and all works above plinth level, excluding the cost of centering and shuttering but including carriage of cement , aggregates and other materials upto the work site.	m^3	50		
	Repair work in Tunnels (including installation of ventilating system) :				
608	Dsmantling of badly deteriorated concrete lining in tunnel	m^3	1500		

609	Drilling holes for Grouting (38 mm diameter holes)	m	11600		
610	Cement for Grouting including sand , admixtures ,etc. complete.	MT	1160		
	Repair works in tunnels with M25 Concreting :				
611	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping Of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, but including admixtures in recommended proportions as per ls: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge including carriage of cement , aggregates and other materials upto the work site.	m^3	3500		
612	Supplying, fitting and fixing in position reinforcement bars in tunnels conforming to relevant I.S. Code for RCC work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates				

	inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) i)Thermo – Mechanically Treated bars	Quintal	750		
613	Centering and shuttering for curved surfaces in tunnels including strutting, propping, etc. and removal of form for all heights complete and as directed by Engineer- in-charge. For tunnel lining (using steel shuttering).	m^2	12000		
Total for Bill No. 6 (carried forward to Grand Summary, p.					

Bill No. 7: Penstock

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Internal & surface re-coating of the penstock, reparing the expansion joint packing, rehabilitation of the existing drain pipe and valve :				
701	Painting 2 (two) coats with coal tar epoxy anticorrosive paint to internal and external surfaces of penstock inclusive of 2 (two) coats of zinc rich primer with epoxy resin to give an even shade by using Electric Paint Sprayer Gun machine and cleaning the surface area of all dirt, dust, oil, grease and other foreign matter by using Electric Hand Grinder machine fitted with knotted wire cup	m^2	13000		

	brush, sand papers, etc. including necessary scaffolding complete. **N.B :** This bid item includes the following: a) Erection of temporary scaffolding or staging necessary for penstock access b) Installation of temporary fugitive dust and debris control measures c) Removal of existing external and internal penstock coatings and surface corrosion down to bare metal. d) Application of new surface coatings to penstock e) Subsequent removal of temporary scaffolding , debris and dust control measures once the work on the penstock is complete f) Proper disposal of waste products and debris from the penstock surface preparation and recoating process.				
702	Repairing/Opening of expansion joints of Penstock pipe and taking out of all damaged flux packing, fixing of new packing after opening the nuts and bolts, some rusted and jammed nut-bolts are to be cut with gas cutter/welding machine etc and replacing if required and tightening the nuts and bolts in proper way to stop the water leakage	No.	8		

	through expansion joints. Scaffolding of penstock pipes near expansion joint to be provided by the firm/contractor for execution of work and are to be dismantled after completion of work. Consumable items such as welding/gas, electrodes, grease etc are to be provided by the contractor/firm and work should be completed within stipulated time including assembling, testing and commissioning complete as directed .				
	Supply of Non Metallic Black Lubricated Asbestos Graphite Gland Packing.(25mm-35mm) inccluding transportion upto penstock site :				
703	25mm	kg	150		
704	28mm	kg	150		
	Repairing of Stage - III Penstock drain valve of Unit-I (left & right side):				
	Supplying, fitting, fixing ISI marked gun metal full way wheel valve (superior quality) including jointing materials and carriage of materials complete as directed.				

705	150mm	No.	2		
706	100mm	No.	2		
707	Supply of nuts and bolts Length - 300mm Diameter - 25mm.	No.	230		
	Penstock Valve House :				
708	Dismantling of RCC roof and walls of Penstock Valve House to facilitate removal of old valves including removal of spoils/debris upto a lead of 1 (one) km	cu m	70		
709	Recasting of RCC roof slab and walls with M25 grade concrete after installation of new valves including concreting of servo motor foundations of valves.	cu m	75		
710	Providing steel reinforcement with HYSD bars grade Fe 415/500 including cutting , bending ,laying in position , tying with steel wire , etc. complete	kg	2000		
711	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge (using steel shuttering)	sq m	500		
Total for Bill No. 7 (Carried forward to Grand Summary, p					

Bill No. 8 : REPAIRING OF MASONARY DRAIN ALONG THE PENSTOCK

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
801	Clearance of landslips including removal of spoils to the proper grade and level up to 30 m lead including cleaning of road side drains to the original depth and cleaning the side berms to the proper level and grade complete as per direction of the Engineer.	m^3	162		
802	Earth/ Sand filling in layers not exceeding 150mm thick with available excavated earth including breaking clods, consolidating each layer by ramming and watering with all lead and lifts.	m^3	118		
803	Disposal of surplus earth from the work site including loading and unloading complete as directed and lead upto 5 km.	m^3	140		

804	Earthwork in excavation up to a depth of 2m below the existing ground level for foundation trenches including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. (a) In ordinary soil	m^3	105		
805	Providing Stone soling of thickness 100mm in foundation and under floor, sand packed and laid to level and in panels after preparing the sub grade as directed including all labour and materials and ,if necessary, dewatering, complete.	m^3	555		
806	Plain cement concrete works with coarse aggregate of sizes 20mm to 40 mm in foundation bed for footing steps, walls, etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). (a) In prop. 1:3: 6 (1 cement:3 coarse sand : 6 coarse agregate by	m^3	48		

	volume (using mixture machine)				
807	Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortaring prop1:6 with levelling course of 1:6:12 with unsized stone both faces hammer dressed including bonding, providing face stone, through stone and centering including raking of joints, curing and supplying and all carriage of stone as directed. a) Random Rubble Masonry (i) In Sub-structure upto 3 m lift .	m^3	585		
808	Supplying, fitting and fixing in position reinforcement bars upto 1st floor level, conforming to relevant I.S. Code for R.C.C. work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no	Quintal	5		

	measurements for the same is required) (ii) Super Ductile (SD) TMT reinforcement bars				
809	Providing form work of ordinary timber planking of thickness not less than 25mm and removal of the same for concrete member so as to give a rough finish including centering ,shuttering , strutting and propping etc, for height of propping and centering of support floor to the soffit of the concrete member not exceeding 4 m as directed.	sq m	97		
810	Providing and laying concrete in reinforced cement concrete works using concrete mixture machine with coarse sand and 20mm down graded stone aggregate including dewatering if necessary and curing complete but excluding cost of form works and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) i) In Foundation and sub - structure a) M15 or Prop. 1:2:4 (for non-structural works)	m^3	35		

811	15 mm thick Cement plaster in single coat on rough side of wall for interior plastering up to 3 m lift and finished even and smooth including curing complete as directed. a) In cement mortar 1:3	m^2	330		
Total for Bill No. 8 (Carried forward to Grand Summary, p					

Bill No. 9: REPAIRING OF STONE MASONARY OUTLET DRAIN FROM PENSTOCK SITE UPTO STAGE III POWERHOUSE TAILRACE

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
901	Demolishing stone rubble masonry including stacking of serviceable materials and disposal of unserviceable materials as directed for all levels	m^3	13		
902	Earthwork in excavation up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. (a) In ordinary soil	m^3	5		
903	Providing soling in foundation and under floor with stone/best quality picked jhama brick, sand packed and laid to level and in panel after preparing the sub grade as directed including all labour and materials and if	m^2	86		

	necessary dewatering, complete. a)Stone soling of thickness 100mm				
904	Plain cement concrete works with coarse aggregate of sizes 20 mm to 40 mm in foundation bed for footing steps, walls, etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). (a) In prop. 1:3: 6 (1 cement:3 coarse sand : 6 coarse agg. by volume (using mixture machine)	m^3	10		
905	Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortar in prop1:6 with levelling course of 1:6:12 with unsized stone/boulders both faces hammer dressed including bonding, providing face stone, through stone and centering including raking of joints, curing and supplying and all carriage of stone as directed. a) Random Rubble Masonry (i) In Sub-structure up to Plinth Level	m^3	16		
906	15 mm thick cement plaster in single coat on	m^2	201		

	rough side of wall for interior plastering upto 3 m lift and finished even and smooth including curing complete as directed. a) In cement mortar 1:3				
Total for Bill No. 9 (Carried forward to Grand Summary, p					

Bill No. 10: FENCING ALONG PENSTOCK INCLUDING PROVIDING M/S GRILL GATE

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1001	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. a)All kinds of soil (ordinary soil/ hard soil/ dense soil)	m^3	18		
1002	Providing, laying, spreading and compacting local material in block or large discrete particles, such as Kankar, Laterite, Dhandla, etc. to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with three wheel 80-100 kN static roller in stages to proper grade	m^2	0.55		

	and camber, applying and brooming requisite type of screening/binding materials to fill up the interstices of laid material watering and compacting to the required density.				
1003	Earthwork in filling in trenches, plinth, sides of foundation etc in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering. With available excavated earth	m^3	4		
1004	Plain cement concrete works in foundation bed for footing steps, walls, etc. below plinth level as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). b)Proportion 1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)	m^3	3		
1005	Supplying, fitting and fixing in position reinforcement bars up to 3 m lift , conforming to relevant I.S. Code forRCC work including straightening, cleaning, cutting and bending to proper shapes and length as per	Quintal	12		

	details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) b).High Yield Strength Deformed bars or Tor Bars				
1006	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer- in-charge. i) Foundations, footings, bases of columns, etc (using steel). ii) Columns, Pillars, Piers, Abutments, Posts and struts (using steel)	m^2 m^2	5 148		
1007	**Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centerjng, shuttering, finishing and reinforcement- All work up to plinth level:**				
	a) M15 or Prop.1 :2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size)	m^3	15		

	b) M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stone aggregate 20 mm nominal size) in Footing & Columns	m^3	2		
	c) M20 or 1:11/2:3 (1 cement: 11/2 coarse sand: 3 graded stone aggregate 20 mm nominal size) in in walls (any thickness), including attached pilasters, buttresses, fillets, columns, pillars, posts and struts etc. above plinth level up to first floor level, excluding cost of centering, shuttering, finishing and reinforcement:	m^3	1		
1008	Steel work welded in built up sections/framed work including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel ,etc. as required. i) ln gratings, frames, guard bars, ladder, railings, brackets, gates and similar works.	kg	156		
1009	Fencing with RCC post placed at required distance, embedded in cement concrete blocks, every 15th post, last but one end post and corner post shall be strutted on both sides and end post one side only, provided	m	4087		

	with horizontal lines and two diagonals of barbed wire weighing 9.38 kg per 100 m (minimum), between the two posts fitted and fixed with G.I. staples on wooden plugs or G.I. binding wire tied to 6 mm bar nibs fixed while casting the post (cost of RCC posts, struts, earth work and concrete to be paid for separately):- Payment to be made per metre cost of total length of barbed wire used.				
1010	15 mm cement plaster on rough side of wall of mix 1 :4 (1 cement: 4 sand)	m^2	151		
1011	White washing with lime to give an even shade to new work (three or more coats)	m^2	142		
1012	Applying priming coat with ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	m^2	9		
1013	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade: New work (two or more coats) over and including water thinnable priming coat with cement primer	m^2	9		
1014	Finishing with Epoxy paint (two or more coats)	m^2	9		

	at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete. On steel work				
Total for Bill No. 10 (Carried forward to Grand Summary, p					

Bill No. 11 Repairing of Security Barrack at Umiam-Umtru Stage-III Penstock Site, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1101	Dismantling doors, windows and clerestorey windows (steel or wood) shutter including chowkhats, architrave, hold fasts, etc. complete and stacking within 50 metres lead: a)Of area 3 sqm and below	No.	12		
1102	Dismantling roofing including ridges, hips, valleys and gutters etc., and stacking the material within 50 metres lead : a) G S Sheet	m^2	17		
1103	Brick work in cement mortar with first class brick in superstructure above plinth level up to first floor level in all shapes and sizes : a)Cement mortar 1 :4 (1 cement: 4 coarse sand)	m^2	81		
1104	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc,, including cutting, hoisting, fixing in position and applying a	Kg	795		

	priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete.				
1105	Providing wood work in frames of false ceiling, partitions, etc. sawn and fixed in position with necessary stainless steel screws, etc. i) With lst class Local wood (Pooma/ Hollock/ Gamari and the like)	m^3	0.5		
1106	Providing wood work in frames of doors, windows, clerestorey windows and other frames and fixing in position with hold fast, lugs or with dash fasteners of required diameter & length. i)With lst class Local wood (Pooma/ Hollock/ Gamari and the like)	m^3	0.25		
1107	Providing, fitting and fixing steel windows (including ventilators) of standard rolled steel sections as per relevant I.S. Code, joints mitred and welded with 15x3xl00 mm lugs embedded in cement concrete block of M-10 grade including providing and fixing of projecting hinges (not more than 65 mm and not less than 15 mm wide) bolting device, steel handles, pegs, stays	m^2	5		

	of 300 mm long etc. complete including providing 12xl2 mm square bars duly welded to steel frame at not more than 12 cm c/c, applying a priming coat of red-lead paint, etc. complete as per drawing. a) Openable				
1108	Providing and fixing M.S. grills of required pattern in frames of windows, etc. with M.S. flats, square or round bars, etc. including priming coat with approved steel primer all complete. a) Fixed to steel windows by welding.	m^2	5		
1109	Providing corrugated G.S or galvanised iron sheet roofing including vertical/ curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and Al limpet washers or with G.I limpet washers filled with white lead, including a coat of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.	m^2	44		

	i) 0.63 mm thick with zinc coating not less than 275 gm/sqm				
1110	Providing and fixing 15 cm wide, 45 cm overall semi-circular plain G.S. sheet gutter with iron brackets 40x3 mm size, bolts, nuts and washers, etc., including making necessary connections with rain water pipes complete. a) 0.80 mm thick with zinc coating not less than 275	m	9		
1111	Providing 10 mm thick plaster of Paris (gypsum anhydrous) ceiling up to a height of 5 m above floor level, over first class wood strips 25x6 mm with 10 mm gap in between and reinforced with rabbit wire mesh fixed to wooden frame (frame work to be paid separately): a)Flat surfaces	m^2	63		
1112	12 mm cement plaster of mix 1:4 (1 cement: 4 fine sand)	m^2	210		
1113	Extra for plastering exterior walls of height more than 10 m from ground level for every additional height of 3 m or part thereof.	m^2	60		
1114	Providing and fixing panelled or panelled and glazed shutters for doors, windows and clerestorey	m^2	10		

	windows , fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:- Butt hinges and necessary screws shall be paid separately) a) With Teak wood/ Sissu wood. (i) 35 mm thick shutters				
1115	Applying one coat of water thinnable cement primer of approved brand and manufacture on surfaces:	m^2	215		
1116	Applying priming coat with ready mixed pink or Grey primer of approved brand and manufacture on wood work (hard and soft wood)/ with ready mixed aluminium primer of approved brand and manufacture on resinous wood and plywood	m^2	36		
1117	Applying priming coat with ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	m^2	4		
1118	Finishing walls with water proofing cement paint of required shade: a) New work (two or more coats applied @ 3. 84 kg/10 sqm)	m^2	215		

1119	Finishing with Deluxe multi surface paint system for interiors and exteriors using Primer as per manufacturer's specifications, including scaffolding: i) Painting wood work with Deluxe Multi Surface Paint of required shade. Two or more coats applied @ 0.90 ltr/10 sqm over an under coat of primer applied @ 0.75 Itr/10 sqm of approved brand and manufacture	m^2	36		
1120	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturers specifications, including scaffolding: i) Painting Steel work with Deluxe Multi Surface Paint to give an even shade. Two or more coat applied @ 0.90 ltr/10 sqm over an under coat of primer applied @ 0.80 ltr/10 sqm of approved brand and manufacture	m^2	4		
1121	Providing & fixing glass panes with putty and glazing clips in steel doors, windows, clerestory windows, all complete with a) 4.0 mm thick glass panes	m^2	5		

Total for Bill No. 11 (carried forward to Grand Summary, p	

Bill No. 12: Repair of Security Barrack's Toilet at Umiam-Umtru Stage-III Penstock Site , Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1201	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	m^3	0.76		
1202	Coursed rubble masonry (first sort) with hard stone in foundation and plinth with: a) Cement mortar 1 :6 (1 cement: 6 coarse sand)	m^3	0.76		
1203	Earthwork in filling (excluding rock) in	m^3	0.20		

	trenches, plinth, sides of foundation, etc. in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering. a) With available excavated earth				
1204	Providing soling with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete.	m^2	0.58		
1205	65 mm thick cement concrete flooring with concrete hardener topping, under layer 50 mm thick cement concrete 1 :2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) and top layer 15 mm thick cement hardener consisting of mix 1 :2 (1 cement hardener mix: 2 graded stone aggregate, 6 mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacture's specifications. This includes cost of cement slurry, complete.	m^2	0.58		
1206	Brick work in cement mortar with first class	m^2	7.57		

	brick in superstructure above plinth level up to first floor level in all shapes and sizes: a Cemem mortar 1 :4 (1 cement: 4 coarse sand)				
1207	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc,, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete.	Kg	48.51		
1208	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought trained and fixed in position with hold fast lugs or with dash fasteners of required diameter & length. i) With lst class Local wood Pooma/ Hollock/ Gamari and the like	m^3	0.05		
1209	Providing and fixing panelled or panelled and glazed shutters for doors, windows and clerestory windows fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge.	m^3	1.08		

	(Note:- Butt hinges and necessary screws shall be paid separately) a) With Teak wood/ Sissu wood. (i) 35 mm thick shutters				
1210	Providing corrugated G.S or galvanised iron sheet roofing including vertical/ curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and Al limpet washers or with G.I. limpet washers filled with white lead, including a coat Of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost Of purlins, rafters and trusses and including cutting to size and shape wherever required. i) 0.63 mm thick with zinc coating not less than 275 gin/sqm	m^2	2.56		
1211	12 mm cement plaster of mix: 1 :4 (1 cement: 4 fine sand)	m^2	17.48		
1212	Extra for plastering exterior walls of height more than 10 in from ground level for every additional height of 3 m or part thereof.	m^2	9.91		

1213	Applying one coat of water thinnable cement primer of approved brand and manufacture on surfaces:	m^2	17.48		
1214	Finishing walls with water proofing cement paint of required shade: a) New work (two or more coats applied @ 3,84 kg/10 sqm)	m^2	17.48		
1215	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturers specifications, including scaffolding: i) Painting wood work with Deluxe Multi Surface Paint of required shade. Two or more coats applied @ 0.90 ltr/10 sqm over an under coat of primer applied @ 0.75 Itr/10 sqm of approved brand and manufacture	m^2	1.08		
1216	Providing & fixing white vitreous china water closet squatting pan (Indian type) along with "S" or "P" trap including dismantling of old WC seat and "S" or "P" trap at site complete with all operations including all necessary materiais, labour and disposal of dismantled material , all complete as per the direction of Engineer-in charge. Orissa pattern	No.	1		

	W.C pan of size 580x440 mm (a) White				
1217	**Providng and fixing soil, waste and vent pipes :**				
	a) 100mm diameter. i) Sand cast iron S&S pipe as per IS: 1729.	m	20.00		
	(b) 75mm dia i) Sand cast iron S&S pipe as per IS: 1729.	m	3.00		
1218	Providing and fixing bend of required degree with access door, insertion rubber washer 3mm thick, bolts and nuts complete with sand cast iron S&S as per IS:1729:				
	a) 100mm dia.	No.	3		
	b) 75mm dia.	No.	1		
Total for Bill No. 12 (Carried forward to Grand Summary, p					

Bill No. 13: Rewiring of Security Barrack, at Umiam-Umtru Stage-III Penstock Site, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1301	Providing , supplying including carriage testing of the following sizes Allumiumn armoured underground cable and all over PVC selected as per ISI mark of 1100volt grade a) 4 x 6mm2	m	13		
1302	Drawing of 3 Phase main line 4 wire with DGSD approved VIR or PVC cable 660 volt grade in casing capping with all accessories. i) With 4 x 4mm2 Copper Conductor	m	10		
1303	Drawing of Main and Sub Main Line with DGSD approved VIR or PVC 250/440 volt grade in PVC casing capping complete with all accessories. a) With 2 X 2.5 sqmm conductor i) With Copper conductor	m	28		
1304	Wiring in looping system with Copper PVC cable 250/440 volt grade of size 1.5 sq mm of approved quality using PVC casing capping				

	including 5 ampere switch best quality.				
	b) Short point wiring upto 3 m. i) With Copper conductor	No.	7		
1305	**Wiring as in Item No.1304 complete to a wall Light plug Point when fixed elsewhere:**				
	b) Short point wiring upto 3 mts. i) With Copper conductor	No.	4		
1306	Wiring as in Item No.1304 to a) wall Light Point :				
	b) Short point wiring upto 3 m. i) With Copper conductor	No.	9		
1307	Supplying with fittings & fixing complete 415V TPN IC Main Switch with neutral link. i) 63 Amp Capacity	No.	1		
1308	Supplying fitting and fixing of Single Opening Metal Enclosure Distribution MCB Distribution Box b) 4/6/8 Way	No.	1		
1309	Supplying & fixing of load Kontaket Miniature Circuit Breaker (MCBs). i) 6-32 Amp SP MCB Capacity.	No.	3		
1310	Supplying fitting and fixing of load Kontaket Miniature Circuit Breaker Double Pole (Isolator)	No.	2		

	i) 32-125 Amp DP Isolator.				
1311	Supplying fitting and fixing 15 Amp FT Switches socket combined mounted on PVC board or concealed to the wall complete with all accessories.	No.	4		
1312	Supplying fitting & fixing earthing with GI pipe of 200cm length 40mm dia including all accessories & providing masonary enclosure with cover plate having locking arrangements etc with charcoal salt complete as required.	Set	1		
1313	Supplying fitting connection testing of 8-SWG wire along the wall colums etc with necessary clamping as required. B) With G.I Wire	m	4.2		
1314	Supplying and fitting of ceiling fan AC operated type 220/250 volt complete with 3 nos of blades, down rod canopy, hanging shackle & regulator complete with 30mm length down rod supplied with fan by the dealer but the extra length will be charged @ Rs.25.00/m (Bajaj/Orient) i) AC ceiling fan '1200'mm Sweep.	No.	3		

Total for Bill No. 13 (Carried forward to Grand Summary, p	

Bill No. 14: Renovation work of Power House Building

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1401	Removing existing white or colour wash on wall surfaces by steel wire brushing and/ or scraping, sand papering and preparing the surface smooth including necessary repairs to scratches complete.	sq m	5100		
1402	Applying priming coats with primer of approved brand and manufacture, having low Volatile Organic Compound (VOC) content. Old works.	sq m	5100		
1403	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturer's specifications, including scaffolding: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including	sq m	5100		

	one coat of Special primer applied @ 0.75 ltr/10 Sqm				
1404	Painting Steel work with Deluxe Multi Surface Paint to give an even shade. Two or more coat applied @ 0.90 ltr/10 sqm over an under coat of primer applied @ 0.80 ltr/10 sqm of approved brand and manufacture, including scaffolding	sq m	250		
1405	Flooring works , including chipping of old floor , providing new floor with tiles as approved by Engineer-in-charge	sq m	2014		
1406	Complete renovation of Sanitary Works in toilets, including supply of materials required for the toilets as approved by Engineer-in-charge	sum	sum		
1407	Repair of roof to avoid leakage of the power house	sq m	644		
1408	**Providing False Ceiling at Control Room of Power House:**				

	Providing and fixing tiled false ceiling of specified materials of size 595x595 mm in the horizontal level, suspended on interlocking metal grid of hot dipped galvanized steel sections (galvanized @ 120 grams/sqm, both sides inclusive) consisting of main "T" runner with suitably spaced joints to get required length and of dja. and 50 mm long dash fasteners, 4 mm Gl adjustable rods with galvanised butterfly level clips of size 85x30x0.8 mm spaced at 1200 mm centre to centre along main T, bottom exposed width of 24 mm of all T-sections shall be pre-painted with polyester paint, all complete for all heights as per specifications, drawings and as directed by size 24x38 mm made from 0.30 mm thick (minimum) sheet, spaced at 1200 mm centre to centre and cross 'T' of size 24x25 mm made of 0.30 mm thick (minimum) sheet,1200 mm long spaced between main "T" at 600 mm centre to centre to form a grid of 1200x600 mm and Secondary cross "T" of length 600 mm and size 24x25 mm made of	sq m	180			

	0.30 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grids of 600x600 mm and wall angle of size 24x24xO.3 mm and laying false ceiling tiles of approved texture in the grid including, required cutting/ making, opening for services like diffusers, grills, light fittings, fixtures, smoke detectors etc. Main "T" runners to be suspended from ceiling using Gl slotted cleats of size 27x37x25xl,6 mm fixed to ceiling with 12.5 mm thick square edge PVC Laminated Gypsum Tile of size 595x595 mm, made of Gypsum plasterboard, manufactured from natural gypsum as per IS:2095 Part I and laminated with white 0,16 mm thick fire retardant PVC film on the face side and 12 micron metalized polyester on the back side with all edges sealed with the face side PVC film which goes around and wraps the edges and is bonded to the edges and the back side metalized polyester film so as to make the tile a completely sealed unit.					

1409	Providing and fixing GI Clip in Metal Ceiling System of 600x600 mm module which includes providing and fixing 'C' wall angle of size 20x30x20 mm made of 0.5 mm thick pre painted steel along the perimeter of the room with help of nylon sleeves and wooden screws at 300 mm centre to centre, suspending the main C carrier of size 10x38xl0 mm made of G.I steel 0.7 mm thick from the soffit with help of soffit cleat 37x27x25xl.6 mm, rawl plugs of size 38xl2 mm and C carrier suspension clip and main carrier bracket at 1000 mm c/c. Inverted triangle shaped Spring Tee having height of 24 mm and width of 34 mm made Of Gl steel 0.45 mm thick is then fixed to the main C carrier and in direction perpendicular to it at 600 mm centres with the help of suspension brackets. Wherever the main C carrier and spring T have to join, C carrier and spring T connectors have to be used. All sections to be galvanized @ 120 gm/sqm (both sides inclusive), fixing with clip in tiles into spring T with: i) GI Metal Ceiling Clip jn plain Bevelled edge	sq m	180		

	global white colour tiles of size 600x600 and 0.5 mm thick with 25 mm height, made of G I sheet having galvanizing of 100 gins/sqm (both sides inclusive) and 20% perforation area with 1.8 mm dia. holes and having NBC of 0.5, electro statically polyester powder coated of thickness 60 microns (minimum), including factory painted after bending and perforation.				
1410	Providing and fixing thermal insulation of ceiling (under deck insulation) with Resin Bonded Flockwool conforming to IS:8183,density 48 kg/cum, 50 mm thick, wrapped in 200 G Virgin Polythene bags fixed to ceiling with metallic cleats (50x50x3 mm) @ 60 cm and wire mesh of 12.5 mm x 24 gauge wire mesh, for top most ceiling of building.	sq m	180		
1411	Supplying ,fitting and placing HYSD bar reinforcement (Fe 415) in superstructure complete as per drawing and Technical Specifications.	Quintal	20		
1412	Centering and shuttering including strutting, propping etc. and	sq m	100		

	removal of form for all heights complete and as directed by Engineer- in-charge. i) Foundations, footings, bases of columns, etc (using steel shuttering)				
1413	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centerjng, shuttering, finishing and reinforcement: i) M25 grade concrete.	cu m	50		
1414	Providing 15 mm thick cement plaster on rough side of wall of mix 1 :3 (1 cement: 3 sand) including cleaning the surface , curing , etc.	sq m	50		
1415	**Temporary bund at Tail Race :** Providing temporary bund at the tail race of the Power House with earth filling in layers not exceeding 20 cm thick including watering , consolidating and carriage upto 5 m lead. i) With burrowed earth	cu m	100		
1416	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge. For Columns, Pillars, Piers, Abutments, Posts and struts, walls , etc. (using steel)	sq. m	150		

1417	Providing and laying M20 Plain Cement Concrete 30 cm thick in retaining walls, etc. and all works above plinth level, excluding the cost of centering and shuttering but including carriage of cement , aggregates and other materials upto the work site. .	cu m	50		
1418	Dismantling of bund including 30 cm thick M20 concrete facing by mechanical means including removal of debris and its disposal into a designated dumping area upto 7 km lead. i) Soil	cu m	150		
1419	Providing structural steelwork to support the Service Bay slab from below with steel joists, channels /angles,etc. to lend support to the Service Bay slab during stator assembly.	MT	13		
1420	Conducting non-destructive tests for assessment of structural integrity of turbo-generator foundations in the power house.	lumpsum	lumpsum		
Total for Bill No. 14 (Carried forward to Grand Summary, p					

Bill No. 15: Renovation of the firefighting system

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1501	Supplying fitting and placing HYSD bar reinforcement (Fe 415) in superstructure complete as per drawing and Technical Specifications.	Quintal	15		
1502	Providing and laying reinforced cement concrete complete including centering and shuttering excluding reinforcement as per drawings and Technical Specifications.. i) R.C.C. grade M25 (1 : 1.5 : 3) Nominal Mix	m^3	32		
1503	Providing 12 mm thick cement plastering in cement mortar 1 : 3 including cleaning the surface, curing and carriage of all materials within 200 m complete as per Technical Specifications.	m^2	12		
Total for Bill No. 15 (Carried forward to Grand Summary, p					

Bill No. 16: CONSTRUCTION OF HOIST PLATFORM FOR OPERATION OF 15HP SUBMERSIBLE PUMP FOR PUMPING WATER TO PRIMING TANK FOR FIRE FIGHTING SYSTEM

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1601	Earth work in excavation by manual/ mechanical means (Hydraulic excavator) over areas (exceeding 30 cm in depth,1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, as directed by Engineer-in-charge.	m^3	1		
1602	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately).	m^3	1		
1603	Supplying, fitting and fixing in position reinforcement bars (Thermo-Mechanically Treated bars) up to lst floor level, conforming to relevant I.S. Code for R.C.C. work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying	kg	100		

	and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurementfor the same is required				
1604	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement- All work up to plinth level. M20 or 1:1.5:3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	m^3	1		
1605	1 :4 (1 cement: 4 coarse sand) Cement Plaster	m^2	1		
1606	Structural steel work rivetted / bolted and welded in built up sections, trusses and framework, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	kg	500		
1607	Steel work in built up Hot finished seamless type tubular (round, square or rectangular hollow tubes etc.) trusses etc,, including cutting, hoisting, fixing in position and applying a	kg	150		

	priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete.				
1608	Providing corrugated G.S or galvanised iron sheet roofing including vertical/ curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and a.I. limpet washers or with G.I. limpet washers filled with white lead, including a coat Of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost Of purlins, rafters and trusses and including cutting to size and shape wherever required. 0.80 mm thick(with zinc coating not less than 275 gin/sqm)	m^2	10		
1609	Providing and fixing hand rail of approved size by welding etc to steel ladder railing, balcony railing, stair case railing and similar works, including applying priming coat of approved steel primer. C. G.I pipes	kg	200		
1610	Painting with synthetic enamel paint of approved	m^2	18		

	brand and manufacture to give an even shade:				
Total for Bill No. 16 (Carried forward to Grand Summary, p					

Bill No. 17: CONSTRUCTION OF PANELLED-HOUSE FOR PUMPING WATER TO PRIMING TANK FOR FIRE FIGHTING SYSTEM

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	***Description***	***Unit***	***Quantity***	***Rate***	***Amount***
1701	Earth work in excavation by manual / mechanical means (Hydraulic excavator) over areas (exceeding 30 cm in depth,1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth , as directed by Engineer-in-charge :				
	a) Footpath	m^3	70		
	b) Column Foundation, Plinth wall	m^3	6		
1702	Providing soling with stone/ best quality picked jhama brick, sand packed and laid to	sq m.	47		

	level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete				
1703	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately): i)1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)	cum	1.52		
1704	Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement: 6 coarse sand: 12 graded stone aggregate 20 mm nominal size) up to plinth level with: i) Cement mortar 1 :6 (1 cement: 6 coarse sand)	cum	3		

1705	Supplying, fitting and fixing in position reinforcement bars upto 3 m lift , conforming to relevant I.S. Code forRCC work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required i) Thermo-Mechanically Treated bars	Quintal	1		
1706	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer- in- charge : i) Foundations, footings, bases of columns, etc. for mass concrete (using steel shuttering).	sq.m.	12		

1707	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centerjng, shuttering, finishing and reinforcement- All work upto plinth level: i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	cum	1.49		
1708	Earthwork in filling (excluding rock) in trenches, plinth, sides of foundation, etc. in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering. (a)With available excavated earth	cum	2		
1709	Brick work in cement mortar with first class brick in superstructure above plinth level up to first floor level in all shapes and sizes: Cement mortar 1 :4 (1 cement: 4 coarse sand)	cum	3.96		
1710	65 mm thick cement concrete flooring with concrete hardener topping, under layer 50 mm thick cement concrete 1 :2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) and top layer 15 mm thick cement hardener consisting of mix 1 :2 (1	sq.m.	11		

	cement hardener mix: 2 graded stone aggregate, 6 mm nominal size) by volume, hardening ompound mixed @ 2 litre per 50 kg of cement or as per manufacture's specifications. This includes cost of cement slurry, complete.				
1711	Cement plaster 1 :4 (1 cement: 4 coarse sand)	sq.m.	97		
1712	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc,, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. i) Hot finished seamless type tubes	kg	436		

1713	Providing corrugated G.S or galvanised iron sheet roofing including vertical/ curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and a.I. limpet washers or with G.I. limpet washers filled with white lead, including a coat of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required. i) 0.80 mm thick(with zinc coating not less than 275 gin/sqm	sq.m.	20		
1714	Providing ridges or hips of width 60 cm overall width plain G.S. sheet fixed with polymer coated J or L hooks, bolts and nuts 8 mm dia. G.I. limpet and bitumen washers complete. a) 0.80 mm think with zinc coating not less than 275 gin/sqm	m	5		
1715	Providing and fixing angle iron frames for doors, windows and ventilators of mild steel Angle sections of size 35x35x5 mm, joints mitred and welded by angle iron	kg	50		

	35x35x5 mm or 35x5 mm flat pieces to the existing T-iron frame or to the wall with dash fastener, including fixing Of necessary butt hinges and screws and applying a priming coat of approved steel primer, all complete as per the direction of Engineer-in-charge.				
1716	Providing, fitting and fixing steel windows (including ventilators) of standard rolled steel sections as per relevant I.S. Code, joints mitred and welded with 15x3xl00 mm lugs embedded in cement concrete block of M-10 grade incl ding providing and fixing of projecting hinges (not more than 65 mm and not less than 15 mm wide) bolting device, steel handles, pegs, stays of 300 mm long etc. complete including providing 12xl2 mm square bars duly welded to steel frame at not more than 12 cm c/c applying	sq.m.	3		
1717	Distempering with dry distemper of approved brand and manufacture (two or more coats) of required shade on new work, over and including water thinnable priming coat to give an even shade	sq.m.	67		
1718	Painting with synthetic enamel paint of approved	sq.m.	5		

	brand and manufacture to give an even shade:				
1719	Providing & fixing glass panes with putty and glazing clips in steel doors, windows, clerestory windows, all complete with 4.0 mm thick glass panes	sq.m.	3		
Total for Bill No. 17 (Carried forward to Grand Summary, p					

Bill No. 18: WIRING AT PANELLED HOUSE INCLUDING PUMP HOUSE AT STAGE III POWERHOUSE SITE, KYRDEMKULAI.

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1801	Providing , laying, connection testing & commissioning of the following sizes of 1100V grade aluminium conductor armoured under ground cable & overall PVC sheated cable as per ISI code in trenches including the cost of digging of trenches sand cushioning with laying etc and refilling the same in layers or by supporting them in walls and all other accessories as required. c) With 3 1/2 '' Core 50 sq.mm	m	112		
1802	Providing supplying including carriage testing of the following sizes Allumiumn armoured underground cable and all over PVC selected as per ISI mark of 1100volt grade b) 4 x 6mm2	m	24		

1803	Wiring in looping system with Copper PVC cable 250/440 volt grade of size 1.5 sqmm of approved quality using PVC casing caping including 5 ampere switch Indian Best quality ceiling Rose etc capable to a Highest point. a) Short point wiring upto 3 m i) With Copper conductor	No.	6		
1804	Wiring as in Item No.1803 complete to a wall light plug point when fixed elsewhere. b) Short point wiring upto 3 m i) With Copper conductor	No.	4		
1805	Wiring as in Item No.1803 to a wall Light Point b) Short point wiring upto 3 m. i) With Copper conductor	No.	2		
1806	Supplying, laying, testing & commissioning of underground cable of the following sizes of 1100volt grade, 2 core PVC aluminium cable along wall etc in ground including the cost of digging of trenches sand cushioning besides laying etc & refilling the same in layers or by supporting them on the wall. a) With 2.5 sq.mm	m	20.7		

1807	Drawing of 3 Phase main line 4 wire with DGSD approved VIR or PVC cable 660 volt grade in casing capping with all accessories. i) With 4 x 4mm2 Copper Conductor.	m	2.4		
1808	Drawing of Main and Sub Main Line with DGSD approved VIR or PVC 250/440 volt grade in PVC casing capping complete with all accessories. a) With 2 X 2.5 sq mm conductor i) With Copper conductor	m	7.6		
1809	Supplying with fittings & fixing complete 415V TPN IC Main Switch with neutral link. a) 32 Amp Capacity	No.	1		
	b) 63 Amp Capacity	No.	2		
1810	Supplying & fixing of load Kontaket Miniature Circuit Breaker (MCBs). i) 6-32 Amp SP MCB Capacity.	No.	4		
1811	Supplying fiting and fixing of load Kontaket Miniature Circuit Breaker Double Pole (Isolator) i) 32-125 Amp TP Isolator.	No.	2		
1812	Supplying fitting and fixing of SPN/TPN MCB Metal Enclosure Distribution Board. i) 12 way (8+36) Modules	No.	1		

1813	Supplying , fitting and fixing of 440 Volt grade 4 Pole Change Over Main Switch (Best Quality). i) 63Amp Capacity	No.	1		
1814	Supplying fitting and fixing 15 Amp FT Switches socket combined mounted on PVC board or concealed to the wall complete with all accessories.	No.	1		
1815	Supplying materials fabrication and erection of street light poles 2.5 mts high made of heavy gauge G.I pipe 90mm base plate duly fixed in ground with concrete puff projection outside the ground for post top fittings etc.	No.	2		
1816	Supplying , fitting and fixing CFL fitting of different wattage surface or recess or pole mounting direct or in direct luminar square or round shape also suitable for porch lighting etc fitted with mirror reflector complete with all necessary accessories. a) CFL Fitting Single Lamp (Square /Round shape)	No.	4		
1817	Supplying, fitting and fixing and commissioning of Metal Hellide Flood Light complete with necessary accessories b) 400 W Fitting	No.	1		

1818	Supplying fitting & fixing earthing with copper earth plate 600 x 600 x 6mm thick including accessories & providing masonary enclosure with cover plate having locking arrangements & watering pipe etc with charcoal salts etc complete as required.	set	1		
1819	Supplying fitting connection testing of 8-SWG wire along the wall colums etc with necessary clamping as required. B) With G.I Wire	m	4.5		
Total for Bill No. 18 (Carried forward to Grand Summary, p					

Bill No. 19: LAYING OF STAGE III FIRE FIGHTING PIPE LINE FROM TAILRACE UPTO PRIMING TANK , KYRDEMKULAI

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
1901	Providing and fixing G.I pipes complete with G.I fittings including trenching and refilling etc. External Work i) 80mm dia.	m	87		
1902	Providing and fixing G.I Union in GI pipe including cutting and threading the pipe and making long screws etc complete (New work): i) 80mm dia.	No.	2		
1903	Painting G.I pipes and fitings with two coats of anti-corrosive bitumastic paint of approved quality: i) 80mm diameter pipe.	m	87		
Total for Bill No. 19 (Carried forward to Grand Summary, p					

Bill No. 20: SUPPLY OF 15 HP SUBMERSIBLE PUMP AT STAGE III POWERHOUSE TAILRACE, KYRDEMKULAI INCLUDING TRANSPORTATION AND OTHER ACCESSORIES

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	***Description***	***Unit***	***Quantity***	***Rate***	***Amount***
2001	Supplying and fixing of 15HP submersible pump.	No.	1		
2002	Supplying and fixing of 15HP Star Delta Starter.	No.	1		
2003	Supplying of Submersible wire	m	20		
2004	Supplying and fixing of 1Ton Chain Pulley	No.	1		
2005	Supplying of Iron Chain (10mm) including accessories	No.	1		
Total for Bill No. 20 (Carried forward to Grand Summary, p					

Bill No. 21: FENCING (L= 121.00m) AT RIGHT SIDE INCLUDING PROVIDING PRECAST SLAB AT EXISTING DRAIN OF STAGE – III POWER HOUSE

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2101	Providing and fixing 1.8 m high GI Barbed wire fencing with 2.4 m R.C.C. M15 grade 150 mm x 150 mm post placed every 3 m centre to centre founded in M15 cement concrete, 600 mm below ground level, every 15th post, last but one end post and corner post shall be strutted on both sides and end post on one only and provided with 12 horizontal lines and 2 diagonal interwoven with horizontal wires, fixed with GI staples, turn buckles etc. complete as per Technical Specification Clause 1705.	m	121		
2102	Providing precast reinforced concrete slab (200 mm thick) in proportion 1:2:4 with stone aggregate of 20 mm downgraded with 16 mm dia Tor steel reinforcement main bars at bottom @100 mm c/c	No.	15		

	12 mm dia at the top @ 200 mm c/c and 10 mm dia @ 200 mm c/c as distribution bars both ways including shuttering, curing, carriage of sand and aggregates etc. within 200 m including fitting, fixing in position complete as directed (rate inclusive of reinforcements) i) 135 cm long x 35 cm wide x 20 cm thick.				
Total for Bill No. 21 (Carried forward to Grand Summary, p					

Bill No.22: Renovation of Guest House No. 3 at Zero Point , Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2201	Demolishing R.C.C. work including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge.	sq m	26		
2202	Demolishing stone rubble masonry including stacking of serviceable material and disposal of unserviceable material as per direction of	cu m	257		

	Engineer-in-charge.				
2203	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts . a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	cu m	108		
2204	Providing soling with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. a) Brick soling 100 mm thick	sq m	72		
2205	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). i) 1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)	cum	11		
2206	Supplying, fitting and fixing in position reinforcement bars up to 3 m lift , conforming to relevant I.S. Code for RCC work including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks,	Quintal	98		

	supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) i) High Yield Strength Deformed bars or Tor Bars				
2207	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer in charge. 4.1 Foundations, footings, bases of columns, etc. for mass concrete (using steel).	sq m	27		
2208	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement- All work up to plinth level: i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	cum	33		
2209	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, fillets, columns, pillars, posts and struts etc. above plinth level up to first floor level, excluding cost of centering, shuttering, finishing and reinforcement: i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	cum	21		
2210	Brick work in cement mortar with first class brick in superstructure above plinth level upto first floor level in all shapes and sizes: (a) Cement mortar 1 :4 (1 cement: 4 coarse sand)	cum	64		

2211	15 mm cement plaster on the rough side of single or half brick wall of mix: (a)Cement mortar 1 :4 (1 cement: 4 coarse sand)	sq m	1230		
2212	Demolishing cement concrete of all grades including disposal of material as per direction of Engineer-in-charge.	cum	279		
2213	Demolishing cement concrete including disposal of material as per direction of Engineer-in-charge.	cum	44		
2214	15 mm thick cement plaster on the rough side of single or half brick wall of mix: (a)Cement mortar 1 :4 (1 cement: 4 coarse sand)	sq m	322		
2215	Precast terrazzo tiles 22 mm thick with graded marble chips of size upto 12 mm, laid in floors, and landings, jointed with neat cement slurry mixed with pigment to match the shade of the tiles, including rubbing and polishing complete, on 20 mm thick bed of cement mortar 1 :4 (1 cement: 4 coarse sand): (a) Light shade pigment using white cement	sq m	323		
2216	Providing and fixing Glass mosaic tiles on finished plain wall surface of size 20x20x4 mm in all colour, design, fixing in customize design as per direction of Engineer-in- Charge. The glass mosaic tiles to be fixed on the wall surface with the help of approved adhesive applied @ 2.5 kg/sqm and grouting of the same. The rate is inclusive of all operation, material and required pattern approved by	sq m	402		

	Engineer-in-Charge:				
2217	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade: (a) New work (two or more coats over an under coat of suitable shade with ordinary paint of approved brand and manufacture)	sq m	437		
2218	Painting one coat (excluding priming coat) on old wood and wood based surfaces with enamel paint to give an even shade including cleaning the surface of all dirt, dust and other foreign matter sand papering and stopping.	sq m	704		
2219	Providing and fixing paneled or paneled and glazed shutters for doors, windows and clerestory windows fixing with butt hinges of required size with necessary screws, excluding paneling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:- Butt hinges and necessary screws shall be paid separately) i) With lst class Local wood	sq m	72		
2220	Providing and fixing factory made UPVC white colour fixed glazed windows/ ventilators comprising Of UPVC multi- chambered frame and mullion (wherever required) extruded profiles duly reinforced with 1.60 ±D.2 mm thick galvanized mild steel section made from roll forming process of required	sq m	41		

	length (shape & size according to UPVC profile), UPVC extruded glazing beads of appropriate dimension, EPDM gasket, G.I fasteners 100x8 mm size for fixing frame to finished wall, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame shall be mitred cut and fusion welded at all corners, mullion (if required) shall be also fusion welded including drilling of holes for fixing hardware's and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of required size and of approved quality, all complete as per approved drawing & direction of Engineer-in-Charge. (Single/ double glass panes shall be paid separately). Note: For UPVC frame, sash and mullion extruded profiles minus 5% tolerance in dimension i.e. in depth & width of profile shall be acceptable. Variation in profile dimension in higher side shall be accepted but no extra payment on this account shall be made. Casement window double panels with S.S. friction hinges (300xl9xl.9 mm) made of (small series) frame 47x50 mm, sash 47x68 mm & mullion 47x68 mm all having required wall thickness and single glazing bead of				

	appropriate dimension. (Area of window upto 0.75 sqm).				
2221	Providing and fixing floor mounted, white vitreous china single piece, double traps siphonic water closet of approved brand/make, shape, size and pattern including integrated white vitreous china cistern of capacity 10 litres with dual flushing system, including all fittings and fixtures with seat cover, cistern fittings, nuts, bolts and gasket etc including making connection with the existing P/S trap, complete in all respect as per directions of Engineer-in-Charge.	No.	4		
2222	Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink as per IS:13983 with C.I. brackets and stainless steel plug 40 mm, including painting of fittings and brackets, cutting and making gcod the walls wherever required : (a)Kitchen sink with drain board	No.	2		
2223	Providing, fitting and fixing mirror of superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shade	No.	4		

	with 6mm thick hard board backing: i) Rectangular shape 1500x450mm				
2224	Providing, fitting and fixing recessed soap tray / soap dish complete as directed and specified.	No.	6		
2225	Providing, fitting and fixing CP towel rail complete as directed and specified.	No.	6		
2226	Providing and fixing toilet paper holder : CP Brass.	No.	4		
2227	Providing, fitting & fixing C.I grating to the floors complete as directed and specified.	No.	4		
2228	Supplying fitting and fixing wall mounted shower panel of Jaquar make complete with thermostatic mixer, 3 round body showers, hand shower, rain shower with extended shower arm and cast aluminium body as directed.	No.	4		
2229	Cleaning & clearing of service septic tank/ inspection chamber and removing the night soil and debris etc manually from the tank / chamber to a distant place preferably during holidays or at night by bailing out the deposited night soil, clearing off the block in connecting soil pipes by pushing with bamboo kamis, burying the same in nearby trenches/ pits which has been dug earlier and covering the same including cleaning the service septic tank/ chamber with clear water, complete as directed by the department.	No.	2		
2230	Providing CC/ Brick/ Stone Open Surface Drain with 15 mm thick cement plastering in prop. 1:3 finished with a floating coat of cement slurry as directed with necessary	m	180		

	shuttering for sides and earth work in excavation of foundation trenches and refilling the sides after completion of work, etc as specified. a) with Cement Concrete 1:3:6 (i) 300mm wide and average 150 mm deep				
2231	Supplying and planting of terrestrial orchids with required size of pot including filling the pot to the top surface with appropriate soil media made of garden soil, river sand, cowdung, leaf mould, fertilizer, pesticides as per specification and necessary maintenance for a period of 4 months from the date of planting complete as specified and directed . (Mixing of different ingredients of soil media to be made in presence of Deptt. official /Specialist concerned)	No.	20		
2232	Supplying fitting and fixing of water heater (geyser) of 1.5kw with pressure release value including all necessary accessories as required (Bajaj).	No.	4		
2233	Supplying fitting and fixing decorative wall fitting complete with all glass shade cfl lamp holder etc as per department direction and approved (Double Lamp).	No.	16		
2234	Supplying fitting connecting testing and commisioning of calling bell/indicator type suitable for 230 V and all necessary accessories as per department direction and approved. i) 6way indicator bell	No.	6		
2235	Supplying and fitting of ceiling fan AC operated type	No.	7		

	220/250 volt complete with 3 nos of blades down rod canopy hanging shackle & regulator complete with 30mm length down rod supplied with fan by the dealer but the extra length will be charged @ Rs.25.00/mtr (Bajaj/Orient) Fan '1050'mm Sweep.				
2236	Dismantling wood work in frames, trusses, purlins and rafters up to 10 meters span and 5 meters height including slacking the material within 50 meters lead:	cum	4		
2237	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc,, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete.	kg	5955		
2238(a)	Providing corrugated G.S or galvanized iron sheet roofing including vertical/ curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and a.I. limpet washers or with G.I. limpet washers filled with white lead, including a coat Of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost Of purlins, rafters and trusses and including cutting to size and shape wherever required. i) 0.63 mm thick with zinc coating not less than 275 gm/sqm	sq m	336		

2238(b)	Providing and fixing insulating board ceiling of approved quality with necessary nails, etc. including ceiling frame work complete (a) Natural colour insulating board 12 mm thick.	sq m	323		
	WIRING OF GUEST HOUSE NO 3 AT ZERO POINT,KYRDEMKULAI				
2239	Providing supplying of Multi core cables including carriage testing of the following sizes PVC insulated and FR PVC Round Sheathed, Copper Conductor (flexible) industrial cable, 110volt, conforming to IS 694 iii) 4 core 25 sq mm 3 Core Cable	m	70		
2240	Drawing of 3 Phase main line 4 wire with DGSD approved VIR or PVC cable 660V grade in heavy gauge 16SWG Rigid pipe including with all necessary accessories a) With 4 X 10 sq mm conductor i) With Copper conductor	m	46		
	b) With 4 X 4 sqmm conductor i) With Copper conductor	m	38		
2241	Drawing of Main and Sub Main Line wiring as in Item No.2240 above with VIR or PVC Single core 250V grade cable a) With 2 X 2.5 sqmm Copper wire	m	121		
2242	Concealed Wiring in looping system with 2 x 1.5 sqmm PVX insulated single core cable of 600v grade in heavy gauge PVC pipe including occuping and fitting of elbows, bends, fees, junction boxes etc including required				
		No.	52		

	size of MS concealed boxes and front plate for housing of switches, sockets, fan regulators, bell push etc complete to light point i) Medium point upto 6m				
2243	Wiring as in Item No.2240 complete to a wall Light plug Point when fixed else where with continuous earth wire complete. i) Short point wiring upto 3 m.	No.	18		
2244	Wiring as in Item No.2240 to a wall Point b) Short point wiring upto 3 m	No.	30		
2245	Wiring as in Item No.2240 to a Calling bell/Bell Indicator i) Long point point wiring upto 10 mts	No.	4		
2246	Wiring as in Item No.20 above to power plug point with 2 x 4mm2 including supplying and fitting of 15 Amp modular switch socket combined with continuos earth to a power plug point Complete b) Long point point wiring upto 10 mts	No.	8		
2247	Supplying with fittings and fixing complete heavy duty double break fuse switches HBC Fuse type in sheet enclosure 50Hz 415V 3 pole with nuetral link (TPN) i) 100 Amp capacity	No.	1		
2248	Supplying fitting and fixing of Distribution board SPN DB's for MCB Isolator RCCB and RCBO c. IP43 -#1K with acrylic door d) 16way +16 Module	No.	3		
2249	Supplying & fixing of load Kontaket Miniature Circuit Breakers RX3 MCBs. Single pole i) 40Amp	No.	12		

2250	Supplying fitting and fixing of RX3 Isolator (35 sqmm cage terminals with safety shutters. i) Four Pole 63 Amp	No.	3		
2251	Supplying fitting & fixing earthing with copper earth plate 500 x 600 x 600 x 6mm thick including accessories & providing masonry enclosure with copper plate having locking arrangements & watering pipe, etc. with charcoal salts, etc. complete as required.	set	1		
2252	Supplying, fitting and fixing of Copper lightning arrester with 5nos finger at the top & copper base plate at the bottom complete. i) with 5ft high copper rod	No.	1		
2253	Supplying and fitting of ceiling fan AC operated type 220/250 volt complete with 3 nos of blades down rod canopy hanging shackle & regulator complete with 30mm length down rod supplied with fan by the dealer but the extra length will be charged @ Rs.25.00/mtr (bajaj/Orient) i) AC ceiling Fan '1400'mm Sweeps.	No.	3		
2254	Supplying and fitting & fixing of A.C with heating and cooling facility including supply of all necessary accessories as required for installation of Air Conditioner (AC) i) 3 Ton Cassette AC (Hot and Cold)	No.	5		
	Procurement of Furniture for Guest House No.3 at Kyrdemkulai			.	
2255	Single bed 78X48 smart wood	No.	5		

2256	Mattress 78X48	No.	5		
2257	Wooden sofa set	set	3		
2258	Wardrobe 78X36	No.	4		
2259	Computer Table	No.	4		
2260	Bed side table (2 dr)	No.	5		
2261	Plastic chair with cushion	No.	15		
2262	Room table	No.	6		
2263	Wooden dining table 10 seater	set	1		
2264	Blanket single	No.	12		
2165	Pillow	No.	12		
2266	Bed sheet	No.	12		
	Total for Bill No. 22 (Carried forward to Grand Summary, p				

Bill No.23: Construction of Overhead Water Tank Including Water Supply at Inspection Bungalow Zero Point, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2301	Earthwork in excavation in foundation trenches, including dressing of sides and ramming of the bottom including stacking of serviceable stones, disposal and removal of excavated earth within lead of 50 m and lift of 1.50 complete as directed. a) In medium rock of hard shale i) Without using blasting materials	cu m	53		
2302	Plain cement concrete works with coarse aggregate of size 20 mm in foundation bed for footing steps, walls, etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid seperately). In prop. 1: 3: 6 (1 cement: 3 coarse sand : 6 coarse aggregate by volume (using mixture machine)	cu m	4		
2303	Suppllying, fitting and fixing in position reinforcement bars upto3 m lift , conforming to relevant I.S. Code for R.C.C. Work/ R.B. Walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates	Quintal	102		

	inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurements for the same is required) From Primary Sources like TATA/ SAIL/ ESSAR/ JINDAL/ SHYAM/ RINL i) Super Ductile (SD) TMT reinforcement bars				
2304	Extra over Item 2203 above for each subsequent 3 m lift or part thereof above .	Quintal	70		
2305	Earth/ Sand filling in plinth in layers not exceeding 150mm thick. (b) With available excavated earth including breaking of clods, consolidating each layer by ramming and watering with all lead and lifts.	cu m	45		
2306	Providing formwork of ordinary timber planking of thickness not less than 25mm and removal of the same for concrete members so as to give a rough finish including centering, shuttering, strutting and propping etc., for height of propping and centering of supporting floor to the soffit of the concrete member not exceeding 4 m as specified for the following items: Columns, Pillars, Posts & Strut i) Circular or curved in plan	sq m	501		

2307	Providing and laying Concrete in Reinforced Cement Concrete Works using Concrete Mixture Machine with coarse sand & 20mm down graded stone aggregate including dewatering if necessary, and curing complete but excluding cost of form work and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately). In columns, pillars, posts, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, cantilever, staircase . Above plinth level upto 3 m lift. (Without using admixture, plasticiser) a)M20 or prop. 1: 1.5: 3	cu m	27		
	b) M25 grade concrete	cu m	49		
2308	Extra over Item no.2207 above for each subsequent floor or part thereof above the 1st floor level.	cu m	75		
2309	20 mm thick Cement plaster on rough side in two coats (backing coat 15 mm and finishing coat 5 mm thick) on single or half brick walls for interior plastering up to 1st floor level including arises, internal rounded angles, chamfers and / or round angles not exceeding 80 mm in girth and finished even and smooth including curing complete as directed. (a) In cement mortar 1: 3	sq m	675		
2310	Extra for providing and mixing Plasticizer Sikament 170 of Sika India Ltd. / Rheobuild 620 of BASF @ 1.0%-1.5% by weight of cement in concrete for waterproofing structures like roof slabs, basement,	cu m	49		

	sunken slabs, chajjas, tunnels, water tank etc as specified and directed by the Department complete at all levels. a) M25 Grade				
2311	Extra for providing and mixing waterproofing Plasticizer Plastocrete Plus of Sika India Ltd / Dr. Seal kit LW Super (Asian Chemicals) / RHEOMAC 730 of BASF @ 200 gms per bag of cement in concrete for waterproofing as specified and directed by the Department complete at all levels. (b)In Plasters / mortars of proportion (i) 1 : 3 (1 cement : 3coarse sand)	sq m	224		
2312	Supplying, erection and commissioning of DECOR INDIA THREE TIER FOUNTAIN in a pool of 8 m dia comprising of 1 no centre jet, 1 no inward ring, 1 no outward ring, hydraulic circuit, accessories and fittings, 36 nos of 150 watt & 220 V submersible lamps in aluminium casting powder coated body, gaskets, light stand, light changer, 3 phase 10 HP submersible pump set with necessary electrical submersible cabling, conducting etc electrical panel, MCB, starter, fuse, necessary internal wiring etc outdoor electrical enclosure for the above electrical panel, plumbing, fitting of valve etc complete as specified and directed. (Construction of Pool to be done as per the standard drawing and to be measured and paid separately).	set	1		
2313	Supply, Installation, Fixing of ABC DRY CHEMICAL POWDER Fire Extinguisher of 10kg trolley mounted confirming to IS : 2171 and CO2 cartridge	No.	12		

	confirming to IS : 4947, Powder confirming to IS : 4308. CHLORINATED POLY VINYLE CLORIDE (CPVC) PIPES				
2314	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) Pipes, having thermal stability for hot and cold water supply including all CPVC plain and brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings, with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer-in-charge.Concealed work, including cutting chases and making good the wall etc. Exposed or in trenches i) 25 mm dia OD	m	150		
2315	Supplying fitting and fixing G.I. Pipes (TATA / SAIL/ NEZONE and the like) with all necessary fittings in exposed or in trenches including trenching and refilling the same etc complete as directed. i) 65 mm diameter	m	350		
2316	Supplying, fitting & fixing water pump set separated by A.C. 3 phase 440 volt grade. i) 3 HP 3 Phase	set	2		
	ii) 5 HP 3 Phase	set	1		
Total for Bill No. 23 (Carried forward to Grand Summary, p					

Bill No.24: Construction of Water Filtration Chamber

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2401	Earthwork in excavation upto a depth of 2.00m below the existing ground level for Foundation trenches of foundations, footing of column /walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all lead and lifts as directed and specified for the following classification of soils. In Hard / Dense soil	cum	61		
2402	Providing brick soling in foundation and under floor with stone/best quality picked jhama brick ,sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. Stone soling of 150mm	sqm	32		
2403	Plain cement concrete work with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps, walls, brickwork, etc. as directed and specified including dewatering if necessary and curing complete (shuttering where necessary shall be measured and paid separately). In prop. 1:3:6 (1 cement: 3 coarse sand :6 coarse aggregate) by volume(using mixture machine) PCC septic tank	cum	4		
2404	Supplying, fitting and fixing in position reinforcement bars	Quintal	14		

	upto 1st floor level confirming to relevant I.S.Code for R.C.C work/R.B. walling including straightening ,cleaning, cutting and bending to the proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers, etc. complete .(rates inclusive of all wastage, lappages,hooks chairs,anchorage etc and no measurements for the same is required) : Other ISI approved TMT reinforcement bar (of SAIL/BISCON / XTECH/THERMAX make or equivalent				
2405	Providing formwork of ordinary timber planking of thickness not less than 25mm and removal of the same for concrete members so as to give a rough finish including centering ,shuttering, strutting and propping etc. for height of propping and centering of supporting floor to the soffit of the concrete member not exceeding 4.0M as specified for the following item : Vertical surface such as walls (any thickness), parapet walls, partition, walls of septic tank ,inspection pit etc. including attached pilasters ,buttresses, plinth and string courses and the like.	sqm	100		
2406	Providing and laying concrete in Reinforce Cement Concrete works using Concrete Mixture Machine with coarse sand & 20mm down graded stone aggregate including dewatering if necessary , and curing complete but excluding cost of formwork and reinforcement	cum	14		

	for reinforced concrete work (formwork and reinforcement will be measured and paid separately) In Foundation and sub-structure including footing ,columns with base ,tie and plinth beam ,pile cap ,raft slab base slab ,RCC walls, retaining walls ,walls of septic tank ,inspection pit and the like and other works not less than 100mm thick up to plinth level. (Without using admixture, plasticizer) : M25 grade concrete				
2407	Brick work in cement mortar with 1st class brick including raking out joints and curing complete in sub-structure upto plinth level including dewatering if necessary as directed. In proportion 1:4 (1-cement : 4 sand)	cum	1.50		
2408	20 mm thick Cement plaster on rough side in two coats (backing coat 15 mm and finishing coat 5mm thick) on single or half brick walls for interior plastering upto 1 st floor level including arises, internal rounded angles, chamfers and / or rounded angles not exceeding 80mm in girth and finished even and smooth including curing complete as directed. In cement mortar 1:3	sqm	88		
2409	Supplying, fitting and fixing G.I Pipes (TATA/ SAIL / NEZONE and their equivalent) with all necessary 'R' brand or similar approved G.I. fittings such as bend, tee, elbow, reducer, nipple, plug, long screw fitting, H.W clamps, etc. complete at all levels including below G.L as directed and specified.				
	(g) 65 mm diameter	m	60		

	(e) 40 mm diameter	m	150		
2410	Providing and placing filter media of approved quality and as per specification, in the filter bed free from dirt and other impurities including carriage within 200m and forest royalty all complete as directed :				
	Sand	cum	5.5		
	Stone	cum	8.5		
Total for Bill No. 24 (Carried forward to Grand Summary, p					

Bill No.25: Brickwall Fencing at Inspection Bungalow, Zero Point, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2501	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal Of surplus earth with all lead and lifts as directed and specified for the following classification of soil. a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	cum	327		
2502	Providing soling with stone/ best quality picked jhama brick,sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. i) Stone soling	sqm	106		
2503	Plain cement concrete works in foundation bed for footing steps, walls, brick works, etc. below plinth level as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). ci)1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)	cum	26		
2504	Supplying, fitting and fixing in position reinforcement bars upto 3 m lift , conforming to relevant I.S. Code for RCC work in columns , pillars , etc. including	Quintal	250		

	straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) i) Thermo-Mechanically Treated bars				
2505	**Centering and shuttering including strutting, propping , etc. and removal of form for all heights complete and as directed by Engineer- in – charge :**				
	i) Foundations, footings, bases of columns, etc. for mass concrete (using steel). Columns, Pillars, Piers, Abutments, Posts and struts (using steel).	sqm	71		
	ii) Columns, Pillars, Piers, Abutments, Posts and struts (using steel).	sqm	450		
	iii) Lintels, beams, plinth beams, girders, bressummers and cantilevers (using steel).	sqm	374		
2506	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement- All work up to plinth level: i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	cum	64		
2507	Coursed rubble masonry (first sort) with hard stone in foundation and plinth with: a Cement mortar 1 :6 (1 cement: 6 coarse sand)	cum	169		
2508	Brick work in cement mortar with first class brick in	cum	95		

	superstructure above plinth level up to first floor level in all shapes and sizes: i)Cement mortar 1 :4 (1 cement: 4 coarse sand)				
2509	20 mm cement plaster of mix: a 1 :4 (1 cement: 4 fine sand)	sqm	1307		
2510	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	kg	418		
2511	Providing and fixing concertina coil fencing with punched tape concertina coil 600 mm dia. 10 in openable length (total length 90 in), having 50 nos. rounds per 6 in length, up to 3 in height of wall with existing angle iron 'Y. shaped placed 2.4 in or 3.00 in apart and with 9 horizontal P.B.T. reinforced barbed wire, stud tied with G.I. staples and a.I. clips to retain horizontal, including necessary bolts or G.I. barbed wire tied to angle iron, all complete as per direction of Engineer-in charge, with reinforced barbed tape (Pl.B.T.)/ Spring core (2.5 mm thick) wire of high tensile strength of 165 kg/sq.mm with tape (0.52 mm thick) and weight 43.478 gin/in (cost of M.S. angle, C.C. blocks shall be paid separately).	m	281		
Total for Bill No. 25 (Carried forward to Grand Summary, p					

Bill No.26: Providing MS Grill Gates At Inspection Bungalow, Zero point, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2601	Earthwork in excavation by manual means up to a depth of 2m below the existing ground level for foundation trenches of foundations, footings of column/ walls, retaining walls, septic tank etc. including bailing out water where necessary and removal Of surplus earth with all lead and lifts as directed and specified for the following classification of soils. a) All kinds of soil (ordinary soil/ hard soil/ dense soil)	cum	7		
2602	Providing laying, spreading and compacting local material in block or large discrete particles, such as Kankar, Laterite, Dhandla, etc. or as per Table 400.13 to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with three wheel 80-100 kN static roller in stages to proper grade and camber, applying and brooming requisite type of screening/binding materials to fill up the interstices of laid material watering and compacting to the required density as directed.	sqm	0.55		
2603	Plain cement concrete works in foundation bed for footing steps, walls, brick works etc below plinth level as directed	cum	1		

	and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). i) 1 :3:6 (1 Cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size)				
2604	Supplying, fitting and fixing in position reinforcement bars upto 3 m lift , conforming to relevant I.S. Code for RCCwork including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (Rates inclusive of all wastage, lappage, hooks, chairs, anchorage etc. and no measurement for the same is required) i) High Yield Strength Deformed bars or Tor Bars	Quintal	2		
2605	Centering and shuttering including strutting, propping etc. and removal of form for all heights complete and as directed by Engineer- in - charge :				
	i) Foundations, footings, bases of columns, etc. for mass concrete (using steel).	sqm	5		
	ii) Columns, Pillars, Piers, Abutments, Posts and struts (using steel).:	sqm	9		
2606	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost Of centering, shuttering, finishing and reinforcement- All work up to plinth level. i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone	cum	2		

	aggregate 20 mm nominal size)				
2607	Reinforced cement concrete work in walls (any thickness), including attached buttresses, fillets, columns, pillars, posts and struts etc. above plinth level up to first floor level, excluding cost of centering, shuttering, finishing and reinforcement: i) M20 or 1:1.5 :3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20 mm nominal size)	cum	1		
2608	Earthwork in filling (excluding rock) in trenches, plinth, sides of foundation, etc. in layers not exceeding 20 cm thick including breaking of clods, consolidating each layer by ramming and watering, lead up to 50 in and lift up to 1.5m. With available excavated earth	cum	4		
2607	Steel work welded in built up sections/framed work including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc as required. i) ln gratings, frames, guard bar, ladder, railings, brackets, gates and similar works.	kg	156		
2608	15 mm thick cement plaster on rough side of single or half brick wall of mix: a) 1 :4 (1 cement: 4 coarse sand)	sqm	10		
2609	Applying priming coat with ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanized iron/ steel works	sqm	9		
2610	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade: New work (two or more	sqm	10		

	coats) over and including water thinnable priming coat with cement primer				
2611	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete : On steel work	sqm	9		
Total for Bill No. 26 (Carried forward to Grand Summary, p)					

Bill No. 27: Extension of Security Shed at Stage- III , Face – III Intake, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2701	Earthwork in excavation up to a depth of 2m below the existing ground level for foundations, footing of column/walls retaining walls, septic tank etc including bailing out water where necessary and removal of surplus earth with all lead and lift as directed and specified for the following classification of soils. a) Ordinary soil	cum	11		
2702	Demolishing RCC work including stacking of steel	cum	0.5		

	bars and disposal of unserviceable material as directed for all levels.				
2703	Providing brick soling in foundation and under floor with stone/best quality picked jhama brick, sand packed and laid to level and in panel after preparing the sub grade as directed including all labour and materials and if necessary dewatering, complete.	sqm	33		
2704	Providing and laying cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps walls brick works etc. as directed and specified including dewatering if necessary and curing complete(shuttering where necessary shall be measured and paid separately). a) In proportion 1:3:6(1cement:3coarse sand :6coarse aggregate by volume(using mixture machine)	cum	3		
2705	Supply, fitting and fixing in position reinforcement bar up to first floor level, conforming to relevant I.S code for RCCwork/RB walling including straightening, cleaning cutting and bending to proper shapes and binding with 20G annealed black wire and placing in position wit proper blocks, support chairs, spacers etc complete(rates inclusive of all wastage,lappage, hooks, chairs anchorage etc. and no measurement for the same is required).	Quintal	7		

	a)From primary source like TATA/SAIL/ESSAR/JINDAL /SHYAM/RINL. ii) Super ductile(SD) TMT reinforcement bar.				
2706	Providing formwork of ordinary timber planking of thickness not less than 25mm and removal of the same for concrete member so as to give a rough finish including centering ,shuttering , strutting and propping etc,for height of propping and centering of support floor to the soffit of the concrete member not exceeding 4 m as specified for the following items:				
	a) foundation, footing bases of column pile cap, raft and mass concrete works etc.	sqm	5.50		
	b) Sides of beams, grade beam etc. at or below ground level requiring form work at sides only.	sqm	5.00		
	c) column, pillar, post &strut i) Square , rectangular, polygonal in plan or any shape like Tee/L, etc. having plane vertical face	sqm	8.50		
	d) Sides and soffit of beams, beam hunching, cantilever girder, bressumer, lintels and horizontal ties. i) For depth not exceeding 1.0M.	sqm	4.50		
	e)flat surface such as soffits of suspended floors, roofs, landings, cantilever slabs, chajjas, balconies and the like. i)Thickness of floor/ slab up to 200mm	sqm	22.50		
2707	Providing and laying concrete in reinforced cement concrete works using concrete mixture				

	machine with coursed sand and 20mm downgraded stone aggregate including dewatering if necessary and curing complete but excluding cost of form works and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) :				
	i) In foundation and sub - structure including footing , column with base, tie and plinth beams, pile cap raft slab, base slab,RCC walls, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level.(Without using admixture, plasticizer) (b) M20 or Prop. 1:11/2:3	cum	1.50		
	ii) In column pillars, post, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever staircase etc. above plinth level up to 1st floor level. (Without using admixture, plasticizer)	cum	3		
2708	Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortaring prop1:6 with leveling course of 1:6:12 with unsized stone/boulders both faces hammer dressed including bonding, providing face stone, through stone and centering including raking of joints, curing and supplying and all carriage	cum	4		

	of stone as directed. a) Random Rubble Masonry				
2709	Earthwork in filling including necessary carriage, watering, ramming etc. complete as directed and specified. i) With available excavated earth including breaking clods, consolidating each layer by ramming and watering with all lead and lifts.	cum	7.50		
2710	Brick work in cement mortar with 1st class brick including racking out joints and curing complete in super structure above plinth level up to 3 m lift including dewatering if necessary as directed.	sqm	4.50		
2711	Providing, fitting and fixing steel windows (including ventilators) of standard rolled steel sections as per relevant I.S. Code, joints mitered and welded with joints mitered and welded with 15mmx13mmx100mm lugs embedded incement concrete block of M-10 grade including providing and fixing of projecting hinges (not more than 65mm and not less than 15mm wide) bolting device, steel handles, pegs, stays of 300mm long etc. complete including providing12mmx12mm sq. bars duly welded to steel frame at not more than 12cm c/c applying a priming coat of red-lead paint etc. complete as per drawing. (a) Openable	sqm	5		

2712	Providing woodwork in frame (chowkats) of doors, windows, clerestory windows and other similar works wrought, framed and position in contact with C.C or brick fixed in masonry wall including supplying, fitting and fixing with M.S. holdfast (40mmx3mmx250mm) as per design embedded in cement concrete block in proportion 1:2:4 and with two coats of oiling to the timber faces in contact with C.C and masonry as directed and specified.	cum	0.10		
2713	Providing, fitting and fixing full panelled doors/ windows including oxidized M.S butt hinges (100mm x 75 mm x 3.55mm) with necessary screws (other fittings to be measured and paid separately)	sqm	3.50		
2714	15 mm thick Cement plaster in single coat on rough side of single or half brick wall for interior plastering up to 1st floor level including arises, internal rounded angles, not exceeding 80mm girth and finished even and smooth including curing complete as directed. i) In cement mortar 1:4	sqm	120		
2715	Extra over Item no 2714 above for exterior plastering up to a height of 3 m above ground level including curing complete as directed. a) On single coat plaster.	sqm	75		
2716	65mm thick cement concrete floor consisting of 50mm under layer of cement concrete in	sqm	13.50		

	prop1:3:6(1-cement:3-coarse sand:6- coarse aggregate of 25mm and down) and 15mm thick wearing layer in cement concrete in prop1:1:2 (1 cement :1coarse sand : 2 coarse aggregate of size 10mm down)laid in panel and finish including curing etc. complete as directed.				
2717	White washing with lime on wall surfaces (two coats) to give an even shade including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter.	sqm	120		
2718	Applying priming coat over new wood based surfaces including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter , sand papering and knotting. (a) With ready mixed paint, wood primer (pink/ white)	sqm	4.50		
2719	Applying primary coat over new steel and other metal surface over 100mm in width or girth with ready mixed "red-lead/ red oxide" primer after preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and scoured with wire brushes, fine steels, wood scrapers and sand paper. (a) With ready mixed paint, wood primer (pink/ white)	sqm	3.50		
2720	Painting two coats (excluding priming coat) on new steel and other metal surface with enamel paint of approved brand and manufacture(Asian paint/Berger paint/ ICI	sqm	3.50		

	paint/ J & N paint/Nerolac) to give an even shade including cleaning the surface of all dirt, dust and other foreign matter. (a) Surfaces over 100mm in width or girth. (i) General purpose (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac).				
2721	Painting one coat (excluding priming coat) on old wood and wood based surfaces with enamel paint to give an even shade including cleaning the surface of all dirt, dust and other foreign matter sand papering and stopping. (a) Surfaces over 100mm in width or girth. (i) General purpose (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac).	sqm	4.50		
2722	Providing and fixing clear sheet glass bedded in putty and fixed with/without wooden beading including necessary cutting of glass to the required size (payment for wooden bead shall be made separately). (a) 3.00mm thick (Area of glass panes not exceeding 400 sq.cm.)	sqm	8.50		
2723	Providing CC/ Brick/ Stone Open Surface Drain with 15mm thick cement plastering in prop. 1:3 finished with a floating coat of cement slurry as directed with necessary shuttering for sides and earth work in excavation of foundation trenches and refilling the sides after completion of work etc. as specified.	m	19		

	(a) With cement concrete (1:3:6) having 100mm thick sides and 100mm thick bed laid over brick flat soling.				
Total for Bill No. 27 (Carried forward to Grand Summary, p.....)					

Bill No. 28: Re-wiring of Extended Security Shed at Stage - III Face – III Intake

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2801	Providing supplying including carriage testing of the following sizes Allumiumn armoured underground cable and all over PVC selected as per ISI mark of 1100volt grade b) 4 x 6mm2	m	5		
2802	Drawing of 3 Phase main line 4 wire with DGSD approved VIR or PVC cable 660 volt grade in casing capping with all accessories. i) With 4 x 4mm2 Copper Conductor	m	6		
2803	Drawing of Main and Sub Main Line with DGSD approved VIR or PVC 250/440 volt grade in PVC casing capping complete with all accessories. a) With 2 X 2.5 sqmm conductor i) With Copper conductor	m	13		
2804	Wiring in looping system with Copper PVC cable 250/440 volt grade of size 1.5 sqmm of approved quality using PVC casing caping including 5 ampere switch best quality. b) Short point wiring upto 3 m. i) With Copper conductor	No.	8		
2805	Wiring as in Item No.2804 complete to a wall Light plug Point when fixed elsewhere. i) Short point wiring upto 3	No.	2		

	m. i) With Copper conductor				
2806	Wiring as in Item No2804 to a wall Light Point a) Short point wiring upto 3 m i) With Copper conductor	No.	4		
2807	Wiring as in Item no.2804 to a celing/exhaust fan point. a) Short point wiring upto 3 m i) With copper conductor	No.	2		
2808	Supplying with fittings & fixing complete 415V TPN IC Main Switch with neutral link. i) 63 Amp Capacity	No.	1		
2809	Supplying fitting and fixing of Single Opening Metal Enclosure Distribution MCB Distribution Box b) 4/6/8 Way	No.	1		
2810	Supplying & fixing of load Kontaket Miniature Circuit Breaker (MCBs). i) 6-32 Amp SP MCB Capacity.	No.	2		
2811	Supplying fiting and fixing of load Kontaket Miniature Circuit Breaker Double Pole (Isolator) b) 32-125 Amp DP Isolator.	No.	1		
2812	Supplying fitting and fixing 15 Amp FT Switches socket combined mounted on PVC board or concealed to the wall complete with all accessories.	No.	2		
2813	Supplying and fitting of ceiling fan AC operated type 220/250 volt complete with 3 nos of blades down rod canopy hanging shackle & regulator complete with 30mm length down rod supplied with fan by the dealer but the extra length	set	2		

	will be charged @ Rs.25.00/mtr (bajaj/Orient) i) AC ceiling Fan '1200'mm Sweeps.				
2814	Supplying fitting & fixing earthing with GI pipe of 200cm length 40mm dia including all accessories & providing masonary enclosure with cover plate having locking arrangements, etc. with charcoal salt complete as required.	set	1		
2815	Supplying fitting connection testing of 8-SWG wire along the wall colums etc with necessary clamping as required. i) With G.I Wire	m	4.1		
2816	Supplying and fixing of weather proof Bulk Head Light with CFL lamp and other accessories as required.	No.	1		
Total for Bill No. 28 (Carried forward to Grand Summary, p.....)					

Bill No. 29: Construction of toilet including septic tank and soak pit for Stage – III Face -III barrack, Kyrdemkulai

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
2901	Earthwork in excavation up to a depth of 2m below the existing ground level for foundations, footing of column/walls retaining walls, septic tank etc including bailing out water where necessary and removal of surplus earth with all lead and lift as directed and specified for the following classification of soils. a) ordinary soil	cum	11		
2902	Providing brick soling in foundation and under floor with stone/best quality picked jhama brick, sand packed and laid to level and in panel after preparing the sub grade as directed including all labour and materials and if necessary dewatering, complete.	sqm	5		
2903	Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortaring prop1:6 with leveling course of 1:6:12 with unsize stone/boulders both faces hammer dressed including bonding, providing face stone, through stone and centering including raking of joints, curing and supplying and all carriage of stone as directed. a) Random Rubble Masonry	cum	1		

	i) In sub-structure up to plinth level				
2904	Providing and laying cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps walls brick works etc. as directed and specified including dewatering if necessary and curing complete(shuttering where necessary shall be measured and paid separately). a) In proportion 1:3:6(1cement:3coarse sand :6coarse aggregate by volume(using mixture machine)	cum	1		
2905	Brick work in cement mortar with 1st class brick including racking out joints and curing complete in sub-structure up to plinth level including dewatering if necessary as directed. i) In proportion 1:4 (1 cement : 4 sand)	cum	5		
2906	Brick work in cement mortar with 1st class brick including racking out joints and curing complete in super structure above plinth level up to 1st floor level including dewatering if necessary as directed. i) In proportion 1:4 (1 cement : 4 sand)	cum	1.20		
2907	Supply, fitting and fixing in position reinforcement bar up to first floor level, conforming to relevant I.S code for RCC work/RB walling including straightening, cleaning cutting and bending to proper shapes and length	Quintal	1		

	as per details, supplying and binding with 20G annealed black wire and placing in position wit proper blocks, support chairs, spacers etc complete(rates inclusive of all wastage,lappage, hooks, chairs anchorage etc. and no measurement for the same is required). a)From primary source like TATA/SAIL/ESSAR/JINDAL /SHYAM/RINL. ii) Super ductile(SD) TMT reinforcement bar.				
2908	Providing form work of ordinary timber planking of thickness not less than 25mm and removal of the same for concrete member so as to give a rough finish including centering ,shuttering , strutting and propping etc,for height of propping and centering of support floor to the soffit of the concrete member not exceeding 4m as specified for the following items:				
	i) Sides of beams, grade beam etc. at or below ground level requiring form work at sides only.	sqm	1		
	ii)Flat surface such as soffits of suspended floors, roofs, landings, cantilever slabs, chajjas, balconies and the like. i)Thickness of floor/ slab up to 200 mm.	sqm	7		
2909	Providing and laying concrete in reinforced cement concrete works using concrete mixture machine with coursed sand and 20mm down graded stone aggregate including dewatering if necessary and				

	curing complete but excluding cost of form works and reinforcement for reinforced cement concrete work (formwork and reinforcement will be measured and paid separately)				
	i) In foundation and sub - structure including footing , column with base, tie and plinth beams, pile cap raft slab, base slab,RCC walls, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level.(Without using admixture, plasticizer) a) M20 or Prop. 1:11/2:3	cum	0.5		
	ii) In column pillars, post, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever staircase etc. above plinth level up to 1st floor level. (Without using admixture, plasticizer) (b) M20 or Prop. 1:1.5 :3	cum	1		
2910	Providing dressed wood work in post, walls, battens, post plate, etc. including supplying and fixing with spikes, nails, bolt and nuts of 12mm dia M.S and required length etc. complete with oiling two coats to faces in contact with C.C or masonry (M.S flats, angle cleats and bolt and nuts required for flats, angle cleats wherever use shall be measured and paid separately). c) With Red Pine wood	cum	0.15		

2911	Providing wood work in frame (chowkats) of doors, windows, clerestory windows and other similar works wrought, framed and position in contact with C.C or brick fixed in masonry wall including supplying, fitting and fixing with M.S. hold fast (40mmx3mmx250mm) as per design embedded in cement concrete block in proportion 1:2:4 and with two coats of oiling to the timber faces in contact with C.C and masonry as directed and specified. i) Red Pine	cum	0.10		
2912	Providing, fitting and fixing full paneled doors/ windows including oxidized M.S butt hinges (100mm x 75 mm x 3.55mm) with necessary screws (other fittings to be measured and paid separately) a) With Red pinewood (i) 40mm thick	cum	1		
2913	Providing corrugated galvanized Iron sheet roofing of TATA SHAKTEE / SAIL including fitting and fixing necessary galvanized J or L hooks, bolts and nuts 8 mm dia with bitumen washer 25 mm dia x 3 mm thick and 1.6 mm thick limpet washer complete excluding cost of roof truss, purlin etc. (Roof trusses and purlin etc.to be measured and paid separately). i) 0.60 mm thick	sqm	3		
2914	Providing fitting and fixing vitreous water closet squatting pan (Indian type W.C Orissa pattern) with all	No.	1		

	fittings and fixtures complete including cutting and making good to the walls and floors wherever required. (Flushing Cistern to be paid separately) Indian type W.C Orissa pattern of size 580 x 440 mm (a) White				
2915	Supplying, fitting and fixing PVC flushing cistern with all internal fittings with CI brackets including fitting and fixing standard size CP flush pipe, union clamps etc. compete as directed and specified (pipes will be measured separately): White (i) Normal	No.	1		
2916	65mm thick cement concrete floor consisting of 50mm under layer of cement concrete in prop1:3:6(1-cement:3-coarse sand:6- coarse aggregate of 25mm and down) and 15mm thick wearing layer in cement concrete in prop1:1:2 (1 cement :1coarse snd : 2 coarse aggregate of size 10mm down)laid in panel and finish(using cement slurry for bond 2075kg. per square metre of floor area)including curing etc. complete as directed.	sqm	6		
2917	Earthwork in filling including necessary carriage, watering, ramming etc. complete as directed and specified. i) With available excavated earth including breaking clods, consolidating each layer by ramming and watering with all lead and lifts.	cum	3		

2918	15 mm thick Cement plaster in single coat on rough side of single or half brick wall for interior plastering up to 1st floor level including arises, internal rounded angles, not exceeding 80mm girth and finished even and smooth including curing complete as directed :				
	a) In cement mortar 1:3	sqm	31		
	b) In cement mortar 1:4	sqm	18		
2919	Extra over Item no. 2918 for exterior plastering up to a height of 3 m above ground level including curing complete as directed. a) On Single coat Plaster.	sqm	16		
2920	Construction of filter bed in soak pit including earth work in excavation of soil and then filling up of the trench with brick bats/Charcoal covered with earth over a layer of A.C. plain sheet above brick bat filling complete as directed. (sizes of soak pit may vary depending on the sizes and capacities of the septic tank as well as the number of users as mentioned in the table.	cum	5		
2921	Supplying, fitting and fixing PVC pipes/bends/ Junctions etc. of Supreme/Prince or other ISI approved make, including joining ,fitting and fixing with clamps etc. as necessary complete at all levels including below G.L as directed and specified :				
	i) PVC pipes of 6 Kg/cm2 as directed and specified. (a)	m	30		

	160mm dia.				
	ii) 87.5 degree PVC bend with door as directed and specified. (a) In exposed surfaces or in trenches. (i) 160mm dia	No.	1		
	iii) 45degree PVC bend as directed and specified. (a) In exposed surfaces or in trenches. (i) 160mm dia	No.	3		
Total for Bill No. 29 (carried forward to Grand Summary, p.)					

Bill No. 30: Concrete Pavement Roads

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3001	Clearing and grubbing road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees of girth upto 30 mm, removal of stumps of such trees cut earlier and disposal of unserviceable material to be used or auctioned upto a lead of 1000 m including removal and disposal of top organic soil not exceeding 150 mm in thickness as per technical specifications A. By Manual means i. In area of non -thorny jungle	hectare	1.125		
3002	Compacting Original Ground. Compacting original ground supporting subgrade. Loosening of the ground upto a level of 300 mm below the subgrade	m^3	1690		

	level, watered, graded and compacted in layers to meet the requirements for subgrade construction as per Technical Specifications				
3003	Construction of granular sub-base by providing well graded material spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC and compacting with smooth wheel roller to achieve the desired density, complete as per Technical Specifications. (By Manual means) Grading I material	m^3	1125		
3004	Construction of granular sub-base by providing well graded material spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC and compacting with smooth wheel roller to achieve the desired density, complete as per Technical Specifications. (By Manual means) Grading III material	m^3	845		
3005	Construction of Roller Compacted Concrete Pavement (R.C.C.P) with coarse and fine aggregates conforming to IS:383, the size of coarse aggregates not exceeding 25 mm with minimum aggregate cement ratio of 5 : 1 and with minimum cement content of 310 kg/cum, aggregate gradation to be as per IS specification after blending,	m^3	3375		

	mixing in concrete mixer at optimum moisture content, transporting to site, laying with wheel barrows or steel pans or with mechanical paver, compacting with 80-100 kN smooth wheel, tandem, vibratory roller to achieve, the designed flexural strength, finishing and curing as per drawing and Technical Specifications. .				
3006	Construction of hill side drains in accordance with the requirement of specifications true to lines and grades. Dimension and other particulars as per drawing and Technical Specifications :				
	i) Earthwork in excavation for structures as per drawing and Technical Specifications By manual means , Ordinary soil	m^3	1075		
	ii) Plain cement concrete M15 grade ,Nominal mix 1 : 2 : 4 (hand mixing)	m^3	465		
3007	Construction of subgrade and earthen shoulders with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacted to meet requirement with lead upto 1000 m as per Technical Specifications.	m^2	675		
Total for Bill No. 30 (Carried forward to Grand Summary, p.)					

BillNo.31:Bituminous Road

Item No.	Description	Unit	Quantity	Rate	Amount
	Renovation of access road :				
				-	-
3101	Clearing and Grubbing Road Land .(Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned up to a lead of 1000 metres including removal and disposal of top organic soil not exceeding 150 mm in thickness.) as per technical specification clause-201	Hect	1.6		
3102	Providing & laying Semi Dense Bituminous Concrete (SDBC) with hot mix plant using crushed aggregate of specified grading as per table-500.14 (Mort&H)	Cum	187.5		
3103	Providing and applying bituminous macadam with hot mix plant using crushed aggregates of grading as per Table 500.4 premixed with bituminous binder, transported to site upto a lead of 1000 m laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled to achieve the desired compaction as per Technical Specification Clause 504.	Cum	375		
3104	Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the material with water at OMC in mechanical mixer (Pug Mill), carriage of mixed material by tipper to site, laying in uniform layers in sub-base/base course on a well prepared sub-	Cum	1000		

	base and compacting with smooth wheel roller of 80-100 kN weight to achieve the desired density including lighting, barricading and maintenance of diversion, etc. as per Tables 400.11 & 400.12 and Technical Specification Clause 406.				
3105	Construction of granular sub-base by providing well graded material, mixing in mechanical mix plant at OMC carriage of mixed material to work site upto a lead of 1000 m, spreading in uniform layers with motor grader on prepared surface and compacting with smooth wheel roller to achieve the desired density, complete as per Technical Specification Clause 401.	Cum	2940		
3106	Providing and applying primer coat with bitumen emulsion (SS-1) on prepared surface of granular base including cleaning of road surface and spraying primer at the rate of 0.70 - 1.00 kg/sqm using mechanical means as per Technical Specification clause 502.	Sqm	8000		
3107	Providing and applying tack coat with bitumen emulsion (RS-1) using emulsion distributor at the rate of 0.25 to 0.30 kg/sqm on the dry and hungry bituminous surface cleaned with hydraulic broom as per Technical Specification Clause 503.	Sqm	15000		
3108	Construction of subgrade and earthen shoulders with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of Tables 300.2 with lead upto 1000 m as per Technical Specification Clause 303.1.	Cum	960		
3109	Scarifying granular surface to a depth of 150 mm and disposal of scarified material with a lift upto 3 m and leads upto 1000 m as per Technical specification Clause 301.4	Sqm	7500		
3110	Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the Engineer including preparation of ground, fetching of sods	Sqm	17888.54382		

	and watering as per Technical Specification clause 309.				
3111	Painting lines, dashes, arrows etc. on roads in two coats on new work with ready mixed road marking paint conforming to IS : 164 on bituminous/concrete surface, including cleaning the surface of all dirt, dust and other foreign matter, demarcation at site and traffic control as per drawing and Technical Specification Clause 1702. (Edge Lane Marking)	Sqm	600		
3112	Painting lines, dashes, arrows etc. on roads in two coats on new work with ready mixed road marking paint conforming to IS : 164 on bituminous/concrete surface, including cleaning the surface of all dirt, dust and other foreign matter, demarcation at site and traffic control as per drawing and Technical Specification Clause 1702. (Center Lane Marking)	Sqm	200		
3113	Maintenance of drains due to erosion including repair, clearing, cleaning, reshaping, regrading, deepening of side drains as well as catch water drains as per Technical Specification Clause 1907.	Rm.	2000		
TotalforBillNo.31 (CarriedforwardtoGrandSummary,p.)……..					

Bill No. 32: Switch Yard (Control Room and Indoor Yard)

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3201	Plain cement concrete works in foundation bed for footing, steps, walls, brick works etc below plinth level as directed and specified including	m^3	41		

	dewatering if necessary and curing complete(shuttering where necessary shall be measured and paid separately) 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20mm nominal size)				
3202	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for RCC work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without imparing strength and durability as per direction of Engineer-in-charge				
	a. All works up to plinth level	m^3	16		
	b. All works above plinth level	m^3	32		
3203	Supplying fitting and fixing in position reinforcement bars up to 1st floor level, conforming to relevant IS code for RCC work/RB walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20 G annealed black wire and placing in position with proper blocks, support chairs, spacer etc complete. (Rates inclusive of all wastage, lapping, hooks, chairs, anchorage etc. and no measurement for the same is required).				

	High Yield Strength Deformed bars or Tor Bars	Quital	60		
3204	Structural steel work rivetted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	MT	4		
3205	Brickwork in cement mortar (1 cement: 4 coarse sand) with first class brick upto first floor level/3 m lift .	m^3	55		
3206	20mm cement plaster of mix 1:6 (1 cement: 6 fine sand)	sq m	240		
3207	Finishing walls with acrylic smooth exterior paint of required shade, including scaffolding: New work (two or more coat applied @ 1.67 ltr / 10 sqm and including priming coat of exterior primer applied @ 2.2 kg / sqm)	sq m	240		
3208	Pre-cast terrazzo tiles 20 mm thick with marble chips of sizes up to 6 mm laid in floors, treads of steps, landing with a bed of 10mm thick cement plaster in proportion 1:3 (1 cement : 3 coarse sand) jointed with neat white cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing complete.	sq m	36		
3209	Sanitary Works in toilets	No.	1		
3210	Providing corrugated G.S. or galvanized iron sheet roofing including vertical / curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and G.I. limpet washers or with G.I. limpet washers filled with white lead, including a coat of approved				

	steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal / vertical or curved surfaces), excluding the cost of purlins, rafters and trusses and including cutting to size and shape whatever required:				
	i)1.00 mm thick with zinc coating not less than 275 gm / sqm	sqm	108		
3211	Dismantling of existing control building	No.	2		
Total for Bill No. 32 (carried forward to Grand Summary, p					

Bill No. 33: Power Supply Arrangements at Face III Intake and Main Dyke

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3301	Power supply arrangements at Face-III Intake including Sundries (Paint, Danger Board, Aluminium binding tape, insulating tape, anticlimbing device, clamp connector, jumpering materials & other accessories) inclusive of T&P cost, contingency cost, erection & stringing charges and GST.				

	i) 11/0.4 KV 63 KVA Transformer	No.	1		
	ii)Support PSC Pole 10 meter	No.	2		
	iii) Top Pressure Channel: 100x50x6 mm MS channel - 2.8 m long - 2 Nos. (9.2 Kg per m)	kg	52		
	iv)Transformer mounting channel: 100x50x6 mm MS channel - 2.8 m long - 2 Nos. (9.2 Kg per m)	kg	52		
	v) Mounting Channel for AB Switch & HG Fuse: 75x40x6 mm MS channel - 2.8mtr long - 4 Nos. (6.8 kg per m)	kg	77		
	vi) Cantilever Channel for supporting AB Switch & HG Fuse arms: 75x40x6 mm MS channel, 1.5mtr Long, 4 nos (6.8 kg per m)	kg	41		
3302	Angle for Cantilever arrangement for AB Switch & HG Fuse: 50x50x6 mm MS Angle - 1.5 m Long – 4 Nos. (4.5 Kg per m)	kg	32		
3303	Channel for supporting AB Switch handle: 75x40x6 mm MS channel - 1.5m long – 1Nos. (6.8 Kg per m).	kg	10		
3304	Transformer belting Angle: 50x50x6 mm: MS Angle - 2.8 m long - 2 Nos. (4.5kg per m) with side angle (Total 7 m)	kg	32		
3305	11 KV XLPE Cable 95 sq. mm	m	60		
3306	11 KV Disc insulator	No.	6		
3307	11 KV Hardware fittings	No.	3		
3308	11KV Gang operated AB Switch (400 A)	Set	1		
3309	11KV HG Fuse (400 A)	Set	1		
3310	12KV 5KA Lightning Arrestor	No.	3		

3311	HT Stay set (Complete)	No.	2		
3312	11 KV Stay Insulator	No.	2		
3313	Side Stay clamp	pair	2		
3314	GI Pipe earthing 40 mm dia Medium gauge - 2.5 mtrs long	No.	3		
3315	Earthing support (Coil Type)	No.	2		
3316	G.I Nuts, bolts & washers	kg	30		
3317	Clamp for bracing Channel	kg	6		
3318	No-6 GI wire for earthing	kg	15		
3319	7/10 SWG Stay Wire	kg	20		
3320	Concrete material for stay Anchor Plate	No.	2		
3321	Padding & Concreting material for support	No.	2		
3322	Materials for earthing including Masonry work for earth Pit, Charcoal, salt etc. for earthing.	No.	1		
3323	LT Distribution box including MCCB and bus bar arrangement.	No.	1		
3324	LT 3.5 PVC Cable 50 sq. mm	m	100		
3325	1000 watt LED Fitting	No.	2		
3326	Socket, Cable & other accessories	sum	sum		
	Power Supply Arrangements at Main Dyke including Sundries (Paint, Danger Board, Aluminum binding tape, insulating tape, anticlimbing device, clamp connector, jumpering materials & other accessories) Inclusive of T&P cost, Contingency cost , erection& stringing charges and GST.				
3327	11/0.4 KV 15 KVA Transformer	No.	1		

3328	Support PSC Pole 10 metres	No.	2		
3329	Top Pressure Channel: 100x50x6 mm MS channel- 2.8 m long - 2 Nos. (9.2 Kg per m).	kg	52		
3330	Transformer mounting channel: 100x50x6 mm MS channel: 2.8 m long - 2 Nos. (9.2 Kg per m).	kg	52		
3331	Mounting Channel for AB Switch & HG Fuse: 75x40x6 mm MS channel: 2.8m long - 4 Nos. (6.8 kg per m).	kg	77		
3332	Cantilever Channel for supporting AB Switch & HG Fuse arms: 75x40x6 mm MS channel: 1.5mtr long- 4 Nos. (6.8 kg per m).	kg	41		
3333	Angle for Cantilever arrangement for AB Switch & HG Fuse: 50x50x6 mm MS Angle - 1.5 m Long - 4nos. (4.5 Kg per m)	kg	32		
3334	Channel for supporting AB Switch handle: 75x40x6 mm MS channel - 1.5 m long - 1no. (6.8 Kg per m)	kg	10		
3335	Transformer belting Angle: 50x50x6 mm MS Angle - 2.8 m long - 2 nos (4.5Kg per m) with side angle (Total 7 m).	kg	32		
3336	11 KV XLPE Cable 95 sq. mm	m	40		
3337	11 KV Disc insulator	No.	6		
3338	11 KV Hardware fittings	No.	3		
3339	11KV Gang operated AB Switch (400 A)	Set	1		
3349	11KV HG Fuse (400 A)	Set	1		
3341	12KV 5KA Lightning Arrestor	No.	3		
3342	HT Stay set (Complete)	No.	2		
3343	11 KV Stay Insulator	No.	2		

3344	Side Stay clamp	pair	2		
3345	GI Pipe earthing 40 mm Dia Medium gauge - 2.5 mtrs long	No.	3		
3346	Earthing support (Coil Type)	No.	2		
3347	G.I Nuts, bolts & washers	kg	30		
3348	Clamp for bracing Channel	kg	6		
3349	No-6 GI wire for earthing	kg	15		
3350	7/10 SWG Stay Wire	kg	20		
3351	Concrete material for stay Anchor Plate	No	2		
3352	Padding & Concreting material for support	No	2		
3353	Materials for earthing including Masonry work for earth Pit, Charcoal, salt etc. for earthing.	No.	1		
3354	LT Distribution box including MCCB and bus bar arrangement.	No.	1		
3355	LT 3.5 PVC Cable 50 sq.mm	m	20		
3356	PSC Pole 10 meter	No.	1		
3357	Arial bunch Conductor (ABC) with 1x35 sq.mm (phase) and 1x25 sq.mm (neutral)	Km	0.3		
3358	Pole clamp for AB cable	Pair	4		
3359	Dead end Clamp for AB cable	No.	2		
3360	Eye hook for AB cable	No.	4		
3361	Suspension clamp	No.	4		
3362	Neutral connector Type B	No.	4		
3363	LT Stay set	No.	4		
3364	7/12 SWG Stay wire	kg	6		
3365	LT Stay Clamp	Pair	4		
3366	LT Stay Insulator	No.	4		

3367	Earthing Coil	No.	4		
3368	No-8 G.I wire for earthing	kg	2		
3369	G.I Nut, bolt & Washer	kg	2		
3370	Piercing connector	No.	4		
3371	Concrete material for stay Anchor Plate	No.	4		
3372	Padding & Concreting material for support	No.	4		
3373	1000 watt LED Fitting	No.	4		
3374	Socket, Cable & other accessories	sum	1		
Total for Bill No. 33 (Carried forward to Grand Summary, p.)					

Bill No. 34: Log boom

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3401	**Supply , installation of Log Boom to arrest floating debris and including transportation at Site :** Trash Boom with following specification: 1) Boom Specifications1. Height of the Trash Boom-2000mm, Freeboard-400,				

	Draft-1600mm. 2. Section Length- 6 meters X width- 2.74m. 3. Mesh: 4mm Dia Galvanized wire mesh size- 50mmX 50mm. 4. Outer support parts MS Galvanized clamps and Square Pipe 5. Working Load- 5 Tons per section. 6. Floats: 20" & 17" HDPE Pipes with Polyurethane Closed Cell Foam inject inside. 7. Boom End Connector- ASTM F-2438. 8. Flooring- 3 mm Aluminum chacker plates. 2) Mesh/Net Specifications (Heavy Duty MS Galvanized Mesh). 1. Outer Thickness: 10 mm square pipe. 2. Inner wire Thickness: 4 mm. 3. Mesh Size: 50x50mm. 4. MOC: Mild steel.	m	80		
3402	Sliding Connectors 1. MOC:Aluminum,GradeT6061 2. Marine Grade	No	2		
3403	Anchoring Set Danforth Anchors- 100- 150KG i) Buoy – 4 nos ii)12 mm chain -200m iii) D Shackles – 20 nos.	No.	4		
	Total for Bill No. 34 (Carried forward to Grand Summary, p. ----------)				

Bill No. 35: Motor Boat for inspection purposes

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto

the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3501	Supply of Motor boat for inspection purposes including transportation with the following specifications : 10 Seater Ferry Passengers boat with following accessories	No.	1		
	1) Oars - 2 Nos.				
	2) PP Rope- 50 ft				
	Length: 7.00 m				
	Breadth : 2.00 m				
	Depth : 0.90 m				
	Model: VICTORY 10				
	Seating Arrangement - Individual chair Type/ Bench type				
3502	25 HP OBM YAMAHA 2 STROKE Manual Rope Start	No.	1		
	Total for Bill No. 35 (Carried forward to Grand Summary, p.)				

Bill No. 36: Land Reclamation

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
3601	Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortaring prop1: 4 with leveling course of 1:3:6 with unsized stone/boulders both faces hammer dressed including bonding, providing face stone, through stone and centering including raking of joints, curing and supplying and all carriage of stone as directed . a) Random Rubble Masonry	cu m	2500		
3602	Earthwork in excavation upto a depth of 2.00m below the existing ground level for Foundation trenches of foundations, footing of column /walls, retaining walls, septic tank etc. including bailing out water where necessary and removal of surplus earth with all leads and lifts as directed and specified for the following classification of soils. i) In Hard / Dense soil	cu m	1200		
3603	Levelling of the silt / debris in the dumping area.	cu m	15000		
3604	Providing 1 (one) metre thick layer of soil over the silt/debris in the dumping area for plantation of trees .	cu m	4000		

3605	Plantation of trees in the dumping area with seedlings available from the State Forest Department and their maintenance for a period of five years .	No.	150		
	Total for Bill No. 36 (Carried forward to Grand Summary, p.)				

Bill No. 37 Provision of Automatic rain gauge , Instruments , etc.

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

	Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	3701	Automatic Weather Station (Air Temperature, Barometric Pressure, RH, Wind velocity, Solar radiation and Rain Gauge)	No.	1		
	3702	Ordinary Rain gauge	No.	5		
	3703	Piezometers for embankment (Range 20Ksc)	No.	1		
	3704	Temperature gauges	No.	1		
	3705	Supply and installation of water level recorder (automatic recorder)	No.	3		
	3706	Life jacket (M)	No.	10		
	3707	Life jacket (L)	No.	10		
	3708	Life bouy	Pair	10		
	3709	FRP Oars	Pair	10		
	3710	Low Reachargeble LED water Proof Torch	No.	6		

		Tents:				
	3711	Coleman-Sundome-2	No.	2		
	3712	Coleman-Sundome-3	No.	2		
	3713	Quechua-3	No.	2		
	3714	Quechua-2	No.	2		
		Sleeping Bags:				
	3715	Biker Sleeping Bag	No.	6		
	3716	Quechua Arpenaz-15	No.	6		
	3717	Camo - O	No.	6		
	3718	Quechua Arpenaz-20	No.	6		
		Lights:				
	3719	Headlamps - MH5	No.	6		
	3720	Headlamps - MH4	No.	6		
	3721	Headlamps - MH8	No.	6		
		Camping Lantern:				
	3722	BL- 100	No.	6		
	3723	BL- 40	No.	6		
		Camping Essentials:				
	3724	Mat Quechua Arpenaz	No.	6		
	3725	Camping Mat -100	No.	6		
	3726	Folding Chair	No.	6		
	3727	Folding Stool	No.	6		
	3728	Knife Multi Tools	No.	6		
	3729	Knife Survivour Black	No.	6		
	3730	Life Straw	No.	6		

	3731	Dry Bag - 30 mtrs	No.	6		
	3732	Mask Snorkle	No.	6		
		Torch Light:				
	3733	P5	No.	8		
	3734	Sl-Pro	No.	6		
	3735	Event Shelter	No.	6		
		Backpack:				
	3736	Rock & Ice 30 Ltrs	No.	6		
	3737	Verge 60 Ltrs	No.	6		
	3738	Trailblazer 35 Ltrs	No.	6		
		Binoculars:				
	3739	Humvee- 10 x 50	No.	6		
	3740	Humvee- 8 x 21	No.	6		
		Camera:				
	3741	Canon Digital Camera EOS 200D Double Kit	No.	2		
	3742	Simplex Tripod VCT - 888	No.	2		
	3743	Sandisk 64GB SD Card	No.	2		
	3744	Throw Bags	No.	6		
	3745	Safety Helmets	No.	10		
	3746	Kayaks (Two Seater)	No.	2		
		Rain Wear:				
	3747	Hypadry Unisex Rain Jacket Suit 2 tone	No.	20		
	3748	Hypadry Unisex Rain Pro Jacket	No.	20		
	3749	Safety Shoes (Blackburn Low Ankle)	Pair	20		
	3750	Safety Gumboots (Double Intensity 13'' Chemicals &	Pair	20		

		Oil/Acid Resistant, Water Proof , Anti-Slip Steel Toe Cap Metro Safety Gumboots				
	3751	Jacket (Down Puffer Jacket)	No.	6		
	3752	Water Proof Jacket SH100 X-WARM	No.	6		
	3753	Trackshoes/Trekking Shoes (Woodland)	Pair	20		
	3754	Safety Glooves (Anti Cut/Cut Resistant/Industrial	Pair	20		
	3755	Trekking/Sun Glasses, Snow Googles	No.	12		
	3756	Safety Googles (OSSDEN)	No.	20		
	3757	Trekking Pole/Stick (Ultra compact- MT500)	No.	12		
	3758	Umbrellas (M/L), Big.	No.	20		
	3759	Neck Gaiter (Wind Proof)	No.	12		
	3760	Sun Hat (Water Proof Treeking/Survey Hat PIPE-TREK 900	No.	12		
	3770	Woolen Hat	No.	12		
	3711	Chains & Harness (Safety Belts) Full Body Adjustable Climbing Harness Safety Belt.	No.	12		
	3762	Safety Vest (Reflective High Visibility Neon waistcoat with 2" Stripes)	No.	20		
	3763	Safety Earmuff (X4P3 32 Db 3M Peltor X4P3 32 Db HiViz Helmet Mounted	Pair	20		
	3764	Safety Face Mask (N95: Protect Mouth Droplets)	No.	20		
	3765	Walkie-Talkie (Boafeng Bf-888S Two Way Radio Walkie-Talkie Long Range (5 Km Radius) Handheld Radios, Reachargeable Battery).	No.	2		
		Total for Bill No.37(carried forward to Grand Summary,p...)				

Bill of Quantities of Hydromechanical Works

Bill no 1 : Schedule of Unit Rates for Repair and Renovation of Fixed Wheel Vertical Lift Intake Gate (Face III) and Replacement of Trash Rack.

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Intake Gate at Face - III				
101	**ROPE DRUM HOIST (20 MT Capacity) without Hoist Bridge** - Manufacturing, Erection, Commissioning & Testing:- Manufacturing with QAP, fabrication, erection, commissioning & testing with 125 % of rated capacity of Rope Drum Hoist consisting of central drive unit, gear train frames, rope drums, gears, pinions, shafts, 3 phase electric motor, brake, reduction gear box, wire ropes, gate position indicators, manual operation arrangement, ICTP main switch, electric starter, etc. All material used shall conformed to related IS Codes specified in IS 6938. It includes all materials, Labour charges, machining and machinery charges, 1km lead charges of transportation, loading and unloading charges of Gate parts at Site, Inspection & Quality control charges, Sand blasting, Painting with one coat of Zinc rich primer on dry film to give total solventless coal tar epoxy paint applied to	No.	1		

	give dry film thickness 70 +/- 5 microns and 2 coats of minimum dry film thickness of 150+/- 5 micron per coat as per IS 14177.				
	Repairs to Vertical Lift Fixed Wheel Type Gate (3.96 m x 3.96 m - 1 No) - (rubber seal, track roller) :				
102	Dismantling of damaged Guide Rollers of Vertical Lift Intake Gate of size 3.96 m x 3.96 m. and fitting with new assembly, complete job with material, sundry material & labour charges.	No.	4		
103	Dismantling of damaged Wire Rope of Vertical Lift Gate of size 3.96 m x 3.96 m - 1 No. Fitting of new Wire rope of Dia 32 mm x 100 Mtr length confirming to IS 2266, with 'D' Clamp Applying Cardium compound (Servo coat - 140) along with satisfactory load test. Complete job with material, sundry material & Labor charges.	m	100		
104	Dismantling of Damaged Rubber Seals from Gate leaf of Vertical Lift Fixed Wheel type Gate size 3.96 m x 3.96 m and fitting of new Music Note Rubber Seal confirming to IS 11855-1986, along, with 16 mm diameter S.S. counter sunk bolts, with Double Washer and S.S. Nut with satisfactory test & trial. Complete job with material, sundry material & labour charges.				
	i) Side Seals	m	10		
	ii) Bottom Seals	m	5		
	iii)Top Seals	m	5		
105	Supply and Erection of MS	m²	15		

	Shed over Rope Drum Hoist, size 5m x 3m x 2m (h), M.S. structural works in roof trusses with tubular sections connected to one another with bracket, gusset cleats as per design, complete including cutting to requisite size, fabrication with necessary metal arc welding using electrodes of approved make and brand conforming to IS:814-1957, haulage, hoisting and erection all complete. The rate includes the cost of rolled steel section, corrugated GI Sheet consumables such as electrodes, gas and hire charge of all tools and plants and labor required for the work.				
106	Design, fabrication, supply, erection and commissioning of Trash Rack (Width - 4.50 m and Height – 4.50 m) consisting of a number of panels of suitable height with vertical trash bars of thickness not less than 12 mm, welded to structural steel frame at wider interval and provided with weld mesh frame for Intake structure of Face - III including cost of all materials,machinery, labour, cutting, aligning, welding, finishing, cleaning, applying one coat of zinc rich epoxy primer and four coats cold applied coal tar epoxy paint etc., complete as per IS: 11388 specifications and approved drawings with all leads and all lifts including packing / forwarding charges.	MT	3.2		

Total for Bill No.1 (carried forward to Grand Summary, p.....)	

Bill no 2: Schedule of Unit Rates for Repair and Renovation of Fixed Wheel Vertical Lift Draft Tube Gates

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	Draft Tube Gates				
	Repairs to Vertical Lift Fixed Wheel Type Gate (5.0 x 2.0 m - 2 Nos.) - (rubber seal, track roller) :				
201	Dismantling of damaged Wire rope of Vertical Lift Gate of size 5.0m x 2.0m - 2 Nos. Fitting of new wire rope of dia 32 mm x 100 m length confirming to IS 2266, with 'D' clamp, applying Cardium compound (Servocoat - 140) along with satisfactory load test. Complete job with material, sundry material & Labour charges.	m	100		
202	Dismantling of Damaged Rubber Seal from Gate leaf of Vertical Lift Fixed Wheel type Gate size 5.0m x 2.0m - 2 Nos. and fitting of new Music Note Rubber Seal confirming to IS 11855-1986, along with Corner Seals, Teflon Coating, 16 mm diameter S.S. counter sunk bolts, with Double Washer and S.S. Nut with satisfactory test & trial. Complete job with material, sundry material & labour charges.				
	a)Side Seals -	m	10		
	b) Bottom Seals	m	12		

	c)Top Seals	m	12		
203	Dismantling of damaged Guide Rollers of Draft Tube Gate of size 5.0m x 2.0m - 2 Nos. and fitting with new assembly, complete job with material, sundry material & labour charges.	No.	8		
204	Design, fabrication, supply, erection and commissioning of structural steel Hoist Supporting Structure consisting of columns, cross beams, bracings, stiffeners, mono-rail with fixtures etc., with all accessories for electrically operated monorail hoist for operating Draft Tube vertical lift gates and PRV including cost of all materials, machinery, labour, cutting, aligning, anchoring, welding, finishing, cleaning, applying two coats of zinc chromate red oxide primer and three coats of synthetic enamel paint etc., complete as per specifications and approved drawings and all leads and lifts including packing / forwarding charges.	MT	9.6		
205	Design, fabrication, supply, erection, testing and commissioning of Automatic Lifting Beam with all accessories for handling, lowering and lifting of Draft Tube Gates and PRV including cost of all materials, machinery, labour, cutting, aligning, welding, finishing, cleaning, applying one coat of zinc rich epoxy primer and two coats of cold applied coal tar epoxy paint etc., complete as per IS: 13951 specifications and approved drawings and all lifts and leads including	MT	2.7		

	packing / forwarding. i) Lifting Beam for Draft Tube Gates				
206	Design, fabrication, supply, erection, testing and commissioning of Dogging/Latching Arrangement with all accessories for handling of Draft Tube Gate including cost of all materials, machinery, labour, cutting, aligning, welding, finishing, cleaning, applying one coat of zinc rich epoxy primer and two coats of cold applied coal tar epoxy paint etc., complete as per specifications and approved drawings including all lifts and leads.	kg	100		
Total for Bill No 2 (carried forward to Grand Summary, p.....)					

Bill no 3: Schedule of Unit Rates for Repair and Renovation of Fixed Wheel Vertical Lift PRV Gates

(Note : The rates should include loading, unloading and carriage of all materials from their sources upto the work site)

Item no.	*Description*	*Unit*	*Quantity*	*Rate*	*Amount*
	PRV Gates				
	Repairs to Vertical Lift Fixed Wheel Type Gate (2.0 x 2.0 m - 2 Nos.) - (rubber seal, track roller) :				
301	Dismantling of damaged Wire rope of Vertical Lift Gate of size 2.0m x 2.0m - 2 Nos. Fitting of new Wire rope of Dia 32 mm x 100 m length confirming to IS 2266, with 'D' Clamp Applying Cardium compound (Servocoat - 140) along with satisfactory load test. Complete job with material, sundry material & Labour charges.	m	100		
302	Dismantling of Damaged Rubber Seal from Gate leaf of Vertical Lift Fixed Wheel type Gate size 2.0m x 2.0m - 2 Nos. and fitting of new Music Note Rubber Seal confirming to IS 11855-1986, along with Corner Seals, Teflon Coating, 16 mm diameter S.S. counter sunk bolts, with Double Washer and S.S. Nut with satisfactory test & trial. Complete job with material, sundry material & labour charges.				
	i) Side Seals	m	9		

	ii) Bottom Seals	m	9		
	iii)Top Seals	m	9		
303	Dismantling of damaged Guide Rollers of PRV Gate of size 2.0m x 2.0m - 2 Nos. and fitting with new assembly, complete job with material, sundry material & labour charges	No.	8		
304	Design, fabrication, supply, erection, testing and commissioning of Automatic Lifting Beam with all accessories for handling, lowering and lifting of PRV including cost of all materials, machinery, labour, cutting, aligning, welding, finishing, cleaning, applying one coat of zinc rich epoxy primer and two coats of cold applied coal tar epoxy paint etc., complete as per IS: 13951 specifications and approved drawings with all leads and all lifts including packing / forwarding.	MT	1		
305	Design, fabrication, supply, erection, testing and commissioning of Dogging/Latching Arrangement with all accessories for handling of PRV including cost of all materials, machinery, labour, cutting, aligning, welding, finishing, cleaning, applying one coat of zinc rich epoxy primer and two coats of cold applied coal tar epoxy paint etc., complete as per specifications and approved drawings with all leads and all lifts including packing / forwarding.	kg	50		

Total for Bill No 3(carried forward to Grand Summary, p.....)	

C. Daywork Schedule

General

1. Reference should be made to Sub-Clause 13.6 of the General Conditions. Work shall not be executed on a daywork basis except by a written order of the Engineer. The Bidders shall enter basic rates for daywork items in the Schedules, which rates shall apply to any quantity of daywork ordered by the Engineer. Nominal quantities have been indicated against each item of daywork, and the extended total for daywork shall be carried forward as a Provisional Sum to the Grand Summary. Unless payment is at current rate or as otherwise adjusted, payments for daywork shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract. The basic rates applied to daywork items may be quoted and payable in a single currency (either local currency or foreign currency) or multiple currencies (both local and foreign currencies), as appropriate.

Daywork Labour

2. In calculating payments due to the Contractor for the execution of daywork, the hours for labour will be reckoned from the time of arrival of the labour at the work location to execute the particular item of daywork to the time of return to the original place of departure. Only the time of classes of labour directly doing work ordered by the Engineer and for which they are competent to perform will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but the time of foremen or other supervisory personnel supervising the work will not be measured.

3. The Contractor shall be entitled to payment in respect of the total time that labour is employed on daywork, calculated at the basic rates entered by him in the **Schedule of Daywork Rates: 1. Labour,** together with an additional percentage payment on basic rates representing the Contractor's profit, overheads, etc., as described below:

   (a) The basic rates for labour shall be deemed to cover all direct costs to the Contractor, including (but not limited to) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances, and any sums paid to or on behalf of such labour for social benefits in accordance with all laws and regulations of [the *country of the Employer*].

   (b) The additional percentage to be quoted by the Bidder shall be applied to basic costs incurred under (a) above, and this additional percentage payment shall be deemed to cover the Contractor's profit, overheads, superintendence, liabilities, and insurances and allowances to labour, timekeeping, and clerical and office work, the use of consumable stores, water, lighting, and power; the use and repair of staging's, scaffolding, workshops, and stores, portable power tools, manual plant, and tools; supervision by the Contractor's staff, foremen, and other supervisory personnel; and charges incidental to the foregoing.

Daywork Materials

4. The Contractor shall be entitled to payment in respect of materials used for daywork (except for materials for which the cost is included in the percentage addition to labour costs as detailed heretofore), at the basic rates entered by him in the **Schedule of Daywork Rates: 2. Materials,** together with an additional percentage payment on the basic rates representing the Contractor's profit, overhead charges, etc., as described below:

   a. the basic rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc., and shall provide for delivery to store for stockpiling at the Site.

b. the additional percentage shall be quoted by the Bidder and applied to the basic cost incurred under (a) above, and this additional percentage payment shall be deemed to cover the Contractor's profit, overheads, administrative costs and all other charges related to the procurement and supply of such material

c. the cost of hauling materials for use on work ordered to be carried out as daywork from the store or stockpile on the Site to the place where it is to be used:

   i. shall not be included in the basic rate or percentage above; and

   ii. shall be paid separately under Schedule of Daywork Rates 1. Labour and/or

d. Schedule of Daywork Rates 3. Contractor's Equipment, as appropriate.

Daywork Contractor's Equipment

5. The Contractor shall be entitled to payments in respect of Contractor's Equipment (including those already on Site) employed on daywork at the basic rates entered by him in the **Schedule of Daywork Rates: 3. Contractor's Equipment,** together with an additional percentage payment on basic rates representing the Contractor's profit, overheads, etc., as described below:

(a) The basic rates for equipment shall be deemed to cover all direct cost to the Contractor including (but not limited to) the depreciation, interest, indemnity, and insurance, repairs, maintenance, supplies, fuel, lubricants, and other consumables directly related to the use of such equipment.

(b) The additional percentage shall be quoted by the Bidder and applied to the basic cost incurred under (a) above and this additional percentage payment shall be deemed to cover the Contractor's profit, overheads, administrative costs and all other charges related to the use of such equipment.

(c) The cost of drivers, operators, and assistants:

   (i) shall not be included in the basic rate or percentage above; and

   (ii) shall be paid for separately under Schedule of Daywork Rates 1. Labour

Schedule of Daywork Rates: 1. Labour

Item No.	*Description*	*Unit*	*Nominal Quantity*	*Rate*	*Extended Amount*
D101	Excavator Operator	hour	200		
D102	Dumper Driver	hour	200		
D103	Helper (Excavator)	hour	200		
D104	Helper (Dumper)	hour	200		
D105	Skilled Labour	hour	600		
D106	Unskilled Labour	hour	1000		
				Subtotal	
Allow__percent1 of Subtotal for Contractor's profit, overheads, etc.					
Total Daywork for Labour (carried forward to Daywork Summary, p._____)					

Notes for the Bidders

1. The Bidder shall indicate the percentage for Contractor's profit, overheads, etc. in accordance with paragraph 3(b) above.

Schedule of Daywork Rates: 2. Materials

Item No.	*Description*	*Unit*	*Nominal Quantity*	*Rate*	*Extended Amount*
D201	Cement	bag	1000		
D202	Sand	cum	150		
D203	Coarse aggregates	cum	50		
D204	Stone boulders	cum	600		
D205	Steel shuttering including props , supports ,etc.	sq m	100		
				Subtotal	
Allow_____percent1 of Subtotal for Contractor's profit, overheads, etc.					
Total Daywork for Materials (carried forward to Daywork Summary, p.____)					

Notes for the Bidders

1The Bidder shall indicate the percentage for Contractor's profit, overheads, etc. in accordance with paragraph 4(b) above.

Schedule of Daywork Rates: 3. Contractor's Equipment

Item No.	*Description*	*Unit*	*Nominal Quantity*	*Rate*	*Extended Amount*
D301	Excavator (including fuel and lubricants)	hour	200		
D302	Dumper (including fuel and lubricants)	hour	200		
D303	Concrete mixer (10 / 7 cft.) (including fuel and lubricants for diesel mixer)	hour	500		
D304	Concrete vibrators	hour	100		
				Subtotal	
Allow.....percent1 of Subtotal for Contractor's profit, overheads, etc.					
Total Daywork for Contractor's Equipment (carried forward to Daywork Summary, p. _____)					

Notes for the Bidders

1. The Bidder shall indicate the percentage for Contractor's profit, overheads, etc. in accordance with paragraph 5(b) above.

Daywork Summary

Description	***Amount***
1. Total for Daywork: Labour	
2. Total for Daywork: Materials	
3. Total for Daywork: Contractor's Equipment	
Total for Daywork (Provisional Sum) (carried forward to Grand Summary, p.)	

Schedule of Specified Provisional Sums

Item No.	Description	Amount
1	Cost of Dispute Board (DB)	Rs. 9.50 Lakh
	Total (carried forward to Grand Summary (C), p._____)	[sum]

Notes for the Bidders

1. Provisional Sums included and designated above shall be expended in whole or in part at the direction of the Engineer and in accordance with Sub-Clause 13.5. Notwithstanding the above, the Provisional Sum for the cost of the DB shall require no prior instruction of the Engineer
2. No Contractor's overhead charges or profit shall be included or payable on the Provisional Sum for the Cost of the DB.

Grand Summary

Description	Page	Amount (Rs. In Lakh)
CIVIL WORKS :		
Bill No. 1: General Items		
Bill No. 2:		
Bill No. 3:		
Bill No. 4:		
Bill No. 5 :		
Bill No .6 :		
Bill No. 7 :		
Bill No. 8 :		
Bill No. 9:		
Bill No.10 :		
Bill No.11:		
Bill No.12:		
Bill No.13 :		
Bill No.14 :		
Bill No.15 :		
Bill No.16 :		
Bill No.17 :		
Bill No.18 :		
Bill No.19 :		
Bill No.20 :		
Bill No.21 :		
Bill No.22 :		
Bill No.23 :		
Bill No.24 :		
Bill No.25 :		
Bill No.26 :		
Bill No.27 :		
Bill No.28 :		
Bill No.29 :		
Bill No.30 :		
Bill No.31 :		
Bill No.32 :		
Bill No.33 :		
Bill No.34 :		
Bill No.35 :		
Bill No.36 :		
Bill No. 37		

HYDROMECHANICAL WORKS :			
Bill No.1 :			
Bill No.2 :			
Bill No.3 :			
(A)	Total of Bills		
(B)	Total for Daywork (Provisional Sum)		
(C)	Specified Provisional Sum		9.50 [sum]
(D)	Total of Bills Plus Provisional Sums (A + B + C)) [carried forward to Letter of Price Bid]		

Technical Proposal

- Site Organization
- Method Statement
- Mobilization Schedule
- Construction Schedule
- Health and Safety Plan
- Environmental Plan
- Schedule of Subcontractors
- Personnel:
  - Form PER-1: Proposed Personnel
  - Form PER -2: Resume of Proposed Personnel
- Construction Equipment
  - Form EQU: Construction Equipment
- [*others*]

Site Organization

[*The Bidder shall insert the organization information.*]

Method Statement

[*The Bidder shall insert the Method Statement.*]

Mobilization Schedule

[T*he Bidder shall insert the Mobilization Schedule.*]

Construction Schedule

[*The Bidder shall insert the Construction Schedule.*]

Health and Safety Plan

[*The Bidder shall insert the Health and Safety Plan.*]

Environmental Plan

[*The Bidder shall insert the Environmental Plan.*]

Schedule of Subcontractors

[*The Bidder shall list below, subcontractors (if any) proposed to be used by the Bidder for the execution of the key activities listed in the Prequalification criteria or Section III, Evaluation and Qualification, Sub-Factor 2.4.2(b) as appropriate, in accordance with Section I, Instruction to Bidders, ITB 16.2, as appropriate. The completed Schedule, once accepted by the Employer will be a Contract document in accordance with the Contract Agreement. Nominated Subcontractors shall not be listed in this Schedule.*]

No.	Key Activity	Subcontractor	
		Name	Nationality

Form PER -1: Proposed Personnel

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

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

JV Member Legal Name: [*insert full name*]

IFB No: [*insert number*]

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

[*The Bidder shall provide the names of suitably qualified personnel to meet the specified requirements stated in Section III, Evaluation and Qualification Criteria, Clause 1.1.1. 'Title of Position' shall be filled in with key positions as listed in the above Clause.*]

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

Form PER -2: Resume of Proposed Personnel

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

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

JV Member Legal Name: [*insert full name*]

IFB No: [*insert number*]

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

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

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

[*The Bidder shall summarize professional experience over the last 20 years, in a reverse chronological order. Indicate particular technical and managerial experience relevant to the position of the proposed personnel.*]

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

Form EQU: Construction Equipment

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

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

JV Member Legal Name: [*insert full name*]

IFB No: [*insert number*]

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

[*The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria, Clause 1.1.2. 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:**	

Bidder's Qualification

[*Option II: 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 Forms included hereunder:

Form ELI -1	: Bidder Information Form
Form ELI -2	: JV Member Information Form
Form ELI -3	: Subcontractor Information Form
Form CON	: Historical Contract Non-Performance and Litigation
Form FIN -1	: Financial Situation
Form FIN -2	: Average Annual Turnover
Form FIN -3	: Financial Resources
Form FIN -4	: Current Contract Commitments
Form EXP -1	: General Experience
Form EXP -2(a)	: Specific Experience
Form EXP -2(b)	: Experience in Key Activities

Form ELI -1: Bidder Information Form

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

IFB No.: [*insert number*]

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

[*Bidders shall provide the following information. The documents listed/ stated as required shall be submitted as attachments hereto.*]

Bidder's legal name: [*insert full name*]
In case of a JV, legal name of the representative member and of each member: [*insert full name of each member in the JV and specify the representative member.*]
Bidder's actual or intended country of registration: [*insert country of registration*]
Bidder's actual or intended year of incorporation: [*insert year of incorporation*]
Bidder's legal address in country of registration: [*insert mailing address*]
Bidder's authorized representative information Name: [*insert full name*] Address: [*insert mailing address*] Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] Email address: [*insert email 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. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -2: JV Member Information Form

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

IFB No.: [*insert number*]

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

[*The following form is additional to Form ELI-1, and shall be completed to provide information relating to each JV member, in case if the Bidder is a JV. The documents listed/ stated as required shall be submitted as attachments hereto.*]

Bidder's legal name: [*insert full name*]
JV Member's legal name: [*insert full name of Bidder's party*]
JV Member's country of registration: [*insert country of registration*]
JV Member's year of incorporation: [*insert year of incorporation*]
JV Member's legal address in country of registration: [*insert mailing address*]
JV Member's authorized representative information Name: [*insert full name*] Address: [*insert mailing address*] Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] Email address: [*insert email 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. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -3: Subcontractor Information Form

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

IFB No.: [*insert number*]

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

[*The following form is additional to Form ELI-1 and ELI-2 (if applicable), and shall be completed to provide information relating to the Subcontractor(s) (if any) proposed to be used by the Bidder for the execution of the key activities listed in the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.2(b), as appropriate. The documents listed/ stated as required shall be submitted as attachments hereto.*]

Bidder's legal name: [*insert full name*]
Subcontractor's legal name: [*insert full name of Subcontractor*]
Subcontractor's country of registration: [*insert country of registration*]
Subcontractor's year of incorporation: [*insert year of incorporation*]
Subcontractor's legal address in country of registration: [*insert mailing address*]
Subcontractor's authorized representative information Name: [*insert full name*] Address: [*insert mailing address*] Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] Email address: [*insert email 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. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form CON: Historical Contract Non-Performance and Litigation

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*] Page [*insert page number*] of [*insert total number*] pages

1. History of Non-Performing Contracts

Non-Performing Contracts			
In accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.1, as appropriate, since 1st January [*2017*]: [*The Bidder shall indicate the applicable wording below by checking the appropriate box.*] ☐ contract non-performance did not occur. ☐ contract non-performance occurred as indicated below:			
Year	**Non- performed portion of contract**	**Contract Identification**	**Total Contract Amount**
[*insert year*]	[*insert amount and percentage*]	• Contract Identification: [*insert complete contract name, number, and any other identification*] • Name of Employer: [*insert full name*] • Address of Employer: [*insert mailing address*] • Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] • Email address: [*insert email address*] • Reason(s) for non-performance: [*indicate main reason(s)*]	[*insert current value, currency, exchange rate and USD equivalent*]

2. Pending Litigation

Pending Litigation				
In accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.2, as appropriate: [*The Bidder shall choose the relevant wording below by checking the appropriate box.*] ☐ there is no pending litigation involving the Bidder. ☐ there is pending litigation involving the Bidder as indicated below:				
Year of dispute	**Amount in dispute (currency)**	**Outcome as Percentage of Net Worth**	**Contract Identification**	**Total Contract Amount**
[*insert year*]	[*insert amount*]	[*insert percentage*]	• Contract Identification: [*indicate complete contract name, number, and any other identification*] • Name of Employer: [*insert full name*] • Address of Employer: [*insert mailing address*] • Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] • Email address: [*insert email address*] • Party who initiated Litigation: [*indicate "Employer" or "Contractor"*] • Matter in dispute: [*indicate main issues in dispute*]	[*insert current value, currency, exchange rate and USD equivalent*]

3. Litigation History

Litigation History		
In accordance with the Prequalification criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.2.3, as appropriate, since 1st January [*2017*]: [*The Bidder shall choose the relevant wording below by checking the appropriate box*] ☐ there are no court orders against the Bidder. ☐ there are court orders against the Bidder as indicated below:		
Year of award	**Contract Identification**	**Total Contract Amount**
[*insert year*]	• Contract Identification: [*indicate complete contract name, number, and any other identification*] • Name of Employer: [*insert full name*] • Address of Employer: [*insert mailing address*] • Telephone/Fax numbers: [*insert telephone/fax numbers, including country and city codes*] • Email address: [*insert email address*] • Matter in dispute: [*indicate main issues in dispute*] • Party who initiated litigation: [*indicate "Employer" or "Contractor"*] • Abstract of the Court Order: [*state concisely the court order concerning main issues in dispute*]	[*insert current value, currency, exchange rate and USD equivalent*]

Form FIN -1: Financial Situation

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV. The documents listed/ stated as required shall be submitted as attachments hereto.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*] Page [*insert page number*] of [*insert total number*] page

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

1. Financial documents

The Bidder and its parties shall provide copies of the financial statements1 for the number of years indicated in the relevant Prequalification criteria or Section III, Evaluation and Qualification Criteria Sub-Factor 2.3.1, as appropriate. The financial statements shall:

(a) reflect the financial situation of the legal entity(ies) comprising the Bidder, and not of the affiliated entities (such as parent company(ies), group companies or subsidiaries) of the Bidder unless they are parties to the Bidder under a JV in accordance with ITB 4.1.

(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 herewith are copies of financial statements for the number of years required above, and complying with the requirements.

Notes for the Bidders

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 -2: Average Annual Turnover

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*] Page [*insert page number*] of [*insert total number*] pages

Annual Turnover Data			
Year	**Amount and Currency**	**Exchange Rate**	**USD equivalent**
[*indicate year*]	[*insert amount and indicate currency*]	[*insert applicable exchange rate*]	[*insert amount in USD equivalent*]
Average Annual Turnover 1			

Notes for the Bidders

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

Form FIN -3: Financial Resources

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*]

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

[*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 the Prequalification Criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3.3, as appropriate.*]

Financial Resources		
No.	**Source of financing1**	**Amount (USD equivalent)**
1		
2		
3		

Notes for the Bidders

1. Sources of financing may include working capital (to be taken from FIN-1), Credit Line (to be substantiated by a letter from the bank issuing the line of credit), etc.

Form FIN -4: Current Contract Commitments

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No. [*insert number*]

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

[*The Bidder and each JV member 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 Taking-over Certificate/ Completion Certificate has yet to be issued, in accordance with the Prequalification Criteria or Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3.3, as appropriate.*]

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

Form EXP -1: General Experience

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*]

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

[*The Bidder shall identify contracts that demonstrate continuous experience pursuant to Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.1 and list contracts chronologically, according to their commencement (starting) dates.*]

General Construction Experience			
Starting Year	**Ending Year**	**Contract Identification**	**Role of Bidder**
[*indicate year*]	[*indicate year*]	• Contract name: [*insert full name*] • Brief description of the contract performed by the Bidder: [*describe the contract performed briefly*] • Amount of contract: [*insert amount in currency, mention currency used, exchange rate and USD equivalent*] • Name of Employer: [*insert full name*] • Address: [*insert mailing address*]	[*insert "Prime Contractor (single entity or JV member)" or "Subcontractor"*]

Form EXP -2(a): Specific Experience

[*The following table shall be filled in for the Bidder, and for each JV member if the Bidder is a JV. The documents listed/ stated as required shall be submitted as attachments hereto.*]

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

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

JV Member's Legal Name: [*insert full name*]

IFB No.: [*insert number*]

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

[*The Bidder shall fill out one (1) form per contract, in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.2(a).*]

Contract of Similar Size and Nature			
Similar Contract No. [*insert number*] of [*insert number of similar contracts required*]	**Information**		
Contract Identification	[*insert contract name and reference identification number, if applicable*]		
Award Date	[*insert day, month, year, e.g., 15 June 2015*]		
Completion Date	[*insert day, month, year, e.g., 03 October 2017*]		
Role in Contract [*check the appropriate box*]	Prime Contractor		
	Single entity _ _		JV member _ _
Total Contract Amount	[*insert total contract amount and currency(ies)*]		USD [*insert exchange rate and total contract amount in USD equivalent*]
If member in a JV, specify participation in total Contract amount	[*insert percentage participation*]	[*insert total contract amount and currency(ies)*]	USD [*insert exchange rate and total contract amount in USD equivalent*]
	[*describe participation in JV and work performed*]		
Employer's Name:	[*insert full name*]		
Address:	[*insert mailing address*]		

Contract of Similar Size and Nature	
Similar Contract No. [*insert number*] of [*insert number of similar contracts required*]	**Information**
Telephone/fax number E-mail:	[*insert telephone/fax numbers, including country and city area codes*] [*insert email address, if available*]
Description of the similarity in accordance with Sub-Factor 2.4.2(a) of Section III:	
1. Physical Size of Required Works items	[*insert physical size of items*]
2. Complexity	[*insert description of complexity*]
3. Construction Methods/ Technology	[*insert specific aspects of the methods/ technology involved in the contract*]
4. Other Characteristics	[*insert other characteristics as described in Section VI, Works Requirements*]

Attached herewith are the copies of originals of:

(a) abstracts of contract documents, JV Agreements, etc. evidencing that the size and nature of the above-mentioned contract meets the requirements specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.2(a).

(b) the end-user certificate(s) (i.e. Taking-over Certificate(s)/ Completion Certificate(s)), evidencing that the contract above-mentioned contract has been successfully completed.

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

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

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

IFB No.: [*insert number*] Page [*insert page number*] of [*insert total number*] pag

1. Summary of Key Activities

[*Fill out if the Bidder is a Single Firm / JV or proposes Subcontractors for the execution of any of the key activities.*]

Summary of Single Firm / JV Member/ Subcontractor for Key Activities		
Key Activity		***Single Firm / JV Member/ Subcontractor***
No	**Description**	
1	[*insert name of Activity No. 1*]	[*insert full name(s) of Single Firm/JV Member(s)/Subcontractor(s)*] (i) _____ (ii) _____ (iii) _____
2	[*insert name of Activity No. 2*]	[*insert full name(s) of Single Firm/JV Member(s)/Subcontractor(s)*] (i) _____ (ii) _____ (iii) ___
3	[*insert name of Activity No. 3*]	[*insert full name(s) of Single Firm/JV Member(s)/Subcontractor(s)*] (i) _____ (ii) _____ (iii) _____
4	[*insert name of Activity No. 4*]	[*insert full name(s) of Single Firm/JV Member(s)/Subcontractor(s)*] (i) _____ (ii) _____ (iii) _____
etc.	_____	_____

2. Contract Information

Key Activity No (1): [*insert name of Key Activity*]

[*Fill out one (1) form per contracts performed by the Bidder (Single Firm)/ JV member/ Subcontractor as listed in the Summary of Key Activities above in accordance with Section III, Evaluation and Qualification Criteria,*

Sub-Factor 2.4.2(b). The documents listed/ stated as required shall be submitted as attachments hereto.]

(i) [*insert full name of Single Firm /JV Member's /Subcontractor's Legal Name*]

Contract with Similar Key Activities			
Item	**Information**		
Contract Identification	[*insert contract name and number, if applicable*]		
Award Date	[*insert day, month, year, e.g., 15 June 2015*]		
Completion Date	[*insert day, month, year, e.g., 03 October 2017*]		
Role in Contract [*check the appropriate box*]	Prime Contractor		Subcontractor ☐
	Single entity ☐	JV member ☐	
Total Contract Amount	[*insert total contract amount and currency(ies)*]	*USD* [*insert Exchange rate and total contract amount in USD equivalent*]	
[*insert brief description of the Activity No. (1)*]	[*Describe briefly how the corresponding minimum requirement is met.*]		
Employer's Name:	[*insert full name*]		
Address: Telephone/fax number Email:	[*indicate mailing address*] [*insert telephone/fax numbers, including country and city area codes*] [*insert email address, if available*]		

Contract with Similar Key Activities

Attached herewith are the copies of originals of:

(a) abstracts of contract documents, sub-contract agreements, JV Agreements, etc. evidencing that the above activity meets the criteria specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.2(b).

(b) the end-user certificate(s) (i.e. Taking-over Certificate(s)/ Completion Certificate(s)) for the above-mentioned contract, evidencing that the above activity has been successfully carried out.

i. [*insert full name of Single Firm /JV Member's /Subcontractor's Legal Name*]

ii. [*insert full name of Single Firm /JV Member's /Subcontractor's Legal Name*]

Key Activity No. (2): Key Activity No. (3):

Form ACK

Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans

A) I, [*insert name and position of authorized signatory*], being duly authorized by [*insert name of Applicant/members of joint venture ("JV")*] (hereinafter referred to as the "Applicant") to execute this Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans, hereby certify on behalf of the Applicant and myself that:

(i) all information provided in the Application submitted by the Applicant and its subcontractors for [*insert name of the Project, and name, number and identification of lot(s) (contracts(s)) as stated in PDS 1.1*] is true, correct and accurate to the best of the Applicant's and my knowledge and belief; and

(ii) the Applicant or any of its subcontractors has not, directly or indirectly, taken any action which is or constitutes a corrupt or fraudulent practice and is not subject to any conflict of interest as stipulated in the relevant section of the Guidelines.

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

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

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

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

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

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

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

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

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

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

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

Tel: +81 (0)3 5226 8850

(2) **JICA India Office**

Address
16th Floor, Hindustan Times House, 18-20, Kasturba Gandhi Marg, New Delhi - 110-001
Tel:(91-11)4909-7000
Fax:(91-11)4909-7001/7002/7003/7004
Email: id_oso_rep@jica.go.jp
Media Enquiries: jicaid-PR-India@jica.go.jp

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

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

_____**Authorized Signatory**
[*insert name of signatory; title*]

For and on behalf of
[*insert name of the Applicant*]
Date: [*insert date*]

Form of Bid Security

(Bank Guarantee)

[*Guarantor letterhead or SWIFT identifier code*]

Beneficiary: [*insert its name and address*]

IFB No.: [*insert number of Invitation for Bids*]

Date: [*insert date of issue*]

BID GUARANTEE No.: [*insert guarantee reference number*]

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

We have been informed that [*insert name of the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof*] (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of [*insert description of contract*].

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

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

(a) has withdrawn its Bid during the period of bid validity set forth in the Applicant's Letters of Technical Bid and Price Bid ("the Bid Validity Period"), or any extension thereto provided by the Applicant; or

(b) having been notified of the acceptance of its Bid by the Beneficiary during the Bid Validity Period or any extension thereto provided by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to Bidders of the Beneficiary's bidding document.

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

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

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

[*signature(s)*]

Section V : Eligible Source Countries of Japanese ODA Loans

All countries except Pakistan and China.

PART 2 –WORKS REQUIREMENTS

(Note : For Technical Specifications and Drawings refer Volume – II & IV respectively)

SECTION VI. WORKS REQUIREMENTS

(Note : For Technical Specifications and Drawings refer Volume – II & IV respectively)

Project Brief and Scope of Work

Project Brief

Project Background : The Umiam – Umtru Stage – III H.E Project (2x30 MW) is located at Kyrdemkulai in Ri Bhoi District of Meghalaya . The project was commissioned in 1979 with two units of 30 MW each . The project was so named because it uses the trans-basin discharge of the Umiam river which is utilized to run the Umiam Stage – I and Umiam Stage – II Power Stations together with the discharge of the Umtru river. The tail water from Umiam Stage – II Power Station discharges into the Umtru river A reservoir with live storage capacity of 2.78 Million cum was created downstream by constructing a dam across the river Umtru at Kyrdemkulai . The water from this reservoir is drawn through the Link Tunnel of diameter 3.05 m and length of 2840 m into the Nongmahir Forebay where a pondage was created by constructing a main earthen dyke and 5 (five) saddle dykes to retain the water. From the Nongmahir Forebay , the water is drawn through a 3.96 m diameter Head Race Tunnel of 600 m length and thereafter through two steel penstocks of internal diameter 2.59 m each and length of 366 m each to run two hydro generating units of 30 MW capacity each . The design discharge of the power station is 46.80 cumec and its rated head is 150 m .

Problems encountered : The project has been in operation for more than four decades and a number of operational problems have been encountered during this period . The main problems relating to Civil and Hydromechanical facilities are briefly as follows :

A . Civil Facilities

i) Siltation and collection of debris in the Link Tunnel and at its exit . Though the Link Tunnel could not be inspected throughout because most of its length is under water, it is suspected that in its lower reaches , silt and debris has deposited especially at the exit of the tunnel . As a result of this , the discharge through the Link Tunnel (design discharge is 28.32 cumec) has decreased progressively over a period of time and the present discharge is not sufficient to run the generating units as originally planned .

ii) Deterioration of the concrete lining in both the Link Tunnel and the Head Race Tunnel . It was observed that cavities have formed in the concrete lining and in some places the reinforcement has been exposed. Seepage of water through the concrete lining was also observed . In the HRT a major seepage was observed when the tunnel is filled with water.This seepage from the HRT which is significant , flows into a nearby valley and forms a stream which discharges into the Umtru river near the tail race of the power station .

B. Hydromechanical Facilities

i) Deterioration of the intake gate at the entry to the HRT and its hoisting arrangement and deterioration of the trash rack. It was also observed that collection of debris at the entrance to the intake is a common phenomenon .

ii) Deterioration of the two Draft Tube gates and their hoisting arrangements in the Power House .

iii) Deterioration of the two Pressure Relief Valve gates and their hoisting arrangements in the Power House .

iv) Deterioration of internal and external surface coatings of the penstock , deterioration of seals in expansion joints , etc.

Objectives of the proposed works : The main objectives of the works proposed to be executed under this package are :

i) Life extension of the Civil and Hydromechanical facilities .
ii) Restoration of the design discharge through the Link Tunnel to achieve the power generation as planned .
iii) Improvement of operational efficiency of personnel deployed in the project.

Scope of Works

A. Civil Works

1.Link Tunnel Intake (Face -I) & Exit (Face – II)

i) Providing temporary bunds / barriers at the entrance and exit of Link Tunnel to prevent seepage of water into the tunnel for dry working condition.
ii) Providing PCC lining at the external faces of the temporary bunds to seal any leaks through the bunds.
iii) Repair of approach channel to Intake.
iv) Dismantling and removal of the temporary bunds after all works are over.

2. Nongmahir Dykes and Reservoir

a) Spillway

i) Repair of concrete of spillway

b) Dykes

i) Rearrangement of scattered boulders / rip rap at the heel and upstream face of the dykes

ii) Installation of V – notch at the toe of the main earthen dyke.
iii) Fencing of dykes with barbed wire fencing and RCC posts/pillars
iv) Provision of lighting arrangement at main dyke and intake.

3. Link & Head Race Tunnels

i) Cleaning / dredging of debris and silt from inside the Link tunnel and from its exit into the Nongmahir Forebay.

ii) Rehabilitation of both Link and Head Race tunnels by dismantling the damaged concrete lining wherever necessary , provision of reinforcement , shuttering and concreting of the dismantled lining portion and filling of cavities and worn out portions in the tunnels by pumped concrete .

iii) Rehabilitation of both Link and Head Race Tunnels by contact grouting and consolidation grouting .

4. Penstock

i) Dismantling of RCC roof slab and walls of penstock valve house for removal of old valves and recasting of the roof slab and walls after installation of new valves including construction of RCC foundations for oil pumping units of the new valves .

ii) Painting of internal and external surfaces of penstock

iii) Repair work of expansion joints of penstock

iv) Rehabilitation of drain pipe and valve .

v) Repair of drains , construction of fencing , etc.

5.Surge Shaft

i) Fencing and provision of gate

6. Power House & Switchyard

i) Conduct of non-destructive tests to ascertain the structural integrity of the turbo-generator foundations.

ii) Strengthening of power house structure for the revised loading of machines, if required.

iii) Provision of temporary steel structure under the Service Bay slab to lend additional support to the slab during assembly of stator in Service Bay.

iv) Painting of power house building.

v) Replacement of flooring , provision of false ceiling in control room, etc.

vi) Renovation of sanitary works in power house building

vii) Renovation of firefighting system

viii) Construction of .temporary bund at the tail race to prevent flood water from entering into the power house.

viii) Dismantling and reconstruction of Switchyard control room / store.

f) Operational Facilities

i) Renovation / reconstruction of access road to power house, surge shaft, penstock, switchyard and Link Tunnel Intake Face - I

ii) Renovation of operation houses (Inspection Bungalow at Zero Point and barracks /residential quarters near power house and penstock) including fencing, provision of gates,etc.

iii)Construction of overhead water tank , provision of water supply,etc.

iv)Provision of log boom near tunnel intake.

v) Procurement of Monitoring Instruments, safety items ,etc. for improvement of efficiency of manpower employed in operation & maintenance works.

B. Hydromechanical Works:

i) **(a) Intake fixed wheel gate of size 3.96m X 3.96m (1 no.) at entry to HRT (Face III) :** Gate leaf inspection/ repairing, replacement of wheels , seals and greasing of wheel bearings, inspection and repairing of embedded parts, replacement of existing hoisting arrangement (mechanical and electrical) with new Rope Drum Hoist without hoist bridge , construction of shed over Rope Drum Hoist , replacement of gate seals, adjustment of limit switches including testing for its smooth functioning , dry as well as wet testing the operation of gate, painting of gate, hoist support and hoists.

(b) Trash Rack for Intake (Face-III) : Inspection and replacement of trash rack and painting; testing for its smooth functioning.

ii) **Draft tube gates 5.00 m X 2.00 m (2 nos.) in Power House:** Gate leaf inspection/ repairing; dismantling, cleaning , replacing worn out parts, i.e., bearing seals, etc., reassembly of wheel assembly; inspection and repairing of embedded parts, , monorail , provision of new hoist supporting structure, provision of Automatic lifting beam with all accessories , provision of dogging / latching arrangements for gates , replacement of gate seals including fasteners, adjustment of limit switches including testing for smooth functioning; dry as well as wet testing the operation of gates including painting of the gates and hoisting arrangements .

iii) **PRV gates 2.00 m X 2.00 m (2 nos,) in Power House:** Gate leaf inspection/ repairing; dismantling, cleaning , replacing worn out parts, i.e.,bearings , seals , etc., reassembly of wheel assembly; inspection and repairing of embedded parts, monorail , provision of Automatic lifting beam with all accessories , provision of dogging / latching arrangements for gates , replacement of gate seals including fasteners, adjustment of limit switches including testing for smooth functioning; dry as well as wet testing the operation of the gates including painting of the gates and hoisting arrangements .

BIDDING DOCUMENTS

FOR

RENOVATION, MODERNIZATION AND UPGRADATION OF UMIAM-UMTRU STAGE- III HYDRO ELECTRIC POWER PROJECT

PACKAGE II

[Civil & Hydro Mechanical Works]

Volume – II

Technical Specifications

Part A – General Technical Specifications

Part B – Particular Technical Specifications

EMPLOYER: MEGHALAYA POWER GENERATION CORPORATION LIMITED
COUNTRY: INDIA
PROJECT: UMIAM - UMTRU STAGE III HEPP
LOAN NO. : ID-P 271

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PART – A
GENERAL TECHNICAL SPECIFICATIONS

CHAPTER -G.1 WORKING FACILITIES

1.1 General

1.1.1 Scope of Work

The Contractor shall design, provide, erect, operate and maintain the Working Facilities required for the execution of the Permanent Works, within the specified time schedule, such as but not necessarily limited to:

- Camp and Facilities
- Office parking areas, warehouses, storage areas and medical care services.
- Plant and Equipment
- Concrete and materials processing plant including cement storage.
- Explosives Magazines.
- Dumping, quarry and stock pile area.
- Muck disposal area
- Material Testing Laboratory.
- Underground ventilation system
- Electric Power Supply System
- Telephone & Communication Network
- Water Supply System
- Sewage and Wastewater System
- Access and Haul Roads including public road Diversion.

Working Facilities shall be subject to the Engineer in charge's approval. The Contractor shall comply with all applicable laws, regulations, and ordinances relating to the construction and operation of the working Facilities.

The land for permanent works and muck disposal shall be the responsibility of the owner. However, land for contractor's establishment shall be the responsibility of the Contractor himself and if land is provided by the owner,the contractor shall have to pay rent at the rate(s) fixed by the owner.

Materials for the Working Facilities shall be of first-class quality and if not new, in best condition. The capacity and number of equipment shall conform to the specific minimum requirements for the works they are intended for and the climatic conditions prevailing at the Site. The capacity and number of equipment shall be determined taking into account conversion of equipment throughout the entire work.

The Contractor shall attach to his Bid Documents Drawings, pictures and operating descriptions for his proposed Working Facilities and shall indicate weight, standards, capacity, manufacturing date and country of origin.

Equipment of working facilities must be individually approved by the Engineer in charge prior to being ordered or dispatched.

The Contractor shall, prior to dispatching any items of the working Facilities, inform the Engineer in charge with clear indications about the purpose of the items, the kind, date and place of consignment (factory or as identified by the Contractor), date and place or port of shipment and arrival in the country. Said notice must be given in due time to allow for a possible cancellation in case the items do not comply with the requirements as stipulated. The Engineer in charge will agree or disagree with the inquiry in writing within the next 15 days on arrival of the notice.

The Contractor shall supply all his Working Facilities with sufficient spare parts, special tools for repair work and complete standby units of vital parts to guarantee a continuous operation without untimely delays. The Contractor is fully responsible for any delays due to disregard of said necessity. Should the Engineer in charge determine that the equipment furnished does not meet all requirements the deficiencies shall be corrected by the Contractor before further use, or the deficient equipment shall be replaced with satisfactory equipment. Any cost incurred in the correction or replacement shall be borne by the Contractor. All Working Facilities shall be built in the areas indicated in the Drawings or as directed by the Engineer in charge. The Contractor shall submit 56 days prior to the

start of the Works to the Engineer in charge for approval, a drawing showing the exact positions of the main working facilities.

1.1.2 Submittals

The Contractor shall submit basic plan of Working Facilities together with his bid.

At least 28 days prior to commencing the work, the Contractor shall submit to the Engineer-in-charge for approval the drawings showing layout and details of the Working Facilities.

Monthly electric power capacity required for work sites during construction period shall be submitted together with, or preferably before the above drawings to the Engineer in charge for approval. Additionally, the updated electric power capacity shall be submitted, if any change from the original plan is proposed, at least 28 days prior to the change

1.2 Camp and Facilities

1.2.1 General

The camp and Facilities include but are not limited to

- Staff residential quarters for the Contractor's staff
- Accommodation and canteen for the Contractor's workmen
- Miscellaneous social facilities
- Offices for the Contractor
- Field office for the Engineer in charge
- Warehouse and sheds for the Contractor
- Work and repair shops

All working facilities shall be equipped with electricity arrangement, telephone, water supply with drinking water, sewage system and if necessary with air conditioning.

Entire construction power (Grid as well as DG power) shall be arranged by the Contractor at his own cost. The Contractor shall have to make his own arrangement for construction power for his ancillary works and camps by his own diesel generating sets to meet full requirement. Further the Contractor has to provide distribution facilities and necessary safety precautions at his own cost.

1.2.2 Office Premises

1) Offices for the Contractor.

Offices for the staff of the Contractor shall be of sufficient size and fully furnished and equipped with sanitary facilities, communication system, etc.

2) Field Office for the Engineer in charge

The Contractor shall provide for office use of the engineer-in -charge 1(one) building of minimum 50 (fifty) sq.m plinth area divided into a minimum of 2 rooms with attached toilets . The building shall be located at the site selected by the Engineer-in-charge.

The building shall be completely serviced with electricity (with fixtures), potable water, sewerage, toilet and washing facilities. Also the office shall be equipped with 4 desks and 12 chairs , 2 (two) filing cupboards, a meeting table and a refrigerator. The Contractor shall provide maintenance and repair, and other services throughout the duration of the Contract free of charge to the Engineer-in-charge.

3) Miscellaneous Working Facilities

The Contractor shall construct and maintain warehouse / storage yard, repair shops, , etc. for the efficient execution of the work.

a) Warehouse (s) and sheds

Warehouse (s) for the storage of materials, mechanical and electrical spare units, spare parts, etc. shall be well secured, ventilated (if necessary) and waterproof and shall be installed with the necessary appliances.

b) Work and repair shops

All work and repair shops shall be well secured ventilated (if necessary) and waterproof. They shall be equipped with adequate equipment and tools necessary to carry out all works and repairs which are usually done on the Site.

1.3 Plant and Equipment

1.3.1 General

The Contractor shall provide all construction plants and equipment necessary for the efficient execution of the work described in the Specifications and details supplied by the Contractor the constructional plant and equipment schedule.

The Contractor shall also deploy additional equipment if needed at his own cost for timely completion of works.

In case other Contractors wish to use the plant and equipment provided by the Contractor, the service shall be mutually agreed by the both parties.

Priority over the use of any part of the Contractor's plant and equipment shall be finally decided by the Engineer in charge.

1.4 Electric Power Supply System

During construction, power shall be required for all the working areas including working facilities area, workshop and Owner's permanent establishment.

It is proposed to meet the construction power requirement by installing Diesel generating sets at strategic locations. The DG stations shall be located near the load centre and power to nearby areas shall be taken through cables.

The capacities and locations of DG shall be assessed by the Contractor and submitted to the engineer –in-charge for its approval before start of the works.

DG station shall cater for the power requirements of:

- Construction equipments
- Compressors
- Ventilation
- Dewatering / cooling pumps
- Welding and illumination
- Contractor's facility area
- Magazine areas
- Workshops
- General lighting

1.5 Telephone and Communication Network

The telecommunication system, mobile, internet system shall be arranged by the Contractor for usage at the field office. The Contractor will be responsible for effective internal distribution of the telecommunication system to individual sites/offices. P&T lines as required shall be arranged by the Contractor at his own cost.

1.6 Water Supply System

The Contractor shall design, construct, equip, operate and maintain the installation necessary for the

adequate supply of raw water for construction use and drinkable water for human consumption at the various work areas as well as at the camps. Regulating, transporting, treating and distributing the water shall be included.

For construction use and other use, enough amount of storage shall be secured especially for dry months. The Contractor shall be fully responsible for the arrangement of necessary facilities for water supply. Only adequately treated water which complies with the current sanitary standards will be accepted for human consumption. Installation of non potable water supply systems in the camp areas will not be permitted. Storages tanks with a reserve capacity equivalent to two (2) days of normal usage will be required for the drinking water system.

The Contractor shall take drinking water samples from time to time if so requested by the Engineer in charge. The samples shall be sent for chemical bacteriological analyses to approved laboratories, at his expense and the results of the analysis shall be obtained within 15 days of the sampling. If the sampling and testing are not properly performed, the Employer may perform the same directly and charge the Contractor for the corresponding expenses.

1.7 Sewage and Waste Water System

The Contractor shall design, construct, equip, operate and maintain all the installation necessary to properly collect, treat and dispose of sewage from his camps and other construction facilities.

The Contractor shall not, under any circumstances, discharge sewage or contaminated water into natural streams or any open areas. The pondage system for treatment and disposal of sewage shall not be used.

Treatment and disposal of sewage shall be performed in accordance with the current related standards and laws in force in India and always subject to the Engineer in charge's approval.

The drainage systems shall be designed taking into account the high rainfall rate in the area and the disposal of rainwater shall be accomplished in such a way that no erosion problems are caused which may alter the stability of the surrounding area.

1.8 Access Roads

1.8.1 General

The project roads will be constructed by the Contractor and are scheduled to be completed by the commencement of Main Civil Works. Other temporary access and haul roads shall be constructed by the Contractor.

The Contractor shall design, construct and maintain the haul roads and related work that may be necessary, from the existing roads and tracks to the various work areas, and other areas such as camps, stores, explosive magazines, plants, disposal areas and any other areas related to the work.

Additionally, the Contractor shall improve where necessary and maintain all the existing roads and tracks in and adjacent to the project area to the satisfaction of the Engineer in charge for guaranteeing normal traffic for any kind of vehicle.

The Contractor shall maintain project roads constructed b y others and temporary access and haul roads constructed by the Contractor up to the final completion of the Project to the satisfaction of the Engineer in charge.

The Contractor shall be responsible for the safety of the traffic during the construction.

The training of safe driving together with providing enough quantity of traffic signs are the responsibility of the Contractor. Additionally, he will be responsible for protecting against damage, any part of the work and the property of others in relation to the performance of this works.

The haul roads as well as existing roads will be utilized by the Employer and other Contractors and the Contractor will not be entitled for additional payment for such use.

1.9 Haul Roads

The main haul roads built or improved by the Contractor, shall be wide enough to allow heavy weight traffic in both directions. The longitudinal roadway grades shall be as required by the traffic conditions and in any case shall not be greater than 10%, except for short stretches where grades of up to 15% may be allowed. The cut and fill slopes shall be as required by the material characteristics and by the safety of any part of the works and of the property of others.

The road surface shall consist of a well-compacted layer of selected material. The roads shall be provided with appropriate drainage under all weather conditions. Other related structures and facilities such as guard rail, guide post, drainage, culvert and/ or trench etc. necessary to maintain traffic throughout the construction period shall also be constructed.

1.10 Maintenance

The Contractor shall maintain all the haul roads, constructed by him and also the access roads constructed by others/owners together with the existing roads in and adjacent to the project area for the use of heavy weight equipment.

Maintenance of the haul roads, access roads and existing roads will include, but not be limited to, the following works:

- Repair of irregularities produced by the traffic, water etc. on the roadway surface;
- Repair of related work that is damaged by traffic or by weather;
- Periodical shaping of the roadway where necessary in order to maintain it in optimum conditions for traffic at all times;
- Removal of slides and cleaning of lateral roadway slopes;
- Interior cleaning of culvert, including head wall ditches and drainage trenches'
- Cleaning and shaping of earth ditches and cleaning of concrete ditches;
- Disposal of materials removed from slides, cleaning, shaping etc.;
- Maintaining the necessary traffic signs, guide post etc.
- Carrying out an effective dust control.

Dust control shall consist of applying either water or dust palliative, or both for the alleviation or prevention of dust nuisance.

For the execution of this work, the Contractor shall have available the appropriate personnel, materials and equipment.

The Contractor shall submit, for the Engineer in charge's approval, a work schedule and a schedule of resources used for the execution of the work herein specified. The Contractor shall allocate the resources as necessary to maintain the access to the various zones of the works.

1.11 Measurement and Payment

Unless otherwise specified, no separate payment shall be made for working facilities as described in this Chapter and the cost of the same is deemed to be included in the respective items of work.

CHAPTER- G.2: SAFETY PRECAUTIONS

2.1 Safety Programme and its Implementation

(i) Within 28 days before commencing the work, the Contractor shall submit, in writing, his proposal for a comprehensive safety programme covering all aspects of the Works.

(ii) This safety programme shall detail policies, procedures, and plans which the Contractor intends to implement to ensure the safety and health of his employees. It shall comply with the standards and regulations in force in India applicable to construction safety.

(iii) The Contractor shall designate a competent manager specially trained and experienced to act as Safety Officer, who will administer and be responsible for the implementation of the safety program. He shall carry out frequent and regular safety inspections of the working areas, materials, and equipment. The name and qualifications of the Safety Officer shall be submitted for approval to the Engineer-in-Charge prior to his appointment.

(iv) The Contractor shall be responsible for enforcement of the health and safety provisions for his subcontractors to be employed at the Site.

(v) Prior to the start of any major construction activity or hazardous operation, the Contractor shall submit to the Engineer-in-Charge for approval, a specific plan for safety precautions covering such operation

(vi) All serious and fatal injuries and diseases caused by the progress of work shall be immediately investigated by the Contractor and a comprehensive report shall be submitted to the Engineer-in-Charge

(vii) In case of a fatal accident, only rescue and emergency teams and operations shall be permitted at the place of the occurrence until the Engineer-in-Charge gives permission to resume normal operations.

2.2. Safety Standards

In addition to the requirements specified herein, the Contractor shall comply fully with all applicable national and state governments safety regulations and standards in force in India, as well as with the:

a) Safety standards of the U.S. Bureau of Mines,

b) U.S. Bureau of Reclamation Construction Safety Standards.

2.3 Personal Safety Equipment

2.3.1. General

(i) The Contractor shall provide his and his subcontractor's personnel, as well as, the Engineer's-in-Charge representatives and visitors with appropriate personal safety equipment. The use of such equipment shall be compulsory

(ii) Every person entering the working area in open air or in underground shall wear a protective helmet. Every person entering into underground works shall have an electric lamp.

(iii) The safety-toe footwear with steel caps shall be worn by all employees engaged in work having an inherent danger to the feet. Light footwear such as sandals, canvas or tennis shoes shall not be permitted for construction work.

(iv) During the drilling works and in the areas where the employees are exposed to harmful noise levels, ear protectors shall be made available and required to wear.

(v) Employees engaged in work having an inherent danger of eye or face injury shall be furnished and required to wear protection glasses, goggles or masks. Where irritant or toxic substances may come in contact with the skin or clothing, employees shall be wearing the protective clothing or shall be required to apply a protective ointment by a competent physician.

(vi) Employees working on steep slopes or otherwise subject to possible falls from levels not protected by fixed guard-rails or safety nets, shall be secured by safety belts and lifelines.

2.4 Illumination and Earthing

2.4.1 All working sites in the open, transit areas, excavation sites, access to tunnels, etc., shall be adequately illuminated during night work by electrical lights as specified in Chapter-1 of this Section

2.4.2. Illumination of Underground Works.

a. Each working face shall be brightly illuminated.

b. The vaults along the entire length of the tunnel and shaft shall be illuminated with electrical light throughout the duration of construction works. The lamps shall be located as follows:

(i) every 25 m in unlined stretches,

(ii) every 50 m in lined stretches

(iii) Each lamp shall be 60W minimum. The lamps shall be installed in a particular area immediately after the rock supporting measures have been completed.

(iv) Electrical cables shall be well insulated, protected and firmly fixed to tunnel walls by means of adequate insulators. Lamps shall be well protected against damage.

(v) Lighting by flame is expressly forbidden in the underground.

2.5. Storage and Transport of Explosives

a. The Contractor shall at an appropriate time apply to the national and state governments, police and military or other responsible authorities for all permits needed to allow him to buy, transport, store and use the explosives required for the Works. The Contractor must allow in his work programme for the time needed to obtain the said permits.

b. The Contractor is responsible for proper care and handling of detonators and explosives and he shall strictly comply with the rules and regulations in force in India regarding purchase, transport, storage, handling and use of explosives.

c. Explosive magazines shall be reinforced concrete buildings with walls and slabs of a minimum 250 mm thickness. Doors shall be made of double sheets having a minimum thickness of 5 mm each and shall be fitted with safety type locks.

d. Explosives magazines shall be kept at a safe distance from working areas and living quarters. They shall be surrounded with barbed wire, protected by safety locks, ventilated, and fitted with lightning arrestors. An air space shall be provided between the ceiling and the roof to prevent temperatures from reaching dangerous levels

e. Blasting caps and detonators shall not be stored in the same magazines as explosives, but shall be located in separate magazines at least 15 m away if barricaded and 30 m if not barricaded.

f. Explosives shall be stored only in their original containers and with the top side up as designated on the container

g. Access to the magazines and permission to handle explosives shall be granted exclusively to trustworthy personnel, adequately instructed and experienced in the use and handling of explosives.

h. The Contractor shall maintain a record of storage and withdrawal of all explosives. The Engineer-in-Charge shall be promptly notified of any loss or theft of explosives.

i. Between the magazines and the place of use, the explosives and detonators shall be transported separately in lockable metallic containers loaded on a special wagons designated for the purpose of explosives transport only. These wagons shall be painted with striking colours for easy recognition. The inside of the containers shall be lined with wood in order to prevent a direct contact of the explosive or detonators with the metal.

2.6. Blasting

2.6.1 General

(i) All blasting shall be carried out in a workmanlike and safe manner by a competent, licensed and experienced blasting engineer or foreman. No blasting shall be done without his approval.

(ii) Blasting will be permitted only after adequate provisions have been made for the protection of persons, the Works, and public or private property. The Engineer-in-Charge approval of any of the Contractor's blasting operations shall not relieve the Contractor of his sole responsibility for the safety of persons and property. The Contractor shall be liable for all claims resulting from personal injury and damage to property and equipment that may result from its blasting operations. Any damage done to the Works or property by blasting shall be

repaired by the Contractor.

(iii) Blasting in the open air shall be carried out only at certain hours of the day in accordance with a schedule mutually agreed upon by the Contractor and the Engineer-in-Charge. Barriers shall be erected and warning signal shall be given to the workers at the Site and to the public immediately before blasting, so that no person will enter the danger zone until blasting is finished. Any restriction imposed on the blasting schedule to ensure safety of structures, properties and lives shall not be accepted as a basis for any claim by the Contractor.

(iv) Upon completion of blasting, an "all clear" signal shall be given by the responsible blasting engineer/licenced blaster after he has satisfied himself that all charges loaded have detonated and that no delay-explosions or misfirings are to be expected.

(v) No blasts involving charges larger than 200 kg shall be carried without the written approval by the Engineer-in-Charge, who shall be notified at least one hour prior to the blast.

(vi) No blasting shall be permitted within 25 m of any concrete placed within the previous 7 days. After 7 days, blasting may be performed only with the approval of the Engineer-in-Charge. Blasting will not be permitted within 10 m of structures or installations vulnerable to damage by blasting

(vii) No charging and firing will be permitted during thunderstorms and other electrical disturbances.

2.7. Ventilation of Underground Works

2.7.1 General

(i) The Contractor shall design, furnish, install and operate a ventilating system for each underground work site, and provide a tunnel atmosphere monitoring system. Details of the proposed systems shall be submitted to the Engineer-in-Charge for approval within 28 days prior to commencing the work. This updated design shall include all calculations of fresh air supply volume, type of ventilation scheme, duct diameters, materials and equipment and position of ventilators and dust arrestors. Description of the working cycle including number of persons employed, number and capacity of diesel-powered equipment working at one time at each heading face shall also be included. The design shall be consistent with the proposal submitted by the Contractor with his Bid, as well as, with any subsequent amendments and additions agreed to by the Engineer-in-Charge and the Contractor.

(ii) All parts of the Works shall be maintained in a state that will not be injurious to the health of the personnel. The air in underground sites shall contain no less than 20% oxygen and shall not contain a concentration of gases, vapours or dust greater than is safe for the health of workmen.

(iii) Ventilation ducts shall be firmly fixed to the vault in such position that a minimum clearance of 200 mm remains between the duct and the extremities of train or vehicular traffic employed in the underground.

2.7.2. Ventilating System

(i) The ventilating system shall be of such efficiency that the average air velocity in the largest excavated profile is not less than 0.3 m/s. In case the presence of methane gas is detected or suspected this value shall be increased to 0.5 m/s.

(ii) Furthermore, the main ventilating system shall ensure that both of the following minimum fresh air volume requirements are satisfied at all times:

a) 3.0 m3/min for each person employed underground at one time,

b) 6.0 m3/min for each metric horsepower (PS) of diesel-powered equipment at work underground at one time. This value may be reduced to 4.0 m3/min providing the equipment is using diesel oil low in sulphur content (max. 0.2% of sulphur by volume).

(iii) These fresh air volumes shall be cumulative and the Contractor shall allow in his design calculations for the maximum number of persons and diesel-powered equipment working in the underground at any one time. Any estimated losses, e.g. due to the leaks in the ducts, shall be added to the figures stated above.

2.8 Control of Dust, Silica, and Noxious Gases in Underground Works

2.8.1. Dust and Silica

i) To reduce the amount of dust, only wet drilling will be allowed and during mucking, muck tips shall be kept constantly damp by sprinkling with water. The use of high pressure water jets for this purpose will not be permitted.

(ii) The Contractor shall measure the concentration of fine dust and content of silicon dioxide (SiO2) in all dust-producing underground operations by an approved method.

(iii) Air samples shall be taken before commencing underground works in tunnels, and at 30 days intervals thereafter. Samples shall be taken from actual working areas. The sampling and testing shall be performed by a qualified person or laboratory to be proposed by the Contractor and approved by the Engineer-in-Charge. A copy of the test results shall be submitted to the Engineer-in-Charge within one week of the sampling date.

(iv) The concentration of fine dust (diameter less than 0.005 mm) may not in general exceed the value of 8.0 mg/m3of air and in relation to the silicon dioxide content in the rock this value is lowered as follows

Content of SiO2 in fine dust in percent by weight	**Concentration of fine dust in milligrams per m3 of air**
1 - 15%	8.0 mg/m3
20%	6.0 mg/m3
30%	4.0 mg/m3
60%	2.0 mg/m3
80%	1.5 mg/m3
100%	1.2 mg/m3

(v) Should the concentration of fine dust exceed the limits stated above, the Contractor shall undertake such necessary measures and install such additional equipment, which will ensure that the dust concentrations are within the specified safe hygienic limits.

2.8.2 Noxious Gases

i) Use of internal combustion engines, other than approved mobile diesel-powered equipment will not be permitted in underground construction sites.

ii) Gas concentrations in underground sites may not exceed the following limits:

a) 0.0025% (twenty-five ppm) of carbon monoxide,

b) 0.5% (five thousand ppm) of carbon dioxide,

c) 0.0003% (three ppm) of nitrogen dioxide,

d) 0.001% (ten ppm) of hydrogen sulphide.

- whenever hydrogen sulphide levels exceed 5 ppm (0.0005%) tests for hydrogen sulphide shall be conducted in the affected areas every 4 hours,
- if hydrogen sulphide levels exceed 10 ppm (0.001%) a continuous sampling hydrogen sulphide indicator with alarm shall be used to monitor the work area,
- if the concentration of hydrogen sulphide exceeds 10 ppm (0.001%) twa for an 8-hour period, steps shall be taken to increase ventilation to reduce the concentration.

e) 0.01 milligrams per litre of nitrous oxide

f) 1.0% (ten thousand ppm) of methane or not greater than 20% of the lower explosive limit

- whenever 5% or more of the lower explosive limit for methane or other flammable gases is detected, steps shall be taken to increase the ventilation rate, or other steps shall be taken to lower the methane concentration,
- Whenever 10% or more of the lower explosive limit for methane or other flammable gases is detected in the vicinity of welding, cutting, or other "hot work", such work shall be suspended,

- Whenever 20% of the lower explosive limit for methane or other flammable gases are detected, all employees except those necessary to eliminate the hazard shall be evacuated and electrical power except for explosion proof pumps and ventilation equipment shall be disconnected.

(iii) Concentrations of flammable gases other than methane shall not exceed 20% of the lower explosive limit at the heading face and the total of all flammable gases including methane shall not exceed 20% of the lower explosive limit in the general tunnel or shaft atmosphere.

(iv) If concentrations of noxious gases or other flammable gases exceed the permissible limits set forth above, all operations shall be interrupted immediately and personnel shall be removed to a safe area. All sources of ignition shall be extinguished or removed. All equipment, with the exception of ventilation equipment and explosion proof pumps, shall be shut down.

(v) The required measures will be mutually determined and agreed by the Engineer-in-Charge and the Contractor. In case of need, the Contractor shall engage the services of an independent consultant experienced in gaseous tunnelling. Re-entry and resuming of the work shall be prohibited until the Engineer-in-Charge has authorised re-entry in writing.

2.9. Provisions for Railbound Transport in Underground Works

(i) If the Contractor selects to install railbound traffic for transport of muck, materials and people underground, the traction engines shall be operated by properly trained, reliable and healthy persons capable of quick reaction and decision.

(ii) The rails type and gauge, switches, and crossings shall be of such strength and dimensions, which can sustain the expected wagon sizes and corresponding wheel loads.

(iii) Railways shall be equipped with derailing facilities, located such that the working areas are not endangered, whenever the longitudinal gradient exceeds the following values:

(a) one in one hundred (1%) in ascending heading,

(b) one in two hundred (0.5%) in descending heading

(iv) The minimal distance between two passing trains shall be 300 mm.

2.10 Fire Precautions

i) The Contractor shall organise a fire brigade equipped for the fighting of any fires which could break out on the construction sites, in temporary structures, stores, residential quarters, etc.

ii) An adequate number of fire extinguishers shall at all times be available at each construction site and in each building in camps and in offices and they shall be kept in satisfactory working order.

iii) Fire fighting equipment shall be of the gas, dry powder or other suitable chemical or pumped water type. Their number, type and location will be subject to the approval of the Engineer-in-Charge.

2.11 Dust Abatement

(i) During the performance of the work and any operations appurtenant thereto, the Contractor shall carry out proper and efficient measures, such as sprinkling with water or other means, whenever necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging crops, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from his operations.

2.12. Measurement and Payment

(i) No extra measurement for payment or payment whatsoever will be made for the safety precautions required to be provided by the Contractor and the entire cost thereof shall be included in the Unit Prices for other items of the Works.

CHAPTER- G.3: QUALITY ASSURANCE

3.1. General Obligations of the Contractor

(i) Contractor shall establish, staff, equip and operate a comprehensive quality organisation at the site during the full period of the Works. The principal responsibility and duty of this organisation shall be to ensure that all work carried out and materials produced or supplied by the Contractor comply fully with the Specifications, as well as, with all relevant Indian or other standards.

(ii) With his Bid the Contractor shall submit an outline quality control manual, organisation plan and staffing programme. This manual shall list all internal quality control procedures to be undertaken by the Contractor, give details of laboratories (listing their equipment and testing procedures), reporting procedures and quality control training programmes for their field staff. Prior to finalisation of any contract, the Engineer-in-Charge shall review and comment on these data, and request any modifications or additions, which are considered necessary.

(iii) At all times, the Contractor's quality control and other site personnel will co-operate with and inform fully the Engineer-in-Charge in all matters relating to the work in progress and testing of materials etc., and will reply promptly to any requests by the Engineer-in-Charge and his site supervision personnel for additional information and data.

(iv) Supervision and testing which may be carried out by the Engineer-in-Charge in no way relieves the Contractor of his full and sole responsibility for the quality of the Works and for compliance with the requirements of these specifications.

3.2 Control of the Progress of Work

(i) Close progress control, and the preparation of corresponding progress reports, shall be an important part of a Contractor's quality control responsibilities. A contractor must at all times provide the Engineer-in-Charge with up to date information on the progress of work and must without delay bring to the attention of the Engineer-in-Charge all delays or occurrences which could lead to delay or additional costs.

(ii) Contractor shall submit detailed monthly progress reports to the Engineer-in-Charge, in which the contractual programme for the works is updated and information is given on the quantitative completion of civil works (in the form of tables indicating the quantities of completed work).

(iii) The monthly progress reports shall give full details of any delays to work in progress or planned, delays in transport to/from the site, together with detailed proposals for overcoming or preventing delays, and for regaining any lost time.

(iv) The Contractor shall at any time, at the request of the Engineer-in-Charge, submit detailed reports on particular matters relating to the execution and progress of the works, if such reports are required in order to assess the quality or progress of specific activities or works.

3.3. Contractor's Quality Control Staff

i) The Contractor shall assign one experienced engineer to the site as full-time quality control officer, responsible with complying with all requirements of this Section.

ii) The experience and qualifications of this engineer shall be given in the contractor's tender and shall be subject to the approval of the Engineer-in-Charge.

iii) The positions, and the qualifications and duties, of the contractor's quality control staff shall be indicated in the quality control organisation plan and manual respectively, and shall likewise be subject to approval by the Engineer-in-Charge. As a minimum, the Contractors shall appoint one qualified and experienced engineer to be responsible for quality control of each of the construction activities.

3.4 Contractor's Laboratories

(i) As required herein, the Contractor shall establish, equip and operate on site laboratories for the testing of the following principal construction materials:

a) Concrete, including also the testing of sand, aggregates, cement, water and admixtures.

b) Shotcrete, including also the testing of sand, aggregates, cement, water and admixtures

c) Any site testing and/or calibration of monitoring instruments.

iv) The numbers of samples to be tested, and the timing of testing, shall be as may be given elsewhere in these specifications, or as may be instructed by the Engineer-in-Charge.

v) The staff of a Contractor's laboratory shall have proven experience in similar previous work and their qualifications shall be subject to approval by the Engineer-in-Charge.

vi) Complete records shall be kept of all laboratory tests carried out and shall be available at any time to the Engineer-in-Charge on request.

vii) The Engineer-in-Charge shall be permitted at any time and without notice to observe tests being carried out in any of the Contractor's laboratories, to inspect equipment or to study results.

3.5. Materials delivered to Site

i) The Contractor's quality control staff shall keep full records of all materials delivered to site for use in the Works, and of all tests made on such materials either prior to or following delivery to site.

ii) These records shall be available at all times to the Engineer-in-Charge, together with any factory testing certification.

3.6 Environmental Control

i) The Contractor shall appoint an environmental control officer to be responsible for ensuring compliance with all specified obligations, laws and regulations with regard to environmental protection of the site of the project, access roads and all site installations.

ii) The Environmental Control officer of the contractor must maintain close liaison with the provincial environmental department and its officers and must provide all data needed by this department and/or the Engineer-in-Charge needed at any time to confirm full compliance with environmental regulations and obligations.

(iii) Details of all environmental protection activities, and of any cases of environmental damage, shall be included in the monthly progress reports

3.7 Measurement and Payment

No measurement for payment will be made for any of quality control activities required in this Section. All costs of these activities will be included in the Unit Prices for work listed in the Schedule.

PART -B

PARTICULAR TECHNICAL SPECIFICATIONS

CHAPTER – P.1 CONTROL OF WATER, CONSTRUCTION DRAINAGE AND DEWATERING

1.1 Scope of Work

(i) The Contractor shall provide all labour, material, and equipment necessary to design, build, operate, maintain, and remove the temporary dewatering facilities for protecting the Works against flood flows in the rivers and creeks, and to design, build, install, operate, maintain and dismantle the temporary dewatering facilities required to remove service water and natural surface flow or groundwater seepage from the working areas on surface as well as from underground.

(ii) The Contractor shall be responsible for maintaining work sites free of water at all times. Contractor shall make good any damage whatsoever caused by flooding of the work sites due to failure of equipment, improper maintenance of protective works, and acts of negligence in his performance of the Work. The work shall be executed in accordance with the Contractor's design and specifications, and sequences as approved by the Engineer-in-Charge.

(iii) Temporary dewatering facilities shall be removed upon Completion of Works.

1.2 Submittals

1.1.1.1 At least 21 days prior to scheduled construction of the particular work the Contractor shall submit to the Engineer-in-Charge full details of equipment to be installed and all necessary construction details required for the dewatering purposes.

1.1.1.2 The Engineer-in-Charge reserves the right to demand any additional information deemed necessary to be included in submitted documents.

1.3 Standards

Drainage and Dewatering work shall conform to the latest editions of the following Indian Standards:

IS: 3764 Excavation work – code of safety.

IS: 9759 Guidelines for de-watering during construction.

1.4 Control of Water

The contractor shall be responsible for keeping all the work areas dry by means of suitable dewatering systems described hereafter.

1.5 Dewatering

1.5.1 General

i) Dewatering systems of adequate capacity shall be provided by the Contractor for carrying out dewatering of surface as well as the underground construction sites. The Contractor shall supply, install, maintain, and operate all dewatering pumps, pipes, supports, channels, troughs, electrical installations, and necessary accessories, and other consumables required to maintain the different work sites free of water during construction.

ii) The Contractor shall provide standby power supply unit commensurate with the capacity of the pumps as to cope with the water inflow construction sites during periods of breakdown and maintenance of his main power supply units.

iii) Dewatering of the surface as well as the underground sites shall be undertaken by gravity as far as possible. Only where dewatering by gravity is not practical, pumping shall be resorted to after this mode has been approved by the Engineer-in-Charge.

iv) The Contractor shall propose the permanent sumps locations for approval of the Engineer-in-Charge..

v) Where, in the opinion of the Engineer-in-Charge existing or potential water inflows into excavations can be reduced or controlled by grouting, the Contractor shall perform grouting in accordance with Chapters "Drilling" and "Grouting".

vi) The pumped water carried in pipes or flumes shall be discharged at points sufficiently away from the edge of the working area . Care shall be taken to ensure that there is no seepage or backflow to the working areas.

vii) Water discharge from work areas shall not pollute or endanger the environment. Any polluted water coming

from the working sites shall be treated prior to its discharge. Particular attention shall be paid to avoid possible pollution from oil or solvents coming into contact with the water prior to its discharge from the Site. Oil separators shall be provided within the drainage system as necessary.

viii) The Contractor shall ensure that all drainage water will be disposed of without causing interference to his own or other contractors' operations elsewhere at the site and that no drainage water runs into adjacent Works. The dewatering systems shall not adversely affect any of other project activities and structures or works of other agencies. Where more than one agency are working in the same or adjacent area, the Contractor who has already provided the drainage facility, shall extend this facility to other agencies also. In case of any dispute in apportioning of such expenditure, it shall be decided by the Engineer-in-Charge, whose decision shall be final. In no case, the Contractor shall stop the drainage activity.

ix) In case the flow from one of the Contractor's site is passing through the site of other contractors or agencies, the Contractor in whose site the origin of the water is located shall attend the drainage.

x) If at any time during construction stage, in the opinion of Engineer-in-Charge, dewatering pumps in addition to the installed dewatering capacities are required in any working area, the Contractors shall provide and install such additional capacity of dewatering system.

1.5.2 Dewatering of Surface working sites

(i) The Contractor shall perform all works necessary to drain the surface working sites of rain, groundwater and service water. The work shall include, but not be limited to the following:

a. Design and construction of drainage, ditches, pits, and pump sumps

b. Design, furnishing, operation and maintenance of dewatering equipment,

c. Relocation of dewatering facilities required for the performance of other works,

d. All auxiliary works required for safe and continuous dewatering of the sites.

1.5.3 Dewatering of Underground Sites

(i) The Contractor shall design and provide a complete dewatering system for underground sites. The Contractor shall design and construct corresponding drainage trenches in the tunnel inverts with or without lining as appropriate and as instructed by the Engineer- in- Charge.

(ii) All components of the systems shall always be maintained in ready-for-service condition and all access to pumps and other equipment shall be kept in good condition under the most adverse conditions.

(iii) If any water from another portion of the tunnel or shaft flows into a lower section where concreting is being done, either for the invert or for drainage trench or any other concreting likely to be affected by water, all such water shall be diverted past this area in such a way that no damage occur to the concrete. The length of the affected sections over which water has to be diverted shall be ordered by the Engineer-in-Charge.

1.5.4. Measurement and Payment

Payment shall be made for construction, maintenance and dismantling of cofferdams and temporary bunds, including removal of slush/silt from the working area after floods. Payment for dewatering shall be made as entered in the relevant item in the BOQ .

CHAPTER – P. 2 CONCRETE

2.1 Scope of Work

1) The work under this Chapter includes all labour, materials, equipment and services related to the concrete work to be carried out by the Contractor under this Contract.
2) The concrete work shall be performed to the dimensions as shown on the Drawings or as otherwise directed by the Engineer-in-Charge.
3) The Contractor shall cooperate with all other contractors and organisations related to the construction of Permanent Works where the material or equipment is to be fixed to, or embedded in the concrete structures.
4) Formwork, reinforcement and shotcrete are covered separately in other Sections of these Specifications.
5) The approval given by the Engineer-in-Charge to the Contractor's plants and equipment or their operation or of any construction methods shall not relieve the Contractor of his full responsibility for the proper and safe execution of concrete work or any obligations under this Contract.

2.2 Standards

1) Unless otherwise specified, the standards and recommendations of Indian Standards Code of Practices shall be followed in respect of all materials, equipment and performances.
2) The following Indian Standards are specifically mentioned:

   IS: 8112 - 43 Ordinary Portland Cement

   IS: 456 – Code of practice for Plain and Reinforced Concrete

   IS: 383 – Coarse and fine aggregates from natural sources for Concrete

   IS: 2386 (Part-IV) – Method of testing of aggregates for Concrete- Mechanical properties

   IS: 5878 (Part-V) Code of practice for Construction of tunnels conveying water: Concrete Lining

   IS: 516 – Method of test for strength of Concrete

   IS: 1489 – Portland Pozzolana Cement Fly Ash based

   IS: 1199 – Method of sampling and analysis of Concrete

   IS:9103 - Concrete Admixtures: Specifications

   IS: 7861 (Part-I and Part-II) - Code of practice for Extreme weather concreting,Recommended Practice (Hot weather and Cold weather concreting)
   IS: 2505 - Concrete Vibrators – Immersion type general requirements IS: 1791- Batch type concrete mixers
   IS: 3558 - Use of immersion Vibrator for Consolidating

   Concrete IS: 10262 - Recommended guidelines for concrete

   m i x d e s i g n

   SP 23 – Handbook on Concrete Mixtures, BIS (1983)
3) In absence of relevant Indian Standards and specifications , the recommendations of "ACI Manual of Concrete Practice" and U.S.B.R. Concrete Manual shall be followed.

2.3 Submittals

2.3.1 Submittals before Construction

1) Submittals listed herein are related to items which require the consent of the Engineer-in-Charge and are to be submitted by the Contractor before the appropriate work may proceed.
2) Within 28 days from the date of issue of Notice to Commence, but before procuring or mobilising to the Site the equipment, the Contractor shall submit to the Engineer-in-Charge updated and detailed plans and descriptions, consistent with those submitted with his Tender and any subsequent amendments and additions agreed to by the Engineer-in-Charge and the Contractor, of the following:

a) Aggregates Processing Plant:

Description, flow diagrams and drawings in sufficient details to indicate layout, type and capacity of crushing, screening, washing, conveying and other aggregate processing and handling equipment.

b) Batching and Mixing Plants:

Description, flow diagrams, and drawings of the plants, and details of the equipment the Contractor intends to use to determine and control the amount of each separate concrete ingredient and mixing thereof into uniform mixture.

c) Transport and Placing of Concrete:

Full details of the equipment and methods for transporting the concrete from the concrete plant to the final point of placing, including numbers, type and capacity of transport vehicles, concrete pumps, vibrators, and details of standby plants to be installed.

d) Mode and methodology of concrete curing,

e) Sampling and Testing of Materials:

List and details of equipment for sampling and testing, detailed program for quality control of concrete work, and qualification and experience of the proposed personnel.

f) Foundation and surface preparation equipment

3) At least 56 days in advance of any concrete work being carried out at the Site, the Contractor shall submit to the Engineer-in-Charge following notifications based on the results of the preliminary material testing:

a) Factory or Factories from which cement will be obtained and whether cement will be ordered in bulk or bags. If cement is to be obtained from several mills, the estimated amount of cement from each factory and the proposed Bill of Quantities of shipment shall be stated,

b) The source, analysis, method of delivery, and storage of water for concrete manufacture,

c) Admixtures and pozzolana which the Contractor proposes to use, manufacturers thereof, and information about the chemical names of the principal ingredients and the effects of under or over dosage. Should the Contractor intend to use an accelerator in any concrete work for his own convenience, he shall give full details of the type, dosage, influence on construction, and the cost savings involved,

d) Details of the materials for formwork to achieve desired surface finishes, treatment of construction joints, and construction techniques which the Contractor proposes to use in order to achieve the required concrete surfaces and allowable tolerances,

e) Details for repairing defective surfaces.

4) At least 28 days prior to procuring or despatch to the Site of the particular item of work to which the submittal relates, the Contractor shall submit to the Engineer-in-Charge the following:

a) Details of curing compounds, if any,

b) Details of epoxy mortar for concrete repair.

5) Drawings showing the location of construction joints proposed by the Contractor which differ from those shown on the Drawings, including formwork and reinforcement details, shall be submitted to the Engineer-in-Charge at least 28 days prior to commencement of work on that particular structure.

2.3.2 Submittals during Construction

1) Contractor shall provide the Engineer-in-Charge with a weekly placing scheduling giving the detailed location of the pours, the approximate extent of pours, and the date on which the concrete will be placed. This weekly programme of concrete placement shall be submitted to the Engineer-in-Charge for his acceptance at least 2

days prior to the commencement of the week.

2) Before commencement of the concrete placement the Contractor shall prepare a checklist regarding all preparations for the specified work such as rock surfaces and foundations, cleaning, formwork, reinforcement, embedding, and submit this list to the Engineer-in-Charge, who after his satisfaction about the work preparations will permit the contractor in writing to commence concrete placement.

3) The Contractor shall keep and make available to the Engineer-in-Charge records of the date, amount, and storage location of each delivery of cement and of the part of the Works in which it was used and shall provide facilities for checking the stock of cement.

4) During the performance of the concrete work, the Contractor shall keep a diary where he shall record the construction procedures related to concreting. This diary shall be made available to the Engineer-in-Charge upon request. The records shall contain at least the following:

   a) Commencement and termination of concreting of various parts of the structures,

   b) Quantities and quality of aggregates and cement provided, and the storage from which they were drawn,

   c) Temperature of air, water, cement, aggregates, and concrete,

   d) Meteorological conditions and humidity of air,

   e) Sampling and testing performed and summary of results,

   f) Personnel employed during various stages of the concreting operation and name of the responsible inspector or foreman,

   g) Equipment used,

   h) Directives received from the Engineer-in-Charge,

   i) Any special material or procedures employed.

5) The Engineer-in-Charge reserves the right to require any additional information deemed necessary to be included in the submitted documents.

2.4 Constituents of Concrete

Concrete is a product of cement, aggregate (coarse and fine), water and in some cases admixtures which when hardens, attains strength.

2.4.1 Cement

1) Cement shall be either OPC 43 grade conforming to IS 8112 or Portland pozzolana cement, 43 grade conforming to IS: 1489 part-1 with strength of equivalent OPC cement.

2) Cement shall be procured form the cement sources/plants approved by the Engineer-in-Charge. At least two sources/plants shall be selected out of those intimated by the Contractor so that one is a standby for any eventualities.

3) Each consignment of cement delivered to the Site shall be accompanied by a test certificate issued by the manufacturer in quadruplicate. The Engineer-in-Charge will have the right to attend the sampling and testing at the manufacturer's plant at any time. If delivery is not directly from the manufacturer, the intermediate storage and delivery arrangements shall be subject to the approval of the Engineer-in-charge.

4) Cement which does not comply with relevant IS Code or is damaged in consignment; handling or storage shall be promptly removed from the Site.

5) All facilities for transport and storage of cement shall be subject to approval of the Engineer-in-Charge and shall be such that easy access for inspection is assured.

6) Cement shall be transported to the Site in adequately designed weather-tight trucks, or other means where cement will be protected from exposure to moisture. Immediately upon receipt at the Site, cement shall be stored in a dry, weather-tight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture and constructed in such a way that there will be no dead storage.

7) Cement bags shall be stored in weatherproof buildings with a raised, well ventilated wooden floor, and placed so that each consignment can be segregated if required and used in order of its age. Bags shall not be stacked more than 1.5m high. Cement shall not be stored out of doors, except for immediate use, and in such event shall be protected during storage and handling by waterproof covers and a raised floor. Unused cement shall be placed back into the storage buildings.

8) Cement shall be preferably used in same order in which it has been received at the Site. Cement shall be used on "first supplied" and "first used" basis. Storage of cement shall be limited to 90 days in bags and 150 days in bulk. Cement that has been in storage for longer than this period or which may have absorbed moisture shall not be used unless it has been re-tested by the Contractor and approved by the Engineer-in-charge. Cement that has become lumpy shall not be used. The cements coming from different mills or of different makes shall be stored separately.

9) The Contractor is solely responsible for the timely supply of cement meeting the requirements of these Specifications and the Works. The delay due to the lack of suitable cement will not give the Contractor any right for the extension of time for the Completion of Works, or any claims resulting there from.

2.4.2 Aggregate

2.4.2.1 General

a) Unless otherwise specified, concrete aggregates shall conform to the requirements of IS: 456 and IS:383. They shall be tested in accordance with the provisions of IS: 2386.

b) Aggregates shall consist of clean, hard, dense, durable and uncoated materials, and shall have stable moisture content and grading when delivered to the batching plant. Aggregates shall not contain substances which may impair the quality of the concrete, attack reinforcing steel or reduce bond. The following substances are regarded as being harmful: loam, clay, pieces with large cavities, foam-like or vitreous pieces, and organic materials such as topsoil, roots, wood, coal, lignite, etc. In doubtful cases the effects of harmful substances shall be established by tests.

c) Use of aggregates containing minerals which can cause alkali reactivity shall be permitted with cement conforming to IS. 1489, subject to the approval by the Engineer-in-Charge. Presence of such minerals in the stones to be used as aggregates shall be determined by testing.

d) The shape of the particles shall be generally spherical or cubical. The amount of flat or elongated particles shall not exceed 25% by weight. A flat or elongated particle is defined as one in which the width to thickness, respectively length to width ratio is greater than 3. Rock which breaks down into such shape, regardless of the type of processing equipment used, will not be approved for use in the production of aggregates.

e) The Contractor shall make provisions for crushing and processing of material in accordance with recommendations contained in IS:383 to meet the gradation and other requirements of these Specifications, in order to obtain the total amount of aggregate required for concrete manufacture. Crushing, screening and washing operations, benefaction of aggregates, and blending of crushed and natural aggregates shall at all time be subject to the consent of the Engineer-in-Charge.

f) The handling, transporting, and stockpiling of aggregates shall be such that there will be a minimum amount of fines resulting from breakage and abrasion of material resulting from free fall and improper handling. Excess in any of fine or coarse aggregate sizes shall be disposed of in approved manner.

g) The Contractor shall remove all rejected aggregate from the Site.

2.4.2.2 Source

a) Coarse and fine aggregates shall be obtained from the approved quarries and burrow areas or from other sources as may be designated or approved in the course of the work.

b) Alternative sources developed by the Contractor shall be subjected to approval by the Engineer-in-Charge. The Contractor shall carry out tests to furnish satisfactory evidence that aggregates from such alternative sources comply with the requirements of this Chapter.

c) The aggregate source shall be subject to the approval of the Engineer-in-Charge. However, such approval of source shall not be construed as acceptance of all materials to be taken from that source. The Engineer-in-Charge reserves the right to reject certain localised areas, strata, or channels within the approved areas and zones, when the material is unsatisfactory for use.

2.4.2.3 Fine Aggregates

a) The term "fine aggregate" is used to designate aggregate in which the maximum size of particles is 4.75mm.

b) The gradation of fine aggregate shall be as per IS:383

c) The percentage of deleterious substance in the fine aggregate shall conform to IS: 383, except that the fine aggregate shall contain not more than 0.1% by weight of deleterious (reactive) ferrous sulphide. The total percentage of deleterious substance must not exceed 5% by weight but percentage of clay should be less than 1%.

d) Fine aggregate having specific gravity of less than 2.6 shall be rejected. Fine aggregates, when subjected to soundness test with a solution of sodium sulphate, after five cycles of tests, shall not suffer a loss of weight in excess of 10 per cent.

e) Fine aggregate, upon delivery to the batching plant, shall have uniform and stable moisture content. The amount of moisture shall be less than 6% by weight, and shall not vary by more than 0.5% per hour.

f) The fineness modulus of fine aggregate shall range between 2.3 and 3.1.

2.4.2.4 Coarse Aggregates

a) The term "coarse aggregate" is used to designate aggregate which is retained on sieve opening 4.75mm. The coarse aggregate shall be well graded and its gradation will be decided based on the laboratory tests to obtain dense mass of concrete. The gradation will be approved by the Engineer-in-Charge before production of the concrete. The maximum size shall be as per specifications and class of concrete.

b) Coarse aggregates shall be stored separately in stockpiles or bins in such a manner to avoid intermixing of different size of aggregates. The storing shall be done in following sizes:

- 4.75-10 mm
- 10-20 mm
- 20-40 mm
- 40-80 mm

c) The percentage of deleterious substance in the coarse aggregate shall conform to IS: 383, except that the coarse aggregate shall contain not more than 0.3% by weight of deleterious (reactive) ferrous sulphide.

d) When subjected to following tests as specified in IS:2386 (Part IV), the coarse aggregate shall comply with following requirements:

	High Performance Concrete	**All Other Concrete**
(a) Aggregate Crushing Value	Less than 30%	Less than 45%
(b) Aggregate Impact Value	Less than 30%	Less than 45%
(c) Los Angles abrasion value	Less than 30%	Less than 50%

e) When subjected to sodium sulphate soundness test, coarse aggregate shall not suffer a loss of weight in excess of 12% after five cycles.

f) Coarse aggregate shall be hard, dense, durable, uncoated rock fragments. Rock having absorption greater than 3% or specific gravity less than 2.6 shall not be used.

g) Aggregate delivered to the batching plant shall have uniform and stable moisture content.

h) The nominal maximum aggregate size in relation to the structure dimension shall not be larger than:

- 0.20 of the narrowest dimension between the side of forms,
- 0.75 of the minimum clear spacing between the reinforcing bars,
- 0.25 of the slab depth.

2.4.2.5 Aggregate Storage

a) Aggregates shall be stored in a manner so that each size of aggregate is stored separately in free-draining piles in a manner that reduces breakage, deterioration, contamination and segregation to a minimum. Storage arrangements shall be subject to acceptance by the Engineer-in-Charge.

b) The Contractor shall maintain sufficient aggregate storage at the Site at all times to permit continuous placement of concrete in accordance with the contractual time Bill of Quantities.

c) The moisture content of aggregates shall be controlled as far as practicable, by wetting the stockpiles and by adequate drainage. All aggregate shall remain in a free-draining stockpile for at least 12 hours prior to use.

d) The preparation of stockpile areas, the storage of processed aggregates and the disposal of any rejected material shall at all times be subject to the approval by the Engineer-in-Charge.

e) Materials shall be removed from stockpiles by methods which minimise segregation and crushing. No fine aggregate from the bottom 500 mm of the stockpile shall be used for mixing concrete.

2.4.3 Water

1) A reliable and adequate water supply shall be installed and maintained by the Contractor for washing of aggregates, manufacturing and curing of concrete. The water shall be clean and free from harmful quantities of oil, acids, alkalis, sugar, salt, silt and other organic matters and shall conform to IS:456.

2) Water shall contain not more than 1,000 mg/l of sulphates (SO4), not more than 100 mg/l of chlorides (Cl), and shall have a turbidity limit of not more than 1,000 ppm.

3) Adequate water storage shall be provided at the batching plant to ensure smooth concrete production. The method of storage and delivery of water shall be approved by engineer-in-charge.

4) Contractor shall familiarise himself with source and quality of water available. Attention is drawn to the possible requirement of settling pond and other facilities that he may be required to provide.

2.4.4 Admixtures

1) Admixtures shall be proposed by the Contractor and shall be used only upon written approval of the Engineer-in-Charge. Only admixtures that have been commercially used with satisfactory service in a similar type of concrete work shall be considered for approval. All admixtures shall be manufactured by a reputable company(ies), supported by a fully staffed technical service organisation and research group.

2) The Contractor may use the following admixtures when required with the approval of the Engineer-in-Charge:

   a) Super plasticizer meeting requirement of ASTM C-494, Type F.

   b) Air entraining agent, (complying to IS 9103: 1999)

   c) Non-shrink agent,

   d) Accelerating agent in the concrete, mortar or grout to increase the rate of hydration, shorten the setting time or increase the rate of hardening or strength development, (complying to IS 9103 : 1999)

3) Admixtures shall be stored and handled so as to avoid contamination or damage to their properties by temperature or moisture changes or other influences.

4) The quantity of admixture used and the method of mixing shall be strictly in accordance with the manufacturer's printed instructions, or as required to produce specified results and approved by the Engineer-in-Charge.

5) The Contractor shall be held liable for any damages and difficulties resulting from the selection and use of admixtures such as delay in concrete placing or damage to concrete during forms removal, and shall not be entitled to any time extension or claims resulting here from.

2.5 Concrete Mix Design

2.5.1 General

1) Denomination of concrete classes is based on the nominal cube compressive strength (in Newton per square mm) and maximum aggregate size.

2) The cube compressive strength is defined as the strength as measured at 28 days. The strength shall comply with the requirements of IS: 456.

3) The following table shows, in general, the anticipated classes of concrete required in various sections of work. The specific class of concrete to be used in each area will be shown on the Drawings or designated by Engineer-in-Charge:

4) At least 4 months prior to commencement of any concreting of Permanent Works, the Contractor shall start the testing of materials, propose the composition of concrete mixes and prepare trial mix of each of the proposed concrete class. The Contractor shall prepare the trial mixes using the cement, water, aggregates and admixtures intended for the work and which conform to the requirements specified in this Section.

5) Contractor shall determine, in accordance with IS standards and/or ACI Manual of Concrete Practice, the mix proportions for the designated classes of concrete. The contractor shall submit the test reports to the Engineer-in-Charge for approval. This preliminary test program shall include the determination of following parameters:

   a) Cement properties,

   b) Characteristics of aggregates,

   c) Mixing water properties,

   d) Admixture properties,

   e) Proportion of aggregate ranges in the mix,

   f) Proportion of uncrushed to crushed aggregates,

   g) Cement content,

   h) Water-cement ratio (W/C),

   i) Workability of concrete mixes,

   j) Compressive and tensile strength,

   k) Entrained air,

   l) Density,

   m) Water-tightness.

6) These tests shall be carried out until the concrete mixes show appropriate strength, workability, density, and water-tightness without the use of excessive cement and water.

7) To carry out these preconstruction tests, full scale machine-mixed test batches shall be made and test samples taken there from. Tests shall be made in ample time so that complete and acceptable results are available before concreting of structures.

8) Test samples shall be made in accordance with IS: 1199 and tested in accordance with IS: 516. The test results shall be analysed in accordance with IS: 456.

9) The mixes for different classes of concrete shall be approved by the Engineer-in-Charge.

10) During the progress of the work, the mixes may be changed whenever, in the opinion of the Engineer-in-Charge, such change is necessary or desirable to secure the required strength, workability, water-tightness, density, economy, or to limit shrinkage. The Contractor shall not change the approved mix proportions without the written permission of the Engineer-in-Charge.

11) Water to be added to the mix shall be adjusted to compensate for any variation in the free moisture content of the aggregate as they enter the batch plant. Water beyond the specified water-cement ratio shall not be added without the written permission of the Engineer-in-Charge.

2.6 Quality Control

2.6.1 General

1) The Contractor shall be completely responsible for performing detailed quality control program during the execution of the work. This quality assurance program shall be subject to inspection and checking by the Engineer-In-Charge.
2) The Contractor shall keep records of test results which shall be presented to the Engineer-in-Charge upon request.
3) Should the Contractor wish to reduce his approved testing program he shall notify the Engineer-in-Charge of these changes 2 weeks in advance.
4) Aside from Contractor's testing program the Engineer-in-Charge will make control test to the extent, as he deems necessary. The Contractor shall give all required assistance in sampling and provide for the proper storage and transport of the specimens to be tested by the Engineer-in-Charge.
5) The Contractor shall make such arrangements or purchase new equipment should the test results prove that changes in the aggregates or concrete plant are necessary to obtain required concrete quality.

2.6.2 Site Laboratory

1) The Contractor shall build, equip, and operate the site laboratory in which the tests included in the Quality Control Programme will be carried out. In some cases where special tests are required, they will be made in other specialised laboratories after approval by the Engineer-in-Charge.
2) The laboratory shall be equipped with all the necessary equipment to carry out the tests indicated below.
   a. Tests on aggregates as per IS 2386 (Parts I, II, III, IV)
      - Sieve analysis
      - Compressive strength
      - Specific gravity
      - Water absorption
      - Flakiness
      - Sand equivalent
      - Soundness and organic matter
      - Los Angeles abrasion
      - Crushing Value
      - Impact value
   b. Tests on cement
      - Equivalent alkaline content (IS 4032)
      - Specific Blaine surface (IS 4031 (6))
      - Standard Mortar Compressive Strength (IS 4031 (6))
      - Shrinkage (IS 4031 (10))
      - Heat of hydration (IS 4031 (9))
      - Setting time IS 4031 (5))
   c. Tests on fresh concrete
      - Consistency through slump test (IS 1199)
      - Workability
      - Heat of hydration using thermometers, cells and recording instruments

- Air content
- Temperature

d. Tests on hardened concrete

- Compressive strength on all classes of concrete (IS 516)
- Shrinkage IS 4031 (10))

3) The site laboratory shall be properly air-conditioned and equipped with temperature and relative humidity recording instruments.

2.6.3 Sampling and Testing of Concrete and its Components

1) Aggregates

a) Aggregate samples shall be taken at the batching plant.

b) The sampling shall be done as and when directed by the Engineer-in-charge.

c) The tests mentioned in Para 8.6.2.2(a) shall be carried out.

2) Cement

a) As cement is to be procured by contractor ,the quality control of cement shall be under taken as described below

b) Quality control of cement shall first take place at the cement factory. This will be exercised by the factory itself under the supervision and the follow-up of the employer. The quality control program shall be submitted for the approval of the Engineer-in-Charge.

c) The tests mentioned in Para 8.6.2.2 (b) shall be carried out.

d) Each week a sample of cement shall be taken at the batching plant at the direction of engine-in-charge. The following tests will be carried out:

- Setting time,
- Specific Blaine surface
- Standard mortar compressive strength at 3, 7 and 28 days
- Heat of hydration

1) Admixtures

a) Admixtures to be used for concrete production shall be tested for their suitability with the cement and other materials under actual working conditions. Each shipment of admixtures shall be tested for density and dry extract.

b) Admixtures older than 12 months, after their manufacture, shall not be used without specific permission of Engineer-in-charge.

c) Shipment of which the tested sample has not pass the criteria shall be rejected.

2) Water

A sample of water will be taken from the concrete batch plant every 3 months and submitted to chemical analysis as described in IS 3025.

3) Fresh Concrete

a) The tests mentioned in Para 8.6.2.2(c) shall be carried out by the Contractor on fresh concrete samples at site laboratory.

b) These tests shall be carried out at the beginning of manufacturing of the concrete for each work or part of the work and for large quantities once every 100 m3.

c) All consistency tests shall be determined on that portion of the total sample which passes a 40 mm size.

d) Air content shall be determined in accordance with the established standard.

e) One air test (0.006 m3 capacity bowl) is required at the beginning of manufacturing of concrete, whenever a class change occurs, whenever air test results are deviating from specifications and at 500 m3 intervals for each class of concrete in production.

f) Routine air tests as noted above shall be determined on that portion of the total sample which passes a 40 mm sieve size.

4) Hardened Concrete

a) Set of six samples for compressive strength tests at 7 and 28 days will be taken and tested for each part of the work, being defined as the volume poured in one concreting operation.

b) The tests mentioned in para 8.6.2.2(d) shall be carried out by the Contractor on hardened concrete samples at site laboratory

c) For large concreting operations, this set of sample will be taken every 200 m3.

d) Compressive strength specimens shall be prepared by the Contractor and shall be performed in accordance with Indian Standards and Code of Practice.

5) Analysis of Results

a) The test results will include the different components analyses, the values obtained on fresh and hardened concrete and the characteristics of the corresponding batch given by the printer of the batching plant.

b) The Contractor shall present regularly to the Engineer-in-Charge a synthesis of all the results in the form of tables, charts, statistical analyses by incorporating weekly and monthly reports.

c) Concrete Plant

Monthly checks, or when requested by the Engineer-in-Charge, of the concrete plant's weight-batching accuracy, including the accuracy of any admixture dispenser, shall be made by the Contractor in the presence of the Engineer-in-Charge. When checked by standard weights and volumes its accuracy shall be within 0.5% or as specified by the manufacturer.

2.7 Acceptance Criteria

2.7.1 Concrete Components

1) The measured values shall be within the specified range of values indicated above.

2) Any unsuitable material should be eliminated and the concrete manufacturing be suspended until the Contractor justifies that the replacing component is acceptable.

2.7.2 Fresh Concrete

Any controlled batch which will not satisfy the specified conditions in terms of consistency, air content and temperature, shall be eliminated and concreting suspended until it is shown that corrections brought to the following batches are satisfactory.

2.8 Placing

2.8.1 General

1) Contractor shall place concrete in a given location only after the Engineer-in-Charge has agreed with the placement of such concrete. All concrete shall be placed in presence of the Engineer-in-Charge or his representative. Concrete placed without prior knowledge and approval of the Engineer-in-Charge may be required to be removed and replaced at Contractor's cost.

2) The Contractor shall furnish, install, maintain and operate a telephone system or radio, linking the points of placing concrete with the concrete batching and mixing plant. These facilities shall also be available to the Engineer-in-Charge at all times.

3) When placing the concrete by pumping, direct communication shall be maintained between the concrete placing crew and the pump operators.

4) In order to reduce bleeding, slump shall not be higher than necessary to achieve proper placement and consolidation. Concrete shall be placed before initial set has occurred.

5) No concrete shall be placed when the atmospheric conditions are, in the opinion of the Engineer-in-Charge, such that proper placing and hardening of the concrete are not guaranteed. Specifically, the Contractor shall have the responsibility for meeting the hot and cold weather concreting requirements and for postponing concreting whenever such requirements cannot be met or, based on weather forecast, probably cannot be met. Even if the above requirements are fulfilled, the Contractor has the responsibility of delivering concrete product that meets specified requirements.

2.8.2 Preparation for Concrete Placing

1) Concrete shall not be placed until all formwork, installation of embedded parts, reinforcing steel, and surfaces against which concrete is to be cast have been accepted by the Engineer-in-Charge.

2) All surfaces of forms and embedded items that have become encrusted with dried material from concrete previously placed shall be cleaned of all such material before the surrounding or adjacent concrete is placed.

3) Concrete shall not be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or diverted by pipes, or by other means, and carried out of the forms clear of the work. Water shall not be allowed to stand on any concrete surface until it has attained its final set. Water flow over the concrete, which may injure the surface finish will not be allowed.

4) Pipes, conduits, dowels and other items to be embedded in concrete shall be so positioned and supported prior to placement of concrete to be stable and provide sufficient clearance (50 mm min.) between said items and steel reinforcement to allow proper concreting. Securing such items in position by wiring or welding to reinforcement will not be permitted.

5) Where excavated surfaces which are to form the foundations for structural concrete, are absorptive or likely to become otherwise unsuitable, or where shown on the Drawings, the Contractor shall place a 'blinding course' consisting of a layer of Class M15 concrete 50 to 100 mm thick, as directed by the Engineer-in-Charge, uniformly over the foundation such that the upper surface is at grade elevation. Blinding concrete shall be placed before installing reinforcement or formwork.

6) Immediately before concreting, the forms and all other surfaces which will be in contact with the fresh concrete shall be cleaned of all loose material and debris including shavings, wood chips, sawdust, pieces of wire, nails, fragments of hardened concrete and mortar. Clean-out holes which may be needed for this purpose shall subsequently be securely closed in order to obtain the required surface finish.

7) Immediately before concrete is placed, all surfaces shall be cleaned thoroughly by the use of high velocity air-water jets, sweeping with brooms, wet sandblasting, bush-hammering, or other satisfactory means including combinations of the above.

8) Rock surfaces against which concrete is to be placed shall be clean and free from oil, standing or running water, mud, loose rock, objectionable coating, debris, and loose or unsound fragment. Faults, fissures and seams shall be cleaned to sound rock, and if directed, backfilled with dental concrete, shotcrete or dry-pack as appropriate. Rock surface shall be in damp condition at the time of placing of concrete.

9) The use of compressed air for cleaning will be allowed only if adequate precautions are taken to avoid the deposition of suspended oil on construction joint surfaces, reinforcement or other items which are to be bonded to concrete.

10) The Contractor shall provide such personnel and equipment so that the performance of the concrete work is in a satisfactory manner. The transporting and placing equipment shall be clean and in good condition, adequate, and properly arranged to proceed with the placing without undue delays. The number and condition of vibrators for use and standby shall be ample for the requirements during placement. The lighting system shall be sufficient to illuminate the inside of the forms when concrete is placed at night.

11) The Contractor shall have protective coverings available for fresh concrete surfaces if there is a possibility of rain, hail, sleet, or snow.

12) Before placing the concrete for tunnel lining the following requirements should be met:

a) The excavated cross section profile shall be carefully checked to ensure the minimum lining thickness requirements and if necessary it should be corrected,

b) All loose rock which has been trapped by the wire mesh covering over the excavated surface shall be cleared and the mesh be repaired and if necessary replaced,

c) All timber supports, large wooden wedges used during the initial assembly and erection of steel supports shall be removed,

d) Inverts of tunnel and shafts shall be totally cleaned of debris leaving sound rock wherever required the Contractor shall use mechanical tools to loosen and remove all loosened and blast damaged rock.

13) Before any concrete is cast against previously placed concrete, the surface of the old concrete shall be prepared as described in sub-section "Construction Joints".

2.8.3 Placing and Compaction

1) Concrete shall be carefully placed in designated position. Where dense reinforcement or deep forms may cause segregation of concrete while placing, suitable methods shall be used to prevent segregation. The free fall of concrete shall not exceed 1.5 m.

2) Concrete shall be placed directly in its permanent position and shall not be worked along the forms to that position. Vibrators shall not be used to move concrete laterally.

3) Concrete shall be placed in lifts or pour as shown in the drawings or as directed by the Engineer-in-Charge.

4) The addition of water into concrete after batching to compensate for stiffening of the concrete before placing shall not be permitted.

5) All concrete, with exception of concrete tunnel lining, shall be placed in continuous approximately horizontal layers. The thickness of the layers shall not exceed 400 mm for mass concrete, and 500 mm for structural and all other concrete. Each layer shall be soft when a new layer is placed upon it so that no seams or planes of weakness within the section can form, and the two layers shall be made monolithic by penetration of vibrators.

6) The Engineer-in-Charge reserves the right to order a reduced thickness of layers where the layers as stated above cannot be placed in accordance with the requirements of these Specifications.

7) No concrete shall be placed under water except where shown on the Drawings or specifically so required by the Engineer-in-Charge. No concrete shall be placed in running water. Water shall not be allowed to rise over freshly poured concrete until final set has been achieved.

8) Each layer of concrete shall be consolidated to the maximum practicable density, be free from pockets of coarse aggregate, completely fill all recesses in forms and around embedded parts, and be free of all voids. The concrete shall be compacted and worked into all corners and angles of the forms, around reinforcement and embedded items without permitting the component concrete materials to segregate.

9) No layer of concrete shall be placed until the previous layer in the same lift has been thoroughly consolidated. Each layer of concrete within a lift shall be covered with fresh concrete as soon as possible, but certainly within the period when the lower layer is still capable of being revibrated so that successive layers can be thoroughly worked together.

10) The maximum permissible time between the placing successive layers in a pour shall not exceed initial setting time of cement or 30 minutes, whichever is less, and shall be reduced to suit the temperature, humidity and job conditions. Concrete shall not be piled up in the forms in a manner that causes movement of the unconsolidated concrete, or permits mortar to escape from the coarse aggregate.

11) On proposal of the Contractor and with the Engineer-in-Charge's approval, the concrete lining in tunnel may be placed in one continuous pour from invert to crown with construction joints normal to the axis of the tunnel over the full cross section, or continuous placing may be adopted with a sloping joint corresponding to natural angle of repose at end of each concreting cycle.

12) Concreting of lining shall be carried out by concrete pump using methods which do not cause segregation or requiring remixing of the concrete. The point of discharge when concreting the crown above the springing line shall be kept buried sufficiently to allow enough pressure to be built up to completely fill the crown including

areas of over break in the crown if any.

13) Concrete shall be consolidated with the aid of approved immersion type mechanical vibrators complying with IS: 2505 or electric or air driven vibrators operating at a speed of at least 7,000 cycles/minute when immersed in the concrete. The vibrating equipment shall at all times be adequate in number of units and power to penetrate concrete as it is being placed, to the satisfaction of the Engineer-in-Charge. Vibrators with flexible operating shafts shall be used for reinforced concrete and for concrete in restricted forms. At least one extra vibrator in working condition shall be constantly on hand at each point of placement for emergency use.

14) Application of the vibrators shall be made systematically and at such intervals that the zones of influence overlap and the concrete is properly compacted.

15) Every vibrator shall be operated in a near vertical position and the vibrating head shall be allowed to penetrate under the action of its own weight. In consolidating each layer of concrete, the vibrating head shall be allowed to penetrate and revibrate the concrete in the upper portion of the underlying layers. Extreme care shall be taken to ensure that the vibrators do not touch or disturb the reinforcing, embedded steel or forms.

16) To ensure even and dense surfaces which are free from aggregate pockets, honeycombing or air holes, it may be necessary to supplement internal vibration with hand spading along the boundaries of the concrete and around embedded parts while the concrete is plastic under the vibratory action, should slip forms be used, the equipment and methods shall be such that the finished concrete will be well consolidated and homogeneous.

17) Contractor shall use any or all of the above methods of consolidation, if required, to produce the necessary finish. Form vibrators shall not be used unless the forms are designed for form vibration and unless specifically authorised by the Engineer-in-Charge.

2.8.4 Pumped Concrete

1) Positive displacement pumping or other approved methods may be used to place concrete in locations approved by the Engineer-in-Charge. The type and arrangement of equipment shall be subject to approval, and the equipment shall be operated only by experienced persons. Pneumatic placing will not be allowed.

2) The equipment and its method of operation shall allow the concrete to enter the forms at a low velocity.

3) Concrete pumps and auxiliary equipment shall be in good condition and shall be maintained as such throughout the duration of the work. Thorough washing down of all parts that come in contact with concrete shall be performed after each concreting operation.

4) Pump lines shall consist of rigid steel pipe or flexible pipe made of rubber, spiral-wound flexible metal or plastic, or combination of both. Use of aluminium pipe for pump lines shall not be permitted. Couplings shall be leak proof and strong enough to withstand handling during erection and poor support along the lines. They shall provide a full internal cross section with no constrictions of the smooth flow of concrete.

5) Immediately prior to the start of all concrete pumping, the pump and pump lines shall be primed by pumping an approved grout mixture through the equipment.

6) Concrete pumping operations shall be planned in such a way that concrete does not set before the succeeding layer is placed thereon. An adequate supply of fresh concrete shall be provided at all times.

7) When placing the concrete by pumping in tunnel lining, the sides of the lining shall be brought up evenly through windows prepared in the formwork and care shall be taken so that equal pressure is maintained on the formwork. The crown shall be filled through the slick line running along the top of the formwork. This line shall be deeply buried in the concrete at all times. Identifications marks to indicate the depth of burial shall be provided. The buried pumpline shall be withdrawn from the form work gradually as the placement is completed. Air boosters shall not be permitted until slick lines are buried at least 1.5 m into fresh concrete.

2.8.5 Concrete in Blockouts, Second Stage in Restricted Locations, etc.

1) All concrete required to be placed in blockouts to permit the installation and adjustment of mechanical and other equipment, and second stage concrete in other locations shall be included in respective concrete as described in these Specifications.

2) The concrete surfaces of blockouts and first stage concrete at other locations shall be chipped and roughened as described herein before second stage concrete is placed at such locations.

3) Exceptional care shall be taken to placing concrete in blockouts in order to ensure satisfactory bond with concrete previously placed and to secure complete contact with all metal works in the blockouts.

4) The roughening of the first stage concrete surfaces shall be attained by chipping or sand blasting as approved by the Engineer-in-Charge and in such a manner as not to loosen, crack or shatter any part of concrete beyond the roughened surfaces.

5) After being roughened, the surfaces of concrete shall be cleaned thoroughly of loose fragments, dirt and the objectionable substances and shall be sound and hard to ensure good mechanical bond between the existing and new concrete.

6) Concrete grade M30, which shall be non-shrinking, self compacting type with quick setting admixtures such as Glenium 51 and Glenium stream-II, shall be provided for second stage concreting in blockout for embedment as per Drawings.

7) Dowels as shown in Drawings or as directed by Engineer-in-Charge shall be provided to bind first stage concrete with second stage concrete.

2.8.6 Rate of Placing of Concrete

i) Concreting shall be done as a continuous operation until the structure or section is completed or until a satisfactory construction joint can be made. All arrangements necessary to maintain continuity of concrete placing in any particular pour during meal periods, shift changes, or any other such interruptions shall be made.

ii) Concrete shall not be placed faster than the placing crew can compact it properly.

iii) Placing concrete in thin members and columns, precaution shall be taken against too rapid placement which may result in movement or failure of the form due to excessive lateral pressure. An interval of at least 24 hours, unless otherwise approved or directed by the Owner, shall elapse between the completion of columns and walls and the placing of slabs, beams or girders supported by them.

iv) The rate of placing shall be such as to have no objectionable effect on placement of concrete, particularly near the forms and in and around embedded equipment where the rate shall not exceed the limit placed by the Owner.

2.9 Finishing of Concrete

2.9.1 General

1) The quality of the surface finish shall be in accordance with the requirements for the particular class of finish specified hereunder. The finished surfaces of concrete shall be free from areas of honeycombs, segregation, loss of cement or fine material, from damage due to stripping of forms, from boltholes, abrupt irregularities caused by movement of forms or components, loose knots and similar features, and bulges or depressions in the general plane of the surface.

2) Only one type of formwork shall be used for all parts of a concrete structure which is visible from any direction.

3) The classes of finish shall be as shown on the Drawings or as directed by the Engineer-in-Charge.

2.9.2 Formed Surfaces

1) The classes of finish for formed surfaces are designated by the use of symbol F and the shape of the formwork panels required for concrete work shall be either plane (F1, F2, F3) or curved (F1C, F2C, F3C).

2) Surface finishes and other variations in finishing of concrete shall conform to the tolerances indicated below:

Type of finish	General areas of application and method of forming	Tolerances (in mm)
F1, F1C	Formed surfaces of construction joints and other surfaces which will not be permanently exposed. The surface will require no treatment after form removal other than repair of defective concrete and specified curing, or treatment as specified for construction joints.	+25 -10

Type of finish	General areas of application and method of forming	Tolerances (in mm)
F2, F2C	All permanently exposed formed surfaces. Immediately on the removal of forms all unsightly ridges or fins shall be removed; all holes left by removal of ends of form rods shall be neatly filled with mortar and surfaces treated to meet the required tolerances by tooling and rubbing.	+10 -10
F3, F3C	Formed surfaces which will be exposed to flowing water. These surfaces shall be hard, smooth and dense, free from offsets, pits, voids, air holes and irregularities, and shall be chipped, ground and thoroughly cleaned as necessary to conform to the required tolerances.	+3 -3

2.9.3 Unformed Surfaces

1) The classes of finish for unformed concrete surfaces are designated by the use of symbol U and shall be finished by screeding, floating and trowelling.

2) Surface finishes and other variations in finishing of concrete shall conform to the tolerances indicated below.

Type of finish	General areas of application and method of forming	Tolerances (in mm)
U1	Unformed, screeded surfaces which will be covered by fill materials. Finishing shall consist of sufficient levelling and screeding to produce an even, uniform surface meeting the required tolerance.	+10 -10
U2	Unformed surfaces not concealed by fill. Floating by means of hand or power-driven equipment shall be started as soon as the screeded surface has stiffened sufficiently, and shall be the minimum necessary to produce a surface that is free from screed marks and that is uniform in texture.	+5 -5
U3	Unformed, screeded surfaces which will be exposed to flowing water. This finish shall be applied by steel troweling after the concrete has hardened enough to prevent excess of fine materials and water from being worked to the surface, free from blemishes, ripples and trowel marks. After the surface has nearly hardened, it shall be trowelled once more until the surface is hard and glossy in appearance.	+3 -3

3) Interior surfaces shall be sloped for drainage where shown on the Drawings. Exterior surfaces, which will be exposed to the weather, shall be sloped for drainage even if there is no such indication on the Drawings. In such case the slope shall be at least 2% but not exceed 3%.

2.9.4 Tolerances for Concrete Construction

(i) General

(a) All concrete structures shall be constructed to the exact lines, grades and dimensions established. However, inadvertent variations from the established lines, grades and dimensions shall be permitted to the extent set forth herein.

(b) Where the tolerance are not stated in the specifications or on the Drawings for any individual structure of features thereof, permissible deviations shall be interpreted in conformity with these provisions.

(ii) Tolerance for Concrete in Underground Cavities / Tunnels / Shafts, etc.

The concrete in underground cavities, tunnels and shafts shall conform to the tolerances as per Indian Standards or equivalent international Standards.

(a) The inclination of tunnel invert can differ only by 0.1 % (10 cm per 10 m) from the design inclination; the accumulated vertical deviation of the springline from the theoretical line shall not exceed 20 cm in total. The horizontal deviation shall be within a limit of ± 20 cm

(b) Gradual variations measured with 1.5 m template shall be 12 mm.

(c) Abrupt variation in the direction of flow shall be 6 mm and that across the flow shall be 3 mm.

(iii) Tolerance for Surface Finishes

(a) Surface finishes shall generally conform to the types and tolerances indicated under the para 8.12.2 & 8.12.3 above, unless otherwise specified on the Drawings.

(b) No negative variation in thickness of concrete lining for underground works, i.e cavities / tunnel / shafts shall be allowed.

(c) Positive tolerance shall be measured outside and negative inside the lines and grades defining the structure on the Drawings

2.9.5 Bush Hammer Finish

Bush hammer finish shall be applied on the surfaces when required by the Engineer-in-Charge. Bush hammering shall not commence until at least one month after placement of concrete. The tool used for bush hammering shall be electrically driven and have a head 3 cm2 with 16 pyramid shaped teeth. The surfaces shall be finished at a rate of 250 to 400 cm2/minute indenting the concrete surface approximately 2 mm.

2.10 Joints

2.10.1 Construction Joints in Concrete Structures

1) Construction joints are defined as concrete surfaces on or against which concrete is to be placed and to which new concrete is to adhere and which have become so rigid that the new concrete cannot be incorporated integrally with that previously placed.

2) Construction joints shall be located in the positions shown on the Drawings or as required by the Engineer-in-Charge and the Contractor shall not be permitted to form any additional joints or deviate from the joints indicated on the Drawings, without the written authorisation of the Engineer-in-Charge. Necessary rearrangement of steel reinforcement arising from such modifications shall be to the Contractor's debit.

3) Horizontal construction joints shall be arranged, wherever possible, to coincide with joints in the formwork.

4) Joints at exposed surfaces of concrete shall be straight and continuous. Feather-edged construction joints will not be permitted.

5) The faces of vertical joints shall be shuttered with expanded metal or other approved rough material. The expanded metal shall be removed as far as possible, before the adjacent lift is poured. If required, the surface shall be cleaned by wet sandblasting and roughened by light bush-hammering.

6) The surface of construction joints upon or against which new concrete is to be placed and to which new concrete is to adhere shall be clean, rough, and free of water when covered with fresh concrete. The laitance, loose or defective concrete and foreign material shall be removed from the surface of existing concrete. The previous concrete lift shall be saturated by water but surface dry when the successive lift is placed.

7) The surface of the hardened concrete shall be cleaned and roughened by wet-sandblasting and washing thoroughly with air-water jet. Care shall be taken to prevent undercutting of aggregate in the concrete during sandblasting.

8) Wet-sandblasting equipment shall be operated at an air pressure of approximately 7 bars. Sand to be used for blasting shall be dense, hard, not easily broken and sufficiently dry.

9) In lieu of wet-sandblasting the Contractor may propose high-pressure water blasting utilising pressures not less than 400 bars, provided that such high-pressure water blasting produce equivalent results to those obtainable by wet-sandblasting.

10) The horizontal surfaces of construction joints may be treated by cutting with air-water jets ("green-cutting"). This shall be performed after the initial set has taken place but before the concrete has become too hard for effective cutting. The fresh concrete surface shall be cut with air-water jets to remove all laitance and to expose clean, sound aggregate. After cutting, the surface shall be washed with clean water. Care shall be taken that the treated surface does not become contaminated before new concrete is placed upon it. Should the surface become contaminated that a satisfactory joint with new concrete is not ensured the Contractor shall clean it by means of wet-sandblasting.

11) Water used in cutting, washing and rinsing of concrete surfaces shall be disposed of in such a way that it does not stain, discolour or affect exposed surfaces of the structures.

12) When necessary, as determined by the Engineer-in-Charge, structural concrete placement in forms shall be started with an oversanded mix with 19 mm maximum size aggregate, an extra 50 kg of cement per cubic meter and a 100 mm slump. This mix will be referred to as a starter mix and shall be placed approximately 50 mm deep.

13) Disturbance of the surface at a joint during the early stages of hardening shall be avoided, and traffic on the concrete will not be permitted until the concrete has hardened sufficiently to withstand such treatment without injury.

14) All construction joints shall be kept continuously moist until they are covered with concrete, provided that, if it becomes necessary to delay the placement of new concrete on or against a construction joint for an extended period, moist curing of the surface of the joint may be discontinued at the expiration of the regular prescribed curing period. If the moist curing is so discontinued, it shall be resumed not later than 24 hours prior to the placement of new concrete against the joints.

2.10.2 Preparation of Vertical and Steeply Sloping Construction Joints

(i) Joint surfaces shall be treated as described in the following clause 8.13.3. For this purpose the end shuttering for the joint between form sides may be removed while the concrete is at an early age.

(ii) All the joints shall be thoroughly cleaned. All intersections of construction joints with concrete faces, which will be exposed to view shall be made straight, level and plumb

2.10.3 Preparation of Horizontal and Slightly Sloping Construction Joints

i) While the concrete is at an early age, the surface of the joint shall be prepared for the subsequent placement of fresh concrete by the application of high velocity air-water jets with a pressure of at least 3 atmospheres at the nozzle. The jets shall be applied so that laitance and foreign matter are removed and the clean aggregate exposed, but not so that the edges of the larger particles of the aggregate are undercut.

ii) Should, however, the concrete have become fully set and the above treatment cannot be carried out satisfactorily, joints shall be pick-hammered and thereafter scrubbed with a wire brush. The indentations shall not in any case be taken nearer than 50 mm to exposed edges of the concrete to waterstops. In addition, after the scrubbing the whole area shall be thoroughly scoured using a high velocity air-water jet, until all loose and foreign matter and surface laitance have been removed.

iii) In case the joint surface is left to dry it shall be kept continuously wet for twelve hours prior to placing adjacent concrete.

2.10.4 Preparation of Expansion and Contraction Joints

i) Expansion and contraction joints shall be constructed at such points and of such dimensions as indicated on the Drawings. The method and material used shall be subject to the approval of the Owner.

ii) Standard bitumen sheets, impregnated with saw dust or any other filler material and sealing compounds, required to be placed in the expansion joints, shall be fixed in position as shown on the Drawings or as directed by the Owner.

iii) The surface of the joint shall be carefully cleaned from dirt and foreign matter by means of water hosing.

iv) Where shown on the Drawings, a 3 mm thick bituminous sheeting shall be placed in contraction joints exposed to water pressure. The sheeting shall be pasted on to the hardened concrete surface using warm bitumen in accordance with relevant Indian Standards. The method of fixing the bituminous sheeting shall be tested before the commencement of the concrete works. In other contraction joints, the hardened concrete surface shall be painted twice with plastic paint.

v) Expansion joints shall be provided with a separating strip of preformed, durable, resilient joint filler which shall be continuous through the joint and sealed at surfaces with a sealing compound.

vi) Well in advance of purchases, samples of the bituminous sheeting, the plastic paint, the joint filler and the sealing compound, as well as documentation of the characteristics thereof shall be obtained and approved by the Owner.

2.11 Curing and Protection of Concrete

1) Arrangement for curing and protection of concrete shall be available at the location of each concrete placement before concrete placement is started. The water used for curing shall meet the requirements for water used for mixing concrete. The curing water temperature shall not exceed 25oC.

2) Exposed surface of concrete which have been finished as specified shall be protected from the direct rays of the sun for at least 2 days after placing. Freshly placed concrete shall be protected from damage by rainfall.

3) Exposed surfaces shall be kept moist or the moisture in the concrete shall be prevented from evaporating for at least 14 days after placing by means of continuous sprinkling or spraying with water, or by other methods approved by the Engineer-in-Charge.

4) Care shall be taken not to disturb the steel reinforcement projecting from any placement for at least 24 hours after the completion of such placement.

5) The Contractor shall not move any load on concrete surfaces which in the opinion of the Engineer-in-Charge have not attained sufficient strength. In case loads are required to be moved, the Engineer-in-Charge may permit Contractor to do so on condition that Contractor provides the means for protecting the concrete surface subject to approval of the Engineer-in-Charge.

6) The Engineer-in-Charge may permit the use of curing by means of membrane forming compounds. Sealing compounds proposed by the Contractor will be subject to sampling and testing and will have to be approved by the Engineer-in-Charge.

7) Curing compounds shall be applied according to the manufacturer's recommendations to provide a continuous uniform membrane over all area. Curing compounds shall be applied only after moist curing has been carried out for at least 24 hours. Curing membranes shall be protected from damage at all times.

8) Curing compound shall not be used on any unformed surface where, in the opinion of the Engineer-in-Charge, the irregularities in that surface would prevent the membrane forming an effective seal, on any surface which has a temperature lower than manufacturer's recommended application temperature, on any surface where a bond is required for additional concrete, or where a bonded surface coating is to be applied. Where a curing compound is placed on a surface where a bond is required, it shall be removed by sand blasting or by other means satisfactory to the Engineer-in-Charge.

9) Concrete poured in tunnels to form tunnel linings shall be cured by membrane curing, as described above. Curing compounds used in tunnels shall not contain solvents which may create hazardous conditions.

10) Curing compounds used for surfaces exposed to view shall degrade completely when exposed to air for more than 3 months. They are to remain at least 80% impermeable for 1 month after application.

2.12 Particular Requirements for Individual Concrete Structures

2.12.1 Concrete Linings of Tunnels

1) Concrete used for the construction of the linings of the tunnels shall be as specified on the construction Drawings or as directed by the Engineer-in-charge.

2) The Contractor's proposed method of concrete placement is subject to the approval of the Engineer-in-Charge.

3) The vault and invert of the tunnel lining shall be cast in separate operations. The Contractor shall propose the sequence of the casting operations. The proposed method of concrete placement is subject to the approval of the Engineer-in-Charge.

4) The tunnel lining shall either be poured in sections or by "continuous pouring". If the Contractor wishes to use the latter method, then he shall first satisfy the Engineer-in-Charge that the concrete production, transport and placing equipment to be used has sufficient capacity to produce and handle the amount of concrete necessary for continuous pouring of the lining sections. In addition, the Contractor shall provide details of the steps to be taken in the event of an interruption in the concrete supply.

5) The number of vertical construction joints shall be reduced to minimum. Inclined construction joints will have the naturally running slope of placed concrete. In addition to treatment as specified in aforesaid "Joints in Concrete Structures", in case of inclined construction joints, the concrete in the crown and the invert shall be

removed prior to placing of the next stage to avoid an acute angled construction joints relative to the inside surface of the tunnel lining concrete. No mortar layer will be required on the inclined construction joints in tunnel lining.

6) Prior to concreting, the rock surface shall be cleaned and shall be free from oil, mud, loose rock, objectionable coating, debris and loose or unsound fragments. All surfaces shall be cleaned with air-water jets or by other satisfactory means. Particular attention shall be given to the drainage of flowing, and the removal of standing water where concrete will be placed.

7) The Engineer-in-Charge will determine the extent of the steel reinforcement required in the concrete lining, based on the results of the rock mechanics test, if any, performed in the excavated tunnel. Generally reinforcement will be used where weak rock and/or high permeability is encountered and crack control is required. The maximum spacing of the bars will be 200 mm.

2.12.2 Concrete around Pressure Shaft Steel Liner

1) No windows for introduction of vibrators will be provided in the permanent tunnel/shaft steel liners. Working space has been provided at the crown of the tunnel to permit access for the necessary vibration of the backfill concrete. Special care shall be taken to ensure compaction of concrete and complete filling of the space beneath the steel lining, and the filling of the crown according to the procedure specified in aforesaid "Pumping Concrete".

2) Concrete used for backfilling behind the steel lining shall be as per the drawing or directed by the Engineer-in-Charge.

3) Prior to concreting, the rock surface shall be cleaned and shall be free from oil, standing or running water, sand, loose rock, objectionable coating, debris and loose or unsound fragments. All surfaces shall be cleaned with air-water jets or by other satisfactory means. Particular attention shall be given to the drainage of flowing and the removal of standing water where concrete will be placed.

4) Embedding concrete around steel liners in tunnels shall be placed at a maximum rate of rise of 150 mm per hour, unless reliable bracing has been installed to prevent uplifting of the pipes. In no case shall the differential level of concrete on either side of the liner exceed 150 mm at any time of placing.

5) Installation of subsequent steel liner units shall not proceed until either 24 hours have elapsed since placing of the backfill concrete, or the concrete has been shown to have obtained 20% of it's required 28-days cylinder compressive strength.

2.12.3 Backfill Concrete in Surface and Underground Excavation

1) Backfill concrete in surface and underground works shall be placed for providing immediate support to the rock during excavation.

2) The concrete used for backfilling shall be of the class and grade as specified in the drawing or directed by the Engineer-in-Charge.

2.12.4 Concrete in the Powerhouse and associate buildings

1) The Contractor shall place all required concrete in the Powerhouse in accordance with the requirements of these Specifications, as shown on the Construction Drawings or as directed by the Engineer-in-Charge. Concrete for the transformer cavern is included under this heading.

2) The levels of the floors in the Powerhouse the dimensions of the concrete elements such as beams, columns, floors, walls and openings as shown on the Tender Drawings are typical only and may be changed in the final design to suit the actual shapes and sizes of the equipment to be installed in the power and transformer caverns.

3) Blockouts, holes, pipes, pits, pedestals and embedded metalwork for equipment, cables, anchor bolts and other accessories are not fully detailed on the Tender Drawings and may be changed in number, location or size in the final design.

4) The Contractor shall cooperate closely with the supplier of the mechanical and electrical equipment during equipment installation and its embedding, including provision of bracing and ties necessary to maintain all equipment in their correct position during placement of the surrounding concrete.

5) Concrete slabs to be covered with a floor finish or tiles shall be left at a sufficient depth below the finished floor elevations to permit placing of the required thickness of floor finish or tiles, and proper allowance shall be made for the finish when anchor bolts, pipes and other metalwork are placed.

6) Concrete slabs forming floors shall be carefully screeded to the design levels shown on the Construction Drawings. Scabbing or grinding to bring the floor to the correct levels will not be permitted after installation or mechanical or electrical equipment has commenced.

2.12.5 Plum Concrete

1) Plum concrete of M-15 grade mixed with larger size of selected boulder may be used in mass concrete works or in any filling works or otherwise as directed by the Engineer-in- Charge. As specified in these technical specifications M-12.5 grade concrete with 40mm nominal size aggregates shall be prepared and placed at site in layers of 200 mm to 250 mm thickness. After placing M-15 grade concrete, selected boulder of about 150 mm size shall be hand placed upon the entire surface of the concrete area and well tamped to impregnate inside the concrete. Thereafter, the entire concrete layer shall be well vibrated to form a homogeneous mass. Similarly, entire volume of concreting shall be carried out in layers not exceeding 200 mm to 250 mm.

2) The boulder shall not be more than 150 mm in size; shall be hard, dense and free from all deleterious substances and shall be washed and cleaned before placement. Addition of such boulder shall be limited to 15% by volume of the concrete mass.

3) The plum concrete when tested upon samples of 300mm dia. x 600mm high shall have compressive strength of 12.5 N / sqmm at 28 days

A. Cleaning joints:

a) The joints shall be thoroughly cleaned so as to expose sound concrete surfaces. The method shall be by means of jets of air and water applied at high velocity with such additional roughening of the surface by means of stiff wire brushes as may be required. The whole process shall be conducted in such a manner as not to loosen the coarse aggregates but vigorously enough to expose a fresh clean-cut concrete surface.

b) Should the next lift be delayed, the contact surface shall be kept wet and covered so as to minimize the evaporation of curing water which may cause an injurious coating on the joint. Where necessary, all defective and undesirable concrete shall be removed by chipping and picking by hand or if so required, by wet sand blasting the top to a depth just sufficient to expose a fresh, clean-cut surface over the entire area, which shall then be thoroughly flushed with water.

c) Immediately before depositing fresh concrete, the contact surface shall again be gone over and thoroughly washed to remove all debris and loose material. The final pick up of loose material shall be made near the centre of the joint and away from the outside edges of concrete.

d) Dry contact surfaces shall be kept saturated with water for not less than 24 hours, but all standing water shall be removed from depressions before spreading the mortar layer. The joint shall then be covered with about 1.5 cm of mortar (in the same proportion as in the original concrete but not lower than 1:2) and the concrete immediately deposited thereon.

B. Rate of placing:

a) Concreting shall be continued without avoidable interruption until the structure or section is completed or until satisfactory construction joints can be made.

b) Concrete shall not be placed faster than the placing crew can compact it properly.

c) All concrete shall be placed in approximately horizontal lifts not exceeding 150 cm thickness except to expedite the placing of embedded materials.

d) The interval between two lifts shall also be maintained as constant as possible.

e) The difference of elevation between any two adjacent blocks shall not be more than 900 cm and not less than 150 cm.

f) A period of 5 days for each 150 cm of concrete shall be allowed before the next pour unless heat dissipation

methods warrant otherwise.

g) Where plums are permitted to be used, they shall be washed and and all dripping surface water removed before being embedded in concrete. No stone shall be closer than 30 cm to an exposed surface nor nearer than 15 cm to an adjacent stone. The stones shall not be dropped in place, but each stone shall be laid and carefully embedded so as to avoid any injury to the forms or adjacent masonry and in such a manner that no planes of weakness of unnecessary seams occur in the structure.

C. Large Blocks:

a) While placing concrete in large blocks, the work shall in general proceed from the low side to the high side, so that the working face is never excessively steep nor long. Under no condition, the slope be so steep as to cause the concrete to flow without working, or to cause any segregation.

b) The concrete shall be deposited as nearly as practicable in final position and shall not be piled up in large masses at any point and then pushed, shovelled, or vibrated into space for long distances.

c) Concrete shall be brought up evenly around all large openings, conduits or embedded metal so as to minimize unequal pressure and avoid any displacement.

D. Weather conditions:

a) Concreting operations shall be temporarily suspended during excessively hot, cold, or inclement weather, or whenever conditions are such that the concrete cannot be properly placed and cured.

b) During freezing weather, all aggregates shall be free from ice, snow, heavy frost and frozen lumps.

c) Whenever the temperature is likely to fall below -7 degrees C, within the subsequent 48 hours, concreting operations shall be suspended unless provisions have been made to protect the concrete from freezing. Under such circumstances, the water used for mixing shall be heated and the temperature of concrete shall be kept at not less than 10 degrees C for at least 72 hours after placement.

d) During hot weather, no concrete shall be deposited when the temperature within the forms is more than 50 degrees C. Whenever necessary, exposed surfaces of fresh or green concrete shall be shaded from the direct rays of the sun and protected against premature setting or drying by being cured under continuous fine spray of water.

e) During continued rainy weather or heavy downpours, all freshly placed concrete shall be covered and protected against surface wash. Special precautions shall be taken to prevent the formation of lean seams or sand streaks. Mortar coats for bonding construction joints shall not be placed or left exposed the rain is tending to increase the water cement ratio of the mortar.

f) Under no conditions, concrete shall be placed in a pool or sheet of water.

g) The top of all badly washed or streaked surfaces shall be removed and wasted before depositing the next course.

E. Curing and protection:

a) Exposed finished surfaces of concrete shall be protected against heating and drying from the sun for at least 72 hours after placement. Concrete shall in general kept continuously (not periodically) moist for not less than 14 days.

b) Construction joints shall be cured in the same way as other concrete surfaces and shall also if practicable, be kept moist for at least 72 hours prior to the placing of additional concrete upon the joint.

c) Horizontal and approximately horizontal surfaces shall be cured by sprinkling or by covering with damp sand, or by the use of wet sacks which satisfactorily retain the required amount of water for curing purposes.

d) Water curing shall be used on all concrete in dams and shall be applied by means of sprays or sprinklers to cover the entire area of concrete.

e) Forms shall be kept sprinkled until removal.

f) Concrete shall not be disturbed by workmen walking over it or by storing materials on the surface for at least 10 hours after placing.

g) In special cases such as powerhouses, the use of an approved, properly applied, sealing compound on limited area shall be permitted. The curing compound shall be of surface membrane type which shall thoroughly seal the concrete surface.

h) Curing compounds shall not be used on joints where bonding is required.

i)The concrete surface shall be thoroughly wetted before applying the compound.

j)All methods used for curing shall leave the concrete free from any discolouration or damage to the concrete

F. Construction joints:

a) The location and type of all construction joints shall be as shown on the drawings and no other joints or type of joint shall be built unless specifically approved by Engineer-in –charge.

b) The stipulations for cleaning concrete joints and bonding new concrete to old shall apply to all horizontal construction joints also. Keys or dowels for resistance to shear shall be carefully formed as shown on the construction drawings.

c) Vertical construction drawings shall be built with essentially the same care as other exposed surfaces. The break between the adjoining sections of concrete shall be complete unless otherwise detailed on the drawings.

d) Where horizontal construction joints are subjected to water pressure, special care shall be taken to bond the next lift of concrete. The consistency of the concrete shall be carefully controlled so as to avoid sand streaking; and after compaction no free water shall show anywhere along the joint.

e) The surface shall be carefully cured and protected from mechanical injury.

f) In casting vertical joints required to be water tight, care shall be taken not to injure or displace the grout piping, water stops, or seals called for on the drawings.

g) Wherever placing is interrupted long enough for concrete to take its final set, the working face shall be so formed and finished as to provide union with subsequent work equal to that specified for regular construction joints.

2.12.6 Concrete in R.C.C. Frames/Walls/Slabs

i) Concrete shall be placed in lifts of heights as shown on the Drawings. Within each lift, concrete shall be deposited in approximately horizontal layers about 40 cm in thickness.

ii) At locations where lift heights are not shown on the Drawings, details of the placing procedure shall be approved by the Owner. No concrete shall be placed at such locations without the prior approval of the Owner.

iii) Slabs shall be placed in one lift unless otherwise indicated or directed by the Owner.

iv) In walls, lifts shall terminate at such levels as will conform to the structural requirements.

v) The placement of concrete shall be carried out at such a rate and in such a manner that the formation of cold joints is prevented.

2.13 Repair of Concrete

2.13.1 General

1) Repair of damaged or defective concrete shall be performed by skilled workmen only, and in the presence of the Engineer-in-Charge or his representative. No repair work shall be carried out until the Engineer-in-Charge has inspected the location of the proposed repair and accepted the method of repair proposed by the Contractor.

2) Contractor shall correct all imperfections on the concrete surface as necessary to produce surface that conforms to the requirements specified.

3) Where concrete is exposed to flowing water or to weather, porous and fractured concrete and surface concrete to which additions are required to bring it to prescribed lines shall be removed by chipping openings into the concrete a minimum of 75 mm below the reinforcing bars or to the depth required by the Engineer-in-Charge if

sound concrete is not encountered at 75mm. Repair areas shall be formed, and area filled with fresh concrete. If the concrete section to be repaired contains no reinforcement, concrete shall be chipped to a minimum depth of 100mm.

4) The chipped openings shall be sharp edged and keyed and shall be filled to the required lines with fresh concrete or patching mortar, as approved by the Engineer-in-Charge. Where concrete is used for filling, the chipped openings shall not be less than 75 mm in depth and the fresh concrete shall be reinforced and doweled to the surface of the openings, as directed by the Engineer-in-Charge.

5) Dry pack mortar for patching shall consist of 1 part cementing material, 2 parts by volume of regular sand, and just enough water so that after thorough mixing of the ingredients the mortar will barely held together when compacted by squeezing with the hand. The mortar shall be fresh when placed, and any mortar that is not used within 1 hour after preparation shall be wasted. Just prior to mortar application, the surface to which the mortar is to bond shall be kept wet for at least 2 hours, and then scrubbed with a small quantity of cement grout using a wire brush.

6) When repairs are more than 25 mm deep, the mortar shall be applied in layers not more than 20 mm thick to avoid sagging. After each layer, except the last is placed, it shall be thoroughly roughened by scratching with a trowel to provide an effective bond with the succeeding layers. The last or finishing layer shall be smoothened with a trowel to form a continuous surface with the surrounding concrete. All patches on exposed surface shall be neat and smooth and as nearly as possible of the same colour as the adjoining concrete. All patches shall be thoroughly bonded to the surfaces of the chipped openings, shall be cured to the satisfaction of the Engineer-in-Charge and shall be sound and free from shrinkage cracks and drummy areas.

7) Where bulges and abrupt irregularities protrude outside the limits prescribed in these specifications, the protrusions shall be reduced by bush hammering and grinding so that the surfaces are within specified limit.

8) For concrete surfaces where high velocity flows may occur, and as required by the Engineer-in-Charge, repairs to surfaces having F3 and U3 finishes shall be bonded with an epoxy adhesive approved by the Engineer-in-Charge and used in accordance with the manufacturer's instructions.

9) All repairs to the concrete surface under flowing water shall be ground smooth to meet the tolerances specified for that surface.

10) Skilled workmen shall be involved in the execution of repair works. Repair procedures shall be worked out in consultation with Engineer-in-charge.

2.13.2 Sealing Work in Concrete Lining of Underground Structures

1) The Contractor shall carry out sealing work to reduce water inflow and water losses through, and to guarantee the normal watertightness of the concrete lining of underground structures according to criteria stated hereafter and as directed by the Engineer-in-Charge.

2) The work shall consist of sealing the cold joints, construction joints, shrinkage cracks both vertical and horizontal, honeycombs, and poorly grouted or sealed grout holes. The work shall be performed intermittently, whenever water inflows are observed and measured, wide cracks are discovered (especially after performance of tunnel pressure testing), or the future impermeability is, in the judgement of the Engineer-in-Charge, doubtful.

3) The sealing work shall be carried out when following phenomena are encountered:

   a) Water inflow equals or exceeds 1 l/min measured at each single inflow source,

   b) Any water inflow from grout holes and through honeycombs is unacceptable,

   c) Cracks or joints, regardless whether they are dry or wet, of width greater than:

      - 0.2 mm in tunnels and shafts containing reinforcing steel.
      - 0.5 mm in unreinforced stretches of tunnels or shafts
      - Areas of porous concrete (e.g., due to poor vibration) where depth of porosity is obviously deeper than superficial.

4) Specialised concrete repair agency shall be involved in the execution of sealing works. Sealing procedures shall be worked out in consultation with specialised agency.

2.14 Measurement and Payment

2.14.1 General

1) Measurement for payment for each class of concrete, unless specified otherwise hereafter, will be of the volume placed within the lines, grades, and pay-limits shown on the Drawings or as established at the Site by the Engineer-in-Charge.

2) Unless otherwise specifically stated, no payment will be made for concrete placed outside these limits, other than in additional excavation directed by the Engineer-in-Charge, and the measurement shall not include any filling of over break unless recognised as due to geological conditions conforming to the limits defined in other Chapters of these Specifications.

3) Payment will be made at the Unit Prices for different classes and types of concrete entered in the Bill of Quantities, which shall include, but not be limited to, the following:

   a) Excavation, loading, transportation, crushing, screening, washing, blending, and storage of aggregates,

   b) Batching, supply of mixing water, mixing, transportation, placing, and compacting the concrete,

   c) Transportation, storage and mixing of cement at the nominal content per different classes of concrete indicated in Sub-Chapter "Concrete Mix Design", and complying with all requirements specified.

   d) Labour, tools and equipment for cleaning, and preparing surfaces prior to concreting,

   e) All formwork according to location- vertical, inclined, horizontal, roof, overt etc., unless separate item for formwork is specifically provided in the BOQ.

   f) Forming and treatment of construction joints including furnishing and spreading of mortar layers, or starter mixes before concrete placing,

   g) Surface finishing including bush-hammering,

   h) Attaining the concrete temperature as specified, and hot and/or cold weather precautions,

   i) Protection and curing of concrete,

   j) Repair of defective concrete and removal of rejected concrete,

   k) Communication system connecting the points of placing concrete with the relevant mixing plant or delivery equipment,

l) Furnishing the trial bays and panels, provision of material samples and all activities required in connection with the performance of the tests including their transportation to the testing laboratory.

4) All associated concrete work, such as removal of forms and repairs and finishing of concrete shall be completed as soon as practicable after concrete is placed. Concrete will not be considered for payment until all associated works have been completed to the satisfaction of the Engineer-in-Charge.

5) Measurement for payment and payment for steel reinforcement is stipulated in other Sections of these Specifications.

2.14.2 Concrete Lining of Tunnels

1) Concrete Lining of Tunnels

   a) Measurement for payment for concrete placed in the tunnel lining will be of the volume of concrete placed to restore the lining to its original shape around the tunnels..

b) Measurement for payment and payment will be made for the invert concrete and for concrete placed in the vault (overt) of the tunnels.

c) The Unit Prices shall include, in addition to works described under "General", the entire cost of the following:

- Pumping of the concrete,
- Sealing of cracks, cold joints etc., where directed by the Engineer- in -charge,
- Provision and installation of thermocouples for temperature measuring.

d) Payment for shuttering shall be made separately .

2.14.3 Second Stage Concrete and Concrete in Blockouts for Equipment Embedding

1) Measurement for payment of second stage concrete and concrete in blockouts will be of the volume of placed concrete. Only second stage concrete placed in spaces exceeding 0.10 m3 in volume or 0.05 m2 in cross section will be considered for payment. Concrete placed in blockouts or spaces less then stated above shall be deemed to be included in the Unit Price for concrete in the structure with which it is associated.

2) Payment will be made at the Unit Price per cubic meter entered in the Bill of Quantities, which shall include, in addition to works included under "General", the entire cost of preparation of contact surfaces with parent concrete, furnishing of non-shrink agent where directed and any other related work.

2.14.4 Exclusions - Concrete

1) No extra measurement for payment or payment will be made for the following:

a) Any rounded or bevelled edges, fillets, scoring, chamfers, or any deduction made for voids or embedded items which are either less than 0.10m3 in volume or 0.05 m2 in cross section. No allowance will be made for approved temporary openings, drains, embedded pipes, or recesses created by the Contractor for his own convenience during construction provided they are filled as directed,

b) Any collecting of seepage water or water inflow from rock surfaces and diverting it into the drainage systems as specified in the Chapter "Dewatering During Construction",

c) Any defective and wasted concrete; concrete which has to be removed and replaced due to Contractor's non-compliance with the Specifications or Engineer-in-Charge's directions, and all related cost shall be at the Contractor's expense,

d) Any concrete which the Contractor places or uses for his own installations or for his own convenience,

e) Developing alternative sources of aggregates by the Contractor and the resulting additional material testing,

f) Pumping of the concrete,

g) Any precast concrete units damaged by improper storing, handling or transportation,

h) Any pipe work or material incorporated into the work to aid in placement of concrete.

2.14.5 Cement

1) No separate payment will be made for the nominal cement content required as per "Concrete Mix Design" for the respective class of concrete.

2) In case the required minimum specified compressive strength of a particular concrete class cannot be reached, or is in excess of, with the cement content indicated therein, variation of cement content (increase or decrease over the nominal cement content) will be assessed separately. The basic cost of cement and handling charges shall be paid for or recovered from the Contractor for such variations, as the case may be at the rate defined by the Employer in the Bill of Quantities

3) Measurement for payment of handling charges for variations of Portland cement content used for concrete will be of the quantities, by weight, of cement approved for the different classes of concrete specified, and computed on the basis of the number of cubic meters of concrete measured and approved for payment. The amount of cement required per cubic meter of concrete of each class shall be as established at trial mix stage or the approved

modifications thereof as established by the Engineer-in-charge in the course of concrete work.

4) The cement variation rate for aforesaid variation in cement shall be paid for or recovered from the Contractor as the case may be at the rates specified by the Employer in the contract.

5) No measurement for payment or payment will be made for cement used for ;

   a) Contractor's own convenience,

   b) Used for defective and wasted concrete,

   c) Concrete placed outside of the concrete paylines (e.g. for filling the over break other than approved over break due to geological conditions) or required as a result of careless excavation.

   d) Concrete produced with overuse of admixture.

2.14.6 Admixtures

1) Payment for admixtures is included in the Unit Price of concrete and no separate payment shall be made for admixtures unless otherwise stated in the Bill of Quantities.

2.15 Tests

1) All cost associated with testing as described in this Chapter shall be borne by the Contractor, who shall make allowance for such expense in the Unit Prices for the concrete work. These shall include, but not be limited to, the following :

   a) The costs for all tests to be carried out prior to the start of concrete work, whether carried out at Site or elsewhere,

   b) Routine tests for quality control during the execution of the concrete work carried out by the Contractor as specified herein and as directed,

   c) Other tests required during execution of the work to be carried out by an approved test laboratory(ies),

   d) Preparation, storage, handling, curing and delivery of samples to a laboratory designated by the Engineer-in-Charge, if so required for additional independent testing.

2) Should the Contractor fail to adhere to his testing program, all tests deemed necessary by the Engineer-in-charge to check concrete work will be performed by the Engineer-in-Charge or a laboratory assigned by him, at Contractor's expense.

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CHAPTER- P. 3 REINFORCING STEEL

3.1 Scope of Work

The Contractor shall furnish, fabricate, and install all reinforcement steel as shown on the approved detailed reinforcement drawings and bar lists prepared on the basis of Engineer-in-Charge's Drawings. The work shall further include the furnishing and installation of all tie wires, clips, supports, chairs, spacers, couplers and other appurtenances necessary to produce finished concrete structures.

3.2 Standards

1) Cutting, bending, cleaning, placing and fastening in position shall conform to the requirements of the following Indian Standards (latest edition):
   - IS: 432(Part 1) – specifications for mild steel and medium tensile steel bars and hard drawn steel bars for concrete reinforcement
   - IS: 456 - Code of practice for plain and reinforced concrete
   - IS: 1786 - Specifications for high strength deformed steel bars and wires for concrete reinforcement
   - IS: 2502 - Code of practice for bending and fixing of bars
   - IS: 2571 - Code of practice for welding of mild steel bars
2) A tolerance for reinforcement placing and fastening in position shall be in accordance with IS: 456.
3) In case of a conflict between the above Standards and the Specifications given herein, these Specifications shall take precedence.

3.3 Submittals

1) The Contractor shall submit to the Engineer-in-Charge a certified copy of mill test report before the shipment of each consignment of steel to the site. The report shall show the physical and chemical properties of steel.
2) Within 28 days from the date of issue of Notice to Commence, but before procuring or mobilizing to the Site the equipment, the Contractor shall submit to the Engineer-in-Charge updated and detailed plans and descriptions, consistent with those submitted with his Tender and any subsequent amendments and additions agreed to by the Engineer-in-Charge and the Contractor, of the equipment proposed for the fabrication of reinforcing steel.
3) During the progress of the work, Engineer-in-Charge will prepare reinforcement drawings which will indicate the structural reinforcement required in the particular structure. The Contractor shall notify in writing to Engineer-in-Charge at least 10 weeks before such drawings are required for each section of work. On the base of these drawings the Contractor shall prepare the detail bar bending Bill of Quantities (bar list). All bars shown on the reinforcement drawings shall be identified on the bar lists and all bars shall be defined and dimensioned in clear and unambiguous way and be referenced to the relevant reinforcement drawings. The Contractor shall be responsible for the correctness of the bar lists. The Contractor shall submit to the Engineer-in-Charge three copies of bar lists prepared from time to time to enable the Engineer- in- charge to review and comment.

3.4 Materials

1) All deformed reinforcing bars shall be high yield strength, deformed steel bars conforming to IS: 1786 Grade Fe500.
2) All plain reinforcing bars shall be mild steel and medium tensile strength steel bars conforming to IS: 432 (Part 1)
3) Wire for tying reinforcing steel shall be black annealed iron wire, or acceptable equivalent, with a diameter not less than 1.6 mm.

3.5 Testing

1) In the course of concrete works the Contractor shall conduct test Welded joints or mechanical connections wherever used shall be tested to prove that the joints are of full strength of bars connected.

2) In the course of concrete works the Contractor shall conduct test Welded joints or mechanical connections wherever used shall be tested to prove that the joints are of full strength of bars connected

3.6 Storage

1) Reinforcing steel shall be stored above the ground in separate groups according to size and length. Reinforcing steel which has been cut and bent according to the Bill of Quantities approved by Engineer-in-Charge shall be marked with a bar number shown on the Bill of Quantities, by using weatherproof tag or by placing in marked bins, and shall be stored in such a manner as to be readily accessible when required and to facilitate inspection.

2) Reinforcement fabric supplied in rolls shall be straightened into flat sheets before being placed.

3.7 Fabrication

1) Contractor shall cut and bend all reinforcing steel in accordance with bar schedules supplied by him and duly approved by Engineer-in-Charge.

2) Reinforcing steel bars shall be cut and bent at the site of the works or at a fabricator's plant in an acceptable workmanlike manner in accordance with Indian Standards. Notwithstanding the above, a bar-bending machine and a representative stock of reinforcing steel shall be maintained at the Site, sufficient to allow minor revisions and additions to be carried out as required by Engineer-in-Charge.

3) The bars shall be bent cold at temperature greater than 5°C. Bending below that temperature or warm bending will only be permitted when adequate precautions are taken to comply with the corresponding direction issued by the steel manufacturer for such bending.

4) Reinforcing steel shall not be straightened or rebent in a manner that will damage the materials. Temporary bending and subsequent straightening of bars partially embedded in concrete shall not be permitted, except when shown on the Drawings or with the written approval of the Engineer-in-Charge. Bars with kinks or bends other than those indicated on the Drawings and Bill of Quantities shall not be used.

5) Reinforcement bars, other than tie bars, shall not be spliced at points other than those shown on the Drawings without the consent of the Engineer-in-Charge. On occasions when it becomes necessary to alter the position of such splices, the new position and the type of splice shall be subject to the written approval of the Engineer-in-Charge.

6) Should the necessity of welding of reinforcement arise, the provisions of the IS-2571 and Indian Standard's recommendations for welding cold worked steel bars for reinforced concrete shall be followed.

7) The couplers (BARTEC or equivalent) shall be used for splicing the reinforcing bars of 25 mm diameter and more as indicated in the Drawings or as directed by the Engineer-In-Charge.

8) Patent reinforcement splicing methods shall only be used with approval of Engineer-in-Charge.

9) The Contractor shall not weld any item to reinforcing steel except as approved by Engineer-in-Charge and in conformance with accepted procedures.

10) Reinforcing bars available from the rejected concrete structures shall not be used without prior approval by the Engineer-in-Charge.

3.8 Placing

1) Before being placed in position, the reinforcing steel shall be thoroughly cleaned of loose mill scale and rust, grease, paint, or other coatings that would reduce bond. All splashed concrete that has dried on reinforcing steel shall be removed.

2) Reinforcing steel to be incorporated in the works shall be placed accurately in the positions shown on the drawings and shall be held firmly in place during the placing and setting of the concrete.

3) Reinforcing steel shall be so placed that there will be a clear distance of at least 50 mm between the reinforcing steel and anchor bolts or embedded metal work, if not shown otherwise on the drawings or required otherwise by Engineer-in-Charge.

4) Reinforcing steel shall be maintained in position by the use of small concrete blocks, steel chairs, steel spacers, steel hangers and other steel supports and ties, acceptable to Engineer-in-Charge. Wood supports or spreaders

shall not be used. All intersections shall be securely tied except those where the bar spacing is less than 300 mm in each direction, where only alternate intersections need be tied.

5) Binding wire, and steel supports shall not be carried to permanently exposed surfaces and shall be subject to the same requirements with regard to concrete cover as for the reinforcing steel.

6) The cover of the reinforcement shall be as shown on the Drawings.

7) All reinforcement shall be inspected in place and approved by the Engineer-in-Charge or his representative before placing the concrete. Concrete placed in violation of this provision may be rejected and removal required.

3.9 Tolerance on Placing of Reinforcement

Unless otherwise specified by the Engineer-in-Charge or shown on the drawings, reinforcement shall be placed within the following tolerances:

1) Protective cover:

For cover up to 50 mm	+ 6 mm
For cover 75 mm and more	+12 mm or 1/3rd of specified cover whichever is less.

2) Spacing:

For effective depth 200 mm or less	+ 10 mm
For effective depth between 200 and 2000 mm	+ 15 mm
For effective depth more than 2000 mm	+ 25 mm

3.10 Measurement and Payment

1) Measurement for payment for reinforcing bars will be of the weight of reinforcing steel, including splices, as stated in the bar lists furnished by the Contractor in the course of the work. The weight entered in the bar lists will be computed using the nominal weight per linear metre of different bar diameters based on the specific weight of 7,850kg/m3.

2) Payment will be made at the Unit Price per metric ton or kg entered in the Bill of Quantities for the reinforcement shown in the drawings, which shall include the cost of supply, transportation, storage, cutting, bending, placing, wire clips, ties, separators, chairs, spacer bars, and any other fastening devices.

3) Measurement for payment for couplers will be the number of pieces used. Payment will be made at the Unit price according to Coupler diameter per piece as entered in the Bill of Quantities.

4) No extra measurement for payment or payment will be made for the following:

   a) Wire for tying reinforcement,

   b) Reinforcement in precast R.C.C. lagging

   c) Any additional reinforcement or splices required when Contractor's casting sequences differ from construction joints shown on the Drawings.

   d) Any reinforcing steel placed by the Contractor for his own convenience in addition to those shown on the Drawings and entered in the bar lists.

   e) Any welding of reinforcement.

   f) Any reinforcing steel delivered for testing.

   g) Device like steel chairs, hangers, spacers, small concrete blocks, other supports, tie and anchor rods etc used to maintain steel in position.

CHAPTER P. 4 FORMWORK

4.1 General

The work under this Chapter shall comprise supply of all labour, plant and material and the performance of all work necessary for the design, fabrication, supply, erection, maintenance and removal of formwork and falsework to form concrete structures as shown on the Drawings or as otherwise directed by the Engineer-in-Charge.

No separate measurement for form work shall be made as formworks for all kinds of concrete structures are included in the unit prices of concrete, except where separate item of formwork is shown in the BOQ.

4.2 Definitions

For the sake of clarity, the terms used in this Section are defined as follows:

1) "Forms" or "Formwork" shall mean the moulds into which concrete is placed,
2) "Falsework" or "Shoring" shall mean the structural supports and bracings for forms used in any part of the Works,
3) "Curved forms" shall mean any form not composed of plain surface and limits of curved forms shall not extend beyond the lines of tangency or intersections with flat surfaces.

4.3 Submittals

1) At least 56 days in advance of any concrete work being carried out at the Site, the Contractor shall submit to the Engineer-in-Charge details of the materials for formwork and surface finishes, and construction techniques which the Contractor proposes to use in order to achieve the required concrete surfaces and allowable tolerances.
2) At least 56 days prior to the construction of the steel formwork for the tunnel lining, the Contractor shall submit to the Engineer-in-Charge the shop drawings, details, and structural computations of the formwork construction.
3) At least 28 days prior to commencement of work on each particular structure the Contractor shall submit to the Engineer-in-Charge 4 copies of the detail shop drawings with all formwork details and 2 copies of the structural computations of the formwork construction.
4) Review by Engineer-in-Charge of Contractor's drawing and calculations shall not relieve Contractor of its responsibility for the adequacy of form and falsework, or for the safety of persons or property, for the successful completion of the work.

4.4 Materials

1) Materials used for form sheathing and lining shall be of wood, steel, plywood, or fibreglass. All materials used in formwork construction shall be of adequate strength and quality for their intended purpose and shall be satisfactory to the Engineer-in-Charge.
2) Timber shall be sound, straight, free from warp, decay and loose knots and shall be dressed smooth. Except as expressly approved by the Engineer-in Charge, all timber brought to the Site for use as forms, shoring or bracing shall be new material.
3) Plywood for use as form shall be mill-oiled and edge-sealed. Plywood shall be non-warping, non-wrinkling and manufactured with special water proof glues. Plywood sheets shall be of uniform width and length.
4) The surface of steel of steel lined forms shall be smooth. Forms with dents, buckled areas or other surface irregularities shall not be used.
5) Forms for concrete surfaces exposed to flowing water (other than tunnel lining) shall be lined with sanded, uncoated, plywood veneer. Steel or impermeable plastic liners will not be permitted.
6) Rough sawn boards may be used only for the lowest grade of surface finish (F1).
7) Reuse of forms will be allowed only if they are thoroughly cleaned and repaired and capable of producing the finish required for the concrete. Timber or plywood forms repaired with metal patches shall not be used.
8) Damaged forms which have deteriorated through use shall not be used.

9) Where required, expanded metal fixed to the formwork shall be used in vertical construction joints.

4.5 Form Ties

1) The type, number and positions of internal formwork supports and ties shall be to the approval of the Engineer-in-Charge. Form inserts or other similar permanently embedded items shall be accurately located and securely fastened in place. The number and location of form ties and bolts shall be such as to ensure that forms fit tightly against the concrete previously placed and remain in tight contact during operations.

2) The whole or part of such formwork supports and ties shall be removed without damage to the concrete so as to leave no part embedded nearer the surface of the concrete than the designed cover of the reinforcement or 50 mm in the case of unreinforced concrete. Only metal portions of formwork supports and ties shall be allowed to remain in place.

3) Through-bolts will not be permitted in water retaining walls.

4) Holes left after the removal of supports and ties shall be filled as described in Section "Concrete - Repair of Defective Concrete", and shall be finished off neatly to the standard of the concrete surface. Such filling shall be adequately cured.

4.6 Design

1) Contractor shall be solely responsible for the adequate design, construction and maintenance of any and all formwork and falsework required in the Works. Forms shall be designed to permit the concrete to be deposited as nearly as is practicable directly in its final position, and to allow inspection, checking the cleanup of the formwork and reinforcement to be completed without delay.

2) Formwork and falsework shall be designed, fabricated, erected and removed in accordance with the applicable provisions of the recommended practice for concrete form of IS:456.

3) All falsework shall be designed to withstand safely all live and dead loads which might be applied to the falsework during all stages of construction, service and removal.

4) For the purpose of formwork and falsework design, the Contractor shall assume a value of 2.5 t/m3 for the density of concrete.

5) Detailed drawings of shoring and formwork shall be prepared by Contractor. The calculations and drawings shall show the size and specification of the formwork, including the type and grade of all materials used in the construction, design loads on the formwork supports, horizontal forces imposed on the false work and used for design purpose, and details of splices and connections, including nailspikes and other fasteners. If mechanical equipment such as concrete buggies, screeding machines, etc. are to be used, this information shall be shown on these drawings.

4.7 Erection of Formwork

1) Formwork and falsework shall be constructed only after the formwork drawings have been accepted by Engineer-in-Charge.

2) The Contractor shall construct the falsework in strict accordance with the approved formwork drawings, one set of which shall be kept at the Site at all times. No change will be allowed without prior written acceptance of such change by Engineer-in-Charge.

3) Formwork shall be erected and maintained such as to confine the concrete without loss of mortar and produce required finished surfaces. Forms shall be set and maintained within the specified tolerance limit such that the complete concrete surfaces are within these limits.

4) Forms for concrete against which backfill is to be placed or which will not be exposed to view may be constructed of smooth tight boards not less than 25 mm nominal thickness.

5) Forms for concrete exposed to view shall be constructed of steel or plywood which is smooth and free from defects with matched and sanded joints to give a symmetrical pattern over the entire area. Chamfer strips, 35 mm by 35 mm shall be used on all exposed corners, unless otherwise directed by the Engineer-in-Charge.

6) Any forms which in the opinion of the Engineer are unsafe or inadequate in any respect may, at any time, be rejected and the Contractor shall promptly remove the rejected forms from the Works and replace them.

7) An adequate number of temporary clean-out holes or short pipes shall be provided in the forms to secure the draining of rainwater.

8) When a second lift is placed on hardened concrete, the number, location and tightening of ties at the top of the old lift and bottom of the new shall be such as to prevent any damage to concrete. The form of a new lift shall overlap the hardened concrete by 100 mm, to prevent abrupt irregularities.

9) Forms for sloping concrete surfaces shall permit their placing board-by-board or panel-by-panel immediately ahead of concrete placement so as to enable access for placement, vibration, and inspection of the concrete.

10) All form surfaces shall be thoroughly cleaned before erection and shall be lubricated with a non-staining mineral oil. All excess shall be wiped off the forms prior to placement of concrete. Oil shall not be allowed to come into contact with reinforcement steel or other embedded items.

11) Immediately before concrete is placed, all forms shall be inspected to ensure that they are properly placed, sufficiently rigid, clean, tight, properly surface treated and free from excess of oil or other foreign materials. No concrete shall be placed until formwork has been inspected and accepted by Engineer-in-Charge or his representative..

12) The formwork for the gate groove areas shall be accurately drilled to be held with first stage anchor couplings/plates to be embedded in primary concrete. Both shall be fixed through formwork into the first stage anchors couplings/plates to ensure that the couplings/plates remain flush with primary concrete face and the couplings do not get plugged.

4.8 Tunnel Formwork

1) Steel faced forms shall be used to achieve the F3C finish required on the hydraulic tunnels lining surface. The forms shall be fitted with ample windows at appropriate spacing and locations to allow the introduction of vibrators and to carry out inspections and any other work needed behind the form.

2) The formwork shall allow for continuous concrete pouring of the whole face. It shall be of rigid construction, non-deformable due to working loads imposed upon it. Once installed in the position the form shall maintain it without displacement during concrete placement.

3) The formwork shall be constructed in such a way that no abrupt irregularities arise at vertical construction joint. The joint in formwork shall overlap the vertical construction joint at least 500 mm and one formwork element remains in contact with placed concrete while others are being stripped down and installed for following concreting stages.

4) The windows shall be provided in each side about the mid height at the tunnel and the crown on alternate sides of the centreline. The windows shall be at least 600 mm in the least dimension and shall be spaced at a distance not exceeding 2.5m.

4.9 Finished Tolerances

Forms shall be so constructed that the finished concrete surfaces shall be of uniform texture in accordance with the types of finish specified in Chapter "Concrete".

4.10 Removal of Formwork

1) Removal of forms shall be performed with care so as to avoid injury to the concrete and as soon as permissible in order to avoid delay in curing and repair of surface imperfections. Forms shall not be removed without the consent of the Engineer-in-charge.

2) Forms shall not be removed until the concrete has attained sufficient strength to prevent damage to concrete. Damaged concrete shall be repaired or treated by the Contractor as soon as possible, but not before the Engineer-in-charge has inspected such damage and agreed to the remedial works.

3) The elapsed time between the completion of concrete placing and the removal of forms shall generally be in accordance with IS:406, but not less than the following:

Undersides of beams, deck type slabs, undersides of openings generally	7 days
Piers, columns and walls	
lifts 2 m and under	24 hours

lifts over 2 m	48 hours
Tunnel linings	16 hours
Mass concrete	24 hours

Removing time for propping under beams, slabs etc. will be taken as per IS: 456.

4) The minimum periods indicated above are only indicative. The governing rule to be observed in the 28-day compressive strength, which shall be determined by the cube test in addition to those required by the provisions as described in Chapter "Concrete - Test During Execution of the Work". When fixing the minimum period for formwork removal, the shrinkage and creep of the concrete shall be taken in to consideration.

5) Considering the weather conditions and type of pour, the Engineer-in-Charge may modify the minimum elapsed time required before formwork can be removed from individual pours, and in case of formwork for beams and deck slabs it shall remain in place until concrete has developed the specified design strength.

6) Notwithstanding the above or any approval given by Engineer-in-Charge, Contractor shall be fully responsible for ensuring that sufficient time has elapsed for the concrete to attain adequate strength before removal of formwork.

7) Forms shall be removed so as to avoid cracking, spalling, peeling, breaking of edges or surfaces, or other damage to concrete. If it is necessary to use wedges, only wooden wedges shall be used against the concrete. Damaged concrete shall be repaired or treated by the Contractor as soon as possible, but not before the Engineer-in-charge has inspected such damage and agreed to the remedial works.

8) Upon approval of the Engineer-in-Charge, forms on concrete surfaces close to excavated rock surfaces may be left in place, provided that the distances between the concrete surface and the rock is less than 500mm and that the forms are not exposed to view after completion of the works

CHPATER – P. 5 GROUTING

5.1 Scope of Work

1) The work under this Chapter includes all labour, materials, equipment, operations, and services required for the execution of drill holes, water-pressure test, grouting in the holes from surface and underground construction sites, at locations shown on the Drawings or as specified by the Engineer-in-Charge.

2) The grouting activities shall be required to be executed in underground works:

   a) Contact grouting in all concrete lined tunnels. This contact grouting is performed to fill the voids between concrete lining and the surrounding rock.

   b) Contact grouting between concrete and rock surface in tunnel

   c) Fill grouting of exploratory drill holes & drain holes.

   d) Crack grouting to seal open cracks and joints in the cement concrete

   e) Consolidation grouting of underlying rock behind concrete lining in tunnel

3) The grouting activities shall be required to be executed in surface works:

   a) Fill grouting of drainage trench, conduits and sump pit

   b) Crack grouting to seal open cracks and joints in the cement concrete.

4) Scope of work also includes regular professional advice from competent external agencies to supplement Contractor's own skills for grouting works of various types required under these specifications.

5.2 Submittals

5.2.1 Drilling

1) Prior to the start of drilling (and/or grouting work) in any working area, the Contractor shall make available to the Engineer-in-Charge a drilling and/or grouting plan, with 28 days' time for review. Once work has commenced and as the local sub-surface conditions are disclosed, the drilling and/or grouting plan may have to be modified accordingly based on consultation with and direction by the Engineer-in-Charge. The Contractor shall be prepared and equipped for variations in the drilling and grouting work.

2) The Contractor shall make drilling logs and other pertinent information available to the Engineer-in-Charge on completion of each work phase and as needed during the work.

3) The Contractor shall provide notice of and make available to the Engineer-in-Charge reports giving the results of each water-pressure test performed within one working day of the end of the shift in which the tests were carried out. The reports shall contain complete records of the execution of the test as described in this Chapter.

4) The Contractor shall provide to the Engineer-in-Charge (prior to scheduled use in the field) documentation of the effects on the grouting mixture of any additive proposed for use in the drilling water, and no additives shall be used without prior approval by the Engineer-in-Charge.

5) Within 24 hours of completion of any drilling with core recovery, the Contractor shall submit, in duplicate, a technical log of the drill hole in a form approved by the Engineer-in-Charge. The log shall be in accordance with IS:4464 and shall include the following data:

   a) Date of beginning and end of drilling,

   b) Drill hole number,

   c) Location, ground surface elevation, coordinates, inclination, direction, and length of drill hole,

   d) Type and diameter of drilling bit and core barrel used, make of drilling rig and length and diameter of casing, if used,

   e) Elevation of ground water levels encountered, including dates and times of measurement,

   f) Results of leakage tests and other drill hole tests, if any,

g) Length of each core run and the length, or percentage, or both of the core recovered and location and cause of core losses,

h) Any changes in the character of the drilling water or mud, and in case the drilling water was lost (partly or totally), the elevation or depth when this happened,

i) A simple driller's interpretation and description of the nature of the formation encountered as the drilling progress,

j) Location and nature of cavities, seams, cracks, soft or broken rock, whether filled or open, and any other observation which could give information in connection with the purpose of exploratory drilling,

k) Names of driller's and inspectors.

6) Geological logging shall be performed by the Contractor's geologist which shall be got approved by the Engineer-in-charge.

7) Colour photographs of the core boxes from each drill hole shall be submitted to the Engineer-in-Charge in 3 copies within 10 days from the completion of the drill hole.

8) The Contractor shall submit reports in duplicate giving the results of each water-pressure test performed, within 24 hours of the end of the shift in which the tests were carried out. The reports shall contain the following:

   a. Location and number of drill hole,

   b. Date and time of test performance,

   c. Type of test,

   d. Pressure readings and water levels before and after testing,

   e. Packer rod characteristics and depth of packer(s),

   f. Total injected water volume and rate per minute and per linear meter of hole for various pressures applied. A plot showing water take versus increasing and decreasing pressure shall be prepared and both data and plot shall be submitted.

   g. Description of all surface water leaks indicating the distance and approximate quantity.

9) Should the Contractor intend to use a water-soluble additive to drilling water, he shall submit a notification and a sample of the additive to the Engineer-in-Charge for approval at least 15 days prior to being used.

5.2.2 Grouting

1) At least 28 days prior to the start of the grouting works, the Contractor shall submit for approval fully detailed proposals and a detailed layout of his proposed arrangements for grouting, including specifications of all equipment, tools and all grouting materials to be used, and qualification and experience of the proposed personnel, and extent of technical support from external agencies.

2) An overall grouting program shall be drawn up jointly between the Contractor and the Engineer-in-Charge. Grouting mixes, pressures, pumping rates, and sequencing will be selected, subject to modifications, to meet local conditions encountered during the performance of the work. Grouting works shall be planned in such a manner that they can be carried out according to the approved plan concurrently with other activities. Modifications to the grouting program shall be implemented as directed by the Engineer-in-Charge.

3) Prior to each phase of grouting, the Contractor shall submit for approval a detailed program for the particular grouting works along with information relating to the methods he proposes to use and details of grout mixes. No grouting work shall be executed without prior written approval by the Engineer-in-Charge.

4) During the performance of the grouting works, the Contractor shall keep complete daily records of all grouting operations. These grouting records shall be compiled on an approved form and shall be submitted weekly to the Engineer-in-Charge. Results of water pressure tests and grout takes shall be presented in tabular form as well as graphically. The records shall contain all the information as per guidelines of IS:6066 - 1994, and shall include

the following:

a) Number and location of the drill holes,

b) Results of water-pressure tests,

c) Grouting method,

d) Date and time of commencement of grouting and of each change in grouting operations,

e) Rate of pumping,

f) Grouting pressures and gauge reference number,

g) Water-cement ratio and its variations,

h) Separate quantities of cement, sand, bentonite, fly ash, admixtures and chemicals used,

i) Connections, if any, with other holes and cracks, as well as any surface leakage of water or grout; crack location, how it was caulked, and the success of caulking shall be described and approximate station and offset of each surface leak shall be recorded where it occurs.

j) Number of holes and depth of holes left for redrilling,

k) Time of completion,

l) Name of the foreman in charge.

5) The Engineer-in-Charge reserves the right to require any additional information deemed necessary to be included in the documents to be submitted.

5.3 Definitions

1) **GROUTING** is defined as injecting a mixture of cement and water with the addition of admixtures, sand, bentonite, and fly ash, if required, or similar approved mixture under pressure into overburden or rock mass or between rock/concrete contact through a system of boreholes by means of a pump designed for such a purpose. Cement grouts are subdivided as under:

2) **Unstable mixtures** are simple suspensions of cement in water. These suspensions are only homogeneous as long as they are in movement and the sedimentation starts as soon as the movement is stopped.

3) **Stable mixtures** are colloidal suspension dissolved in water in which grain size is so small that no appreciable sedimentation occurs during the grouting operation. These suspensions are obtained by high speed mixing of cement with addition of bentonite

4) **Thixotropic mixtures**. When percentage of bentonite in the stable mixture in increased, the mixture becomes thixotropic. Thixotropy is the property of denser stable bentonite suspensions to form gel when left at rest.

5) **ZONE** is part of the impervious curtain grouting or consolidation grouting where all the drill holes have the same depth or the same inclination or where a level for the depths of holes is specified. In a zone, Engineer-in-Charge may adjust and drillholes as required by the topographical and geological conditions to ensure a continuous grouting curtain.

6) **STAGE** is a section of a drill hole in which grouting or water pressure testing is performed.

7) **WATER PRESSURE AND LUGEON TEST**- Lugeon test (Water Pressure) is defined as the process of measuring permeability of the rock mass. The purpose of this test is to obtain information on the rock quality in order to determine the consistency of the grout to be used and to moisten the surface of rock seams in order to avoid premature sealing of the seam by thickening of the grout mixture.

8) **PACKER GROUTING** consists of drilling a hole to its full depth in a single operation, cleaning and washing, water pressure testing if required and grouting the hole in successive stages in any desired sequence of section which are isolated by use of packers from the ungrouted sections. This method shall generally be used.

9) **STAGE GROUTING** consists of drilling and grouting a hole by stages. First a hole is drilled to a limited depth, cleaned, subjected to water pressure tests if required and then grouted. Just after the initial set of grout, the hole is cleaned by washing or by other appropriate means. Then the hole is drilled to another limited depth,

cleaned, subjected to water pressure tests if required and grouted and so continued in successive stages until satisfactorily grouted to its full depth. This method is to be used only when directed by Engineer-in-Charge.

10) **FULL DEPTH GROUTING** means that each hole is drilled to the full desired depth, washed, pressure tested and grouted in one operation. This method is usually limited to short holes 5 m or less or holes up to 10 m that have only small cracks and joints and there is no risk of surface leakage.

11) **SPLIT SPACING** consists of progressively closing curtain or consolidation grouting by drilling and grouting holes midway between holes which have previously been drilled and grouted. The spacing between primary and secondary holes may vary from one zone to another depending upon geological conditions encountered.

12) **CONTACT GROUTING OR PACK GROUTING** is drilling and grouting at low pressures required filling the voids between concrete and rock surface or between concrete and steel lining.

13) **OPEN END WASHING** is the process of cleaning drill cuttings and sludge from a drill hole by injecting water or water and air at the bottom of the hole and returning the fluid and suspended matter to the top of the hole.

14) **GROUTING PRESSURE** shall mean the pressure of grout injection as measured at the nearest pressure gauge near collar of hole while the grout is being pumped into the hole.

15) **EFFECTIVE PRESSURE** shall mean the actual pressure of grout at the packer end, taking into consideration the difference of elevation between the packer end and the nearest pressure gauge or the water table.

16) **SUCCESSFUL CONNECTION** means the completion of all operations necessary to achieve a proper seating of a packer assembly that can sustain the required pressure without leakage or loss of pressure during pressure water testing or grouting to refusal.

17) **GROUT TAKE OR GROUT ABSORPTION** is the quantity of materials injected in a hole expressed in units of metric tonne of dry cement/bentonite and of sand.

18) **WATER CEMENT RATIO** is the ratio of the mass of water to the mass of cement.

5.4 Equipment

5.4.1 Drilling Equipment

1) All drilling equipment used shall be of a type, capacity and mechanical condition capable of performing the drilling required under this Contract and shall be subject to the approval of Engineer-in-Charge.

2) The Contractor shall have sufficient drilling rigs at the Site for the timely completion of the Works. The drilling rigs shall be in good operating condition and adequate for the satisfactory progress of the work. Combustion engines for operation of drilling equipment will not be permitted for underground work.

3) Drilling equipment shall be capable of drilling at any angle, upward or downward, and shall have the following capacity:

   - Exploratory holes up to 100 m,
   - Curtain grouting upto 60m
   - Consolidation grouting up to 20 m,
   - Contact grouting upto 5m.

4) Standard drilling equipment of the rotary and percussion type shall be used to perform the drilling as specified herein or as required by the Engineer-in-Charge. Percussion drilling equipment shall be equipped with a water swivel for continuous flushing of the holes during drilling.

5) The Engineer-in-Charge may require some of the grout holes and pressure relief holes to be drilled using rotary type drills with core recovery. The rotary type machines shall be capable of drilling NX size holes utilising double tube core barrels equivalent and capable of recovering soft or friable materials with maximum possible core recovery. The equipment and crew shall be made available at site when Engineer-in-Charge requires exploratory holes to be drilled. All such cores shall be properly stored in wooden boxes and logged for inspection as per the Indian Standard.

6) The drilling units shall be mobile and of size suitable to the dimensions of the adits, tunnel, shaft & cavern.

7) The Contractor shall keep at the Site an ample supply of different types and sizes of drilling bits to allow optimal drilling in the different materials to be encountered in the course of work, and sufficient rods and casings of various diameters to allow proper telescoping and to ensure the stability of drill holes.

8) The Contractor shall provide measuring equipment for checking the actual inclination and alignment of drill holes.

5.4.2 Grouting Equipment

1) Only modern, properly operating grouting equipment approved by the Engineer-in-Charge and operated by trained and experienced crew shall be used for the performance of the work. This shall be specifically observed when dealing with chemical products.

2) The grouting equipment required to carry out the work shall include mixers, grout pumps, packers, pipes, grout lines, fittings, pressure gauges, telephones, lighting circuits, trolley grout platforms and miscellaneous supplies. Sufficient grouting equipment shall be provided to meet the construction Schedule and each plant shall be capable of satisfactorily supplying, mixing, stirring, pumping and injecting grout mixes of various viscosities as specified herein. The equipment shall be maintained in good operating condition at all times and any grout hole that is lost or damaged due to mechanical failure of equipment or inadequate delivery of grout shall be replaced by another grout hole by Contractor at no additional cost to Owner.

3) The grouting equipment for mixing and placing the grout shall be such as to provide a continuous circulation of grout throughout the system and to permit accurate volume and pressure control. It shall be capable of effectively mixing and stirring the grout and forcing it into the hole in a continuous uninterrupted flow at any desired pressure up to the maximum required grouting pressure for a flow rate of 150 litre/min.

4) Grout pumps shall be of the progressive cavity type and shall be capable of pumping at least 150 litres/min of grout at a maximum discharge pressure of 1,700 kPa (1.7 N/mm2).

5) Grout mixers shall have a minimum capacity of 0.5 cum and shall be mechanically operated horizontal paddle type or preferably colloidal high speed impeller type. Facilities shall be provided at the mixer for the accurate measurement of grout materials so that mix proportions can be carefully controlled.

6) Sump or holding tanks having a minimum capacity of 0.5 cum shall be mechanically operated and designed to keep the mixed grout agitated and in suspension. All grouts should be discharged from the mixer into the agitator and from the agitator into the pump panel through a 2.36 mm screen to remove lumps and large particles.

7) Water meters shall be calibrated in litres and tenths of liters without bypass so that water can be measured directly in the mixer. A strainer with cleaning valve shall be provided in the water supply line, upstream of the meter to prevent sand and abrasive particles from entering the meters.

8) Pressure gauges of the approved make shall be of such calibration to cover a range of pressures from 0 to 0.5 N/mm2 (500 kPa) and from 0 to 1.5 N/mm2 (1500 kPa), an adequate number of spare gauges shall be provided at each grout plant. Contractor shall provide a standard master gauge against which all other gauges shall be checked periodically for accuracy and satisfactory operation. All the pressure gauges shall be numbered for identification.

9) Packers shall be capable of effectively sealing the grout holes at the specified elevation and shall be capable of withstanding without leakage pressures up to the maximum grouting pressure. The type of packer to be used shall be of the pneumatically expanded rubber sleeve type. Double packer assemblies separated by up to 4 m of perforated pipe shall also be provided.

10) A double line circulating system shall be used and the inside diameter of all lines, walls and connections shall be not less than 25 mm. Hoses and supply lines shall be capable of withstanding pressure 50% greater than those specified for grouting.

11) Grouting headers shall be provided for feeding grout into the holes. The header shall include a supply connection, a connection with a valve to the hole, and a return line with valve. Two number of approved make pressure gauges for the appropriate pressure range shall be installed. One shall be installed to indicate the pressure of the supply at the pump and the other to measure the back pressure at the hole.

12) Contractor shall furnish, install, maintain and operate satisfactory communication system between grout plants and the holes being grouted regardless of grout area locations.

13) Contractor shall supply sufficient operating personnel, supervisors, labour, spare tools, to carry out each phase of the work properly and expeditiously.

14) The grouting units shall be mobile and of size suitable to the dimensions of the galleries/drifts.

5.4.3 Water Pressure Testing Equipment

1) The washing and water pressure testing equipment shall include pumps, piping, pressure gauges, valves, seal assemblies and all other accessories, necessary to perform the Work.

2) The Contractor shall provide a sufficient number of complete sets of pressure testing equipment (with spares) to allow simultaneous testing at the various drilling and/or grouting locations.

3) The pumps furnished shall be of the gear, centrifugal, or other acceptable types, with a minimum output of not less than 0.28 cum/min at 1.5 N/sqmm (1500 kPa) gauge pressure and shall be capable of maintaining constant pressure.

4) The Contractor shall supply water storage tanks sufficient for the pumps in addition to flow meters and pressure gauges for calibration and checking.

5) Water-meters and pressure gauges shall be calibrated and certified by an independent laboratory prior to installation at the Site and shall be subject to periodic verification. One pressure gauge and one water-meter shall, after independent checking, remain at the disposal of the Engineer-in-Charge for further checking purposes. The Contractor may be requested to establish, by way of tests, correction graphs for pressure losses occurring in the pipes. Pressure gauges shall be installed directly at the collar of the drill hole.

5.5 Site Laboratory

1) The Contractor shall have a laboratory specially equipped for studies and tests relating to grouting works available on the Site. The laboratory shall be manned by experienced laboratory assistant(s) familiar with conventional grout tests.

2) In addition to the usual general laboratory equipment such as scales, oven, permeability meter and the like, it shall be equipped with:

- A multi-speed laboratory mixer,
- A Marsh test cone,
- A mould for pressure testing the above cubes, variable from 0 to 2 tons,
- A set of sieves for grain size analysis of fines,
- Conventional laboratory glassware, including 1 litre beakers and test tubes, thermometers and aerometers, and Atterberg limit measuring cups,
- A Baroid scale type mud density meter.

3) The Engineer-In-Charge shall be given free access to the laboratory and shall be entitled to carry out any studies and measurements he deems necessary.

4) The Contractor shall prepare and test the trial mixes as directed by the Engineer-in-Charge at least 28 days before commencement of any grouting. Materials for use in grout mixes shall be tested for compliance with the applicable requirements stipulated in "Materials" of this Chapter. Tests shall be performed on the grout mixes proposed for use in the Works, to establish the consistencies in mixes, practical mixing ratios, initial and final setting times, and such other properties as may affect the quality of the grout.

5) During the actual grouting operations, the Contractor shall carry out tests on grout mixes at the same time as grouting, and shall plot values of viscosity, sedimentation limits, compressive strength, and maximum viscosity possible for the grouting on a diagram. The frequency of testing will be once for each grouting job site or until acceptance criteria have been met. However, if a significant change in the cement source occurs, sampling and testing must be repeated, and the new mix approved by the Engineer-in-Charge.

5.6 Grouting Materials

1) Water used for all drilling, washing and water testing and as an ingredient of grout mixtures shall be fresh,

clean and free from deleterious amounts of silt, organic matter, alkali, acids, salts, oil and other impurities.

2) Cement used in the grout mixes shall be PPC cement. Fine cement (Blaine surface area 3500 cm2/gm) may be specified during the course of work, if so required.

3) Whenever sand is added to the grout mix, it shall consist of clean, hard and durable particles free from lumps or clay and objectionable foreign matter. A supply of 5 cubic meters of sand shall be kept in proximity of the work at all times. Sand shall conform to the following grading requirement:

Sieve size (mm)	Percentage passing by weight
2.360	100
1.800	95-100
0.600	60-85
0.300	30-50
0.150	10-30
0.075	0-5

4) Bentonite which shall be sodium based, high grade (HG) may be required in grout mixes. The bentonite used shall conform to IS: 12584.

5) Approved admixtures shall be used by Contractor in the grout mix to optimise the strength, viscosity, density, decantation, setting time and shrinkage. Only admixtures proved by testing prior to the start of grouting may be used, when approved by the Engineer-in-Charge. Manufacturer's certificates or guarantees will not be accepted as relieving the Contractor of his responsibility for the suitability of any admixture.

6) The Contractor shall handle, store and protect all cement and additives in such a manner that these materials will not be subject to deterioration or contamination. Deteriorated or contaminated materials shall not be used in the Works.

5.7 Grout Mixes

5.7.1 Selection of Grout type

Following table shall be used as a general guidance only for selection of grout type for a particular application which may or may not occur at this project and may require other additives to be determined during grout optimisation process:

Type of Grouting	Objective	Ground Characteristics	Grouting Compounds
Contact grouting in tunnels	Void Filling		Pure Cement slurries (w/c ratio < 0.8%)
Consolidation grouting in tunnels.	Strength	Narrow or wide joints and fissures filled with sand or clay	Pure cement slurry
		Wide empty joints or fissures high permeability	Thick stabilized cement suspensions.
		Injected grout leaks into adjoining open holes. Inflowing water in fissures	Thick Thixotropic suspensions (bentonite added for thixotropy)
		Crushed rock injected grout leaks to the surface	Thick Thixotropic suspensions with fine sand added additives for quick setting (if required)

5.7.2 Pure Cement Slurries

1) Water/cement slurry mixes are defined in terms of the W/C (water/cement) ratio by weight.

2) High turbulence mixing of these slurries shall last at least two minutes after pouring of the full cement weight into the mixer.

5.7.3 Use of bentonite in cement suspension grout

Preferred rate of sedimentation of a grout suspension is below 10%. Normal grout mixes don't meet this requirement when the water cement ratio is more than 0.8.

To meet the requirement of sedimentation rate below 10%, the grout suspension must be stabilised. As a rule, stabilization is effected by bentonite addition in the range of 1% to 4% of the weight of cement. The relative loss of strength of hardened grout is negligible up to 6% bentonite addition.

5.7.4 Stable Bentonite-Cement Grouts

1) Stable bentonite/cement grouts shall be laboratory tested prior to use. The following graphs, in particular, shall be drawn.
   a) Equiviscosity curves,
   b) Bleed limit curves,
   c) Curves of equal mechanical strength,
   d) Curve of maximum possible viscosity for grouting.
2) These figures shall be obtained with a mixer which reproduces the high turbulence of the site mixers and with the same materials (cement, bentonite, water) as will be used on the site. Bentonite/cement mixes for grouting shall not bleed more than 5%, expressed in terms of the volume of water visible above the grout after setting and the total volume prior to setting, as measured in a 1 litre, 6 cm diameter test tube.
3) Viscosity shall be measured with a Marsh cone or equivalent method.
4) Unconfined compressive strength after 7 and 28 days shall be measured on 5 cm cubes stored in water. 28 days compressive strength shall be no less than 1 MPa.
5) The time to initial set shall not be longer than 24 hours.

5.7.5 Preparation

1) The bentonite/cement grout shall be made by first mixing a bentonite/water parent slurry in a high- turbulence mixer and storing it, once adjusted to the defined W/B ratio, for approximately 24 hours in a large tank where it shall be kept in gentle movement, after which a quantity of parent slurry shall be taken and mixed with additional water and cement in a high-turbulence mixer.
2) The final mixing of the parent slurry with cement shall last at least two minutes after addition of all ingredients.
3) The same mixing drum shall under no circumstances be used for mixing both bentonite/cement grouts and bentonite/water slurries. Bentonite shall not be suspended in water which contains even the slightest amount of cement.
4) The Contractor shall provide detailed information regarding the material and batching, mixing and grouting plant he proposes using in his submission for the Engineer-In-Charge's approval.

5.8 Execution

5.8.1 General

1) The extent of proposed drilling and grouting programme is tentative. Engineer-in-Charge reserves the right to increase or decrease any part of the drilling and grouting programme should conditions indicate that this is required.
2) The Contractor shall provide sufficient pump capacity and storage to ensure a continuous supply of water to all grouting operation at all times at each grouting location. Minimum water pressure in the supply lines shall be 0.35 N/sqmm. Sufficient compressed air shall be supplied by the Contractor to perform the work with all equipment using compressed air operating at full capacity, the minimum delivery pressure in the air supply lines shall be 0.70 N/sqmm at all times.
3) In order to ensure efficient and satisfactory performance, Contractor shall employ competent and experienced drilling and grouting supervisors who shall execute directions of Engineer-in-Charge and supervise the work to be done.
4) During drilling, grouting, washing and pressure testing operations, the Contractor shall keep concrete and rock

surfaces free and clean of oil, grease, drill cuttings, grout, cement, excess of water or any kind of waste. At all times during the progress of the work covered by this Chapter Contractor shall protect all open drill holes from becoming plugged or filled with oil, grease, drill cuttings, grout or waste. Contractor shall clean up; and remove all waste upon completion of the work in each area before he vacates that area.

5) Modifications to drilling and grouting techniques may be required as the knowledge and experience of rock and foundation conditions are gained. The Contractor will be required to alter his operations properly to meet such modifications as per instructions of the Engineer-in-Charge. Necessity may also arise for drilling holes at certain places in a telescopic manner for which equipment and accessories are required to be available.

6) All drill holes shall be thoroughly washed and cleaned by allowing drilling water to run until the return from the hole is reasonably clean as explained in IS:6066 - 1984.

7) Drilling through overburden shall be done by ODEX or other suitable method approved by the Engineer-in-Charge. Consequently, grouting shall be done by method "grouting through tubes with sleeves" as described in IS:4999 or any other equivalent method approved by Engineer-in-Charge. Execution and controls shall be as per IS: 4999 for overburden grouting.

8) All drill holes shall be protected from being clogged. Clogged holes shall be redrilled and cleaned at Contractor's cost.

9) Unless indicated otherwise, the drill holes shall not deviate from their designed alignment by more than 3% of their designed length.

5.8.2 Drilling

1) Drilling Holes for Grouting

a) The holes shall be drilled at locations, in the sequence, orientation, inclination and to the depths shown on the Drawings or as required by Engineer-in-Charge.

b) Most of the holes for consolidation, contact grouting, curtain and pressure relief will be drilled with drill of the percussion type which shall be equipped for constant water flushing at the far end of the drilling rod.

c) Holes drilled for contact/consolidation/curtain grouting in various structures shall not be less than 38 mm dia. Holes drilled for pressure relief shall also not be less than 38 mm dia, unless otherwise stated.

d) The use of rod dope, grease or other lubricants on drill rods shall not be permitted. No drilling water additives of any kind shall be used without the written permission of Engineer-in-Charge.

e) All holes shall be established to within 250 mm of the specified location. All orientation shall be within 1 degree of the orientation specified. If for any reason the drill hole deviates in inclination or orientation in such a way that it does not satisfy the purpose for which it was intended, the Contractor shall correct the deviation or shall drill another hole to the satisfaction of Engineer-in-charge.

f) Whenever the drill water is lost or artesian flow is encountered drilling operations may be stopped by Engineer-in-Charge who may require the hole to be grouted before drilling operations are resumed. The Contractor is required to record the location, the flow and pressure of any artesian conditions encountered in any drill hole.

g) On completion of drilling and washing of any grout or pressure relief holes drilled through the floor of the galleries, the Contractor shall immediately cap the holes with proper removable plugs (wooden or plastic) and shall protect them from entry of dirt or other foreign material. Any grout or pressure relief hole that gets obstructed prior to grouting or installation of elbow shall be cleaned out or another hole shall be drilled by the Contractor.

h) Grout or pressure relief holes shall not be drilled within 12 m of another hole which is being grouted or which has been grouted within the previous 24 hours.

i) No hole shall be drilled through concrete before 5 days after the placement of the concrete.

a) All exploratory holes shall be NX size, unless otherwise specified.

5.8.3 Washing and Water Pressure Testing

1) Immediately before grouting or pressure testing, the hole shall be thoroughly washed with water as explained in

IS:6066 - 1984 or any other standard practice as approved by the Engineer-in-Charge.

2) For routine grouting operations, simple water tests shall be conducted immediately prior a stage of any grout hole is grouted.

3) A simple water pressure test involves isolating a segment of a hole generally 3 to 5 m in length by means of a single or double packer and pumping in water at constant pressure for a period of 15 minutes. The tests shall be carried out as per IS: 6066 or any other standard procedure or code of practice approved by the Engineer-in-Charge.

5.8.4 Grouting

1) Contact Grouting in Tunnels

a) Low pressure contact grouting shall be carried out between concrete lining and rock over the entire length of concrete lined tunnels.

b) Contact grouting shall be performed from holes drilled in the overt of concrete lining of the tunnels. 5 to 6 number holes at longitudinal interval of 3 m shall be drilled 300 mm into rock (or as shown in the Drawings).

c) Washing and water pressure testing will not be required prior to contact grouting.

d) In any section of the tunnel, the concrete lining within 90 m of that section shall have been in place for at least 21 days before grouting commences.

e) Contact grouting shall be carried out at low pressure and shall continue until all voids are filled, unless otherwise directed by the Engineer-in-Charge. Vent pipes for the release of air and water during grouting shall be provided in locations directed or approved by the Engineer-in-Charge.

f) After the grouting of any hole is completed, the pressure shall be maintained by means of a stopcock or other suitable device until the grout has set.

g) Check grouting shall be carried out where directed by the Engineer-in-Charge, to verify that voids have been completely filled with grout. Grouting will be regarded as being satisfactory if the pressure can be maintained for at least 5 minutes without further grout take.

2) Contact Grouting between backfill concrete and steel lining

a) Grouting between the steel lining and the backfill concrete in any section of the tunnel and shaft shall not commence until the backfill concrete within 100m of that section has been in place for at least 28 days.

b) Low pressure contact grouting shall be carried out until all voids between the steel lining and backfill concrete are thoroughly filled. The maximum grouting pressure shall be 3 bar or as directed by Engineer-in-charge. A special air chamber and safety valve shall be incorporated into the grouting system to smooth out pressure fluctuations and limit maximum pressure.

c) Only stable cement water mixers with addition of palstifying agent shall be used for this grouting.

d) Pre-taped holes for the grouting complete with threaded steel plugs will be provided by the lining supplier in the steel lining. The contractor shall provide threaded pipes to protect the thread of the grouting hole during the drilling and grouting operation.

e) Caution shall be exercised by the contractor during the grouting operations to prevent any damages to already applied corrosion protection of the steel lining.

f) After completion of grouting, the contractor shall clean the threaded holes and screw the plugs into position. The plugs will be welded permanently into the steel lining and the stub heads ground off flush by the lining supplier. When this work is complete the contractor shall thoroughly clean the whole steel lining surface of all grout remnants and other debris, and shall assist the lining supplier in restoration of the pre-applied corrosion protection.

g) After conclusion of the grouting, the engineer-in-charge and the contractor will inspect together the effectiveness of the grouting. Should a hollow sound indicate voids, the lining supplier will open additional holes through which the contractor will inject grout until all voids are completely filled. The contractor shall

extend all assistance to the lining supplier.

3) Consolidation grouting

Consolidation grouting shall be carried out as per IS : 5878 Part – VII and other relevant IS codes.

4)Protection of Drainage System During Grouting

The contractor's grouting plan shall be such as to afford maximum protection against blockage of temporary and permanent drains. If necessary, the contractor shall maintain a flow of water through the drains likely to be affected during grouting operations. Should leakage of grout into drains occur, the Contractor shall remove grout from the affected drains.

5) Closure of Holes and Clean-up

a) Upon completion of grouting work each hole shall be filled with thick grout and connections not embedded in the concrete shall be removed. The drilled holes in the concrete lining shall be reamed or redrilled (as needed) to a depth corresponding to the two-thirds of theoretical concrete lining thickness, and filled with dry-pack mortar, flush with the concrete surface

b) After completion of the grouting works the internal surface of the concrete or steel lining shall be cleaned and restored to its original condition

6) Crack Grouting in Concrete Lined Tunnels

c) Crack grouting shall be performed to seal the cold joints, construction joints, shrinkage cracks, honeycombs, poorly closed grout holes etc. In the structural concrete linings of underground structures as directed by the Engineer-in-charge and as stipulated in Chapter "Concrete".

d) Crack grouting shall consist of injecting a stable, cement-water mix through holes especially drilled into cracks or joints. Prevention measures shall be taken by ploughing the joint with wooden wedges, cardboard, cement-gypsum mortar, or other suitable means to prevent the grout from flowing out of the crack.

5.9 Measurement and payment

5.9.1 Contact and cosolidation grouting in concrete lined tunnels

1) Drilling for contact and consolidation grouting in tunnels shall consist of drilling not less than 38 mm dia holes in concrete / lagging / rock. Drilling shall be measured and paid at the Unit Price per linear meter of hole drilled as entered in the Bill of Quantities.

2) Measurement and payment for Grouting which will include cement, sand, bentonite, admixtures as consumed actually will be by weight of the materials in MT . The payment will be made at the Unit Price per MT of each of the materials entered in the Bill of Quantities.

5.9.2 Exclusions

No extra measurement for payment or payment will be made for following:

a) Regular professional advice from competent external agencies to supplement contractors own skills for grouting works of various types required under these specifications and as ordered by Engineer-in-Charge,

b) Preparation and testing of trial mixes,

c) Grouting materials used in mixture which has been prepared more than one hour prior to injecting and ordered therefore by the Engineer-in-Charge to be wasted or which have been lost due to improper handling or rejected due to improper mixing.

d) Supply and injection of water,

e) Plugging and caulking leaks during grouting,

f) Protection of drainage system, if any, during grouting,

g) Communication facilities required during grouting,

h) Closure of the holes as specified and clean-up,

i) Preparation and submission of records and reports on grouting operations.

CHAPTER-P. 6 MASONRY WORKS

6.1 Scope of Work

This document covers specifications for the following items of work:

- Brick masonry in cement mortar (A),
- Random ashlar stone masonry in cement mortar (B),
- Course stone masonry in cement mortar (C),
- Random rubble stone masonry in cement mortar (D),
- Conglomerate block masonry work in cement mortar (E).

The scope of the Construction Contractor (CC) shall cover the supply of all labour, material, equipment and performance of all operations necessary to complete the masonry works in accordance with the construction drawings and specifications given herein.

6.2 Applicable Standards

IS 269	Specifications for ordinary Portland cement.
IS 383	Specification for coarse and fine aggregates from natural source.
IS 460	Specification for test sieves
IS 2248	Glossary of terms relating to clay products for buildings
IS 1077	Specification for common clay building bricks
IS 1542	Specification for sand and plaster.
IS 2212	Code of Practice for brick work.
IS 1630	Specifications for mason's tools for plaster work and painting.
IS 3495 (parts I to IV)	Specification for crushing and water absorption test for bricks.
IS 5454	Methods for sampling of clay building bricks.
IS 1597 (part 2)	Code of Practice for construction of stone masonry – ashlar masonry.
IS 1129	Recommendations for dressing natural Building Stones.
IS 2185 (part 1)	Specifications for concrete masonry units - Hollow and solid concrete blocks
IS 6042	Code of Practice for construction of light weight concrete block masonry.
IS 13757	Burnt clay fly ash building bricks.

6.3 Brick Masonry (A)

The item of brick masonry for the powerhouse and other buildings shall include providing and laying, by the CC, brick masonry using common burnt clay building bricks. Brick masonry shall be used in superstructure for external walls, partition walls, parapets, etc. as shown on construction drawings and as directed by OWNER, including all scaffolding, raking out joints, curing, etc.

For the purpose of this specification, definitions as given in IS 2248 shall apply.

6.3.1 Material

1) Bricks

The bricks shall be machine moulded or hand moulded and made from suitable soil and then kiln burnt. They shall be free from cracks and flaws and nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform colour. The bricks shall be moulded with a frog of 100 mm x 40 mm and 10 mm to 20 mm deep on one of its flat sides. The bricks shall not break when dropped to the ground from a height of 500 mm. The size of bricks shall be 190 mm x 90 mm x 90 mm or 230 x 110 mm x 70 mm and shall conform to **IS 1077-1976**. Only bricks of standard size shall be used on the work. The following tolerances specified below shall be permitted for the standard conventional size for a particular work:

- length : 3 mm,
- width : 1.5 mm,
- Height : 1.5 mm.

The average compressive strength of bricks shall not be less than 3.5 MPa. The average water absorption shall not be more than 20% by weight. Necessary tests for compressive strength and water absorption shall be carried out by the CC as directed by OWNER.

Sampling and criterion for conformity of bricks shall be done in accordance with specifications laid down in **IS 5454.**

Wherever specified by OWNER, the CC shall use heavy duty burnt clay building bricks conforming to **IS 2180**.

The cement mortar for brick masonry shall generally conform to IS 2250. The mix used shall be in the ratio of one part cement and five parts sand by weight.

Cement mortar shall be machine mixed. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio may be adopted as per mix design and as directed by OWNER. In case of mechanical mixing, the mortar shall be mixed for at least three minutes after addition of water.

The mortar so prepared shall be used within 30 minutes of mixing. Only such quantity of mortar shall be prepared that can be used within 30 minutes. The unused mortar after that period or the mortar which has partially hardened or damaged shall not be tempered or remixed. It shall be disposed at the cost of the CC.

2) Sand

The sand shall consist of natural sand, crushed stone or crushed gravel or combination of any of these. It shall be hard, durable, clean and free from adherent coating and organic matter and shall not contain any appreciable amount of clay balls or pellets. It shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal, mica, shale or similar laminated or other materials in such form or in such quantities as to affect adversely the hardening, the strength, the durability or the appearance and to cause corrosion of metal or reinforcing steel.

The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand shall not exceed the following limits:

a) Clay find silt and find dust
   - Not more than 4 % by weight in natural sand.
   - Not more than 10 % by weight in case of crushed stone sand.

b) Organic impurities (determined in accordance with Appendix D of **IS 383-1952)** below that indicated by comparison with the standard solution or with colour 0.3 (as specified in Appendix D of **IS 383-1952**).

The grading of sand for the works shall be within the limits specified below in table. It shall be preferable to use a slightly coarser grading if it can be achieved without increase in effort.

▪ IS sieve designation	Percentage by weight retained fine sand for masonry work, plaster and pointing, etc.
480	0
240	0 - 10
120	0 - 30
60	5 - 60
30	35 - 90
2.15	85 - 100
Fineness Modulus	1.25 - 2.9

Deviation of 5% from the specified limits in the grading for fractions passing IS sieve 120 and 60 only may be allowed.

The sand grading of which falls outside the specified limits due to excess or deficiency of coarse or fine particles may be processed to comply with the standard by screening through a suitably sized sieve and/or blending with required quantities of suitable sizes of sand particles The various sizes of particles of which sand is composed shall be uniformly distributed throughout the mass.

6.3.2 Wetting of bricks

The bricks required for masonry work shall be thoroughly soaked in clean water in the tank for approximately two hours before use or as directed by OWNER. The cessation of bubbles, when the bricks are submerged in the tank, is an indication of thorough wetting of the bricks.

6.3.3 Laying Brick Masonry

Brick masonry shall be constructed in accordance with specifications laid down in **IS 2212**. Brick shall be laid in English bond unless directed otherwise by OWNER. Half or cut bricks shall not be used except when necessary to complete the bond. Closers in such case shall be cut to required size and used near the end of walls. Before spreading the mortar for each course of brick work, the sub base shall be cleaned of all dirt, scum and loose materials and then wetted without forming any pool of water on the surface. A layer of mortar shall be spread on the full width and for suitable length of the lower course. Each brick shall be properly bedded and set home by gently tapping with the trowel handle or a wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. Upon completion of each course, the vertical joints shall be fully filled from the top with mortar.

The brick wall shall be taken up plumb. All courses shall be laid horizontal and all joints shall be vertical. Vertical joints in alternate courses shall generally be directly one over the other. The thickness of the brick course shall be kept uniform. The brick shall be laid with frog upwards. Both faces of walls of thickness greater than 23 cm shall be kept in proper alignment. All completed brick work shall be kept not more than one metre above the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45°.

Bricks shall be so laid that all joints are flushed with mortar. Thickness of joints shall not exceed 10 mm. The face joints shall be raked out daily during the progress of work, when the mortar is still green so as to provide a key for plaster or pointing to be done for a depth not less than the thickness of joints. The face of the brick shall be cleaned the same day the brick is laid and all loose mortar shall be removed.

The frames of doors, windows, cupboards, etc. shall be housed into the brick masonry at the correct location and level as shown on the drawings. The heavy steel doors, rolling shutter, window frames, etc. shall be framed and anchored with brick work, but for ordinary steel doors and windows, the required opening shall be left in the wall and the frames embedded later in order to avoid damage to the frame. All fixtures, water pipe outlets, etc. which are to be built in the wall shall be embedded in cement mortar.

All scaffolding required for the masonry work shall be provided. The scaffolding support shall be sound and strong and tied together with horizontal pieces over which the scaffolding planks shall be fixed. Simple scaffolding shall be normally allowed. In this case, the scaffolding hole in the masonry shall be located in header horizontal course only. A minimum number of holes shall be left in the brick work to support the horizontal pieces.

The CC shall be responsible for providing and maintaining a strong scaffolding capable of withstanding all loads likely to come upon it.

6.4 Reinforced Brickwork

The CC may be required to construct reinforced brickwork when directed by OWNER. Such brickwork shall conform to **IS 2212**.

Reinforcement in half brick partition walls may be in the form of mild steel flats or hoop iron, expanded mesh, or mild steel bars or fabric. These are generally used in every third or fourth courses of the brickwork. They shall be securely anchored at their ends where the partitions bond.

In case of round bars used as reinforcement, the diameter shall not exceed 8 mm. Flat bars and similar reinforcement shall not have a thickness exceeding 8 mm.

The thickness of reinforced brick wall shall be not less than 100 mm.

The crushing strength of the bricks used in reinforced brick masonry shall be not less than 7.5 MPa.

The mortar used for reinforced brickwork shall generally be rich, dense, cement mortar of mix about 1:4. Lime mortars shall not be used.

The inlaid steel reinforcement shall be completely embedded in mortar. Overlaps in the reinforcement, if any, shall not be less than 300 mm.

The mortar covering in the direction of joints shall be not less than 15 mm. The mortar interposed between the reinforcement bars and the brick shall be not less than 5 mm thick.

Where reinforcements cross inside a joint, the diameter of the reinforcement shall not exceed 5 mm, unless specially shaped bricks are used to permit larger reinforcement.

Metal, reinforcement for use in brick masonry shall conform to one of the relevant Indian Standards stated below:

- Mild steel or conforming to **IS 432** medium tensile (parts 1 & 2),
- Steel bars or steel fabric or conforming to **IS 1566** hard-drawn steel wire,
- Expanded metal conforming to **IS 412**.

6.4.1 Curing

Green masonry work shall be protected from rain. Masonry shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.

6.5 Random Ashlar Stone Masonry (B)

1) Ashlar stone masonry

The item of random ashlar stone masonry in powerhouse and other buildings or outdoor, includes providing and laying random ashlar stone in superstructure for masonry walls, partition walls, etc. shown on drawing or as directed by OWNER, (in cement mortar 1:5) with stones of approved quality and shade including dressing the stone to the required size and shape, and finishing the joints with cement mortar 1:2, providing scaffolding, curing, with all leads and lifts, etc.

2) Cement mortar pointing

The work of cement mortar comprises providing and laying cement mortar 1:5 in masonry courses and pointing of joints in cement mortar 1:2, including providing scaffolding, curing, etc.

6.5.1 Material

1) Stones

Stones used for ashlar masonry shall conform to the specifications laid down in **IS 1597 (part 1)**. All stones to be used in the works under these specifications shall be obtained from quarries approved by OWNER. The stone shall be of hard, tough, sound and durable quality free from voids, flaws, cracks, earth cover, zeolite, etc.

The stone shall be free from defects like cavities, cracks, flaws, sand-holes veins, patches of soft or loose materials, etc. Generally, the stone should not contain crypto-crystalline silica or chert, mica or any other deleterious material like iron oxide, organic impurities, etc.

The stone shall be such as not to absorb more than a quarter percent of water by weight after being kept under water for twenty four hours.

The ashlar stone masonry shall be of various sizes of stones and shall have assorted tints of colours viz. light yellow, brown, white, etc. as directed by OWNER.

Other material such as cement, sand and water shall conform to the relevant specifications in GTS-CW section 2 (concrete).

2) Dressing

The dressing of stones shall be as specified for individual type of masonry work and shall also conform to the general requirements of dressing of stones covered in **IS 1129**. Every stone shall be fine tool dressed on all beds, joints and faces, full true and square giving perfectly vertical and horizontal joints with the adjoining stone. The faces of stones shall be chisel dressed for this work, true square and full. The surface of stone shall be plain or, to uniform cures or twist, as shown in construction drawings or as directed by OWNER. All stones on the work shall be similar as per approved samples.

3) Sizes of stones

The dimensions of the stones to be used shall not be less than 20 cm in height on any face and breadth not less than

1.6 time the height. The stone course shall be of 40 to 60 cm in height but no course shall be thicker than any course below it. The horizontal continuous course shall comprise stones of different height as shown in drawings or as directed by OWNER.

4) Cement Mortar

The cement mortar required for stone masonry shall be in proportion of one cement and five sand by weight. Cement mortar for pointing shall be in proportion of one cement and two sand by weight.

6.5.2 Preparation of bed

The bed of stone masonry over concrete/rock shall be thoroughly cleaned of all loose materials including chips, sand, dirt and slightest film of oil or grease. This shall be done with the help of stiff wire brooms, hammers, picks, air and water jet at pressure. The bed of masonry shall be kept completely dry during construction and as would be required for the masonry to set.

6.5.3 Wetting of stones

All stones shall be cleaned and free from dust or mud to ensure good bond with mortar and shall be thoroughly wetted before being laid. For this purpose, the stones that are immediately to be used shall be sufficiently wetted, with good clean water, before laying of stone masonry to prevent absorption of water from mortar.

6.5.4 Laying of random Ashlar stone masonry

The natural bed of the stratified stone shall be so laid that the pressure is always perpendicular to the strata.

Stones shall be laid on flat bed over a layer of cement mortar already spread on full width for suitable length. The face stone shall be laid headers and stretchers alternately. The stones in adjacent layers shall break joint on the face for at least half of the height of course, and proper bond shall be maintained throughout. Each course shall be truly horizontal and each stone shall be laid in its natural bed and side joints vertical throughout. The wall shall be truly in plumb. Where the depth of courses vary, the largest stone shall be placed in the lower course. The thickness of courses shall also decrease gradually to the top.

The bed or joints being in no case more than 0.3 cm in thickness and all visible edges shall be quite free from unsightly chipping. Each stone shall be struck with a maul, when laid to bring it to a solid bearing, both as to bed and joints. All courses shall be of same height unless otherwise specified or directed by OWNER, but no course shall be thicker than the course below it.

No fresh course shall be laid over masonry previously laid before 24 hours of its laying. The maximum height of masonry course that is allowed to be constructed at a time shall be 60 cm.

The frames of doors, windows, glazing cupboards, etc. shall be housed into the masonry work at the correct location and level as directed.

The relevant specifications for scaffolding under §.4.2.1 shall be applicable. Double scaffolding wherever used shall conform to **IS 2750.**

6.5.5 Curing

Green work shall be protected from rain and sun. The masonry shall be kept moist on all the faces for a period of ten days. The top of masonry work shall be kept well wetted at the close of the day.

6.5.6 Jointing and pointing of masonry

All joints shall be full of mortar.

6.5.7 Workmanship

The mortar in stone masonry shall be raked out of the joints for a minimum depth of 5 mm, when the mortar is still green in stone masonry.

Before commencing pointing, the joints shall be thoroughly cleaned of any dirt or loosely adhering cement or mortar by brushing. They shall be washed with water properly and thoroughly wetted.

The joints shall then be filled with cement mortar of specified proportion, and thoroughly pressed by proper tool of required shape. The mix shall be neither too dry nor too wet when used. The extra mortar, if any, shall be removed.

Ruled pointing shall be carried out. The finished work shall give a neat and clean appearance with straight edges.

The pointing shall be cured for 10 days.

6.6 Coursed Stone Masonry in Cement Mortar (C)

Course stone masonry may be used like in desilting chamber or forebay or tailrace channel, power house walls, etc. or at other locations as shown in the drawings or as directed by OWNER.

6.6.1 Material

1) Stones

The stones shall be durable, hard, tough and sound. The stones with round surface shall not be used. The stones shall conform to the following tests:

- Water absorption shall not be more than 5% of the dry weight, when immersed in water for 24 hours, as per test specified in **IS 1124**.
- Los Angeles abrasion value shall not be more than 50% when tested according to **IS 2386 (part IV).**
- The stone shall withstand 30 cycles of durability test with sodium sulphate solution as per **IS 1126**, i.e. shall not show any cracking or excessive rounding at edges of test specimen after completion of 30 cycles.

2) Mortar

The mortar shall consist in one part of cement and four parts of sand. Dry mortar shall be prepared by using and corresponding to one bag of cement measured by batching boxes, and then spreading the bag of cement over it. The mixture shall then be thoroughly mixed and then specified quantity of water added to obtain the final mortar for use. Mortar, once mixed, shall be consumed preferably within 20 minutes and not later than 30 minutes in any case. Old mortar remaining back in taslas shall be thrown away and taslas thoroughly cleared before filling the same with fresh mortar. In no case, fresh mortar shall be mixed with old mortar.

6.6.2 Dressing

The stone, as specified above, shall be dressed on almost three faces, thoroughly to give right angle faces suitable for straight reaches and on corners and curves.

6.6.3 Laying

The dressed stones shall be wetted thoroughly before laying. The face stone shall be laid in alternate headers and stretchers. The masonry should be of regular course with proper breaking of joints. The walls shall be carried up truly in the plumb. All courses shall be laid truly horizontal. Each stone shall be laid with both bed and vertical joints quite full or mortar. The thickness of joint shall not exceed 1 cm.

6.6.4 Protection and curing

The masonry during construction shall be protected from sun and rain by suitable covering and the masonry shall be kept moist for at least 21 days after laying. When the work is to be done under frost condition, special precautions shall be taken as directed by OWNER such as mixing of calcium chloride at the rate of 0.5% in cement, use of warm water in mixing and curing, covering of masonry with gunny bags, etc. Watering shall be carefully done so as not to wash any mortar out of the joints.

6.7 Random Rubble Stone Masonry (D)

Random Rubble stone masonry may be used and their locations shall be as shown in the construction drawings or as directed by OWNER.

6.7.1 Material

1) Stones

Stones shall conform to the specifications laid down in **IS 1597** and also in § 5.1.

2) Mortar

The mortar shall consist of one part of cement and three , four or more parts of sand as specified in the BOQ items..

Dry mortar shall be prepared by using sand corresponding to one bag of cement measured by batching boxes, and then spreading one bag of cement over it. The mixture shall then be thoroughly mixed and then specified quantity of water added to obtain the final mortar for use. Mortar, once mixed, shall be consumed preferably within 30 minutes in any case. Old mortar remaining back in taslas shall be thrown away and taslas thoroughly cleaned before filling the same with fresh mortar. In no case fresh mortar shall be mixed with old mortar.

6.7.2 Dressing

Stones, as received from the quarry, shall have their weak corners and edges knocked off and hammer dressed on the face, the sides and the beds to enable them to come into proximity with neighbouring stones.

6.7.3 Laying

The stones shall be wetted before laying. Every stone shall be carefully fitted to the adjacent stones so as to form close joints as far as possible. The clips and spalls of stone shall be used wherever necessary to avoid thick mortar beds and joints. The clips shall not be used below the hearting stones and their use shall be restricted to the filling of inter stick between the adjacent stones in the hearting and these shall not exceed 20% of the quantity of stone masonry.

The masonry shall be carried up regularly and no step shall be allowed more than 60 cm. When the masonry of one part has to be delayed, the work shall be raked back at an angle not exceeding 45°.

Bond stones running through the thickness of wall shall be provided in walls up to 60 cm thick. If these walls are more than 60 cm thick, two or more bond stones, overlapping each other by at least 2 cm, shall be provided on a line from face to back. At least one bond stone or a set of bond stones shall be provided for every 0.5 m² of wall surface. The walls shall be carried out truly in plumb.

The thickness of the joint shall not exceed 2.5 cm.

6.7.4 Protection and curing

The masonry during construction shall be protected from sun and rain by suitable covering and the masonry shall be kept moist for at least ten days after completion. When the work is to be done under frost condition, special precautions shall be taken as directed by OWNER such as mixing of calcium chloride at the rate of 1.5% in cement, use of warm water in mixing and curing, covering of masonry with gunny bags, etc. Watering shall be carefully done so as not to wash any mortar out of the joints. The curing shall be done for 21 days.

6.7.5 Supporting mortar

Mortar shall be made up of a mix of cement and sifted sand as specified in the BOQ items..

The sand used shall be washed and free of any gypsum, oxide or pyrite dust and shall conform to **IS 2116**.

The mixing water shall be clean and free of plant particles conforming to the GTS-CW, section 2 (concrete).

6.7.6 Protection against rising soil moisture (DAMP PROOF COURSE)

The bed face shall comprise a mortar 2 cm thick, gauged at 500 Kg of cement per m3 of dry sand 0-3 mm, plus a waterproofing agent.

6.8 Measurement and Payment

6.8.1 Common Provisions

The prices quoted for different masonry items shall cover the following works:

- the supply, transport and construction of the various materials,
- scaffolding and accesses,
- construction of weep holes, if any; the volume of the weep holes is not deducted from the volume of the structures for payment,
- scraping of dirt and runs stuck to the floor and surfaces,
- Cleaning/making of visible surfaces.

- Dealing with surface constraints
- preparation of the sub grade profile
- connections at surface limits
- pointing of joints ,at visible surfaces, wherever specified
- all construction constraints, particularly related to corners and the presence of lintels and tie beams; openings with the cross-section of not more than 10 dm2 are not deducted from the calculation of the surface area,
- Construction constraints related to the slope, where facings are to be done on slopes.
- The units applicable shall be as indicated against the respective items in the Schedule of items(BOQ)

CHAPTER-P. 7 DOORS AND WINDOWS

7.1 Scope of Work

This chapter covers specifications for shutters, doors and windows in powerhouse or other buildings. This chapter does not cover specifications for glazing works, which are specified in separate chapter.

7.1.1 Mild Steel Rolling Shutters

The Item of Mild steel (MS) rolling shutters includes providing and installing rolling shutters of required sizes and types, at different locations as shown on the construction drawings and as directed by OWNER.

7.1.2 Mild Steel Doors

The item of MS doors includes providing and installation of MS sliding door and MS single leaf doors of required sizes and types, at different locations as shown on the drawings and as directed by OWNER.

7.1.3 Aluminium Glazed Doors and Windows

The item of Aluminium doors & windows includes providing and installation of various sizes and types of glazed doors & windows of required sizes and types, at different locations as shown on the drawings and as directed by OWNER.

7.1.4 Medium Density Fibre Panelled Doors

The item of medium density fibre board panelled doors includes providing and installation of single leaf and double leaf panelled doors of required sizes, at different locations as shown on the drawings and as directed by OWNER.

7.1.5 Fire Resisting Doors

The item of fire resisting doors includes providing and installation of the doors, including frame, panels and all necessary accessories and qualification tests. The doors shall be of different sizes and at different locations, as specified on construction documents.

7.2 Classification with Construction Contractor Scope

The material supplied and installed by the Construction Contractor (CC) shall be of different types.

7.2.1 Mild Steel Rolling Shutters

The CC shall provide and install MS rolling shutters of approved make, of 80 mm wide and minimum 1.25 mm thick. MS laths shall be interlocked together, through their entire length, and jointed together at the ends by end locks. These end locks shall be mounted on specially designed pipe shaft, with bracket plates, guide channels and arrangement for inside and outside locking, with push pull operation complete. The works shall include the cost of hood cover, spring, priming coat and painting as per specifications and as directed by OWNER.

The dimensions, width, and height of the shutters shall be indicated on the construction drawings for schedule of doors

7.2.2 Mild Steel Doors

The CC shall provide and install MS sliding doors and MS single leaf doors. The works shall include steel angle frame 50 mm x 50 mm x 5 mm as per drawing, including anodised steel fixtures and fastenings and shutter frame 30 mm x 30 mm x 4 mm, including priming coat of oil paint and two coats of aluminium paint etc., complete as per drawings or OWNER instructions, and approved by OWNER.

7.2.3 Aluminium Glazed Doors and Windows

The CC shall provide and install aluminium glazed doors and windows, including frame of aluminium sections and anodised steel fixtures and fastenings, etc. using 4 mm thick glass complete as per construction drawing and as directed by OWNER.

7.2.4 Medium Density Fibre Panelled Doors

The CC shall provide and install medium density fibre panelled doors, with both sides 8 mm thick Dura tuff prelaminated MDF board panels, at different locations as per construction drawings and as directed by OWNER.

7.2.5 Codes and Standards

- **IS 4351** - Specifications for steel door frame.
- **IS 1038** - Steel doors, windows and ventilators.
- **IS 1948** - Aluminium doors, windows and ventilators.
- **IS 1081** - Fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
- **IS 7452** - Hot rolled steel sections for doors, windows and ventilators.
- **IS 6248** - Metal rolled shutters and rolling grills.
- **IS 1019** - Specification for rim latches.
- **IS 453** - Specification for double acting spring hinges.
- **IS 452** - Specification for spring rat rail type.
- **IS 1477** - Code of practice for painting of ferrous metals in buildings.
- **IS 793** - Specification for wrought Aluminium and Aluminium bars, rods and sections.
- **IS 1285** - Specification for Aluminium alloy rounds, tubes and Hollow sections.

7.3 Rolling Shutters

7.3.1 General

The rolling shutters shall conform to **IS 6248 - 1979**. Rolling shutters shall be supplied of specified type with accessories. The size of rolling shutters shall be as specified in the drawing and as directed by OWNER. The shutters shall be constructed with interlocking lath sections, formed from cold rolled steel strips, not less than 0.9 mm thick and 80 mm wide for shutters up to 3.5 m width, and not less than 1.25 mm and 80 mm wide for shutters 3.5 m in width and above, unless otherwise specified by OWNER. The lath sections formed from cold rolled steel strips, 80 mm rolling, centres with effective bridge depth of 12 mm lath section, shall interlock together through their entire length and shall joint together at the end by end locks mounted on specially designed pipe shaft with brackets clips.

Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) jointless construction fitted, with necessary fittings and fixtures. The thickness of sheet used shall not be less than 3.15 mm. Hood covers shall be made of mild steel sheet, not less than 0.9 mm thick. For shutters having width 3.5 m and above, the thickness of mild steel sheet for hood cover shall be not less than 1.25 mm. The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength, to balance the shutters in all positions. The spring pipe shaft, etc. shall be supported on strong mild stone or malleable cast iron brackets. The brackets shall be fixed on or under the lintel as specified with raw plugs and screws, bolts, etc.

The locking arrangement shall consist of hasp and staple on the bottom plate of shutter at both ends. The shutters shall open from outside, except otherwise specified on construction drawings or by OWNER.

The shutter shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

The rolling shutters shall be self-rolling type up to 8 m2 clear area, without bearing and up to 12 m2 clear area with full bearing. For larger area than 12 m2, mechanical gear type and/or electrically operated shutter shall be capable of withstanding horizontal forces up to 150 Kg/m², without any appreciable deflection.

Operation system of electrically operated rolling shutter shall be installed inside of the building. Each motor shall be controlled by one push button station located inside the building. The shutters are to be equipped with a safety edge to prevent damage to shutters during closing or opening operation, limit switch shall also be included. The power drive shall be so designed as the electric motors may be removed without affecting operation, by means of an auxiliary endless chain gear operator (mechanical gear type).

Wicket door in the shutter shall be provided as directed by Engineer-in-charge.

7.3.2 Painting and Finishing

Shutters shall be painted by one epoxy priming coat in shop and by two or three coats of epoxy coal pitch

or hydrocarbon epoxy paint of desired colour finishing coat after installation.

7.3.3 Erection of Rolling Shutter

The rolling shutter shall be approved by OWNER before erection. The shutter shall be erected completely with all necessary hardware, operating mechanisms, equipment, wiring and materials, to suit sizes of openings.

All installation and erection works shall be done in accordance with the Manufacturer's instructions. The CC shall arrange, with no additional cost for OWNER, the service of the Manufacturer's Inspector during erection. The shutter shall be in best operating condition after completion of erection.

7.3.4 Electrical Work

All electrical work provided for rolling shutters shall be in strict accordance with the latest Indian Electricity Rules.

7.3.5 Test at Contractor's Work

After completing the manufacture of the different components of rolling shutter, drives and other accessories, tests shall be carried out at the Manufacturers works in accordance with the approved standards and in the presence of the CC and OWNER if necessary. Seven copies of all the test certificates shall be sent to OWNER and submitted for approval.

7.3.6 Acceptance test on Site

After the equipment has been installed on site, test will be carried out by the CC in the presence of OWNER, to determine whether the performance of equipment supplied is satisfactory or not.

7.3.7 Drawings

The CC shall furnish to OWNER drawings which include the following :

1) Foundation and anchorage drawings for the equipment, drive and their auxiliaries and with similar detail drawing for other equipment.
2) Dimensioned assembly and sub-assembly drawings showing plan and section of the equipment, instrument, safety devices, etc. clearly indicating dimensions if any.
3) Completed assembly drawing, wiring and connection diagram for all instruments, gauges and controls.

7.3.8 Hood Cover

After installation and testing, if any damage or rectification is required, it shall be made good by the CC without any extra claim. The hood cover as specified shall be installed by the CC in proper position and submitted to OWNER for approval. The shutter already painted by one coat of red oxide paint at shop, shall be painted by two coats of synthetic enamel paint of desired colour, approved by OWNER. The painting shall be done according to **IS 1477** or equivalent.

7.4 Steel Doors

7.4.1 Materials

1) Structural Steel

All structural steel shall conform to **IS 7452 - 1974** and **IS 226 - 1975**. The steel shall be free from any defects according to provisions of **IS 226 - 1975** and shall have smooth finish. The material shall be free from loose mill scale rust pits or other defects affecting the strength and durability. When the steel is supplied by the CC, test certificate of the Manufacturers shall be obtained according to Indian Standards.

Black steel sheet shall be used for doors of specified thickness, as specified on construction documents or by OWNER

2) Oil Paints

Oil paint shall be of the specified colour and shade and as approved by OWNER. The ready mixed oil paint shall only be used. However, if ready mixed paint of specified shade or tint is not available, white ready mixed paint with approved strainer shall be allowed by OWNER. In such case, the CC shall ensure that the shade of the paint so allowed is uniform.

All the paints shall meet with the following general requirements:

a) Paint shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, livering, caking or colour separation and shall be free from lumps and skins.

b) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.

c) The paint shall not skin within 48 hours in a three quarters filled closed container.

d) The paint shall dry to smooth uniform finish free from roughness, grit, unevenness and other imperfections.

Ready mixed oil paint shall be used if possible as received from the Manufacturers, and generally according to their instructions and without any admixtures whatsoever. The CC shall take into account the expiration date of the ready mixed oil paint to organise his supply by the Manufacturer and the storage of the material.

3) Paints for External Doors

For external doors, the paint described in paragraph 1.4.4. of chapter 4 shall be applied.

4) Fixtures and Fastenings

The fixtures and fastenings, that is butt hinges, tower bolts, door latch, bathroom latch, handle door stopper, window fasteners, casement stays and ventilators catch shall be made of the metal as specified in the item. They shall be made from anodised iron and medium type. The fixtures and fastenings shall be smooth finished and shall be such as they shall ensure ease of operation. The samples of fixtures and fastenings shall be approved by OWNER, with regard to quality and shape before providing them.

5) Holdfasts

Holdfasts shall be made from steel flats (50 mm and 5 mm thick) 25 cm length. The holdfasts shall be bent at right angle and at one end, two 6 mm diameter holes shall be made in it for fixing it to frame with screws or welded. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

6) Butt hinges

The railway standard heavy type butt hinges shall be used.

7) Sliding door bolts (aldrops)

In case of single leaf door, where iron rocket plate or aluminium fixing bolt (of sliding door bolt) cannot be fixed, a hole of suitable size shall be made in the door frame and counter sunk plate not less than 1.5 mm thick cut to shape shall be fixed at the face of hole. Aldrops shall be approved by OWNER.

Handles, door catch, stopper, ventilator catch, etc. shall be as per drawings and approved by OWNER prior to installation.

8) Fabrication and Installation

All steel doors shall be approved by OWNER before shop paint work is undertaken by the CC, regarding the quality of work.

The work shall be done as shown in the shop drawings which shall clearly indicate various details of joints to be welded, shop and site welds as well as type of electrodes to be used. Symbol for welding on plans and shop drawings shall be according to **IS 813 - 1961**. The welding works shall conform to **IS 816 - 1969**.

Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

Before welding is started, the steel section shall first be brought together and firmly clamped or spot welded at specified distance or at joints. This temporary connection shall be strong enough to hold the frame accurately in place without displacement.

All operations connected with welding and cutting equipment shall conform to safety requirements given in **IS 118 - 1968**. The following shall be borne in mind during welding:

a) Weld shall be made in flat position wherever practicable.

b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove, etc. The defective welds which shall be considered harmful to the structural strength shall be cut out and re-welded. Finishes welds and adjacent parts shall be protected with clean boiled linseed oil and after all slag has been removed, welds and adjacent parts shall be painted after approval of OWNER. All members shall be thoroughly cleaned of rust, scales, dust, etc. and given priming coat of red lead paint/approved paint before fixing them in position.

c) Welding shall be done by electric process only. All work shall be accurately formed to the required dimensions, true in line and level in all directions, and properly sized to suit the structural opening in masonry or concrete. The door frame and shutters corners shall be fabricated to true right angles from steel sections, the corners of the doors shall be accurately mitred, jointed and fitted to produce flush joint and welded along the concealed line of contact. All welding shall be done on unexposed sides, in order to prevent pitting, discoloration and other surface imperfections. The weld shall thoroughly penetrate the metal, resulting in complete fusion between the two sections. No field fabrication of frames shall be permitted. All frames shall be extended to the unfinished floor slab.

d) The bottom shall be provided with removable steel angles for knee bracing and shall be secured to the floor slab if directed by OWNER. The doors shall be fixed with all fixtures and fastenings of approved type as per drawings.

e) The CC shall install the door frames in position as the masonry or concrete works are in progress. All doors shall be perfectly installed (within allowable tolerances) and tested for smooth operation of shutters and the operation of hardware items.

9) Application of Paint

The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed part of the steel surface shall be carried out in wet, damp or otherwise unfavourable weather, and all the surfaces shall be thoroughly dry before painting work is started. Spray painting may be acceptable on directions of OWNER.

The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists in covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angle to same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

Each coat shall be allowed to dry completely and (except final coat) lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied and approved by OWNER.

7.5 Aluminium Glazed Doors and Windows

7.5.1 Materials

Aluminium doors, windows, curtain wall etc…shall be fabricated from approved extruded sections and the manufacture & installation shall be carried out by an approved specialised agency. Unless otherwise specified, the fabrication shall be done with heavy gauge extruded box sections. The sections free of scratches shall be of the sizes and details shown on drawings. The detail shown on the drawings indicates generally the sizes of the component parts and the general standards. These may be varied to some extent to suit the standards adopted by the manufacturers of the aluminium work.

All materials and details especially the weather strip, gaskets and sealants shall be of approved high quality material capable of resisting the local climatic and environmental requirements.

7.5.2 Shop drawings and samples

The CC shall submit complete shop drawings and samples of each type of door, window, ventilators curtain wall and other aluminium works to the Engineer for his approval. The shop drawings shall be prepared after taking actual measurements at the site. The shop drawings shall show full size sections of doors windows etc, thickness of metal, details of construction details of glazing, anchoring details, hardware as well as connection of curtain wall windows, doors and other metal work to adjacent work. Samples of all joints and methods of fastening and joining etc… also

shall be submitted to the Engineer for approval well in advance of commencing the work. Samples of the actual work shall be installed at the site and got approved before proceeding with the work.

7.5.3 Sections

The Aluminium extrusions shall be from Hindalco, Indal, Bharuka or equal approved make. The sections shall be extruded from aluminium alloy HE9WP of IS 733 of commercial quality and free from all defects impairing appearance, strength and durability. Hollow box sections shall be extruded from HP9-WP aluminium alloy as per IS 1285. The permissible dimensional tolerances of the extruded sections shall be such as not to impair the proper and smooth function/operation and appearance of doors and windows. For any excess weight of section used nothing extra shall be paid.

The sections shall also conform to the following parameters.

- Minimum tensile strength = 19 kg/mm²
- Maximum allowable deviation in length from a straight line of 0.5 mm/metre
- Maximum allowable deviation from straight of 1 degree.
- Maximum permissible twist of 0.5 mm
- Maximum variation in flatness of not more than 0.125xwidth/25

7.5.4 Anodizing / Powder coating

All aluminium materials used shall be specially anodized for protection against corrosion in marine environment on approved shade. The anodic coating shall conform to IS 1868-1968 and shall be of AC25 grade with minimum thickness of 20 microns when measured as per IS 660/2-1970 and density shall be at least 32 MG/sqm.

The anodic coating shall be double sealed or alternatively sealed with steam a nd shall be of a minimum thickness of 50 micron.

The anodic coating shall be tested in an approved laboratory by Eddy current method as per IS 6012 for thickness. Sulphuric acid shall be used as the electrolyte for the anodic process. Prior to anodizing all aluminium shall be rendered uniform in appearance free from disfiguring scratches, stains or other blemishes and etched in a caustic soda solution. Requisite test shall also be carried out at the site as required by the Engineer and the contractor shall arrange all assistance and equipment required for the purpose.

Wherever specified, polyester grade machine applied powder coating of minimum thickness 20 micron shall be provided and such coating shall be of approved shade. Sample of powder coated panels s hall be submitted by the CC w ell in advance to commencement of the work from the approved agency.

Pre-treatment to frames shall be carried out to suit the requirements of final finishing as stated above.

7.5.5 Protection & Handling

All aluminium members shall be wrapped with approved self adhesive non staining PVC tapes and crated in a suitable manner to protect the material against any damage during transportation. The loading, unloading, storing shall be carried out in an approved manner with utmost care.

7.5.6 EPDM Gasket

EPDM gaskets of approved make, size and profile shall be provided and installed at all locations as shown and as called for to render the installation absolutely air and weather tight.

7.5.7 Sealant

The gaps between the Aluminium member and the perimeter and also any gaps in the door and window sections themselves shall be raked out as directed and filled with silicon sealant of approved make and colour and make sure to ensure complete water tightness.

The silicon sealant shall be of such colour and composition that it would not stain the masonry/concrete work, shall receive paint without bleeding, will not sag or run and shall not set hard or dry out under any conditions of weather. Silicon sealant shall be applied with a special gun as per manufacturer’s recommendation.

7.5.8 Aluminium doors and windows

1) Doors

The kick panel shall be of 1.25 mm aluminum alloy sheet conforming to IS designation NS3-1/2H of IS 737-1965. Specifications for Wrought Aluminium and Aluminium alloys sheet and strip (for general engineering purposes) and shall be screwed to the frame and the glazing bar. The Hinge shall be stainless steel frictional hinges of same type as in windows but of larger size. The hinges shall normally be of 50 mm projecting type. Non projecting type hinges may also be used if approved; The handles for door shall be of specified design and of same specifications as the windows. A suitable lock for door openable either from outside or inside shall be provided. In double shutter doors, the first closing shutter shall have a concealed aluminium alloy bolt at top and bottom. IT shall be so constructed as not to work loose or drop by its own weight.

Single and double shutter doors may be provided with a three way bolting device. Where this is provided in the case of double door, concealed aluminium bolts may not be provided

2) Side hung windows and Ventilators

For fixing stainless steel hinges, slots shall be cut in the fixed frame and the hinges inserted inside and may be riveted to the frame. The hinges shall normally be of the projecting type not less than 65 mm and not more than 75 mm wide. The pins for hinges in case of non-oxidised work shall be of stainless steel of non magnetic type or of suitable aluminium alloy. However, in the case of anodised work only suitable aluminium alloy for pins shall be used. Friction hinges shall be provided for side-hung shutter windows - in which case peg stay will not be required. In case of non friction type hinges, peg stay which shall be either of cast aluminium conforming to IS designation A5M of IS 617-1959 or folded from IS Designation NS4 aluminium alloy sheet conforming to IS 737-1955. It shall be 300 mm long complete with peg and locking bracket and shall have holes for keeping the shutter open in three different positions. The peg and locking bracket shall be riveted or welded to the fixed frame.

The handle for side-hung shutters shall be of cast aluminium conforming to IS designation A5M of IS 617 1975 and mounted on a handle plate or welded or riveted to t he opening frame in such a way that it could be fixed before the shutter is glazed to match the window. The handle shall be anodised. The handle shall have a two point nose which s hall engage an aluminium striking plate on t h e fixed frame in a slightly open as well as in a closed position.

3) Centre hung Ventilator

This shall be hung on two pairs of cup pivots of stainless steel and riveted to the inner and outer frames of the ventilator to permit the ventilator to swing, through an angle of approx. 85 deg. The opening portion of the ventilator shall be so balanced that it remains open at any desired angle under normal weather conditions.

Stainless steel cord pulley-wheel in a bracket shall be fitted at the sill of the ventilator with stainless steel screws riveted or welded to t he bottom inner frame bar of the ventilator in position corresponding to that of the pulley.

4) Fabrication

All jointing shall be of a mechanical type. The aluminium sections joints shall be designed to withstand a minimum wind load of 175 kg per sqm. The designed shall also ensure that the maximum deflection of any framing shall not exceed L/175 of the span of the member. All members shall be accurately machined and fitted to form hairline joints prior to assembly. The jointing accessories such as cleats, brackets etc. shall be of such materials as not to cause bimetallic action. The design of the joint and accessories are fully concealed. The fabrication shall be done in suitable sections to facilitate easy transportation, handling and installation. Adequate provision shall be made in the door and window members for anchoring to supports and fixing hardware and other fixtures as approved by the Engineer. The fabricated frames shall be square and flat with corners in a true right angle.

5) Installation

Just prior to installation, the doors, windows, etc. shall be stacked on edge on level bearers and supported evenly.

Unless otherwise shown window/door frames shall be fixed to opening with 25 mm thick aluminium sub-frame. Width of sub frame shall be exactly the same width as the frames. Aluminium sub-frame shall be pre-fixed to the masonry surrounds with approved fasteners. The face of sub frame to receive frame shall be in true line, level and plumb.

When the sub frame is properly secured and all major internal and external finishing works are completed, the

assembled doors/windows shall be placed in correct final position in the opening and fixed to the aluminium frame.

Sizes, details, spacing etc. given above are approximate and indicative only. They can be varied at the option of Engineer to suit particular sizes and situations and the CC shall carry out the instructions of the Engineer in this regard at no extra cost to the owner. The CC may suggest alternative methods of fixing and anchoring for consideration of the Engineer while the decision of the Engineer in this regard shall be final and bending.

In the case of composite windows and doors, the different units are to be assembled first. The assembled composites units shall be checked for line, level and plumb before final fixing is done. Units may have to be assembled in their final location if the situation is so warrants.

Where aluminium comes into contact with masonry, concrete, plaster or some dissimilar metal, it shall be coated with an approved insulation lacquer or plastic tape to ensure that electro-chemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

The CC shall be responsible for assembling composite units, bedding and pointing with mastic inside and outside at the transoms and mullions, placing the doors, windows etc… in their respective openings. After the doors/windows have been fixed in t heir concrete shall be filled with cement grout (1 cement: 3 coarse sand) densely packed and finished neat. Packing grout shall be of the expanding type made by approved additive.

6) Protection and final cleaning

The doors and windows shall be suitably protected from damage until handing over. Care shall be taken not to use the doors and windows for support, centering etc… and no scaffolding or other materials and devices shall rest on these. All the openable members shall be kept firmly closed. The PVC wrapping shall be retained till the glazing work is commenced. After the glazing and all work connected with installation of doors/windows is complete, all aluminium work shall be cleaned with a suitable thinner and left in clean unblemished and in an openable condition.

7.5.9 Glazing

Refer to separate chapter.

7.6 MDF Panelled Doors

Single/double leaf metal doors with insulation material of medium density fibre (MDF) panels shall be provided and installed as per drawing in accordance with **IS 1038** or other equivalent standard.

7.7 Fire Resisting Doors

7.7.1 General

The shutters of the fire resisting door of approved make conforming to **IS 3614–1966 (Part 1)** shall be designed so as to provide the specified fire resistance of 1 hour when tested as per **IS 3614–1992 (Part 2)** and **BS 2750**, and to suit the specified requirement. The Manufacturer shall produce certificates of a recognised laboratory to the satisfaction of OWNER.

7.7.2 Frame

Door frames of 120 mm x 70 mm section (nominal) with heat activated intumescent fire seal strips of size 12 mm x 4 mm (for smoke sealing) shall be mounted in the groove in frame suitable for mounting 60/30 minutes fire rated shutters, with one coat of anti-termite fire retardant primer.

7.7.3 Panels

50 mm thick asbestos free composite fire / smoke check shutters of 60 minutes fire resistance rating shall conform to **BS 476 Part 22 / IS 3614 Part 11**. They shall comprise two non-combustible boards each 12 mm thick, sandwiching 20 mm thick fire resistant insulation, faced with 3 mm commercial ply veneering on both faces. They shall be seasoned leak wood lipping around the shutters with heat activated intumescent fire seal strips of size 12 mm

All fittings used in the manufacturing of the door shall be heavy duty type. The doors shall be fitted with heavy duty concealed type automatic door closers, of approved make.

7.7.4 Seal

A heat activated intumescent seal of approved quality and make, conforming to **BS 476 (Part 8**), shall be provided on all edges of doors to check the spread of smoke in case of fire.

7.7.5 Paint

The door frame and panel shall be treated with ready mixed silicate type Fire Retardant anti-termite primer and paint of approved shade and Manufacturer as **per BS 162–1950 (BS 476 – Part 1)**.

7.8 Measurement and Payment

7.8.1 Glazed aluminium window frames

The quoted price shall concern to the supply and fitting of glazed units, in lacquer coated aluminium, as specified.

These Prices also include:

- anticorrosion protection by lacquered top coating,
- hinges and seals,
- laminated glazing,

They apply per m2 of structural opening.

7.8.2 Fixed unit in polycarbonate

The quoted price shall concern the supply and fitting of a fixed unit in polycarbonate with aluminium structure, as specified.

This Price also includes anticorrosion protection of the structure and connectors, by lacquered top coating.

It applies per m2 of structural opening.

7.8.3 Glazed external entrance door

The quoted price shall concern the supply and fitting of a double leaf glazed external entrance door.

This Price also includes:

- anticorrosion protection by lacquered top coating,
- factory painting
- hinges and seals,
- a hydraulic door closer,
- Safety locks with 4 keys.
- Laminated glazing.

It applies per m2 of structural opening.

7.8.4 Steel doors

The quoted price shall concern the supply and fitting of external steel entrance doors, plated on both sides, with single or double leaves.

These Prices also include:

- insulation in polyurethane foam,
- factory painting
- hinges and seals,
- a hydraulic door closer,
- top and bottom lock bolts,
- Safety locks with 4 keys.
- Floor-fitted door stops.
- Panic bar, if specified or indicated on the drawing.

They apply per m2 of structural opening.

7.8.5 Price supplement for panic bar

The quoted price shall concern the supply and fitting of a panic bar.

This Price also includes anticorrosion protection.

It applies per unit.

7.8.6 Laminated timber door (single leaf)

The quoted price shall concern the supply and fitting of a single leaf internal door in chipboard, faced in laminated plywood.

This Price also includes:

- hardwood door framing,
- water-repellent, fungicide and insecticide timber treatment,
- laminated finish,
- cover-strip,
- hinges,
- safety lock with 4 keys,
- Final top-coat painting / varnishing.

It applies per m2 of structural opening.

7.8.7 Door in laminated timber, (single leaf) 1 hour fire rating

The quoted price shall concern the supply and fitting of a single leaf internal door in chipboard, faced in laminated plywood, fireproof for 1 hour.

This Price also includes:

- hardwood door framing,
- water-repellent, fungicide and insecticide timber treatment,
- laminated finish,
- compression door joint,
- cover-strip,
- hinges,

- a hydraulic door closer,
- safety lock with 4 keys,
- Final top-coat painting / varnishing.
- panic bar, if specified or indicated on the drawing

It applies per m2 of structural opening.

7.8.8 Door in laminated timber, (double leaf) 1 hour fire rating

The quoted price shall concern the supply and fitting of a double leaf internal door in chipboard, faced in laminated plywood, fireproof for 1 hour.

This Price also includes:

- hardwood door framing,
- water-repellent, fungicide and insecticide timber treatment,
- laminated finish,
- compression door joint,
- cover-strip,
- hinges,
- a hydraulic door closer,
- safety lock with 4 keys,
- Final top-coat painting / varnishing.
- panic bar, if specified or indicated on the drawing

It applies per m2 of structural opening.

7.8.9 Price supplement for steel door with louvers

The quoted price shall concern the supply and installation of steel louver panels set within the door panel,

It applies per m2 of opening.

7.8.10 Price supplement for doors with glazed vision panels

This Price applies to the supply and installation of glazed vision panels set within the door panel. If the door is fire rated, the vision panel shall be compatible and of georgian wired safety glass. All panels will be square or rectangular in shape.

It applies per m2 of opening.

7.8.11 Steel doors with 1 hour fire rating

The quoted price shall concern the supply and installation of internal steel doors with 1 hour flame protection.

They also include:

- insulation in polyurethane foam,
- factory painting
- hinges and seals,
- a hydraulic door closer,
- top and bottom lock bolts,
- Safety locks with 4 keys.
- Floor-fitted door stops.
- panic bar, if specified or indicated on the drawing

They apply per m2 of structural opening

CHAPTER-P. 8 PAINTING AND WHITE WASHING

8.1 Cleaning and Painting of Metalwork

8.1.1 General

The Construction Contractor (CC) shall furnish, prepare and supply all materials for cleaning, painting and coating of metalwork as hereinafter specified. After erection, all metal surfaces, either unpainted or shop-painted shall be cleaned, repainted or re-coated with two coats of applicable primer conforming to the specifications given herein.

The usual painting system on metalwork shall consist of two primary coats (Alkyd) and two Aluminium paint coats.

8.1.2 Cleaning surfaces

Surfaces shall be cleaned and prepared in accordance with **IS 1477-1971**, Part I and II "Code of Practice for painting ferrous metals in buildings" for pre-treatment and painting respectively and by the method specified in this sub-paragraph. Weld spatter or any other objectionable surface irregularities shall be removed by any suitable means before cleaning. All oil, grease, corrosion inhibitor compound and dirt shall be removed from the surfaces by using clean mineral sprits, xylol or white gasoline and clean wiping material. After the solvent cleaning, all loose rust, loose mill scale and other foreign substances from the surfaces of metalwork supplied without application of primer, and from damaged areas of surfaces of metal-work supplied with application of primer, shall be removed by scraping, chipping or other effective means.

In the event of rust formations, or the surfaces becoming otherwise contaminated in the interval between cleaning and painting, re-cleaning shall be required.

8.1.3 Application procedures

1) General

Paint and coating materials shall be applied in accordance with the content of this sub-paragraph. All paint and coating material shall be thoroughly mixed at the time of application and shall not be thinned except where hereinafter specifically provided. Any warming of the paint shall be performed by means of a hot water bath and except as specifically provided, the paint shall not be heated to a temperature higher than 38° C. Surfaces shall be free from moisture at the time of painting. The first coat shall be applied immediately after cleaning (maximum time 2 hours). When paint is applied by spraying, suitable means shall be provided to prevent segregation during the painting operations. Effective means shall be provided for removing all fee oil and moisture from the air supply lines of all spraying and blasting equipment. Each coat of paint shall be done to completion and shall be free from runs and sags. Except otherwise specifically provided, each coat shall be allowed to dry or harden before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after installation (except inaccessible surface of metalwork which have been shop coated with priming paint) shall be completely painted as per specifications prior to installation.

2) Primary coats

Two coats of Alkyd priming paint shall be applied to give total thickness of minimum 100 micron-metres (µm) to the surface of metal work which shall be finally painted with aluminium paint in accordance with the specifications. The CC shall ensure that all irregularities such as rivets, welds, bolts and seams shall also receive total thickness of minimum 100 µm after application of two coats of Alkyd priming paint.

3) Aluminium paint

Aluminium paint shall be reserved to inside steel surfaces, without condensation, with easy access for touch-up.

Aluminium paint shall contain aluminium flakes in a phenolic resin spar mixing varnish. Aluminium paint shall be applied by brushing or spraying to give minimum thickness of 125 µm of each coat. Two coats of aluminium paint shall be applied to give total thickness of minimum 250 µm. Mixing of about 200 g of aluminium paste per litre of varnish shall be performed in the field. Only enough paint for each day shall be prepared at one time.

4) Epoxy paint

Epoxy paint shall be applied for more sensible surfaces than in 1.4.3. and with difficult access. System chosen:

- Zinc epoxy priming coat, thickness: 50 µm

- 2 coats epoxy pitch solvented with color, thickness: 2x100 µm minimum

The system's minimum thickness shall be 200 µm

Priming coat and first coat shall be applied in the workshop and the final coat shall be applied on site after erection.

5) Paint for surfaces with risk of condensation

The following system shall be applied to steel surfaces under cover that still risk condensation:

- Zinc epoxy priming coat, thickness : 50 µm
- 2 coats colored solvented epoxy pitch: thickness : 2x150 µm minimum

The system's minimum thickness shall be 300 µm

Priming coat and first coat shall be applied in the workshop and the final coat shall be applied on site after erection.

6) Paint for outside surfaces

This paint shall be applied to steel surfaces in aggressive environment conditions.

The system to be applied is:

- 1 epoxy priming coat, thickness : 50 µm
- 2 or 3 coats of epoxy-coal pitch or hydrocarbon epoxy finishing paint: thickness : 2x225 µm or 3x150 µm

The system's minimum thickness shall be 300 µm

The first coats shall be applied in the shop and the final coat shall be applied on site after erection.

7) Test plate and coat thickness

a) Test plate

Before starting on work, the CC shall submit reference metallic test plate of size 200 mm x 300 mm x 2 mm. The test plate shall be prepared according to the specifications and shall receive the specified number of coats of approved materials for paint.

b) Coats thickness

Upon completion, the finished coating shall be in accordance with the specifications and the test plate supplied. The CC shall check thickness of the coat both during the application of paint and after their completion. owner may check thickness of coats after their drying time in a number of areas.

The necessary devices to measure painting thickness shall be supplied by the CC.

The thickness measuring device shall be calibrated and cross checked by owner and the CC.

The CC shall have to bring up the thickness of the coating wherever it is recognised to be insufficient.

8) Repair and Protection of Coating

The number of coats shall be two or more coats to give a smooth required finish to be approved Metalwork that has been shop painted or field painted should be handled with care so as to preserve the coating in best practicable conditions. Before proceeding with the regular painting or coating operation, the CC shall clean and repair all areas of shop coat which are defective or damaged. Areas on which paint is loose, weakly bonded, blistered, abraded, rusted or otherwise defective, the paint shall be cleaned by scraping, chipping, power wire brushing or other effective means. Areas thus prepared shall be cleaned of all dust, dirt and other contamination using clean rags and clean solvent. This surface shall then be repainted in accordance with the specifications. Hair line cracks or thin areas of paint which are otherwise undamaged shall be cleaned of all dust, dirt wash or other contamination and shall be re-coated with additional paint. All repainted areas of paint shall be required to pass acceptance tests performed by owner.

8.2 Painting of Walls

8.2.1 White Washing

The white washing work shall comprise of supply of labour, materials, tools, equipment and performance of all work

necessary for white washing and distempering on plastered masonry surfaces or on concrete surfaces. The contractor shall also undertake all precautions to prevent damage, disfiguration or staining to work of other Contractors or other installations.

At least 30 days prior to commencement of work, the contractor shall submit the schedule, sequence and methodology of works to the owner for approval. He shall also submit colour samples and specifications of all colours and distempers to be used, to the owner for approval.

All whitewashing and distempering shall conform to the relevant Indian Standard Specifications, some of which are indicated below.

List of reference Indian Standards and Code of Practices

Number of Code	Title of Code
IS : 426	Distemper, dry colour as required
IS : 428	Distemper, oil, emulsion, colour as required
IS : 712	Specifications for Building limes
IS : 1200 (P-XIII)	Method of Measurements of Building and Eng. Works- White washing, colour washing, distempering and painting
IS : 6268	Code of practice for white washing and colour washing

White washing shall be done using pure shell lime or fat lime or a mixture of both, as instructed by the Engineer-in-charge and shall conform to IS: 712 latest editions. Samples of lime shall be submitted for approval and lime as per approved samples shall be brought to the site in unslaked condition. After slaking, it shall be allowed to remain in a tank of water for two days and then stirred up with a pole, until it shall acquire the required consistency of thick cream.100gms of gum to 6 litres of white wash water and a little quantity of indigo or synthetic ultramarine blue shall be added to the lime.

Before starting the work, the contractor shall obtain approval of the Engineer in charge regarding the soundness and readiness of the surface to be white washed. The surface where white washing is to be applied shall be cleaned of all loose materials and dirt. All holes and irregularities of the surface shall be filled up with lime putty and shall be allowed to dry up before application of the lime solution. One coat of white wash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke and another from left to right before the previous one dried up completely and similarly third coat shall be applied and in case the Engineer-in-Charge feels that one or more coats are required the Contractor shall do so without any extra costs to the Employer. No brush marks shall show on the finished surface. The inner plastered surfaces of wall shall be given 3 or more coats of white washing.

8.2.2 Painting with Acrylic Emulsion Paint

1) General

Plastic emulsion paint as per **IS 5411-1969** of approved brand and manufacture and of the required shade shall be used for walls.

The wall surface shall be prepared as specified below:

a) Application

The number of coats shall be two or more coats to give a smooth required finish to be approved by OWNER. The paint shall be applied in the usual manner with brush or roller. The paint dries by evaporation of the water content and as soon as paint dries by evaporation, the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces.

The thinning of emulsion is to be done with water and not with turpentine. Thinning with water shall be particularly required for the undercoat which is applied on the absorbent surface. The quantity of water to be added shall be as per Manufacturer's instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats shall be applied till the surface presents a uniform appearance.

Anti-dust painting shall be applied as per construction drawings. In this case, it shall be only one coat of plastic emulsion paint, qualified as per IS to be used as an anti-dust painting.

b) Precautions

- Old brushes, if they are to be used with emulsion paints, should be completely dried of turpentine or oil paints by washing in warm soap water.
- Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.
- In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes, etc.
- Splashes on floors, etc. shall be cleaned out without delay as they will be difficult to remove after hardening.
- Washing of surfaces treated with emulsion paints shall not be done within 3 to 4 weeks of application.

8.2.3 Waterproof cement paint

Waterproof cement paint will be applied as per construction drawings, on external or internal concrete walls, and even on ceiling, for protection and waterproofing purposes.

1) Materials

The water proof cement paint of required colour and shade shall be obtained ready mixed of an approved brand and manufacture conforming to **IS: 5410-1969**.

2) Preparation of surface

The surfaces of concrete or plaster shall be thoroughly cleaned of all mortar dropping, dirt, dust, algae, grease and other foreign matter by wire brush, and shall be thoroughly wetted with clean water before the water proof cement paint is applied.

Planeness (flatness)

- maximum gap under 2 m straight edge : 7 mm,
- maximum gap under 0.20 m straight edge: 3 mm.

Straightness of edges and re-entrant angles

- Maximum gap under 2 m straight edge: 7 mm.

Out-of-flush

Out-of-flush differences between formwork panels shall not exceed 1 mm.

The developed length of joints of elements making up formwork panels shall be not more than 1 meter per square meter of exposed surface.

Skin

- surface voids :
- individual area of surface voids : less than 1 cm2,
- surface void depth : less than 5 mm,
- stationary crack (except for surfaces to which waterproofing systems designed to resist moving cracks ≤ 5/10 mm or ≤ 1 mm are applied).

3) Preparation of mix

Water proof cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will get and thicken, affecting glow and finish. Water proof cement paint shall be mixed with water in two stages. The first stage shall comprise of two parts of water proof cement paint and one part of the water, stirred thoroughly and allowed to stand for five minutes. Care shall be taken to add the water proof cement paint gradually to the water and vice-versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases, the Manufacturer's instructions shall be followed.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

4) Application

The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has set for at least 24 hours. Before application of the second or subsequent work, the surface shall be treated with three or more coats of water proof cement paint as found necessary to get a uniform shade.

8.2.4 Chemical Resistance Painting

Chemical resistant paint shall be conforming to IS: 157 of approved brand and manufacturer's specification.

8.2.5 Fire Resistant Paint

Fire resistant paint (Silicate type) shall be as per IS: 162 and of approved brand and manufacture. Primer used shall be as per manufacturer's recommendations. Fire resistant paint shall be applied on all concrete and steel surfaces as indicated in drawings or as directed. The thickness of the films and number of coatings shall be recommended by the manufacturer, to withstand a fire of 2 hours rating. Before applying the paint, the surface shall be prepared as per the specifications of the manufacturer and all other precautions required as per the specifications of the manufacturer shall be followed.

8.2.6 Acid Resistant Paint

Acid resistant painting shall be one of the emulsion type synthetic resin paints which have a proven quality of acid resistance.

8.2.7 Floor Painting

Floor paint shall be epoxy-resin type which has enough durability against rubbing. In powerhouse, floor paint will be applied on whole floor area of the room or only the safety asile, of which the Engineer-in-charge will direct the location.

8.3 General Application Conditions

8.3.1 Inspections and Tests Performed by the Contractor

All materials for paint shall be made available for sampling at least 30 days prior to use and no materials for paints shall be used until they have been tested and approved by owner. The Contractor shall provide facilities and assistance required for procuring representative test samples which shall be furnished to owner. The Contractor shall furnish detailed information regarding specifications with all materials. The replacement of the materials for paint, if the analysis discloses anomalies, shall be made by the Contractor at his expense. Preparation of the materials for paints used and their labelling shall comply with the rules applicable to paints. The safety rules required during their application shall be strictly observed.

The Contractor shall carry out conformity tests starting from test pieces taken from site, in his workshops or on the Manufacturer's premises, dealing with the Fast Identification Characteristics (F.I.C.): density, dry extract and ash content. He shall send the reports to owner.

The Contractor shall keep a witness sample corresponding to each test carried out throughout the storage period defined in the Manufacturer's technical datasheet. This sample shall be labelled as follows:

- contract number,
- sampling date,
- system code,
- trade name,
- colour,

- name of the part and conditions for preparation of the mix, if several components are used,
- batch number,
- Manufacturing date.

8.3.2 Packaging

1) Receptacle characteristics

If coating products are delivered in metallic receptacles, they shall be protected against oxidation.

The lid of receptacles is hermetically closed and made tamperproof by a crimping or sealing system marked with the Manufacturer's stamp. The lid is fitted with a closer with a sufficiently large cross-section so that the product can be stirred.

Products with several components are delivered in pre-proportioned packages.

2) Labelling

Each receptacle shall be fitted with a single label marked in indelible characters containing all information necessary for its identification:

- Manufacturer's name,
- Manufacturing date and number,
- trade name and classification or similar,
- product colour and reference number,
- name of the part and conditions for preparation of the mix, if several components are used,
- limiting usage date (expiration date),
- limiting temperatures at the storage location,
- product toxicity,
- Net weight or volume of the contents.

8.3.3 Shipment to site

Each time that the Manufacturer ships paint to the Contractor, he shall simultaneously send transmittal forms to the Contractor containing the following information:

- quantity and packaging of each dispatched product, by batch number,
- labelling of the dispatched batch,
- Self-checking certificate for each batch number.

8.3.4 Storage

Stores for products used by the Contractor and witness samples shall be kept closed, covered and at a temperature compatible with satisfactory storage of the products and samples.

Products are stored separately depending on the nature of the product.

Any product contained in a receptacle that shows any signs of a leak, before it is used, shall be scrapped and replaced at the Contractor's expense.

8.3.5 Protection of surrounding surfaces

The Contractor shall take whatever steps are necessary to make sure that surrounding equipment and surfaces are protected against splashes of the products used, and damage caused by his surface preparation.

Equipment or surfaces that are degraded or made dirty despite all precautions, shall be repaired or cleaned at the Contractor's expense, and if this is impossible, they shall be replaced at the Contractor's expense.

As a general rule, joint caulking products shall never be painted and consequently a special protection shall be applied to them before painting.

8.3.6 Work conditions

For work done on site, no operations shall be started until OWNER has been informed in advance and in good time to enable it to make whatever checks he considers are necessary, and until OWNER has given his approval for the corresponding technical datasheets.

The Contractor shall inform owner about the qualitative and quantitative equipment and personnel resources that he intends to use to carry out his services, before he starts the work.

8.4 Measurement and Payment

For measurement of openings whose jambs, sill, soffits, etc. are to be painted the following procedure shall be followed.

1) For openings up to 0.5 m2 each, no deduction shall be made and no additions shall be made for jambs, sills, etc.
2) For openings exceeding 0.5 m2 but not exceeding 3.0 m2 deductions shall be made for half the area of openings, and no additions shall be made for jambs, sill etc.
3) For openings exceeding 3.0 m2 deductions shall be made for the whole area, and additions shall be made for jambs, sill's soffits, reveals etc.
4) For opening, pipes, sleeves etc. whose sides are not finished, no deductions shall be made for openings, etc up to 0.1 m2 in area each and full deductions shall be made for all openings above 0.1 m2 in area each.
5) No extra shall be made for painting, etc. done around openings, sleeves, pipes, ducts, inserts etc.
6) No extra payment shall be made for painting, etc. on wall features such as grooves, ducts, beads, projections, cornices, etc. unless given different finish or otherwise specified in the Bill of Quantities. The actual area of the features shall be girthed and included in the wall measurements.
7) For painting of uneven surfaces in doors, windows, ventilators, louvers, guard boards, balustrades, gratings, railings, etc. equivalent plain area shall be measured as given in Clause 17.2 (Table-II) of IS: 1200 (Latest Revision), or as specified in the Bill of Quantities.
8) For painting pipes for sanitary and plumbing work, measurement shall be made on actual work done in m' for different diameters. Measurement shall be along the centre lines of pipes laid. No deduction or additions shall be made for valves, fittings etc.

8.4.1 Painting of steelwork surfaces

The price quoted shall include for the preparation of the steel surface prior to application of all paint layers, including the first primer coats at the factory, besides all materials and labour involved for all coats.

It applies per tonne by mass of the steel element painted.

8.4.2 Painting /white washing of concrete surfaces and rendered masonry walls

The price quoted includes for the preparation of the surfaces prior to application of all subsequent paint layers, besides all materials and labour involved for all coats.

It applies per square meter.

8.4.3 Painting of floors with epoxy based industrial paints

The price quoted includes for the preparation of the surfaces prior to application of all paint layers, besides all materials and labour involved for all coats.

Epoxy floor paints will generally extend a height of 150 mm along the bottom of walls.

It applies per square meter.

8.4.4 Painting of concrete surfaces with anti-dust paints

The price quoted includes for the preparation of the surfaces prior to application of all paint layers besides all materials and labour involved for all coats.

It applies per square meter

CHAPTER- P.9 SURFACE EXCAVATION

9.1 Scope of Work

1) This chapter covers all clearing, grubbing and stripping and all surface excavation work to be performed under this Contract, which shall consist of removing all existing material of whatever nature soil or rock to the lines and grades shown on the Drawings or as otherwise directed by the Engineer-in-Charge. This work shall include clearing, grubbing and stripping, excavation, drilling and blasting, loading, hauling and disposal of excavated materials in designated spoil, stockpile areas or directly as construction materials.

2) This Chapter covers all excavation work for the surface structures including but not limited to:

   a) Clearing, removing vegetation and stripping

   b) Foundation excavation for pothead yard and appurtenant works

   c) Tunnel / adit portals and approach to portals

3) The Contractor shall also be responsible for excavation which is not specifically required for the construction of Permanent Works, but incidental to the installation of temporary facilities such as site roads, haul roads, office buildings, camp site, construction plants, etc.

4) Slope protection and stabilisation measures, which may be needed in conjunction with excavation work, are covered in other chapters of these Specifications.

5) The approval given by the Engineer-in-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his responsibility for the proper and safe execution of excavations, or of liability for injuries to or death of persons, or any obligations under this Contract.

9.2 Submittals

1) With his tender, the Contractor will be required to submit a methodology and work programme for the excavation at all the project components including haul roads etc. indicating the proposed plant and equipment for excavation and haulage, blasting methods, soil drainage and safety precautions, procedures for the installation of soil/rock supporting and stabilisation works, and procedures for construction of the new haul roads and for maintaining that portion of project roads as constructed by the other agencies/owner during the construction work. The interface between the activities should be indicated very precisely in the programme.

2) At least 28 days prior to the commencement of any surface excavation, the Contractor shall submit to the Engineer-in-Charge the detailed method statement and programme for the activities set out in (1) above, giving full details of the proposed excavation methods and sequences, including necessary site drainage and safety precautions. Any variations from the corresponding data submitted with the Contractor's tender will be explained and justified to the satisfaction of the Engineer-in-charge.

3) Within 14 days of receipt of the detailed methods statement and programme, Engineer-in-Charge will advise the Contractor in writing of his acceptance of, or comments on the submitted plans. The Engineer- in- Charge reserves the right to reject the proposed plan if in his opinion it is unworkable. If acceptance is withheld, a new plan in whole or in part shall be submitted. Excavation shall only be carried out in areas for which the plan has been accepted by Engineer-in-Charge.

4) In addition to preparing and submitting at least 14 days prior to commencing rock excavation a detailed drilling, blasting plan, the Contractor shall submit, a detailed proposal showing the details of the proposed blast. The Contractor shall not proceed with the blasting until permission to load holes with explosives has been given by Engineer-in-Charge.

5) At least 14 days prior to dumping or stockpiling any material, the Contractor shall submit the layout including height, grades, drainage, retaining measures etc. of soil or stockpile areas, which will be within the areas designated on the Drawings or as approved by the Engineer-in-Charge. All pertinent data of working methods and provisions for the security, stability and temporary and permanent drainage of the areas shall be included. Details of volumes, material types, heights and grades shall be provided.

6) The pre and post survey measurement plan shall be submitted by the Contractor to the Engineer-in-Charge for approval as per Chapter G2.

7) The Contractor shall submit and agree with the Engineer-in-charge a monitoring plan for the excavation to observe potential or actual movement of the slopes excavated. This plan shall also give details of the procedures and equipment to be employed by the Contractor to stabilise or protect as quickly as possible any areas in which it is determined that untoward movement or deformation is occurring or is threatened.

8) A detailed safety program covering all aspects of storage, handling of explosives and carrying out blasting operations shall be prepared and submitted by the Contractor to the Engineer-in-Charge for approval at least 28 days prior to the time the Contractor brings explosives to the site. This shall include but shall not be limited to transporting, storing and use of explosives.

9.3 Lines and Grades

1) The Contractor shall be responsible for setting-out all the structures and slopes as shown on the Drawings, in accordance with the Chapter "Surveying and Setting-out Work". All extra work and over excavation caused by improper setting-out by the Contractor shall be corrected by him immediately on the direction of the Engineer-in-Charge.

2) However, where the final excavation grades are defined by line and grade, the Contractor shall take every precaution, and use the most appropriate method of excavation, to avoid the loosening of material or the breaking of rock beyond the lines and grades shown on the Drawings.

3) The bottom of all excavations shall be trimmed to line and grade. The final 200 mm of any loose geological formation in all excavations where concrete is to be placed, shall be excavated by hand to avoid disturbance of the bottom.

4) If, for any reason, excavation is carried out beyond the lines and grades shown on the Drawings, the Contractor shall take the necessary measures to restore the required lines and grades with approved backfill or concrete, as directed by the Engineer-in-Charge at his own cost.

5) Should the Contractor wish to excavate beyond the limits given on the Drawings for his own convenience, he may do so only with the prior consent of the Engineer-in-Charge.

9.4 Slopes, Slides, Geological Over Break and Unsuitable Foundations

1) If geological conditions during the performance of the work do not permit excavation as shown on the Drawings, or where the material is unsuited to form a firm foundation for the structures, the Engineer-in-Charge will modify the drawings accordingly to change the slopes and grades.

2) If over break, slides or rock falls occur, which, in the opinion of the Engineer-in-Charge are due to improper working methods or negligence by the Contractor, and the effective excavated surfaces are beyond the excavation lines shown on the Drawings, the Contractor shall remove all excessive material and, shall take the necessary measures to restore the required lines and grades with approved backfill or concrete, as directed by the Engineer-in-Charge at no cost to the Employer.

3) Excavation beyond the lines and grades shown the Drawings, or as directed by the Engineer-in-Charge, is defined as over break.

4) Geologically accepted over break in surface excavation is defined as over break which occurs while both of the following conditions are simultaneously fulfilled:

   a) The Engineer-in-Charge is informed and given an opportunity for inspection while both the cause and the extent of the over break are clearly visible,

   b) The over break did not occur while, in the opinion of the Engineer-in-Charge, the Contractor was using improper working methods or was otherwise negligent, and it could not have been prevented by prompt and appropriate installation of supports.

9.5 Execution

9.5.1 General

1) The Contractor shall conduct all excavation procedures and operations so as to produce the required lines and grades.

2) The surface excavation shall be performed by any approved method using any excavating and hauling equipment

suitable for the work in accordance with the submitted detailed plans and time Bill of Quantities, or approved modifications thereof.

3) All excavated areas shall be drained to the satisfaction of Engineer-in-Charge. Any surface or subsurface water shall be satisfactorily controlled by dewatering methods acceptable to Engineer-in-Charge. When underwater excavation wherever authorised by the Engineer-in-charge is to be performed, suitable equipment shall be used.

4) At all times during construction, Contractor shall adopt excavation procedures such that at no time shall the stability of any slope be impaired. The acceptance by Engineer-in-Charge of excavation procedures or equipment shall in no way relieve Contractor of his sole responsibility for safeguarding the stability of all the rock faces and slopes excavated under this Contract.

5) The Contractor shall carry out periodic cleaning to ensure that no hazardous accumulation of loose material occurs on the slopes or on any berm or ledges forming part of the excavation profile. The removal of mud and slush resulting from rain or flooding of the sites shall be performed by the Contractor as and when required by the Engineer-in- Charge, to ensure the safe and effective performance of the work. The decision of the Engineer-in-charge shall be final and binding.

6) Excavation for foundations for all structures shall be performed in the dry. Final surfaces shall be protected against damage by erosion and movement of construction equipment. Any damage caused shall be repaired by the Contractor to the full satisfaction of the Engineer-in-charge.

7) Rock faces and surfaces at sensitive excavations such as tunnel portals, shall be carefully excavated and preserved during construction. Appropriate smooth blasting techniques shall be generally used there. Line-drilling may be applied at certain locations. Rock supports shall be installed where indicated on the Drawings, or directed by the Engineer-in-Charge, to suit the actual geologic conditions encountered.

8) The Contractor shall exercise particular care when excavating in the vicinity of existing structures or those under construction. He shall be liable for any damage to structures or equipment caused by his operations. The Contractor shall protect the subsoil and particularly the ground water from contamination by fuel or oil from his equipment.

9) The Contractor shall ensure dust free atmosphere in work area including haul roads.

9.5.2 Classification of Excavation

Surface excavation is classified according to the method used to carry out the work, as follows:

a) Clearing, Grubbing and Stripping

b) Common Excavation.

c) Rock Excavation by Blasting.

d) Minor Excavation Work.

Excavation of rock by ripping may be used at the Contractor's discretion, subject to the approval of the Engineer-in charge and providing that the work complies fully with the quality requirements of these specifications for rock excavation by blasting. Any such ripping work will be paid for as excavation by blasting.

Clearing, Grubbing and Stripping

1) Clearing and grubbing shall consist of cutting and disposing of all shrubs, stumps, debris and any other vegetation and organic topsoil, existing structures, foundations of structures (except concrete or masonry in mortar), fences and other materials on the surface of the ground within the areas to be cleared as indicated on the Drawings, or as required by Engineer-in-Charge.

2) All flammable material resulting from clearing shall be either burnt or disposed of by the Contractor in a manner acceptable to the Engineer-in-Charge. The contractor shall be responsible for taking all safety measures required for burning of the materials, and he shall be responsible for any damage done by fire resulting from his work. The fire shall at no time be left unattended, until it has been fully extinguished. The Contractor shall have suitable equipment and supplies for fighting fire during the burning of material and shall take all necessary precautions to prevent fire from spreading. None of the disposed material shall be piled in stream of river or in a location where in the opinion of Engineer-in-Charge it is liable to be washed away by

floods.

3) Stripping consists of removing all rubbish, humus, vegetable material and all or part of the organic topsoil in the areas and to the depth as indicated on the Drawings or as directed by the Engineer-in-Charge

9.5.3 Common Excavation

1) Common excavation means general excavation of material such as clay, silt, sand, gravel, and boulders of up to 2 cum in volume and soft or disintegrated rock, which can be removed by common earth moving equipment without ripping or blasting. The activities of stripping, clearing and grubbing shall be carried out by the Contractor in areas designated for common excavation.

2) Common excavation as defined above shall be accomplished by proper excavation and hauling equipment suitable for the work which allows for an efficient work progress for the soil conditions encountered.

3) It shall be carried out as per lines and grades shown in the drawing or as directed by Engineer-in-Charge.

4) When excavation is completed the Engineer-in-Charge will inspect the final surfaces of foundation / bed and could demand further excavations necessary to obtain acceptable foundation.

5) When the bottom of excavation as indicated on the Drawings is not rock and the natural foundation material is disturbed or loosened, for any reason, the Contractor may be asked to improve it by compaction or replace it with approved fill and compaction as directed by the Engineer-in-Charge.

9.5.4 Rock Excavation

1) General

i. Rock excavation by blasting includes all solid rock in place which cannot be removed until loosened by blasting, barring or wedging, removal of all boulders or detached pieces of solid rock larger than 2 cum in volume, as well as any existing structural foundation made of concrete or masonry placed in mortar which cannot be removed during common excavation or by ripping.

ii. Lines shown on the Drawings such as "sound rock", "top of rock" etc., are approximate and for information only. They will not be used for measurement purpose.

iii. All excavation shall be performed using methods and techniques that will produce smooth and sound rock surfaces with minimum over break and fracturing beyond the lines and grades or limits of excavation shown on the Drawings, or as required by Engineer-in-Charge, and will preserve the structural integrity of the excavated openings. All precautions shall be taken by the Contractor to achieve this result and also preserve, in a soundest possible and undisturbed condition all the materials beyond the limits of the excavation of lines and grades shown on the drawings. Particular care shall be exercised where vertical or near vertical faces are required.

iv. Drilling and blasting shall be done in such a manner as to ensure that the rock will break along the desired lines and grades. Rock shattered by blasting operations outside the established limits of excavation shall be removed and replaced by concrete if necessary. Rock faces and slopes shall be scaled or cleaned of loose or overhanging rock immediately after excavation. Rock surfaces, both temporary and permanent, shall be regularly inspected by the Contractor and rectified whenever necessary.

v. The diameter and the spacing of the blast holes shall be constantly adapted to the actual conditions at the Site. The Contractor shall develop the blasting techniques as the work progresses to obtain the best possible excavation surface after blasting. The techniques used shall be at all times subject to the agreement of the Engineer-in-Charge, who may order blasting tests to be undertaken by the Contractor to substantiate his proposed methods of blasting. The Contractor shall engage a qualified professional blasting consultant to assist in establishing satisfactory techniques

vi. Rock excavation close to the final excavated surfaces shall be performed using controlled blasting methods such as "pre-splitting", "cushion blasting", and “smooth blasting" as defined hereinafter. Line-drilling and broaching shall be used to limit the over break and damage of surrounding rock. These shall be adopted after approval from engineer in charge.

vii. Shattering or splitting of rock, or the opening up of seams and joints in the rock, beyond the limits of excavation, shall be avoided. If in the opinion of Engineer-in-Charge such damage occurs due to Contractor's

negligence, then additional rock support shall be installed and any resultant shattered material beyond such lines shall be removed and replaced with rock fill or concrete as required by Engineer-in-Charge.

viii. Immediately following the blasting, and at any time throughout the duration of the Contract, the Contractor shall scale and remove from the excavations all loose material which appears to be unsafe or to endanger persons, work or property. The fact that such scaling and removal may enlarge the excavation beyond the required excavation lines shall not relieve the Contractor from the necessity of performing such scaling and removal.

ix. After scaling and prior to excavation of the next bench or round, the Contractor shall install rock stabilisation and reinforcement, and provide any surface treatment needed, as shown on the Drawings or as directed by the Engineer-in-Charge.

x. All blasted rock shall be removed from the bench toe before the succeeding bench is shot. The maximum bench height shall be as indicated on the Drawings and may be changed only with approval of Engineer-In-Charge.

xi. The excavation shall be made to sufficient depths to secure foundations of structures on sound rock free from weathered materials or other objectionable defects, as determined by the Engineer-in-Charge. The exploratory investigations of the foundations are not sufficiently complete to disclose all seams, defects, and other irregularities that may exist in the foundation rock. The lines of excavation shown on the Drawings shall therefore not be interpreted as indicating the final or actual lines of excavation or that no defects exist. The excavations at all elevations shall be so shaped as to produce as uniform and regular a profile as is practicable to obtain using excavation methods described herein.

xii. The final excavated surfaces shall have no abrupt changes in slope and sharp projections greater than 100 mm. Projections in excess of 100 mm shall be treated where necessary by supplementary excavation as determined by the Engineer-in-Charge, to produce the desired surface of contact between concrete and rock.

xiii. Whenever, in the opinion of the Engineer-in-Charge, further blasting may injure the rock upon or against which concrete is to be placed, or is otherwise undesirable, the use of explosives shall be limited to light charges or discontinued, and the excavation shall be completed by wedging, barring, line-drilling or other suitable methods approved by the Engineer-in-Charge.

xiv. Should the presence of rock appear to make excavation for the foundations of any structures unnecessary to the extent which is shown on the Drawings, the Contractor shall consult the Engineer-in-Charge before proceeding with such work. The Engineer-in-Charge will issue directions in writing on whether to proceed with the work as shown or to define as how the work shall be modified.

xv. When the excavation has been completed to the approximate grade, as shown on the Drawings or established by the Engineer-in-Charge, the surface shall be cleaned off by barring, wedging, picking or other approved methods, and with an air and/or water jet under high pressure for purpose of inspection. If it is found to be unsatisfactory, as determined by the Engineer-in-Charge, supplementary excavation shall be made as directed, and the surface again cleaned for inspection. This procedure shall be repeated until a satisfactory surface is obtained. Just prior to placing the concrete, a final cleanup of the rock surface shall be made. All loose, shattered, or disintegrated material shall be removed, and the final surface cleaned with jets of air and/or water under high pressure.

xvi. Contractor shall regularly monitor and inspect all excavations made under this Contract, and shall forthwith promptly remove and dispose of any rock which Engineer-in-Charge deems loose, unsound or disintegrated, or in any other way unsafe.

2) Control Perimeter Blasting

a) Bench or open-cut excavation of permanent rock slopes shall be carried out using the cushion blasting or presplitting techniques. However, depending upon the detailed geometry of rock slopes, other techniques, such as line-drilling, may be used with written approval of Engineer-in-Charge. Production holes within 3 m of the perimeter row of holes shall be drilled at a reduced spacing and charged with a reduced load. Perimeter holes shall be drilled in such a manner to meet the following tolerances with respect to length, collar, locations and alignment:

- The collar of perimeter holes shall be located within 75 mm of the perimeter line.

- Perimeter holes shall not be longer than 6.0 m unless agreed otherwise by Engineer-in-Charge,
- All perimeter holes shall be aligned so that each hole terminates within 200 mm of the line to which the holes are being drilled,
- Within 1 m of corners, the hole spacing shall be reduced by drilling intermediate holes so that satisfactory and high-quality excavation lines are maintained. The intermediate guide holes may or may not be loaded, depending on the results obtained and as required by Engineer-in-Charge.

b) Holes for perimeter blasting technique shall be at spacing of 450 mm, 600 mm or 750 mm. The selection of centre-to-centre spacing of holes for perimeter blasting shall be developed by trial. In initial stages of excavation, perimeter holes shall be assumed, drilled at 450 mm spacing and based on results this spacing may be varied.

c) Contractor's controlled perimeter drilling and blasting techniques shall be considered acceptable and in conformity with these Specifications for controlling the completed rock surfaces if :

- At least 50% of the drill hole traces of each round are visible in the final rock surface, distributed uniformly, after the scaling down of all loose and shattered rock that is liable to fall before or during rock reinforcement installation and if all drill hole traces are close to the lines shown in the Drawings,
- Engineer-in-Charge may modify the above criteria if, in its opinion, the achievement of such results is not reasonably possible because of adverse rock conditions.

d) Drill holes for controlled perimeter blasting shall be loaded in a manner and detonated in a sequence so as to ensure a minimum of damage to the rock beyond the excavation lines.

3) Line-drilling

a) Line-drilling shall be used where control perimeter blasting may cause excessive damage to the surrounding rock or where there are structures adjacent to the excavation.

b) Line-drilling is defined as a single row of unloaded holes drilled along the neat excavation line, spaced no more than two to four times the hole diameter on centres. These will form a surface of weakness to which the primary blast can break. Light blasting with well-distributed charges fired after the main excavation is removed may be permitted in the holes. If, however, in the opinion of the Engineer the blasting may injure the rock, the use of explosives shall be discontinued and the excavation shall be completed by broaching, wedging, or barring.

9.5.5 Dental Excavation

1) Dental excavation shall include the removal of unsuitable material from shear zones, clay seams, pockets, joints, caverns, or from spaces between boulders beyond the lines of excavation shown on the Drawings or established in the field, which are too small to be excavated by common earth moving equipment.

2) Dental excavation, depending on its extent, will require the use of a back-hoe, hand tools, or other small excavating equipment, as well as the use of a high velocity air- water jet. The methods employed shall be such as to avoid fracturing of the rock adjacent to the material being removed.

3) Dental excavation shall be performed where directed. The extent to which such material shall be removed, including the depth, direction, and dimensions of the work, will be determined by the Engineer-in-Charge. In general, however, excavation into cracks or seams shall be to the depth that is a minimum of three times the seam width, and such excavation shall be backfilled with concrete or shotcrete. No blasting shall be permitted.

9.5.6 Minor Excavation Work

1) Minor excavation work consists of excavation, in all materials, of trenches or holes of less than, or equal to, 2 m of width, and in other small or restricted areas, which will be carried out manually or using small items of equipment.

2) The Contractor shall excavate to the limits, lines and grades shown on the Drawings.

3) Bracing, shoring or other methods of supporting the excavation shall be carried out as necessary.

4) Mechanical excavation of trenches, except those in rock, shall be stopped not less than 100 mm above final bottom level. The remainder of the excavation shall be removed, shaped, and graded manually.

5) In rock, the trenches shall be excavated to such depth and space for placing of compacted sand bedding at least 10 cm thick shall be provided between the rock and the underside of any equipment or pipe.

9.5.7 Additional Excavation

1) The Contractor may be directed by the Engineer-in-Charge to perform excavation beyond the lines and grades of already completed work. Such excavation shall be defined as additional excavation.

2) Additional excavation may consist of any or all classes of excavation stipulated in this Chapter.

3) Excavation outside the excavation limits, which is required by the Contractor for his own convenience, may be performed only with agreement by the Engineer-in-Charge, who may direct the Contractor to refill it with concrete or rockfill in a satisfactory manner.

9.6 Excavated Materials

1) All suitable materials from the excavations shall be utilised to the fullest extent practicable as construction materials in Permanent Works with the approval of Engineer-in-charge.

2) The Contractor's blasting and excavating techniques shall be such that, as far as practical, construction materials of satisfactory quality will be obtained. Wherever possible, such materials shall be excavated separately from materials to be disposed off to the spoils.

3) Whenever possible, excavated material which is suitable for construction purposes shall be transported directly from the excavation area to the designated final locations for its use.

4) If the immediate placement in the final location is not possible, the materials shall be stockpiled. If the moisture content of excavated materials which would be suitable for embankments or backfill is too high after excavation, such material shall be drained and dried in the stockpile until the moisture content is sufficiently reduced to allow for placement.

5) The Contractor shall remove any cobbles, boulders or rock fragments found in otherwise approved materials which are greater or smaller than permitted for specific jobs and place them at other locations or dispose them of appropriately.

9.7 Disposal of Excavated Materials

1) Excavated materials which are not suitable for, or are in excess of the construction requirements shall be disposed of in the spoil area shown on the Drawings, or in areas designated as such by the Engineer-in-Charge in the course of the work. The Contractor shall be responsible for the stability of all fills, embankments and stockpiles created by the disposal of excavated materials. It may include retaining structures, if required, by the Engineer-in-Charge.

2) The spoils shall be located where they will not interfere with the natural flow of streams or rivers, with construction operations in the borrow and quarry areas, with flow of water to or from works, or with accessibility to the Site.

3) Excavated materials shall be transported to the disposal areas in such a way that spillage onto roads etc. is avoided. Any materials which, despite the Contractor taking reasonable care, do fall onto roads etc. shall be promptly cleared and removed by the Contractor.

4) No rock material, excavated earth or soil material may be dumped into any river or creek.

5) The surfaces of all disposed excavated materials which are to remain permanently exposed shall be finished to prescribed lines and to stable slopes approved by Engineer-in-Charge. Adequate diversion of water courses in such areas and drains shall be constructed to prevent the undesirable accumulation of water in or around the disposal or stockpile areas.

6) The Contractor shall be liable for any damage to Temporary or Permanent Works or to third parties and their property caused by inadequate drainage of the spoil or stockpile areas.

9.8 Preparation and Protection of Excavation Surfaces

1) Excavation surfaces against or upon which concrete, embankment fill, or backfill will be placed shall be prepared and protected as specified herein and in combination with specifications contained in the pertinent Sections of these Specifications or as shown on the Drawings.

2) If, during excavation work, material beyond the limits of excavation shown on the Drawings is loosened or disturbed, the Contractor shall recompact the loosened material or remove it altogether and replace it with other compacted fill as directed.

3) If, during excavation in rock for concrete structures or linings, the rock beyond the limits of excavation shown on the Drawings becomes broken or shattered, the Contractor shall remove all loose material and replace it with concrete or shotcrete as directed and no separate payment shall be considered for such concrete or shotcrete.

4) Foundation excavation shall be kept well drained and free of standing water. The Contractor shall provide all necessary drains, ditches and sumps, and use pumps when necessary; in order to ensure that foundation surfaces are not harmed by water. When foundations are thus affected, the affected material shall be removed and replaced with approved backfill.

5) Shotcrete shall be applied to finished excavation surfaces where, in the opinion of the Engineer-in-Charge, it is deemed necessary to prevent air slaking, erosion or other deterioration of the surface. The protective coating shall be applied to excavated surfaces either with or without steel wire mesh reinforcement in accordance with the provisions of the Section "Shotcrete".

9.9 Monitoring and Protection from Blasting

1) The Contractor shall adequately protect existing structures from the effects of blasting, both from impact with rock or debris and from excessive shock. Structures at risk shall be inspected both before and after blasting, and shall be monitored during the blasting operations by appropriate means, if so directed by the Engineer-in-Charge.

2) Blasting within 25 m of concrete or grout will be permitted only after concrete or grout is 7 days old and only after submission by Contractor, and approval by Engineer-in-Charge, of a plan showing the relative positions of structures or grouted area and the area to be blasted, Contractor's proposed drilling and blasting plan, together with outline of precautions to be taken. All concrete and other completed work within 25 m of blasting shall be protected by limiting the size of blasts. Blasting will not be permitted within 10 m of structures or installations vulnerable to damage by blasting. Replacement or repair of work damaged by blasting shall be carried out by the Contractor at no expense to the owner, unless otherwise instructed by Engineer-in-Charge.

3) The blasting restrictions stated above are given as a guide only and may be revised by Engineer-in-Charge on the basis of observations during the progress of the work. If results of blast monitoring indicate that Contractor's blasting methods endanger excavation, grout or concrete work, Contractor shall be required to alter its blasting methods accordingly at no expense to the Employer.

9.10 Measurement and Payment

9.10.1 General

1) Measurement for payment of clearing, grubbing and stripping specified herein will be of the surface area as measured from a survey in accordance with Chapter G2 prior to any clearing or stripping work.

2) Measurement for payment for all classes of excavation specified herein will be of the in-situ volume as measured from a survey in accordance with Chapter G2 prior to any excavation work and the lines and grades shown on the Drawings or established at the Site by the Engineer-in-Charge.

3) Payment for all classes of excavation will be made at the appropriate Unit Price per cubic meter entered in the Bill of Quantities, which shall include the entire cost of the following

   a) Provision of all labour, equipment and materials required for clearing, grubbing and stripping of the area designated for excavation.

   b) Provision of all labour, equipment and materials required for excavation, including any hand work necessary for trimming excavated surfaces; preparation, protection and maintaining excavated surfaces in satisfactory conditions until concrete or fill is placed; all additional excavation for Contractor's convenience; any temporary supports necessary to support the sides of the excavations.

c) Loading, hauling and dumping the excavated material on spoil tips upto the lead distance as indicated in the information for bidders from the excavation site,, formation and maintenance of spoil tips as specified; and drainage and dealing with water in spoil tips.

d) Loading, of incorporation in Permanent Works, formation and maintenance of hauling and dumping the excavated material on stockpiles at points stockpiles as specified; and drainage and dealing with water in stockpiles; rehandling of suitable materials including segregating, grading, draining and drying of materials suitable for use in embankment construction or as backfill.

e) All delays during excavation work resulting from installation of rock supports, stabilisation and protection works required by the geotechnical conditions of the material encountered.

f) Complying with all requirements of statutory laws and regulations relating to blasting work and any restrictions resulting there from; obtaining all necessary permits and licenses for the purchase, use, storage and transport of explosives or any other material and equipment,

g) Surveying, setting-out, checking of excavated profile and alignment, and any subsequent rectification works resulting from undue or incorrect surveys; provision of suitable equipment for, and delays due to carrying out this work.

4) Measurement for payment of additional volumes of excavation resulting from modification of slopes and grades shown on the Drawings, which may be necessary in the course of the work subject to approval of the Engineer-in-charge, will be of the in-situ volume as measured between the original and the modified lines and grades as defined in Chapter G.2.

5) All cost of dewatering and keeping the surface excavation site dry will be paid as specified in the Chapter "Dewatering during Construction".

9.10.2 Geological overbreak and Unsuitable Foundations

1) Measurement for payment for the removal of material arising from over break accepted by the Engineer-in-Charge as occurring entirely for geological reasons, will only be made if the Contractor requests measurement to be agreed directly after excavation, and only providing that the over break can clearly be determined as being wholly due to adverse geological conditions.

2) Excavation and refill ordered in writing by the Engineer-in-Charge due to slides or over break for geological reasons or unsuitable foundations will be measured for payment and paid for as follows:

a) Removal of material resulting from over break accepted by the Engineer-in-Charge will be paid per cubic meter in-situ, at the Unit Price entered in the Bill of quantities.

b) In-situ volumes of the additional excavation required in connection with geological over break will be measured in cubic meters and payment will be made at the Unit Price for excavation of approved classification.

c) The concrete placed for refilling additional excavation in rock foundation will be measured in cubic meter of the in-situ compacted volume and payment will be made at the Unit Price per cubic meter for the concrete class as ordered by the Engineer-in-Charge.

9.10.3 Clearing, Grubbing and Stripping

1) Measurement for payment for clearing, grubbing and stripping shall be for the surface area cleared as shown on the Drawings or as directed by the Engineer-in-Charge.

2) Payment will be made at the Unit Price per square meter entered in the Bill of Quantities.

9.10.4 Common Excavation

1) Measurement for payment for common excavation will be of for the in-situ solid volume of the material removed between the cleared or stripped ground surface levels and the lines and grades shown on the Drawings or the surveyed and agreed surface levels for subsequent Excavation.

2) Payment will be made at the Unit Price per cubic meter entered in the Bill of Quantities.

3) The removal of mud and slush resulting from rain or flooding of the sites will be, when ordered by the Engineer-in-Charge, considered as common excavation.

9.10.5 Rock Excavation

1) Measurement for payment for rock excavation will be of the in-situ solid volume of the rock material removed between the surveyed rock surface and the lines and grades shown on the Drawings or as directed by the Engineer-in-Charge.

2) Payment will be made at the Unit Price per cubic meter, entered in the Bill of Quantities, which shall, in addition to work included and described in 2.10.1 “General", cover the entire cost of removal of rock material, protection of structures, properties, installations, trees, etc.; drilling holes for blasting and blasting, development and using controlled blasting methods, blasting tests, and any cost associated with establishing satisfactory blasting techniques.

3) Large boulders and detached pieces of rock that cannot be removed by excavation machinery used for common excavation shall also be classified as "Rock Excavation by Blasting", and shall be measured and paid for under this item.

9.10.6 Control Perimeter Blasting

1) No Separate payment will be made for excavation performed at the final surfaces of excavation by controlled blasting methods and the cost of the same is deemed to be included in the unit price of the excavation.

9.10.7 Line-drilling

1) Measurement for payment for line-drilling will be of the length of the holes actually drilled into the rock along the side of the excavation as directed by the Engineer-in-Charge.

2) Payment will be made at the Unit Price per meter of drilled hole entered in the Bill of Quantities, which shall include the entire cost of drilling the holes, light blasting, broaching, wedging, barring, or other methods used in conjunction with line-drilling.

9.10.8 Minor Excavation Work

1) Measurement for payment for minor excavation either in loose material or in rock will be of the in-situ volume removed between the original surface and the lines and grades shown on the Drawings or as directed by the Engineer-in-Charge.

2) Payment will be made at the Unit Price per cubic meter entered in the Bill of Quantities.

9.10.9 Dental excavation

Measurement for payment for dental excavation will be of the in-situ volume of material removed.

1) Payment will be made at the Unit Price per cubic meter entered in the Bill of Quantities, which shall include the use of any special equipment and hand work.

2) If measurement by volume proves impracticable, the surface area of seams, cracks and caverns to be cleaned may be equated, as the conditions dictate, to a volume mutually agreed upon by the Contractor and the Engineer-in-Charge.

9.10.10 Additional Excavation

1) Any additional excavation in areas where surface excavation has already been completed, which the Contractor may be directed by the Engineer-in-Charge to carry out, will be measured and paid for at the same Unit Prices entered in the Bill of Quantities as per the class of excavation mentioned in this Chapter. No increase in Unit Prices will be allowed for such additional excavation

9.10.11 Exclusions

1) All costs of dewatering and keeping the surface excavation sites dry will be as specified in the Chapter "Dewatering during Construction".

2) No extra measurement for payment or payment will be made for the following:

a) Extra work caused by the Contractor's negligence in setting-out the structures and slopes.

b) Surveys to verify the original ground surface, or for recording the top of the rock surface.

c) Any delays to excavation work resulting from the need to install rock supports, or stabilising or protection works, in excavation areas.

d) Provision and cleaning of drain and ditches on the berms,

e) Removal of the materials resulting from any slides or over break caused by Contractor's inappropriate working methods and for the additional materials required to fill the voids so created.

f) Additional work of removing material, backfilling voids with approved material or concrete, and installing additional rock supports where over break due to adverse geological conditions coincides with that due to Contractor's poor working methods or negligence.

g) Excess excavation required for Contractor's convenience and the resulting additional backfilling with approved materials.

h) Additional excavation resulting from the slopes changed by the contractor without prior approval of the Engineer-in-Charge. In such event, payment will be made only to the lines and grades shown on the Drawings.

i) Excavation which is incidental to the Contractors installations.

j) Shoring, bracing, and supporting of excavated surfaces.

k) Clearing, grubbing and stripping in the borrow and quarry areas, and spoil and stockpile areas.

l) Draining, shaping, and trimming the dumped material in the spoil tips to the lines and grades as directed or approved by the Engineer-in-Charge.

m) Preparation and protection of surfaces and slopes.

n) Stockpiling of construction materials from required excavations materials which cannot be incorporated directly into Permanent Works.

o) Work or materials required when surfaces have been allowed to become unsuitable due to the action of ground or surface water.

p) Extra work or material required to repair damages to the final excavation surfaces caused by the erosion or travel of the construction equipment.

Monitoring of existing structures during blasting operations.

CHAPTER – P.10 DISMANTLING (DEMOLITION)

10.1 General

The term "Dismantling" means to carefully take apart one or more parts of a building or structure without damaging the other parts. The term 'Demolition' on the other hand implies breaking up. The work may comprise dismantling/demolishing whole or part of work including all relevant items consisting of but not limited to stone work, brick work, concrete, floorings, roofing and iron work as specified and or shown on the drawings.

10.2 Precautions

a) All materials retrieved from dismantling or demolition shall be properly stored/ stacked and shall be the property of the Client/Owner unless otherwise specified and shall be kept in safe custody until they are handed over to the Engineer-in-Charge/ Authorized Representative.

b) Before commencement of dismantling/demolition, the Contractor shall prepare and submit his proposals and program for proceeding with the work for approval of the Engineer-in-Charge. Generally, the Contractor will be permitted to demolish the structures only through approved means, Blasting can be permitted provided the necessary precautions are taken to protect the Works, public and private property and all persons in the vicinity of the Works, except if there be pumps, motors, hand rails, structural steel, bricks and other usable materials, the Contractor shall salvage and immediately handover to the Employer at the site of salvaging all such equipment and materials prior to demolishing or removing the structure.

c) The work should generally be performed in reverse order of the one in which the structure was constructed. Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property., Temporary enclosures or partitions and necessary scaffolding wherever specified shall also be provided, as directed by the Engineer-in-Charge.

d) Necessary steps/ precautions should be taken to keep noise and dust nuisance to a minimum. If specified or directed by the Engineer-in-Charge, the Contractor shall provide, erect and remove screens of canvas or other suitable material to minimize the nuisance from dust and shall provide for watering as the work of demolition proceeds. Helmets, goggle, safety belts etc. should be used whenever required and as directed by the Engineer-in-Charge. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cutters may be used carefully as directed. The dismantled articles should be removed manually or lowered to the ground and then properly stacked as directed by the Engineer-in-Charge.

e) Dismantling shall be done by taking out the fixtures with proper tools and not by tearing or ripping off. Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer-in-Charge. All unserviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in-Charge.

f) The contractor shall maintain/ disconnect existing services, whether temporary or permanent. No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area. Screens shall be placed where necessary to prevent injuries due to falling pieces. Water may be used to reduce dust while tearing down plaster from brick work. Safety belts shall be used by labourers while working at higher level to prevent falling from the structure. First-aid equipment shall be got available at all demolition works of any magnitude.

10.3 Measures to be Adopted for Demolition of Certain Element of Structures

10.3.1 Roof Trusses

In case of a pitched roof, the roof structure should be removed to wall plate level manually. Sufficient purloins and bracing should be retained to ensure stability of the remaining roof trusses while each individual truss is removed progressively. Temporary bracing should be introduced, where necessary, to maintain stability. The end frame opposite to the end where dismantling is commenced, should be independently and securely guyed in both directions before commencement of work.The bottom tie of roof trusses should not be cut until the principal rafters are prevented from making outward movement.

10.3.2 Heavy Floor Beams

Heavy bulks of timber and steel beams should be supported before cutting at the farthest point and should then be lowered to a safe working place.

10.3.3 Jack Arches

Where tie rods are present between main supporting beams, these should not be cut until the arch or series of arches in the floor have been removed. Due care should be exercised and full examination of this type of structure undertaken before demolition is commenced. The floor should be demolished in strips parallel to the span of the arch. rings (at right angles to the main floor beams).

10.3.4 Brick Arches

Full time supervision should be given by experienced persons fully conversant in the type of work to ensure that the structure is stable at all times. Dead loads as much as possible may be removed provided it does not interfere with the stability of the main arch rings but it should be noted that the load-carrying capacity of many old arches relies on the filling between the spandrels. The restraining influence of the abutments should not be removed before the dead load of the sprandrel fill and the arch rings are removed.

Special temporary support shall be provided in the case of skew bridges. A single span arch.can be demolished by hand by cutting narrow segments progressively from each springing parallel to the span of the arch until the width of the arch has been reduced to a minimum which can then be collapsed. Where it is impossible to allow debris to fall to the ground below, centering designed to carry the load should be erected and the arch demolished progressively. The design of thecentering should make appropriate allowance for impact.

Where deliberate collapse is feasible the crown may be broken by the demolition ball method working progressively from edges to the centre. Collapse of the structure can be effected in one action by the use of explosives. Charges should be inserted into boreholes drilled in both arch and abutments. This method is the most effective for demolition of tall viaducts.

In multi-span arches before individual spans are removed, lateral restraint should be provided at the springing level. Demolition may then proceed as for a single span, care being taken to demolish the spandrels down to the springing line as the work proceeds. Where explosives are used it is preferable to ensure the collapse of the whole structure in one operation to prevent the chance of leaving unstable portions standing.

10.3.5 Cantilevers (Not Part of a Framed Structure)

A cantilever type of construction depends on the super imposed structure for its stability. Canopies, cornices, staircases and balconies should be demolished or supported before the tailing down load is removed.

10.3.6 In-Situ Reinforced Concrete

Before commencing demolition, the nature and condition of the concrete, the condition and position of reinforcement, and the possibility of lack of continuity of reinforcement should be ascertained. Attention should be paid to the principles of the structural design to determine which parts of the structure depend on each other to maintain overall stability.Demolition should be commenced by removing partitions and external non-load bearing cladding. It should be noted that in some buildings the frame may rely on the panel walls for stability. Where hard demolition methods are to be used, the following procedures should be used.

a) **Reinforced Concrete Beams**

For beams, a supporting rope should be attached to the beam. The concrete should than be removed from both ends by pneumatic drill and the reinforcement exposed. The reinforcement should then be cut in such a manner so as to allow the beam to be lowered under control to the floor.

b) Reinforced Concrete Columns

In case of columns, the reinforcement should be exposed at the base after restraining wire guy ropes have been placed round the member at the top. The reinforcement should then be cut in such a manner so as to allow the column to be pulled down to the floor under control.

c) Reinforced Concrete Walls

Reinforced concrete walls should be cut into strips and demolished.

CHAPTER – P.11 WATER SUPPLY AND SANITARY WORKS

11.1 General

11.1.1 Scope of Works

The scope of works under this Chapter shall cover:

- The supply, laying and installation of pipes, for drainage, fire water, sewage, plant effluent / floor washings etc. with all fittings and fixtures including jointing.
- The supply, laying and installation of pipes for supply of water, water coolers, etc. with all fittings and fixtures including jointing.
- The supply and installation of water tanks with all fittings and fixtures.
- The supply and installation of all sanitary fixtures like water closets, urinals, wash- basins, sinks etc. with all fittings and fixtures.
- The supply and installation of toilet accessories like mirrors, shelves, towel rails, liquid soap containers etc. with all fittings and fixtures.
- The supply and construction of auxiliary works like manholes, drop connections, gully chambers, septic tanks, soak pits etc. with all fittings and fixtures.

The Scope of Works shall also comprise of supply of all labour, materials, tools, equipment, scaffolding, transportation, loading, unloading, preparation of foundation surfaces, adjustment of surfaces adjacent to the walls, linings, pavement, etc, and all other operations including testing and quality control , etc. as required for complete execution of water supply and sanitation along with the allied works in the Powerhouse/ transformer cavern and elsewhere as shown in the Drawings and as specified herein and/or as directed by the Engineer-in-Charge.

11.2 General Requirements

The Contractor shall make his own arrangements for locating the coordinates and positions of all works and reduced levels (RLs) at these locations based on two reference grid lines and one bench mark which will be furnished by the Engineer-in-Charge. The Contractor shall provide all requirements at site so that the work can be carried out accurately according to the specification and drawing.

The Contractor shall make good to the satisfaction of the Engineer-in-Charge all cuttings / damages resulting from his operations during the installation. He shall also dispose of all unserviceable materials at identified spoil areas, unless otherwise directed by the Engineer-in-Charge. All serviceable material shall be stacked within a lead of 500 m from the MAT portal or as directed by the Engineer-in-Charge.

At least 30(thirty) days prior to starting installation of any material or equipment, the Contractor shall submit to the Engineer-in-Charge for his approval the following:

- Layout drawings of Water Supply and Sanitation System including list of equipment and materials to be provided.
- Details of piping with fittings,
- Details of supports, hangers, attachments and anchoring,
- Details of foundations for equipment,
- Sufficient descriptive materials such as catalogues, diagrams, layout drawings and other data published by the manufacturer to demonstrate the conformance to the Specifications and the Drawings as required by the Engineer-in-Charge.

11.3 Standards and Codes

All Standards, specifications, acts and Codes of Practices referred to herein shall be the latest editions of Indian Standards or equivalent internationally accepted Standards and Codes of Practices. Some of the relevant Indian Standards are listed below for reference:

Code No	Title of Code
IS : 458	Specification of Concrete Pipes
IS : 771	Glazed Fire clay Sanitary Appliances (Part-I to VIII)
IS : 774	Flushing cisterns for water closets and urinals
IS : 775	Cast Iron Brackets and Supports for Wash basins and Sinks
IS : 778	Copper alloy gate, globe and check valves for water works purposes
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services
IS : 783	Code of Practice for laying of Concrete Pipes
IS : 1172	Basic Requirements for Water supply, Drainage and Sanitation
IS: 1200 (P-	Laying of Water and Sewer lines including appurtenant items
IS: 1240	Cast iron Rain water pipes and Fittings
IS:1249	Mild Steel Tubes, tubulars and other wrought steel tubings
IS: 1536	Cast iron fittings for pressure pipe for water, gas and sewage
IS: 1724	Cast iron Manhole covers and frames
IS:1742	Code of Practice for Building Drainage
IS: 1795	Pillar Taps for water supply purpose
IS: 2064	Code of Practice for Selection , Installation and Maintenance of Sanitary Appliances
IS: 2065	Code of Practice for Water supply in buildings
IS: 2424	Automatic Flushing Cisterns for Urinals
IS: 2456	Vitreous Sanitary Appliances
IS: 3114	Code of Practice for Laying Cast iron Pipes
IS: 3311	Waste plug and its accessories for sinks and wash basin
IS: 4127	Code of Practice for Laying Glazed Stoneware Pipes
IS: 5329	Code of practice for sanitary pipe work above ground for buildings
IS:5822	Code of practice for laying of welded steel pipes for water supply
IS: 7241	Plastic flushing cisterns for water closets and urinals
IS: 8931	Cast copper alloy fancy bib taps and stop valves for water services
IS: 8934	Cast copper alloy fancy pillar taps for water services
IS: 12701	Rotational moulded polyethylene water storage tanks
SP-35	Hand Book on Water supply and Drainage

11.4 Material

11.4.1 General

All water supply and sanitary appliances and fittings shall be of modern pattern, fancy type and are subject to approval of the Engineer-in-Charge before they are installed.

All pipes, fittings, fixtures, appliances and accessories shall conform to the relevant Standards and / or as directed by the Engineer-in-Charge. These shall be obtained from a reputed manufacturer and shall be approved by the Engineer-in-Charge before supply at site. Wherever indicated by the Engineer-in-Charge, the Contractor shall submit samples of materials. These may be retained by him for subsequent comparison.

The materials brought to the site shall be stored in a separate secured enclosure, away from the building materials. Pipe threads, sockets and similar items shall be specially protected till final installation. Brass and other expensive items shall be kept under lock and key. Fragile items shall be checked thoroughly when received at the site and item found damaged shall be replaced.

Chromium plating on fittings and appliances shall be of grade-2 (10 micron thickness) conforming to IS: 4827.

11.4.2 Appliances and Accessories

All appliances and accessories shall conform to the relevant Indian Standards or equivalent international standards and code of practices.

1) Pillar Taps

Pillar taps shall be chromium plated brass fancy type as approved by the Engineer-in- Charge. The nominal

size of pillar taps shall be 15 mm.

2) Bib/Stop Cock and Gate Valve

All bib cocks and stop cocks used in sanitary appliances shall be of chromium plated brass, fancy type with nominal size of 15 mm. The taps for wash basins and sinks shall be fancy mixer type chromium plated with Hot and Cold markings as approved by the Engineer-in -Charge. Ordinary type bib cocks and stop socks shall be made of brass and shall be polished bright.

Gate valve, wherever provided on main inlet pipe, shall be made of brass. Unless specified otherwise Class-I, non-rising stem, solid wedge type valve shall be provided.

3) Urinal

Bowl type urinal shall be of flat back 430x240x350 mm size, made of white vitreous china or otherwise as directed by the Engineer-in-Charge chromium plated brass fittings. Partition slab of size 824x450x100mm shall also be white vitreous China.

4) Water Closet

European type with pedestal seat, wash down type, 390 mm high, of one piece construction, made of vitreous china. Each water closet shall have an integral trap with at least 50 mm dia. Vent horn on the outlet side of the trap. The cover for water closet shall be made of plastic of approved shade and colour.

5) Flushing Cistern

The flushing cistern shall be mosquito-proof, automatic operated, high level or low level, as specified for water closets and urinals. A high level cistern is intended to operate with minimum height of 124 cm and a low level cistern with a maximum height of 30 cm between the top of the pan and the underside of the cistern. For European type water closet, manually operated low level vitreous china flushing cistern shall be used. Unless otherwise stated, capacity of the cistern shall be 10.0 litres.

For urinal, high level automatic operated cast iron / PVC flushing cistern as approved by the Engineer-in-Charge shall be used. Minimum size of any urinal system shall be based on a minimum capacity of 2.5 litres per urinal served.

Ball valve shall be of 15 mm diameter and the float shall be made of polyethylene. Flush pipe and other fittings of the cistern shall be as approved by the Engineer-in-Charge.

6) Wash Basin

Wash basins shall be of white vitreous China flat back type 630mmx450mm or 550mm x 440mm size unless otherwise specified. Each basin shall be provided with chromium plated, fancy type, double taps (Hot and Cold) of approved quality. Each basin shall be provided with non-ferrous 32mm waste fittings.

7) Sink

Laboratory sink shall be of white vitreous China, conforming to IS: 2456 and shall be of 600x400x200mm size or as directed by the Engineer-in-Charge.

8) Waste Fittings

The waste fittings for wash basin and sinks shall be of chromium plated brass and shall conform to IS: 2963. Waste fittings for wash basin and sink shall be of nominal size of 32 mm and 50mm respectively. The waste plug shall be made of hard rubber, having sufficient chemical resistance.

9) Mirror

The mirror shall be superior sheet glass with edges rounded off or bevelled. It shall be free from flaws, speaks or bubbles. The size of the mirror shall be 600x450mm or as directed by the Engineer-in-Charge and the thickness shall not be less than 5.5 mm. It shall be uniformly silver plated at the back and shall be free from silvering defects. Silvering shall have a protective uniform covering of lead paint.

10) Towel Rail

Towel Rail and supporting brackets shall be made of chromium plated brass. Size of the rail shall be 60 cm x 20 mm

dia, unless otherwise specified. It shall be fixed in position by means of 2 nos. brackets with screws and rowl plugs embedded in the wall. Towel ring shall have about 150 mm dia and 12 mm chromium plated brass rod.

11) Toilet Paper Holder

The toilet paper holder shall be of vitreous China and of size and design as approved by the Engineer-in-Charge. It shall be fixed in position by means of chromium plated brass screws and rowel plugs embedded into the wall.

12) Glass Shelf

Glass shelf shall consist of an assembly of glass shelf with anodized aluminium angle frame to support the glass shelf. The shelf shall be of glass of best quality with edges rounded off. The size of the shelf shall be 60x12 cm and thickness not less than 5.5 mm. The shelf shall have chromium plated brass brackets which shall be fixed with chromium plated brass screws to rowel plugs firmly embedded in the walls.

13) Pipes

Unless otherwise specified and/or as directed by the Engineer-in-Charge, following types of pipes shall be used:

- For water supply to buildings, pipes and the pipe fittings shall be galvanised mild steel pipe and of medium grade.
- For inlet connecting pipes to appliances / fittings, galvanised mild, steel pipes, medium grade of 15mm N.B. with union of approved make shall be used Standard length of 300 to 450mm pipe shall be used to suit the site requirements.
- For sanitary work above ground, sand cast iron / centrifugally (Spun) cast iron pipes, fittings and accessories shall be used. Pipes shall be coated with coal-tar by hot dipping process for both inner and outer surfaces.
- Glazed stoneware pipes of grade A shall be used for sewer and drains.
- Cement concrete pipe used for sewer and drain shall be Class NP2 pipe whereas for road crossing, higher class of pipe or concrete encasement shall be provided to take care of higher load.
- For drain and sewer line work in bad or unstable ground condition, and under building, centrifugally cast (Spun) iron pressure pipes shall be used. Class LA pipe with spigot and socket ends shall be used. Pipes shall be coated with coal-tar.
- For roof drain C.I. or PVC as directed by the Engineer-in-Charge shall be used for rain water pipes. Pipes shall be coated with coal-tar unless otherwise stated.

11.5 Installation of Appliances and Fittings

11.5.1 General

All fittings and fixtures shall be installed in best workman-like manner by skilled workers. These shall be perfect in level, plumb, plane, location and symmetry. All items shall be securely anchored to wall and floors. All cutting in walls and floors shall be made good by the Contractor.

11.5.2 Flushing Cistern

The cistern shall be supported on two cast iron/mild steel cantilever brackets which shall be firmly embedded in the wall, in cement concrete (1:2:4) block, 110x75x150mm and protected by suitable impervious paint. Alternatively, the cistern shall have two holes in the back, set above the overflow level for screwing to wall and supplement by two cast iron/mild steel wall supports. The outlet or flush pipe from the cistern shall be connected to the pan by means of cement or putting joint. The flush pipe shall be fixed to wall by using holder bat clamps of required shape and size. Five litres cistern, however, may be supported by the lugs or brackets cast on the body of the cistern, however, may be supported by the lugs or brackets cast on the body of the cistern. The cast iron cistern, brackets etc. shall be painted with two or more coats of paints of approved shade and quality. Height of installation of overhead cistern shall be 1800mm, unless otherwise specified.

11.5.3 Water Closet

Water closet shall be installed along with necessary appliances and fittings including flushing cistern with flush pipe, seat and cover, The wash down water closet shall be fixed to the floor by means of 75mm long, 6.5mm diameter, counter sunk bolts and nuts embedded in floor. The seat shall be fixed to the pan, by

means of two 8mm diameter corrosion resistant hinge bolts, provided with washer.

11.5.4 Sink

The installation shall consist of an assembly of sink, cast iron brackets, chromium plated brass union chromium plated brass waste and trap. The sink shall be supported on cast iron cantilever brackets, embedded in cement concrete and protected by suitable impervious paint of matching colour. The chromium plated brass union shall be connected to 40 mm nominal chromium plated brass waste pipe, which shall be suitably bent towards the wall and shall discharge into a floor trap. The height of the front edge of sink from the floor level shall be 80 cm unless otherwise shown on the drawing.

11.5.5 Urinal

Urinal installation shall consist of a lipped urinal (single or range), an automatic flushing cistern, chromium plated brass flush and waste pipe. Size of distribution flush pipe shall be 15 mm nominal bore. Waste pipe shall be of 32 mm nominal bore. Urinal shall be fixed at a height of 60 cm from the standing level to the top of the lip of the urinal, unless otherwise directed by the Engineer-in-Charge. Each urinal shall be connected to 32 mm dia waste pipe which shall discharge into a glazed channel of sufficient width, or a floor trap. The white glazed vitreous china partitions shall be provided between the urinals at 60 cm apart.

11.5.6 Wash Basin

The installation shall consist of an assembly of wash basin, pillar taps, C.I. Brackets, chromium plated brass union as specified. The height of front edge of wash basin from the floor level shall be 75 to 80 cm. The basin shall be supported on a pair of C.I. Cantilever brackets with cement mortar 1:3 (1cement: 3 sand). The bracket shall be embedded in cement concrete (1:2:4) block and protected by suitable impervious paint. The bracket shall be fixed in position before dado work is done. The wall plaster on the rear shall be cut to rest over the top edge of the basin. Centre to centre distance between 2 basins shall be 75 cm.

The chromium plated brass bottle trap and union shall be connected to 32 mm dia waste pipe which shall be suitably bent towards the wall and shall discharge into an open drain leading to floor trap or direct into the floor trap on ground floor and shall be connected to a waste pipe stack through a floor trap on upper floors.

11.5.7 Brass and Gun Metal Water Fittings

The fitting shall be fully examined and cleared of all foreign matter before being fixed. The fitting shall be fitted in the pipeline in a workman like manner. The joints between fittings and pipes shall be leak proof when tested to a pressure of 6 kgf / sq.cm. The defective fittings and joints shall be replaced or redone.

11.5.8 Mirror

The mirror shall be mounted on 6mm thick plain asbestos sheet ground and shall be fixed in position by means of 4 nos. C.P. brass screws and C.P. washers, cover rubber washers and wooden plugs firmly embedded in walls. Unless specified otherwise, the longer side shall be fixed horizontally. The mirror shall be fixed at a nominal height of 1.45 m.

11.5.9 Pipes and Pipe Fittings

Relevant Standards Practices shall be followed as general guidance for laying, installation and jointing of different types of pipes and fittings. Some important aspects pertaining to a few commonly used pipes are described in the following clauses for ready reference.

- Unless otherwise shown on the drawing, the minimum gradients of soil and drainage pipes shall be as followed for maintaining minimum self cleaning velocity of 0.75m/sec :

Diameter in mm	Gradient
100	1 in 57
150	1 in 100
200	1 in 175
250	1 in 195
300	1 in 240

- The pipes and special shall be handled with sufficient care to avoid damage to them. These shall be lined upon

one side of the alignment of the trench with socket facing upgrade.

- Cutting of pipes may be necessary when pipes are to be laid in lengths shorter than the lengths supplied. The pipe shall be so marked that the cut is truly at right angle to the longitudinal axis of the pipe.
- Drainage and soil pipes shall not be allowed to come close to water supply pipe lines
- Each separate pipe shall be individually set for line, level, plumb etc. Where lengths of sewer or drain pipes are laid in trench at a height, equal to length of the boning rod to be used, above the required invert level of the drain or sewer at the point where the slight rail is fixed. More sight rails shall be required at manholes, change of gradient and intermediate positions, if the distance for sighting is too far, which shall not be more than 10m apart. The excavation shall be boned at least once in every 1.8m length. The foot of the bonding rod shall be set on a block of wood of the exact thickness of the wall of the pipe. Each pipe shall be separately and accurately boned between sight rails.
- For water pipe lines, meticulous care shall be taken to avoid chances of airlock and water hammer. The layout of pipe work shall be such that there is no possibility of backflow towards the source of supply from any cistern/appliance whether by siphon or otherwise. Where desired by the Engineer-in-Charge, the pipe shall be concealed in masonry or concrete of the structure. Chases, openings, conduits as necessary, shall be cut or left in the masonry or concrete. Clamps and fittings shall be as per standard practice and as approved by the Engineer-in-Charge.
- For entry of the pipe lines into any building or structure, suitable conduits under the structure or sleeves shall be used to facilitate installation and maintenance of the services. When openings or chases are required to be made in the structure for entry of pipe lines, locations and sizes shall be marked and got checked from the Engineer-in-Charge. After laying of the pipeline the opening and chases shall be mended.
- Where soil, waste and ventilating pipes are accommodated in ducts, access to cleaning eyes shall be provided. Connection to drain shall be through a fully with seal cover to guard against ingress of sewer gas, vermin or back flow.
- For transferring the expected thrust in pressure pipes, anchoring of pipes where necessary shall be provided with thrust block or by another suitable means.

11.6 Drains

All drains shall be covered drains and made of stone masonry or cement-concrete pipes as approved by the Engineer-in-Charge. Bed concrete for the drains shall be 100 mm thick cement concrete (1:3:6). The inside of the walls and the top shall be flush pointed with cement mortar (1:4).

The surface drains shall be of the size specified, and laid to such gradients and locations as shown on the drawings or as directed by the Engineer-in-Charge. The drains shall be provided, as far as possible, uniform slope from the starting point to the discharge point. The average depth of various sizes of drain shall be as follows:

Drain Size	Depth
15 cm	20 cm
20 cm	30 cm

The above details shall hold good for building drainage.

11.7 SW Gully Trap

The gully traps shall be fixed on cement concrete foundations, 65 cm square and not less than 10 cm thick. The mix for concrete shall be 1`:5:10 (1 cement: 5 sand: 10 graded stone aggregate 40 mm nominal size). The jointing of the gully outlet to the branch drain shall be done similar to jointing SW pipes.

After fixing and testing gully and branch drain a brick masonry chamber 300x300 cm (inside) in brickwork of specified glass in cement mortar 1:5 (1 cement : 5 sand) shall be built with a 1/2 brick thick brick work round the gully trap from the top of the bed concrete up to ground level. The space between the chamber walls and trap shall be filled in with cement concrete 1:5:10 (1 cement: 5 sand: 10 graded stone aggregate 400 mm nominal size).

The upper portion of the chamber i.e., above the top level of the trap shall plastered inside with cement mortar 1:3 (1 cement: 3 sand) finished with a floating coat of net cement. The comers and the bottom of the chamber shall be rounded off so as to slope towards the grating.

Cast iron cover with frame 300 x 300 mm (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 (1cement: 2sand:4graded stone aggregate) and rendered smooth. The finished top of cover shall be left 4 cm above the adjoining ground level so as to exclude the surface water from entering the gully trap.

11.8 Water storage Tank

Water storage tanks shall be made of Virgin HDPE granules of approved quality. Each tank shall be of 1000litre capacity or more as approved by the Engineer-in-Charge and shall have seamless construction, moulded by rotational moulding. Shape of tank shall be cylindrical-vertical type with corrugation along with length and bottom of the tank. Tank shall have closed top provided with lid and suitable and second ball valve.

Tanks shall be provided with all fittings for inlet, overflow, outlet pipes and ball valves including mosquito-proof coupling. These shall be leakage proof and shall be installed with proper support and anchorage for applicable wind and seismic condition. These tanks shall be placed on the roof of the building.

Unless otherwise specified, the outlet pipe shall be 50 mm above the bottom of the tank and provided preferably with copper gauge strainers. The wash out or draining pipe shall be made flush at the bottom of the tank at its lowest point. The floor of the tank shall be given a slight fall to the washout pipe for the tank. Water level indicator shall be provided, if asked for.

11.9 Septic tank and Effluent Disposal

i. Septic Tank

The design, layout, construction, capacity and sizes of septic tanks shall be as approved by the Engineer-in-Charge. Septic tanks may be constructed of brickwork, stone masonry, concrete or other suitable materials. They shall be of adequate thickness and quality to ensure water tightness and strength. The wall thickness should not be less than one brick thick in brick masonry and 300 mm in case of stone masonry. The wall shall be plastered to a minimum thickness of 15 mm inside the wall as well as outside with cement mortar (1:3). The inside plaster shall be finished neat.

The flooring shall be of PCC of Grade M-15 minimum, thickness not less than 15 cm and shall be provided with a neat finish. Septic tanks built with RCC should be of grade M-20 (minimum) including flooring and roof. However, for masonry construction, cast-in-situ or pr-cast concrete roof slab shall be provided.

Every septic tank shall be provided with a CI cover of adequate strength. Access openings shall be provided for purposes of de-sludging and inspection. The clear opening shall be 500 mm dia. minimum, or 455 x 610 mm rectangular opening. Septic tank shall consist of the tank itself with inlet and outlets complete with all necessary earth work and backfilling. The details of septic tank shall be as shown on drawings. A ventilating CI pipe of at least 50 mm dia. shall be provided with a suitable cage of mosquito- proof wire mesh and cowl at the top. The ventilating pipe shall extend to a height of about 2m when the septic tank is at least 15 m away from the nearest building and to a height of 2m above the top of building, when it is located closer than 15 m. Ventilating pipe can also be connected to the normal soil ventilating system of the building, where so allowed

ii. Commissioning of Septic Tank

After the septic tank has been made water tight and the sewerage system checked, the tank shall be filled with water to its outlet level before the sewage is let into the tank. It shall be seeded with well digested sludge obtained from septic tanks or sludge digesting tanks. In the absence of digested sludge, a small quantity of decaying matter such as digested cow- dung may be introduced.

iii. Effluent Disposal

The effluent from the septic tank shall be disposed off by soil absorption system as established by percolation tests and as approved by the Engineer-in-Charge.

iv. Soak Pit

Soak pit shall be complete as shown on the drawing, with all necessary earth work and backfilling. In the absence of a detailed drawing, it shall consist of minimum 0.90 m dia. pit not less than 1.0 m depth, below the invert

level of the inlet pipe, the pit may be lined with stone, brick or concrete blocks with dry open joints which shall be backed with at least 75 mm of clean coarse aggregate. The lining above the inlet level shall be finished with cement plaster.

If no lining is used, the entire pit shall be filled with loose stones or brick bats 50 to 80 mm nominal size. A masonry ring shall be constructed at the top of the pit to prevent damage by flooding of the pit by surface run off. The inlet pipe shall be taken down to a depth of 0.90 m from the top as an anti-mosquito measure.

11.10 Sampling, Testing and Quality Control

i. General

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and/or International Standards and shall conduct such tests as are called for by the Engineer-in-Charge. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering practice to the directions of the Engineer-in-Charge. Tests shall be done in the field and at a laboratory approved by the Engineer-in-Charge and the Contractor shall submit to the Engineer-in-Charge, the test results in triplicate within three days after completion of a test. The Engineer-in-Charge may, at his discretion, waive off some of the stipulations given for small and unimportant operations.

Material/work found unsuitable for acceptance, shall be removed and replaced by the Contractor. The work shall be re-done as per specification or requirements and to the satisfaction of the Engineer-in-Charge.

ii. Quality Assurance Programme

The Contractor shall submit and finalise a detailed field Quality Assurance Programme within 56 days from the date of award of the Contract before commencement of the work according to the requirements of the specification. This shall include setting up of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, field quality plan etc. On finalised field quality plan, the Employer shall identify customer's hold points beyond which work shall not proceed without written approval from the Engineer-in-Charge.

iii. Testing after Installation

All soil pipes, waste pipes, ventilating pipes and all other pips, shall be gas-tight. All sewers and drain shall be water-tight.

1) Pipe systems shall be tested for hydraulic performance as given hereunder:

Glazed stoneware or concrete pipes shall be subjected to a test pressure of at least 1.5 m head of water at the highest point of the section under test. The tolerance figure of two litres per cm. of diameter per kilometre may be allowed during a period of 10 minutes. The test shall be carried out by suitably plugging the lower end of the drain and the ends of connections, if any, and filling the system with water Knuckle bend shall be temporarily jointed in at the top end and a sufficient length of the vertical pipe shall be jointed so as to provide the required test head or the top end may be plugged with a connection to a hose ending in funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation. Subsidence of test water may be due to one or more of the following causes:

- Sweating of pipes of joints.
- Leakage at joints or from defective pipes.
- Trapped air.

Allowance shall be made for:

- By adding water until absorption has ceased and after which the test proper should commence. Any leakage which will be visible and the defective part of the work shall be removed and made good.
- Cast iron sewers and drains shall be tested similar to glazed stone ware and concrete pipes. The drain plug shall be suitably strutted to prevent their being forced out of the pipe during the test.

2) Obstruction / Straightness Test

The obstructions shall be checked by inserting a smooth ball, of diameter 13 mm less than the pipe bore at the high

end of the sewer or drain. In the absence of any obstruction, such as yarn or mortar projecting through the joints, the bass will roll down the invert of the pipe and emerge at the lower end. The straightness shall be checked by means of a mirror at one end of the line and lamp at the other. If the pipe line is straight, the full circle of the light may be observed. The mirror will be also indicating obstruction in the barrel, if the pipe line is not straight.

3) Testing of Service Pipes

The service pipes shall be slowly and carefully charged with water, allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working condition of pressure and flow, when all draw off taps are closed. The service pipes shall be checked for satisfactorily support and protection from damage corrosion and frost.

4) Testing of Fixtures

All fixtures and fittings shall be connected by water tight joints. No dripping of water shall be acceptable.

5) Testing of Septic Tank

The septic tank shall be tested for water tightness. It shall be filled up with water and allowed to soak for 24 hours. Then, it shall be topped up and allowed to stand again for 24 hours and loss of level recorded. The fall shall not be more than 15 mm.

11.11 Maintenance During Construction

The plumbing system shall be maintained and protected by the Contractor in a satisfactory condition until final acceptance by the Employer. Defective materials and equipment damage in the course of installation or testing shall be replaced or repaired at the expense of the Contractor in a manner as approved by the Engineer-in-Charge.

11.12 Measurement and Payment

Measurement and payment for the supply and installation of the plumbing system shall be made on the basis of unit rates as tendered in the Bill of Quantities. The rates shall constitute full compensation for the cost of all labours, tools, equipment and materials, including those for the tests, periodical maintenance till acceptance of the works and any other items necessary to complete the function of the system stipulated in the Specification.

CHAPTER – P.12 CEMENT PLASTERING FOR WALLS & CEILINGS

12.1 Scope of Work

The work covered under these specifications consists of supplying all materials and rendering all types of plaster/pointing finishes strictly in accordance with these specifications, applicable drawings etc. For all finishing works mentioned above, only blended cement shall be a used.

12.2 General

Blended cement, sand and water required for the work shall conform to specifications laid down herein before under chapter 4 i.e. Plain and reinforced cement concrete, except that sand for finishing coat shall be fine sand conforming to I.S. 1542. The plastering works shall generally conform to I.S. 1661 (Pt. III) (Code of practice for cement and cement plaster finish on walls and ceilings). All general precautions as specified in I.S. 1661 (Pt. III) clause-8, shall be taken and preparation of the back ground shall be done as laid down in I.S. 1661 clause 12 and I.S. 2402 shall be generally followed for rough cast and sand faced plaster work. Scaffolding required for facility of working shall be provided by the contractor at his own cost. This may be double or single according to the requirement and shall be approved by the Engineer -in- Charge. Stage scaffolding shall be erected when ceiling plastering is done. The contractor shall be responsible for accidents, if any, take place. The contractor shall co-operate with the other agencies also. Whenever electrical contractor/agency has to fix up switch boxes in walls, necessary Thiyyas, Tapanish or Dhadas shall be arranged to be given in advance of actual plastering process at these locations so that the boxes are fixed properly in line with finished plaster surface. All finishing in and around these boxes as also around the conduit boxes in ceiling shall be done by plas tering contractor without any extra cost to the Department. The decision of the Engineer-in-Charge in this regard shall be final and binding on the contractor.

12.3 Preparation of Surface

The surface to be plastered shall first be thoroughly cleaned of all muck and cleaned down. All joints shall be raked out in case of brick work / stone masonry and closely hacked in case of concrete, **under the relevant masonry / concrete items.** The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be blended cement mortar ofmix as specified in the schedule of quantities. After erection of scaffolding and before commencement of plastering work, top most junctions/joints/sides with beam/column shall be thoroughly packed with blended cement mortar to prevent cracks.

Before commencement of plastering operation, the contractor shall ensure that all the service pipes, electrical conduits, boxes, switch boxes etc. have been installed in posit ion by other agencies and the plastering surface is duly approved by the Engineer-in-Charge. In order to enable other service contractors to fix the electrical conduits, conduit boxes, EDBs, pipes, outlets etc. in proper level and line with reference to the finished surface of the plaster, Thiyyas and Tapanis i.e. finished plaster patches shall be given by the main civil contractor on walls, ceiling at regular intervals well in advance of his plaster work at no extra cost to the Department. The entire work of preparation of surface before plastering shall thus be coordinated by the main civil contractor with all other agencies working at site.

Just before actual plastering work is taken up in hand, all the ceilings and walls etc. shall be marked with Tapanis or Thiyyas indicating the thickness of plaster required and which shall be in true line, level and plumb. The contractor shall get these marks approved by the Engineer -in-Charge before starting the plastering work. The contractor shall also be responsible to render the final surface true to line, level and plumb etc.

All building operations like construction of walls, concreting etc. shall have been completed before plastering is taken up. The plastering operation should be taken up only after the service pipes etc. that are to be embedded in the wall or ceiling are completed and suitably protected against erosion by other agencies and okayed by the Engineer-in-charge. Damage if caused to any of the existing fittings, fixtures, including doors and windows etc. during the plastering operation shall be made good by the contractor at his own cost.

If the surface which is to be plastered either internally or externally is out of plumb and not in line and level and if the plastering to be done is more than specified thickness to bring the plastered surface to perfect line and levels, in such specific cases, chicken wire mesh is to be provided by the contractor at his own cost and the plaster should be done to required line and level with no extra cost whatsoever. The finished plastered surface shall be free from cracks, fissures, crevices, hair cracks, blisterings, local swellings and flakings.

The finished surface shall be true to line, level, plumb & plain and durable. The adhesion of the mortar with the

background surface is of prime importance as this affects durability of plaster. Preparation of surface which has to take plastering is of great importance. Before starting the plastering work the surface should be got approved by the Engineer-in-charge.

In order to avoid the formation of deep and side cracks and for dispersion of cracks at the junctions between concrete surfaces and brick masonry work as also between junction of windows/door frames and brick masonry works, cautionary measures such as fastening and lapping of chicken mesh over the junction areas should be carried out over which the plastering work has to be taken up as required by the Engineer - in-charge.

The minute gap between window/door frames with cills and jambs should be filled up/caulked by plaster ofparis/epoxy putty/silicon sealants, Rubber based sealants (brand name TECHMAT/TECHCOAT) by caulking guns or by approved methods as instructed/approved by Engineer -in-Charge.

12.4 Grooves

The grooves shall be of required dimensions. The same shall be made to turn wherever necessary. The finish, inside, shall be of the same finish as that of the plaster. The lines of the grooves shall be well defined and rounded. The grooves are to be provided in plastering in internal and external surfaces and shall be paid extra in the rates given in schedule of quantities.

12.5 Mix Proportions

The mortar for plastering shall be of proportion as specified in the item schedule. The mixes specified in the schedule are volumetric.

12.6 Mixing

Cement and fine aggregates shall be mixed dry in the required proportions to obtain a uniform colour. Water shall then be added to get the required consistency for the plaster. Mixing shall be done mechanically. However, manual mixing will be allowed only in exceptional circumstances at the discretion of the Engineer-in-Charge. Manual mixing, where adopted, shall be carried out on a clean water tight platform. After water is added during mixing, the mix shall be held back and forth for 10 to 15 minutes. In machine mixing, the mixer shall run atleast five minutes after placing all the ingredients in the drum. Only so much quantity of mortar which can be used within half an hour after the addition of water shall be prepared at a time. Any mortar for plaster which is set or partially set shall be rejected & shall be removed forthwith from the site.

6 / 12 / 15 MM. PLASTER :

The plaster shall be laid with somewhat more than 12 mm. thickness and pressed and levelled with wooden ruler to a finished thickness of 12 mm. Straight edges shall be freely used to ensure a perfectly even surface. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Note: For 6mm plaster, approved bonding agent shall be used as per manufacturer's specifications, wherever specified in the Schedule of Items.

20 MM PLASTER :

The proportions of sand and cement shall be as specified and shall cover all irregularities, undulations, depressions due to chasing etc. in the surface to be plastered. The mortar shall be applied slightly more than 20 mm. thick and pressed and levelled with wooden ruler or straight edge to finished thickness of 20 mm. Straight edges shall be freely used to ensure a perfectly even surface. The finished surface shall be true and even and present uniform texture throughout and all joining marks shall be eliminated. All corners, edges and angles shall be made perfectly to line, plane and plumb. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Plastering items amongst all other things as described in various items also include:

i) Preparation of surfaces to receive the plaster, providing cement plaster of the specified average thickness and proportions with specified number of coats.

ii) All labour, materials, scaffolding, use of tools and equipment to complete the plastering work as per specifications.

iii) Curing for 10 days.

iv) Cleaning the surface of doors, windows, floors or any other surfaces where plastering might have splashed.

v) Finishing the portion of plaster left above the terrazo, plain cement tiles, ironite or any type of skirting work to be finished rounded or as directed by the Engineer -in-Charge, in a separate operation after laying of floor tiles skirting.

12.7 Neeru Finish

Wherever specified, the surface rendered shall be finished smooth with good quality lime neeru class 'C' conforming to I.S. 712-1956. The lime shall be tested in an approved testing laboratory for the chemical analysis of the lime and test certificate submitted regarding suitability of lime for plaster work. The cost of testing shall be borne by the contractor. Neeru shall be prepared at site out of best quality pure fat lime slaked at site with fresh water and slaked in accordance with the relevant I.S. code for slaking of lime. The slaked and sifted lime shall be reduced to a fine paste by grinding 150 turns in a mortar mill. Sufficient quantity, which can be used within 10 days only shall be prepared at a time. Chopped hessian or jute fibre in the required quantity may also be added to neeru and properly ground to pure paste as per directions of the Engineer-in-Charge.

An entire unobstructed area shall be plastered in one operation. Neeru shall be applied t o the prepared and partially set but somewhat plastic surface with steel trowel to a thickness slightlty exceeding 1.5 mm. (1/16") and rubbed down to 1.5 mm. It shall be polished to perfectly smooth and even finish working from top to bottom for at least 3 days. All corners shall be truly brought to desired lines and levels in the base plaster along and the thickness of neeru shall not exceed 1.5 mm., at these locations. Moistening shall be commenced as soon as the plaster has hardened sufficiently and is not susceptable to injury. The surfaces shall be kept sprinkled with water for 7 days to prevent excessive evaporation. On the sunny or wind -ward side of the building in hot dry weather, matting or gunny bags may be hung over on the outside of the plaster and kept them wet. If blow holes are observed in neeru plaster at any time during the contract period and during the defect liability period, the contractor will have to rectify the defective neeru plaster work including redoing of the white washing/colour washing/distempering work etc. as the case may be, entirely at his own cost. It shall be the contractors responsibility to ensure that cracks do not develop during the execution or subsequently during the defect liability period and the cracks if any observed shall be rectified including finishing, white washing/painting as specified, without any extra cost to the Department, to the entire satisfaction of the Engineer-in-charge.

12.8 Terol Finish of Terraco

Wherever specified, the surface rendered shall be finished smooth with 0.5 to 3 mm. thick coat of TEROL of TERRACO as per manufacturers specification. It shall be ensured that the surface to be covered is free of loose particles, dust, dirt, grease, oil and paint. TERROL shall be applied on top of f inished coat of plaster which should be levelled without any scratch/key marks. Adequate care should be taken that the first coat is levelled well to enable the thin layer TEROL plaster to give smooth finish, substrata/sub base should be moistened with water prior to the application of TEROL thin layer plaster.

1. **Mixing :** Put water into a clean empty drum. Add TEROL start stirring with paddle. Gradually add water and TEROL alternatively in the required proportion to get desired creamy consistency, convenient for application and stir continuously and ensure that no lumps remain. TEROL should not be allowed to stand without stirring for longer than 60 minutes. In normal condition let TEROL set for 5 minutes then stir and use. Where rapid drying conditions are prevalent, it is advisable to mix TEROL 20 minutes before using.

2. **Application :** TEROL is sprayed or hand applied and smoothened with a steel float. Smooth finishing shall be achieved with wooden floating or troweling when TEROL has set. The float should be moistened during the smoothening operation. Curing the surface shall be carried out after 24 hours of application at least for 4 days using light water spray.

12.9 Plaster of Paris (POP – $CaSO_4$, 1 / 2H_2O) Finish

Wherever specified, the wall / ceiling surfaces shall be finished smooth with approved quality Plaster of Paris (POP). POP shall be mixed in water for dehydration at site. Sufficient quantity, which can be used within half an hour only, shall be prepared at a time. POP shall be applied immediately after the under coat of cement plaster has set. An entire unobstructed area shall be finished in one operation. POP shall be applied on top of finished coat of plaster which should be levelled without any scratch/key marks to the prepared and partially set. It shall be ensured that the surface

to be covered is free of loose particles, dust, dirt, grease, oil and paint.It shall be applied with steel trowel to a thickness slightly exceeding 2 mm and rubbed down to 2 mm. It shall be polished to perfectly silk smooth and even finish working from top to bottom. All corners shall be truly brought to desired lines and levels in the base plaster along and the thickness of POP shall not exceed 2 mm, at these locations. If blow holes / cracks are observed in POP plaster at any time during the contract period and during the defects liability period, the contractor will have to rectify the same including redoing painting to match with the adjacent surface etc., all at his own cost to the entire satisfaction of the Engineer-in-charge.

12.10 Gypsum Plasters

12.10.1 Material

Requirement of premixed light weight gypsum shall be conforming to IS: 2547, Part-I &II latest revision. Product Package shall be ISI marked and material shall be got approved prior commencement of work. Physical and Chemical requirement, sample testing to be carried out as per the IS: 2547 Part I&II cost of all test shall be borne by contactor.

1.1. Surface Preparation for RCC: Smooth RCC surface to be hacked for bonding (50 hacks per Sq.Ft.).

1.1.1. Any mould oil (Release oil) or other agents presents should be washed.

1.1.2. Normal ballast concrete should be given sufficient time to cure prior to application of plaster.

1.1.3. Any kind of loose masonry, foreign material adhering to the surface to be removed.

1.1.4. Recommending to use bonding agents to avoid any issue of debonding.

1.2. Application Methodology: The powder should be mixed with clean water preferably in clean plastic buckets to avoid mixing with impurities.

1.2.1. Mix gypsum plaster powders to water ensure through mixing by help of mixing rod has to avoid formation of lumps and unmixed residues.

1.2.2. Material should be thoroughly mixed and free from lumps and impurities before use.

1.2.3. Water to plaster ratio should be as per manufacture recommended.

1.2.4. When the mix has begun to set it should not be further added with additional water or dry material.

1.2.5. Material should always apply above 6” from skirting level.

1.2.6. Can apply gypsum in the thickness range of 3.25 mm. However when applying gypsum plaster in thickness excess of 12-13 mm it has to be applied in layers of 10 mm each and not the whole thickness of 25-30 mm in one single layer.

1.2.7. Similar will be the application process for RCC columns and wall where it has to be applied in layers. However in ceiling it is not recommended to go beyond thickness of 13 mm even it applied on Bond IT or Hacked surface.

1.3. RATE: - Rate quoted shall be all heights and floors including cost of material, scaffolding, transporting, testing , labour and of additional thickness due to variation in plain and plumb etc.

12.11 Sand Faced Cement Plaster

12.11.1 General

Materials and preparation of surfaces and scaffolding etc. for sand faced plaster wherever applicable shall conform to specification laid down here-in-before under section cement plastering and the following specifications are also to be complied with:

12.11.2 Preparation of Surface

The surface to be plastered shall first be thoroughly cleaned down. All joints shall be raked out in case of brick work / stone masonry and closely hacked and wire brushed in case of concrete, **under the relevant masonry / concrete items.** The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be cement sand mortar of mix as specified in the schedule of quantities.

Double scaffoldings required for facility of construction shall be provided by the contractor at his own expenses wherever directed by the Engineer-in-Charge. Scaffolding shall be erected with pipes or ballies or bamboos of adequate strength so as to be safe for all the dead, live and impact loads likely to sustain by it during construction operations. The contractor shall take all measures to ensure the safety of the work and workmen. Any instruction of the Engineer-in-Charge in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to Government property or injury to persons, resulting from faulty scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach for workmen and supervisory staff to every part of the work. Ballies, bamboos etc. for scaffolding shall not be tied to the windows, doors, mulliions, ventilators etc. Any damage done to the windows, doors etc. shall be made good by the contractor to the original conditions at his own cost. For better safety, steel pipe scaffolding is preferred.

12.11.3 Workmanship

The surface to be plastered shall first be dubbed out with cement mortar to cover all irregularities and faces upto proudest part. The dubbing coat which shall be of proportion as specified in schedule and a 12 mm. thick (1/2") layer shall then be applied/scored and keys shall be formed on the surface by thoroughly combing it with heavy horizontal lines about 12 mm. (1/2") apart and about 3 mm. (1/8") deep when mortar has just set. The cement mortar for sand faced plaster shall have washed and approved sand with slightly larger proportions of coarse materials, but not exceeding 3 mm. The proportion of cement to sand shall be as specified in the schedule. The water is gradually added to make the mixture homogenous. The thickness of finishing coat excluding key shall be 8mm. (about 5/16"). After application the surface should be finished with a wooden float lined with cork closely pricked on with a wet sponge tapped gently to bring sand particles into prominence. The chajjas and any other horizontal portions shall be cleaned and set mortar that might have been fallen at the time of plastering at higher elevation, before plastering work is taken up. Junction of wall and chajja shall be rounded off simultaneously as directed by the Engineer -in-Charge.

12.12 Rough Cast Plaster

All materials shall conform to the standards already specified for plaster described above. The preparation of the surface to received the rough cast plaster shall be as described under sand face plaster. Rough cast plaster shall be carried out in two coats. First coat shall consist of 1 part of cement to 3 parts of clean sand or as specified otherwise. The finished thickness of the first coat shall be 12mm. and shall be laid by throwing the mortar (By using strong whipping motion) on the prepared surface with a trowel in a uniform layer but shall not be smooth. The second coat consists of 1 part of cement and 3 part of 6 mm. to 10 mm. down gravel all as approved by the Engineer -in-Charge. The gravel shall thoroughly be got cleaned with water removing all dirt and other organic materials. All these ingredients shall be mixed into a paste which shall be flung upon the first coat with large trowels to form an even protective coat. The second coat must be applied while the first coat is still soft and unset. The thickness of this coat shall be 10 mm. only. Due care shall be taken to avoid concentration of either large size or small size of gravel in one place. A sample of rough cast plaster shall also be got approved by the Engineer -in-Charge as regards the texture etc. before proceeding further with the work. All subsequent work shall generally conform to the approved sample panel. The finished work shall be cured for a minimum period of seven days.

General workmanship, scaffolding, preparation of surface, curing etc. shall conf orm to the specification already laid down under sand faced plastering.

The contractor shall take special care at the time of plastering or pointing to keep the m.s./aluminium window/wallspan etc. fixed by other agency in correct shape, position and to cov er the same with required hessian cloth/gunny bags to keep away from sprinkling of plasters/paint etc. The damage caused to the above if any, shall be made good by the contractor at his own cost.

12.13 Mode of Measurement

Area of plastering will be measured net and shall be paid for. The measurement of length of wall plastering shall be taken between walls or partitions (dimensions before plastering shall be taken) for the length and from top of the floor or skirting or dado as the case may be to the underside of ceiling for the height. All openings more than 0.1 sqm. shall be deducted and all jambs, soffits, sills of these openings if done, will be measured to arrive to the net area for payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. The rate shall include the cost of finishing all the edges, corners, cost of all materials, labours,

scaffolding, transport, curing etc.

The rate shall include the cost of finishing all the edges, corners, cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities. The rate for plastering should include the cost of work towards the following items for co -ordination with electrical item:

1. Neatly plastering around DBs, junction boxes, M.S. boxes etc. should be done and made matching with the wall finish after installation of electrical equipments.
2. All DBs, service boxes, covers etc. should be covered by a plastic cloth or other suitable cove ring materials such that water or materials should not splash the same during brick work and plastering work. This is to be done in such a way that electrical equipments as well as painted surfaces are not spoiled.
3. For fixing M.S. boxes, DBs etc. Thiyya should be given such that the required face of the M.S. box, DB covers etc. inline with final finished plastered surface.
4. The rate for the item shall also include rounding up of corner and angles making sharp corners and angles finishing around ceiling rose and electrical fittings etc. fixed by other agencies, finishing of top of dado and skirting (zad finishing), junctions of roof and wall or beam with the finish as specified in the item. Plastering of brick and concrete cornice and copings and plastering in restricted areas if any shall not be measured separately. Architectural bands and narrow widths of plaster over structural as well as non-structural and the line when prepared in the same thickness of plaster shall not be measured separately and shall be covered by respective plaster items.

12.14 Rough Cast Plaster

The area of surfaces actually plastered will be measured net and shall be paid for. The measurements of length and height of wall plastered shall be correct to a centimeter taken between walls or projections including the width of corner edge strips including the areas of grooves. All the openings more than 0.1 sqm. shall be deducted and all jambs, soffits and sills of these openings, if plastered will be measured to arrive at the net area for the payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. Corner/edges finishing will not be measured separately and the rate shall include the cost of finishing all the edges, corner strips in addition to the cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of BOQ.

CHAPTER – P.13 FLOORING WORKS

13.1 Cement Concrete Flooring

13.1.1 Scope of Work

The work covered under this specification consists of providing and laying at all levels and floors, flooring of different types, strictly in accordance with these specifications and relevant drawings.

13.1.2 Cement Concrete Flooring (Indian Patent Stone)

13.1.3 Materials

The specifications for materials, grading, mixing and the quantity of water to be added shall generally conform to their relevant specifications described under plain and reinforced concrete. The maximum size of coarse aggregate shall be 10 mm. The fine aggregate shall consist of properly graded sand. Concrete shall be mixed preferably by machine, and hand mixing shall be avoided as far as practicable.

13.1.4 Preparation of Base

The base concrete surface shall be thoroughly chipped to remove laitance, caked mortar, loose sand, dirt etc. cleaned with wire brush and washed clean and watered until no more water is absorbed. Where the base concrete has hardened so much that roughening the surface by wire brushes is not possible, the same shall be roughened by chipping or hacking at close intervals. The surface shall be soaked with water for at least 12 hours and surface water removed and dried before laying the topping. Before laying the concrete, cement slurry at 2.75 kg./ sqm. of surface shall be applied for better bond. Concrete flooring shall then be laid in alternate bays in pattern and joints, wide/ flush as per drawing. The edge of each panel into which the floor is divided shall be supported by wooden or metal strips duly oiled to prevent sticking. The panels shall be of uniform size and, unless otherwise specified, no dimension of panel shall exceed 2 m. and the area of a panel shall not be more than 2 sqm. However, the exact size of panel shall be decided by the Engineer-in-Charge to suit the size of the room. The joints in the floor finish shall extend through the borders and skirting/dado. The border shall have mitred joints at the corners of the room. Where glass/ aluminium dividing strips are proposed to be provided, the same shall be fixed in cement mortar 1:2 @ 600 mm. centres or as specified in the schedule for full depth of the finished floor. The depth of dividing strips shall be the thickness as proposed for the finished floor in the item. In the case of flush joins, alternate panels only may be cast on same day. At least 48 hours shall elapse before the concreting of adjacent bay is commenced.

13.1.5 Mixing

The topping concrete shall be of mix of one part of cement, two parts of sand and 4 parts of well graded stone chips of 10 mm. maximum size. The ingredients shall be thoroughly mixed with just sufficient water to the required plasticity, having water cement ratio not more than 0.4.

13.1.6 Laying

The free water on the surface of the base shall be removed and a coat of cement slurry to the consistency of thick cream shall be brushed on the surface. On this fresh grouted base, the prepared cement concrete shall be laid immediately after mixing. The concrete shall be spread evenly and laid immediately after mixing. The concrete shall be spread and levelled carefully. The concrete shall be completed and brought to the specified levels by means of a heavy straight edge resting on the side forms and down ahead with a sawing motion in combination with a series of lifts and drops alternatively with small lateral shifts, either mechanically or manually as directed by the Engineer-in-Charge. While concreting the adjacent bays, care shall be taken to ensure that the edges of the previously laid bays are not broken by carelessness or hand tamping. Immediately after laying the concrete, the surface shall be inspected for high or low spots and any needed correction made up by adding or removing the concrete and whole surface is again levelled. When the layer is made even, the surface shall be completed by ramming or beating and then screed to a uniform line and level.

Before the initial set commences, the surface shall be trowelled to smooth and even surface free from defects and blemishes and tested with straight edges. No dry cement or mixture of dry cement and sand shall be sprinkled directly or empty gunny bags spread over the surface of the concrete to absorb excess water coming on top due to floating.

13.1.7 Finishing the Surface

After the concrete has been fully compacted, it shall be finished by trowelling or floating. Finishing operations shall

start shortly after the compaction of concrete and shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be trowelled intermittently at intervals for several times so as to produce a uniform and hard surface. The satisfactory resistance of floor to wear depends largely upon the care with which trowelling is carried out. The object of trowelling is to produce as hard and close knit a surface as possible. The time interval allowed between successive trowelling is very important. Immediately after laying only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to work a layer rich in cement to the surface, some time. After the first trowelling, the duration depending upon the temperature, atmospheric conditions and the rate of setting of cement used, the surface shall be retrowelled many times at intervals to close any pores in the surface, and to bring to surface and scrap off any excess water in concrete or laitance (it shall not be trowelled back into the topping). The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface. Trowelling of rich mix of dry cement and fine aggregate on to the surface shall not be permitted. Trowel marks should not be seen on the finished surface.

Where broom finish is specified, after the concrete has been thoroughly compacted, and when most of the surface water has disappeared, the surface shall be given broom finish with an approved type of brass or M.S. fiber. The broom shall be pulled gently over the surface from edge to edge in such a manner that corrugation shall be uniform in width and depth, the depth shall be not more than 1.5 mm. Brooming shall be done when the concrete is in such a condition that the surface will not be torn or unduly roughened by the operation. Coarse or long bristles which cause irregularities or deep corrugation shall be trimmed out. Brooms which are worn or otherwise unsatisfactory shall be discarded.

After the concrete in the bays has set, the joints of the panels should be filled with cement cream and neatly floated smooth or jointed. Care should be taken that just the minimum quantity of cream for joint is used and excess spilling over the already finished surface shall be removed when the cream is still green.

In case of wide joints the same shall be filled with pigmented cement concrete (1:2:4) using approved pigment and the joint shall be finished in perfectly straight line.

13.1.8 Steel Trowel Finish

Areas where Marblex tiles are proposed to be used are required to have base concrete finished smooth by steel trowel.

13.1.9 Curing

The completed flooring shall be protected from sun, wind and rain for the first two days and movement of persons over the floor is prohibited during this period. The finished surface shall be covered and cured continuously form the next day after finishing, at least for a period of 7 days.

Bunding with murrum for curing is prohibited as it will leave permanent stain on the finished floor.

Curing shall be done by spreading sand and kept damp throughout the curing period of seven days minimum. The surface shall be protected from any damage to it whatsoever. The surface shall then be allowed to dry slowly. All corners, junctions of floor with plastered wall surface shall be rounded off when required at no extra cost.

13.1.10 Mode of Measurement

The rate for flooring and skirting shall be in square metre of the area covered.

The length and width of the flooring shall be measured net between the faces of skirting or dado or plastered faces of walls which is the proudest.

All openings in flooring exceeding 0.1 sqm. in area where flooring is not done shall be deducted and net areas only shall be measured and paid for. Flooring under dado, skirting or plaster shall not be measured for payment.

Nothing extra shall be paid for laying the floor at different levels in the same room.

The dimensions shall be measured upto two places of decimals of a metre and area worked out upto two places of decimal of a square metre.

13.1.11 General Note for all Tiling Works

Where the size of flooring files and height of risers, skirting or dado does not admit full size of other finished size

tiles, the tile(s) are to be cut / sawn to the required size and nothing extra shall be paid for the same.

13.1.12 Terrazzo / Cement Tile Flooring, Skirting/ Dado Etc.:

Mortars

Cement Mortar

This shall be prepared by mixing cement and sand in specified proportions given in schedule of quantities, in a mixer. Hand mixing will not be allowed.

Proportioning

The unit of measurement for cement shall be a bag of cement weighing 50 kg. and his shall be taken as 0.035 cum.. Sand in specified proportion shall be measured in box es of suitable size. It shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulkage which shall be determined as per IS specifications and as per the method given herein before.

Mixing

The mixing of mortar shall be done at site of work in mechanical mixer. Hand mixing, if permitted, shall be done as directed by the Engineer -in-charge.

Mixing in Mechanical Mixer

Cement and sand in the specified proportion shall be mixed dry Care shall be taken not to add more water than that shall bring the mortar to the consistency of a stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time. Mixer shall be cleaned with water each time, before suspending the work.

Hand Mixing

The measured quantity of sand shall be levelled on clean masonry platform and cement bags emptied on top. In hand mixing the quantity of cement shall be increased by 5% above the specified, with no extra cost to the Department. The cement and sand shall be thoroughly mixed dry by being turned over and over backwards and forwards several time till the mix is of a uniform colour. The quantity of dry mix which shall be used within 30 minutes shall then be mixed in thoroughly with just sufficient quantity of water to bring the mortar to the consistency of a stiff paste. Mixing of mortar on floor slabs or landings of staircase shall not be allowed.

13.1.13 General

Mortar shall be used as soon as possible after mixing and before it has begun to set, and in any case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work.

13.2 Materials

The terrazzo/ cement tiles for flooring and ski rting shall be hydraulically pressed under a minimum pressure of 140 kg./sqcm. and shall conform to I.S. 1237-1959 in respect of constituent materials, manufacture, shape, tolerances, wearing layers, colour, appearance, general quality of tiles, strength, resistance to wear, water absorption and other tests. The tile shall be nominal size and thickness as specified in the schedule for flooring, skirting, dado work etc. and shall be of approved make. Department shall be at liberty to inspect the manufacture of tiles even at the factory to ascertain whether the manufacture is as per the approved tiles for its quality of materials and manufacture. Tiles to be used for skirting and dado shall be semipolished before placing in position. Contractor shall submit samples for flooring and skirting tile for approval of the Engineer -in-charge. The Engineer-in-charge may direct new samples made with varying proportions, sizes and colour of terrazzo chips against varying base before conveying his decision about the approved samples. No claims will be entertained for rejected samples.

The contractor shall ensure the terrazzo finish as per approved sample for the entire qty. of tiles, by dry mixing of the cement, marble chips, powder, white cement, pigments etc. in the same proportions. For wearing layer of all tiles, the contractor shall use the cement from one consignment only to ensure uniformity in background colour/ shade.

If there is a doubt about the quality of the tiles, they shall be tested from each consignment as s pecified in I.S. 1237-1959 and cost of testing shall be borne by the contractor. Sample tiles after being approved shall be kept with the

Engineer-in-Charge for reference till the completion of the work. All tiles which are to be incorporated in the work shall strictly conform to the approved samples.

The tiles shall be stored in room or under such cover as will prevent exposure to dampness, sun, rain, accidental injury or staining. Tiles to be incorporated in the work shall be immersed in water for a minimum period of 6 hours before use.

13.3 Bedding/ Backing Coat

In case of flooring / skirting, the mortar bedding / backing shall be of cement mortar of specified thickness and mix as specified in the schedule of work.. All the ingredients of cement mortar shall be got approved by the Engineer-incharge before incorporating in the work.

13.4 Cleaning of Surface & Laying of Cement Mortar Bedding

Before laying the cement mortar bedding the concrete floor surface shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc. brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Until and unless the surface is approved by the Engineer -in-charge, the flooring shall not be started. A bedding of cement mortar (1:4 of specified thickness or more if required to make up the level or grade) shall be laid evenly and to the required slopes as directed. The terrazzo tiles shall then be laid immediately after laying the mortar. All tiles shall be truly and evenly set in a thick slurry of cement of honey like consistency applied to the sides and bottom and over the prepared base at the rate of 4.4 kg/sqm over such an area would accommodate about 20 tiles. The tiles shall then be tamped down with wooden mallet until they are properly bedded and exactly in true plane and line, with the adjacent tiles. Care shall be taken to ensure that the tiles are solidly bedded without voids and air pockets. All tiles shall be extended upto the unplastered surfaces of masonry walls/ RCC columns/ RCC walls. Wherever full tiles / half tiles can not be fixed, tiles shall be cut /sawn from full tile to the required size and their edges rubbed smooth to ensure a straight and true joint. The tiles shall be close jointed in matching cement slurry and the cement slurry oozing out through the thin joints shall be immediately wiped clean. The joints between the tiles shall not be greater than 1.5 mm. and shall be kept in straight lines or to suit the required pattern. The junction between wall plaster and tile work shall be finished neatly and without any waviness. All tiles shall be laid as to have continuous lines from various rooms to the passage. No change of lines shall be permitted at junction between rooms and passage. The joints shall be fine and made neatly indistinguishable by grouting of the joints @ 2.20 kg/sqm of grey cement slurry mixed with suitable colouring pigments to match with the tiles. People should not be allowed to walk over the freshly laid tiles.

Adjustment of levels in thickness of mortar bedding due to different type of flooring if any, shall be done by the contractor within a reasonable limit/distance as directed by the Engineer -in-Charge without any extra cost to the Department.

13.5 Curing, Polishing & Finishing

The day after the tiles are laid, all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5mm. and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shade of the topping of the wearing layer of the tiles.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be ground evenly with machine fitted with coarse grade grit blocks (No. 60). Water shall be us ed profusely with grinding. After grinding, the surface shall be thoroughly washed, remove all grindings, mud cleaned and mopped, and the joints opened out during grinding shall be grouted once again wherever necessary with matching cement. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit blocks (No. 120) and shall be grouted again the opened out joints with matching cement.

The final grinding with machine fitted with the finest grade grit blocks (NO.320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor as ordered by the Engineer-in-charge.

For small areas or where circumstances so required, hand polishing may be permitted in lieu of machine polishing after laying, entirely at the discretion of the Engineer -in-charge. For hand polishing, the following carborundum stone shall be used. The polishing shall be done in such a manner that there are no visible scratches on the terrazzo tiles. If scratches are observed, the tiles shall be removed and replaced by new tiles.

1st Grinding	Coarse Grade stone (No. 60)

2nd Grinding Coarse Grade stone (No. 60)

Final Grinding Fine grade stone (No. 120)

In all other respects, the process shall be similar as for machine polishing. After the final polish, oxalic acid crystals ground into powder shall be dusted over the surface (@ 2/3 1b per 100 sft. or 32.5 gm. per sqm.), sprinkled water and rubbed hard with Namdah" block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean. If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished.

The finished floor shall not sound hollow when tapped with a wooden mallet.

13.6 Terrazzo / Cement Tile Skirting

Terrazzo tile in skirting shall be of size as specified in schedule of quantities or as directed by the Engineer-incharge, hydraulically pressed and shall be obtained from the same source as for the terrazzo/ cement tiles for flooring. The design and shade of the skirting tiles shall be exactly similar to that of flooring tiles. The specifications for materials and workmanship shall be same as for flooring except that the skirting tile shall be laid against a 12 mm. thick backing of cement mortar 1:3 to the full height of skirting, thus allowing uniform projection beyond the plastered surfaces. In case of dado, the back of tiles shall be buttered with a coat of grey cement slurry/paste and edges with grey or white cement slurry/paste as the case may be, with or without pigment to match the shade of tiles and set in the backing/bedding mortar. Any cutting of brick work, concrete etc. required due to unevenness of brick surface shall be carried out at no extra cost to the Department to maintain this uniform projection beyond the plastered surfaces.

The skirting tiles shall be true in plane, line, level and plumb or in slope. The vertical lines of skirting tiles should be in line with that of flooring tile lines. The colour of the skirting tile and floor tile shall match. The undone portion of plaster work left above the terrazzo tile skirting work shall be finished round or as directed by the Engineer-incharge in the matching plaster. The item of plastering shall be inclusive of this plaster finishing above the skirting tiles, required to be done after laying of skirting tiles. No additional payment will be admissible for this extra operation.

13.7 Sampling and Test

Tiles required for carrying out tests described below shall be taken by "random sampling". Each tile samples shall be marked to identify the consignment from which it was selected. Minimum quantity of tiles for carrying out the test and frequency of test shall be as per IS : 13801. Cost of these tests shall be borne by the contractor.

Mandatory Tests	No. of Samples	Results
a) For conformity to requirements of shape and dimensions, wearing layer and general quality.	12 tiles	Concavity & Convexity shall not exceed 1 mm. Perpendicularity shall not exceed 2% of the length of edge.
b) For wet transverse strength test	6 tiles	Strength shall not be less than 30 kgf/cm2 of the edge.
c) For resistance to wear test	6 tiles	Average wear shall not exceed 3.50 mm and wear on individual specimen shall not exceed 4 mm.
d) For water absorption test	6 tiles	Shall not be more than 10%

13.8 Mode of Measurement

The length and / or width of the flooring / skirting / dado shall be measured net between the faces of skirting or dado or plaster faces of walls which is the proudest, and height of skirting / dado shall be measured from the finished level of floor. All openings exceeding 0.1 sqm. in area where tiling is not done shall be deducted and net areas only shall be measured and paid for. Flooring under dado, skirting or plaster shall not be measured for payment. Nothing extra shall be paid for use of cut tiles nor for laying the floor at different levels in the same room.

All dimensions shall be measured correct up to 2 places of decimal of a meter and area so worked out shall be correct up to two places of decimal of a sqm. for flooring, skirting, dado etc.

Note: Wastage in tile cutting to get the required dimension of rooms etc. as specified in drawing or as directed by the Engineer-in-charge shall have to be taken into consideration by contractor while quoting the rate for work to be measured as above. No extra claim on this account will be entertained.

13.9 Plain Cement Tile Flooring & Skirting

The specifications, mode of measurements etc. in respect of terrazzo tiles in flooring and skirting shall be applicable in general to plain cement tiles except that no marble chips & white cement shall be used in tile manufacture.

13.10 In-Situ Terrazzo Floors, Skirting, Treads of Staircase, Window Sills Etc.

13.10.1 Flooring

In situ terrazzo flooring, the underlayer shall consists of cement concrete mix 1:2:4 (the maximum size of aggregate used shall not exceed 10 mm.) the thickness of which shall be as specified in item of schedule of quantities.

The terrazzo topping shall consist of white cement or grey cement wherever specified in the schedule of quantity with or without pigment and marble chips of best approved quality, shade and grade all mixed in proper proportion as provided in I.S. 2114 and/ or approved by the Engineer -in-charge. The total combined thickness of the underlayer and topping shall as provided in the I.S. Specification and as specified and approved by the Engineer-in-Charge.

The floor surface shall be thoroughly cleaned of all dirt, dust, laitance and loose material, thoroughly wet with water and then smeared with cement slurry. Cement concrete under layer immediately be laid in regular bays not exceeding 1.5 sqm. in area or as directed and allowed to harden . The surface of screed shall be well scratched whilst it is not sufficiently hard to form key for terrazzo topping. 25 x 1 .5 mm. aluminium dividing strips or 3mm. thick glass dividing strips whichever specified in the item of schedule of quantities shall be placed to form bays as directed. When the screed has sufficiently hardened but not later than 24 hours, it shall be thoroughly cleaned down, washed with water and brushed over with neat cement slurry of about the consistency of thick cream. Terrazzo top layer shall then be laid in alternative bays in plastic condition, well troweled into position. Surplus moisture and cement slurry from surface shall be removed and allowed to set sufficiently hard to stand machine or hand grinding, thoroughly cleaned to reveal surface voids, and grouted with neat cement of the same tint as used in terrazzo. When dry and hard, machine grinding with grit blocks as per specifications for terrazzo tiles shall be done with 3 to 5 days between successive grinding during which the terrazzo shall be cured and grouted with neat cement of same tint, if required. The entire surface shall then be kept wet for at least seven days. The edges of treads and window sills shall have straight edges and corners properly rounded up. In case o f window sills, only top layers is covered under the relevant item and concrete base layer under RCC item. The window sills and treads of staircase shall be hand polished instead of machine polished.

Cleaning and applying oxalic acid shall be same as speci fied for terrazzo tile flooring.

13.10.2 In-Situ Skirting & Dado Etc.

In situ skirting and dado shall be as specified in the schedule of finishes.

The surface shall be prepared as per plastering work where required by the architects, the dado or skirting shall be sectionalised as for in situ floor. If shown and required, the junction of the floor and dado shall be rounded to a proper, neat and uniform round to the satisfaction of the Engineer -in-charge. After the work is complete, the surface shall be kept continuously wet for 7 days. Unless otherwise specified, skirting and dado shall match the floor.

Terrazzo skirting and dado shall consist of under coat of 1:4 cement - sand plaster of the thickness specified. This shall be laid simultaneously with the borders of the flooring and same joints as in the floor shall continue. The topping shall be terrazzo as per specifications for in-situ terrazzo flooring except that insitu polishing shall be done by hand to the satisfaction of Engineer-in-charge. 1 .5 mm. thick aluminium strip joint (wherever mentioned 3mm. glass strips shall be fixed) shall be provided in situ terrazzo in both direction or as directed. Care shall be taken to see that the terrazzo in skirting and dado matches the floors. The dado work in columns shall be done in one operation for the full height of the column. The shape of the finished surface shall be uniform for all such columns treated and checked for its accuracy during the progress of work.

13.10.3 Mode of Measurement:

Mode of measurement for cast-in-situ terrazzo flooring and dado shall be same as per terrazzo tile flooring and skirting.

The rate shall include all materials, curing, rounding of junctions, labour, scaffoldings etc..

CHAPTER – P.14 STRUCTURAL STEEL AND MISCELLANEOUS METAL WORKS

14.1 Scope of Work and Materials

1) The work under this Chapter include all labour, materials and equipment required for the supply, fabrication, and installation of various metal works as shown on the Drawings. The specifications contained in this Chapter are applicable for all steel/metal works to be carried out by the Contractor under this Contract. Furthermore, the Contractor shall install metal works supplied by others.

2) This Chapter covers the following items:

   a) Structural Steel frame works

   b) Roof trusses

   c) Steel Pipes

   d) Miscellaneous steel sections

   e) Watertight steel covers, frames, hatch covers and gratings

   f) Handrails

   g) Railing

   h) Ladders, handles, and climbing irons

   i) Steel rails

   j) Embedding/installing steel works supplied by others

3) Unless otherwise stated or shown, all steel rolled sections, plates and other steel items shall be fabricated from carbon steel sections, plates and bars complying with the requirements of IS: 2062- Steel for general structural purpose.

4) All black bolts shall comply with IS:1367-Technical supply conditions for threaded steel fasteners

5) All high tensile steel bolts shall comply with IS 3757- Specifications for high strength structural bolts. High tensile bolts, nuts and washers for use in galvanized structural steel work shall be galvanized or cadmium plated.

6) All threaded fasteners shall comply with ISO metric standards, normal series, coarse pitch

7) Unless otherwise stated or shown, all steel works shall be painted as specified hereinafter. Where specifically so stated, steelwork shall be hot-dip galvanised.

8) The Contractor shall be responsible for material quality control and shall ensure compliance of the metal works to the pertinent standards and these Specifications.

14.2 Submittals

1) The Contractor shall supply certificates of compliance with specified Indian Standards or other relevant standards for all materials supplied to the Works. Manufacturer's catalogues and samples of materials proposed for incorporation in the Works shall be submitted for approval, if requested by the Engineer-in-Charge.

2) From the information given in the Tender and on the Drawings, the Contractor shall prepare, prior to the manufacture, his own shop drawings showing sections and plans of all parts, assemblies, connections and supports, methods and sequences of erection proposed including temporary guys and bracing during erection and the number and type of equipments to be used, for all steel works shown on the Drawings. Two copies of each drawing, calculation sheet and Schedule of Materials shall be submitted to the Engineer-in-Charge for approval, not less than 28 days before start of proposed erection. Within 14 days from the submission, the Engineer-in-Charge will return such drawings either as approved or with requests for modifications. Within 7 days the Contractor shall revise the drawings, calculations and Schedules accordingly and return a new set (again in two copies) of these for the final approval. Works shall not be commenced, until approval is obtained from the Engineer-in-charge

3) After the final approval, the Contractor shall deliver soft copy, one transparency and two copies of the documents to the Engineer-in-Charge for his files.

4) The approval of shop drawings, calculations and erection methods shall not in any way relieve the Contractor of his responsibility and obligations under this Contract, particularly those relating to the adequacy and accuracy of the final product. Any materials ordered, or fabrication work performed, before the Contractor's drawings are approved will be at his own risk.

5) The Contractor shall not be entitled to any time extension based upon the rejection of his designs or detail drawings if these fail to conform to sound engineering practises or to the stipulations contained in these Specifications.

14.3 Fabrication

The fabrication, welding and erection of structural steel works shall be carried out in accordance with relevant Indian Standards and shall be performed by approved experienced specialized personnel of approved firms

1) Materials shall not be transported to the Site until all tests, analyses and final inspections have been made or certified copies of reports of tests and analyses or manufacturer's warranties have been approved. The tests specified in the standard specifications shall be carried out by the manufacturers of the materials or by an approved testing laboratory and certified copies of test reports shall be supplied to the Engineer-in-Charge. Materials for which test reports or certificates have not been approved shall not be used in the Works

2) When doubts exist as to the soundness of any part, such part shall be subjected to a non-destructive testing, if requested by the Engineer-in-Charge, which may include X-rays or gamma rays

3) All materials stored at the fabricating plant before fabrication and all fabricated materials shall be supported above the ground so as not to cause over-stressing, shall be protected properly from rust, and shall be kept free from water, dirt, grease, oil and other foreign matter.

4) Before being laid out or worked on in any way, rolled material shall be straightened and shall be cleaned of all loose rust and dirt. Material which shows signs of pitting caused by rust may be rejected.

5) Sharp kinks or bends will be cause for rejection of the material. If straightening is necessary, it shall be done by methods not likely to produce fracture or other injury. The metal shall not be heated without prior approval, but if approved, heating shall not be to a higher temperature than 650°C. After heating, the metal shall be cooled slowly

6) All cut edges shall be finished neatly. Corners shall be square and true unless otherwise shown on the drawings.

7) Welded splices that develop the full strength of the material being joined may be made at approved locations, but shall be kept to a minimum.

8) Unless otherwise approved or directed by the Engineer-in-Charge, no changes shall be made in any of the Contractor's drawings after they have been approved, nor any substitutions of sections having dimensions different from those shown on such drawings shall be made.

9) Before shipment, each member shall be marked with erection marks for identification and ease of erection and the Contractor shall furnish to the Engineer-in-Charge one transparency of an erection diagram showing the erection marks. Bolts, nuts and washers shall be suitably bagged and tagged to ensure their use in the correct place. Splice plates, cleats and other small pieces required for making field connections shall be temporality shop bolted to their members for delivery.

10) The work shall be shop fitted and shop assembled where possible, and shall conform to the details on approved Contractor's shop drawings.

11) Workmanship shall conform to the best modern shop and field practice. All joints and intersecting members shall be accurately fitted and all work shall be fabricated in true planes (to tolerances as provided on drawings or as specified) with adequate fastenings.

12) Plates and steel sections shall be perfectly straight with smooth surfaces. Edges shall be sharp, clean and without burrs after the cutting. Thick plates may be flame cut, provided that the material is not damaged and that the edges of the cut are ground clean or machined. Plates shall be cold-rolled. Correction of bent members by heavy blows shall be avoided. Special care shall be taken when hot-rolling becomes blows shall be avoided. Special care shall be taken when hot rolling becomes necessary.

13) All members shall be carefully and accurately assembled by welding, screws, bolts, or rivets as approved. The

joints shall be filled, milled, or machined as necessary to provide closed and perfect connections. All frames shall be provided with suitable bracing to maintain alignment during transport. Units shall not be subject to overstressing during transport and erection. Hammering which would injure or distort the members will not be tolerated.

14) All fastenings, anchors and accessories required for fabrication and erection of the work shall be provided. Exposed fastenings shall be kept to an absolute minimum evenly spaced and neatly set out. Wood plugs shall not be permitted.

15) The Contractor shall check the actual dimensions and shapes of existing concrete openings before fabricating steel frames and metal supporting parts of steel covers and gratings.

14.4 Connections

14.4.1 Bolted Connections

1) Bolted connections shall be made using black bolts and/or high strength friction grip bolts. Black bolts shall be either cold forged or hot forged swaged head bolts.

2) All holes for bolts, unless otherwise specified, shall be not more than 1.5 mm larger than the nominal diameter of bolts and drilled full size or, where permitted, punched 0.8 mm undersize and reamed to full size. Burnt holes punched full size will not be permitted under any circumstances. After assembly of the parts to be jointed, all holes shall be true throughout, perpendicular to the face of the member and aligned so as to permit the bolts to be positioned without damage to the threaded portion. Contacting surfaces of parts being jointed shall be free from distortion and all burns or ridges shall be removed

3) The length of each bolt shall be such that the threaded portion will project through the nut for at least one complete thread. The shanks of bolts used in bearing shall be of sufficient length to prevent a smooth bearing surface for the full thickness of parts being joined and no portion of the thread shall be within the thickness of the parts being joined.

4) At least one washer shall be placed under the nut.

5) Bolts in tension, and with their axis at an angle to horizontal, and bolts subject to severe vibration, and all bolts carrying hoist loads, shall be locked in position in a manner approved by the Engineer-in-Charge.

6) Black bolts shall be tightened so that the jointed parts shall be firmly drawn together using a standard ring spanner or a calibrated torque or pneumatic impact wrench. While black bolts shall be tightened as firmly as practicable by those means, care shall be taken not to overstress the bolts and the applied torque shall not exceed that recommended by the bolt manufacturer. In no case shall the bolt tension exceed 65% of the guarantied yield load of the bolt.

14.4.2 Welding

1) All welding shall be carried out by experienced welders using the shielded-arc method as described in the SP12 ISI Handbook for Gas Welders and ISI Handbook of Manual Metal Arc Welding for Welders.

2) Welding rods shall be of the heavily coated type designed for all position welding, and the size, type and manufacture of the rods shall require the consent of the Engineer-in-Charge.

3) All welding shall be continuous along the entire line of contact, except where tack welding is permitted. Bevelling of the materials shall be done as shown on the approved shop drawings and shall be finished to a smooth and true finish with an automatic gas cutter or grinder. The use of manual gas cutters shall require the consent of the Engineer-in-Charge.

4) The surface of the working materials shall be free from slag, moisture, rust, oil, paint or other impurities. Mill scale which cannot be removed with a stiff wire brush will be allowed to remain.

5) The face of welds shall be smooth and form a uniform bead. The size and thickness of weld shall neither be less than specified, nor there an excessive build-up or marked irregularities in the surface appearance.

6) Blow holes, slag, overlap, undercut and unsatisfactory melting of welded joints shall be removed with grinders or by other means and then rewelded. Due care shall be taken to protect the surrounding part from any injury or damage. Deformation of members resulting from welding shall be repaired by an approved mechanical method.

7) Steel which has been previously galvanised shall not be welded.

8) Welding of aluminium shall be done employing a "parent metal" or other approved filler rods. Surfaces which have been previously treated such as anodising shall not be welded.

9) The Contractor shall propose the type and carry out the non-destructive testing of the welds as approved. All joints which are to be watertight shall be tested by dye penetrant.

10) Shop welds shall be used wherever possible and the use of field welds shall be kept to a minimum. Unless otherwise approved field welds shall not be used where shop welds are shown on the drawings.

11) The Contractor shall be responsible for the control of distortion and the limiting of shrinkage stresses.

12) Steelwork which has been galvanised shall not be welded unless the galvanising is removed carefully by grinding before welding. When the galvanising has been removed for welding or damaged, the area affected shall be cleaned and coated with approved zinc rich paint or zinc metalizing.

14.5 Erection /Installation

1) The Contractor shall furnish all necessary equipment and shall erect the structural steel in accordance with these Specifications and approved shop drawings.

2) Structural steel members to be stored shall be placed on blocks so that no part of the members will touch the ground or be over-stressed and shall be kept clean and properly drained.

3) Proper allowance shall be made to compensate for shrinkage of field welds so that the structure will not be unduly stressed or correct alignment affected.

4) The Contractor shall set out lines and levels, and fix and maintain works for the erection and checking of positions of steel work. Arrangements shall be such that no allowable stresses shall be exceeded doing erections.

5) All temporary flooring, planking and scaffolding necessary for the erection work or the support of erection machinery shall be provided conforming to the applicable safety regulations.

6) The framing shall be carried out true and plumb, and temporary bracing shall be provided wherever necessary to take care of all excessive loads. Such bracing shall be left in place as long as required for safety. The steelwork shall be progressively inter-connected to take all dead, wind, and erection caused stresses in a secure manner.

7) Anchor bolts shall be positioned with a template before the concrete is placed to ensure that the anchor bolts are maintained in the correct position during the placing of concrete.

8) Hammering that will injure or distort the members will not be approved. The members shall not be over-stressed during the process of erection. Any error in the work which prevents proper assembling and fitting of parts shall be reported immediately to the Engineer-in-Charge, and his approval of the proposed method of correction obtained.

9) Erection in the field will be by bolting, high-strength friction grip bolting, arc welding or a combination of these methods, as shown on the drawings or directed. In bolted connections where black bolts are used, the bolts shall be drawn tight and, where directed, the threads shall be burred or spot welded so that the nuts cannot be loosened. Where high tensile bolts are required, the method of fabrication and assembly of the connections shall comply with the provisions of the Indian standards for friction type joints.

10) After erection, all temporary bracing and its connections shall be removed, holes plugged and the steelwork, including the protective coating specified, made good. All field bolting and welding shall be subject to inspection and any faulty work shall be removed and replaced by the Contractor upon requested by the Engineer-in-Charge.

11) All items of the miscellaneous metalwork shall be installed in correct position and alignment. Damaged or defective materials shall not be installed. Damaged or defective areas of paint or galvanising shall be cleaned and repaired as directed by the Engineer-in-Charge.

12) Metalwork to be embedded in concrete shall be located accurately and shall be held in correct position and alignment during concrete placing and setting of the concrete.

13) Unless otherwise provided, the anchor bolts shall be set and held in position before concrete is placed. Where it is impractical to embed anchor bolts or anchors for the comparatively light metalwork before the concrete is

placed, and where it is necessary to anchor parts but inserts or anchor bolts have not been provided, holes shall be drilled in the concrete and approved expansion anchors shall be installed. All holes for the anchors shall be straight and true to the diameter recommended by the manufacturer of the expansion anchors. If necessary, the Contractor shall use diamond bits to achieve true, fitting holes. When drilling water is used, surfaces of concrete permanently exposed shall be cleaned immediately to prevent discoloration by the drilling water and cuttings.

14) Supports and base plates shall be levelled or aligned accurately and rigidly secured in place. Adjustment with steel shims shall be done as necessary. All spaces under the supports or base plates shall be filled with concrete or shall be grouted as specified in the Chapter "Concrete".

15) Each complete unit shall be serviced and tested after installation. The servicing shall include lubricating, adjusting, cleaning all parts, and all other work and material required for operation. After each unit has been serviced, it shall be given an operation test, and adjustments shall be made until the operation of the unit is approved by the Engineer-in-Charge.

14.6 Painting

1) All metal components other than stainless steel, aluminium, embedded parts and those that are required to be galvanised, shall be prepared, primed and painted in the shop prior to erection.

2) All metal components other than stainless steel, aluminium, embedded parts and those that are required to be galvanised, shall be prepared, primed and painted in the shop prior to erection.

3) Paints used for both prime and finish coats shall be two component epoxy based, shall be obtained from the same manufacturer and shall be the best quality of their kind. They shall be suitable for application in environments where the relative humidity may exceed 90%. The Contractor shall submit samples of all paints he proposes to use to the Engineer-in-Charge for approval, who will select the colour of the finish coats.

4) Prior to painting, steel surfaces shall be sandblasted down to grade Sa 2 - ½ according to SIS Standard 055 900,to remove all mill scale, weld splatter, rust and any other deleterious material. Oil and grease shall be removed by an approved solvent. The surface shall be wiped clean of any dust prior to priming.

5) Immediately after cleaning, steelwork shall receive two coats of two component zinc epoxy primer, each of dry film thickness min. 0.04 mm, max. 0.06 mm per coat. Any primer applied surface that shows signs of rusting, flaking, powdering or peeling of the prime coat, or any finish coat, shall be sandblasted to remove the paint bare to the metal as described above and repainted.

6) After priming coat, steelwork shall receive an intermediate coat of 2-component epoxy micaceous iron oxide paint, dry film thickness min.0.06 mm. The intermediate shop coat shall be cleaned and lightly roughened before application of the finish coat.

7) Over the intermediate coat, a finish coat of 2-component epoxy paint or 2-component polyurethane paint, dry film thickness min. 0.06 mm, shall be applied. The finish coat shall be applied after the erection of the steel structure at its final location.

8) All painting work shall be carried out in accordance with the manufacturers recommendations in a clean dust-free environment with temperature and humidity controlled to comply with these specifications and the recommendations of the paint manufacturer. All the surrounding works shall be protected in a suitable manner from paint drops and overspray. All smeared and damaged surfaces shall be cleaned or repaired.

9) After erection of painted miscellaneous metalwork the Contractor shall make good any damage to the paint coating in accordance with the manufacturer's recommendations. The Engineer-in-Charge may require items which are badly damaged to be removed, returned to the shop and repainted.

14.6.1 Fasteners

1) Fasteners for miscellaneous metalwork including bolts, anchor bolts, cap screws and nuts shall be of mild steel unless otherwise stated or shown.

2) Studs and anchors for fixing metalwork to concrete shall be of mild steel and shall be of the expanding anchor type (e.g. Nelson or Hilti). Grouted or resin types shall require the consent of the Engineer-in-Charge

14.6.2 Anodising

1) All aluminium parts exposed to view shall have an anodising finish of uniform appearance and shall be free from marks and blemishes.

2) Sulphuric acid shall be employed as electrolyte for anodising unless otherwise directed. The coating thickness shall be 0.02 mm.

14.7 Miscellaneous Metal Works

14.7.1 Steel Pipes

1) The steel pipes shall be of specified diameters as shown on the Drawings or as directed by the Engineer-in-Charge.

2) Steel Pipes used shall be ERW (Electric Resistance Welded) of Steel grade Fe 410 as specified in IS 3589. The thickness of pipes shall generally be as below :

Outer Dia.	Thickness
219.1	4.5 mm
323.9	4.5 mm

Pipes of other diameters and with different thickness may also be required. Weight of the pipe shall be calculated as per Table 5 of IS 3589.

3) Pipes shall be carefully fastened and supported within the shuttering, in order to avoid any movement when pouring concrete.

4) Pipes not cast into concrete shall be adequately supported by galvanised mild steel holder bats or other approved means. The distance between pipe supports shall not exceed 2.0 meters.

14.7.2 Miscellaneous Steel Sections

The Contractor shall supply and install all small galvanised steel sections such as edge protection, angles, frames, bearing plates, brackets, beads at plastered corners, etc., of various dimensions. Bolts, screws, anchors and other accessories for interior or exterior purposes shall be included.

14.7.3 Watertight Steel Covers, Frames, and Gratings

1) The Contractor shall supply and install all watertight steel hatch covers, frames, gratings for cable channels, drains etc., as required by the Engineer-in-Charge or as shown on the Tender Drawings and specified herein. All items shall be fabricated according to shop drawings prepared by the Contractor in the course of Works.

2) Covers shall be manufactured from 6 mm steel checker plate with reinforcing steel sections where required, steel flats and lifting handles. Supporting frames shall consist of steel angles and welded steel flats provided with continuous watertight rubber seal. Frames shall be adjusted during installation to ensure a good fit and water tightness of the cover. The covers shall be placed flush with finished floors.

3) Steel gratings shall consist of 25 mm deep by 2 mm thick welded steel flats. Mesh size shall be 30x30 mm. Frames and steel sections as supports for gratings shall consist of steel angle or channel sections fixed in the concrete. Frames shall be adjusted during installation to ensure a good fit and even bearing for the grating. Gratings shall be placed flush with finished floors.

4) Steel covers, frames and reinforcing members for supporting gratings shall be painted as specified above in this Section. Gratings shall be hot-dip galvanised and shall be fixed to support platforms using stainless steel screws and fittings.

14.7.4 Handrails

1) The Contractor shall supply and install in the buildings handrails fabricated from galvanised steel pipes supported on welded steel flats and steel plates as shown on the Drawings and as specified herein. Material for steel pipes shall be of standard weight and shall conform to IS: 4736. All items shall be fabricated according to shop drawings prepared by the Contractor in the course of Works.

2) Handrails shall be installed following the slopes and in the positions shown on the Drawings and shall be supported to avoid movement when placing concrete in the blockouts. Handrails shall be painted as specified

above in this Chapter.

14.7.5 Railing

1) The Contractor shall supply and install steel pipe railings as shown on the Drawings. Railings shall consist of welded galvanised steel pipes conforming to IS: 4736. All items shall be fabricated according to shop drawings prepared by the Contractor in the course of Works.

2) Railings shall be installed indoor and outdoor, horizontal or inclined in the positions shown on the Drawings and shall be supported to avoid movement when placing concrete in the blockouts. Steel pipe railings shall be painted as specified above in this Chapter.

14.7.6 Ladders, and Climbing Irons

1) The Contractor shall supply and install ladders, and climbing irons fabricated out of steel flats and plain round bars as shown on the Drawings. Ladders may have protection cages whenever required for safety of personnel. Fixings and fittings shall be of stainless steel. All items shall be fabricated according to the shop drawings prepared by the Contractor in the course of Works.

2) Ladders, climbing irons and protection cages shall be painted as specified above in this Chapter.

14.8 Measurement and Payment

1) The rates quoted for Supply and installation by the Contractor shall be deemed to include the provision of all labour, plant and materials necessary for the following:

   a) Preparation and submittal of the shop drawings, calculation sheets, Schedule of materials, and providing catalogues about, and samples of the materials.

   b) Any testing required in approved laboratory or at site.

   c) Cost of materials, and fabrication of steel members assembly including cutting, bending, welding and surface/corrosion protection.

   d) Purchasing or manufacturing, including surface and corrosion protection

   e) Transporting to Site, and to the point of incorporation into works, including loading and unloading

   f) The provision of certificates of compliance with required standards, as specified

   g) Storing and protecting

   h) Erection and Incorporating into the Works, including all necessary fasteners, gusset, splice, and end plates fittings bolts, nuts, washers, weld metal, steel shims and accessories, formation of concrete blockouts, and casting the base mortar or concrete

   i) Servicing and testing of completed units

   j) Removal and replacement of all improper materials or faulty work if directed by the Engineer-in-charge.

2) Should the contractor choose to install heavier steel sections than shown on the approved shop drawings, due to whatsoever may be the reason, payment shall be made as per the sections indicated in the approved shop drawings only.

3) For installation by the Contractor of items of miscellaneous metal work supplied by others, only the relevant points in 2 above shall apply.

4) Measurement for payment for the supply and installation of all structural steel/metal works shall be made based on weight of works installed and assembled in accordance with the drawings or directions of engineer-in-charge.

5) Payment for the supply and installation of all structural steel and metal works shall be made at the appropriate Unit Price per unit weight entered in the Bill of Quantities.

CHAPTER – P.15 CONSTRUCTION AND REPAIR WORK OF ACCESS ROADS

15.1 Road Works

Construction and repair work of all the access roads to different components of the project shall be as per MoRT&H Specifications / relevant IRC Specifications . For concrete road pavement , the grade of concrete is M30.

CHAPTER – P.16 MONITORING INSTRUMENTS

16.1 Scope of Works

16.1.1 General

1. The Contractor shall supply, install, calibrate, test, survey and maintain instrumentation in the surface and underground works as specified in this Section or as directed by the Engineer-in-Charge. He shall supply and install all ancillary measuring equipment and construct protective surrounds for instruments, excavate pits and trenches, drill holes, install pipes and fittings, and cast concrete where required.
2. The extent, type, and location of the individual instruments are shown on the Drawings. The number and location of the instruments may be altered by the Engineer-in-Charge during the construction period, according to the requirements.
3. The contractor shall identify and propose an instrumentation vendor who shall supply, install, maintain instruments and monitor (take readings) the structures and prepare report on behalf of the Contractor.

16.1.2 Measuring devices and structures

1. The instrumentation for the dam comprises the following :
   a. Borehole Standpipe Piezometer in Dyke
   b. Rain Gauges
   c. AutomaticWater level measuring gauge / indicator
2. All instruments and accessories shall be suitable for operation at the project site. All steel parts shall be of hot dip galvanised steel, long-term protected against corrosion or of stainless steel of first quality.
3. The Contract Documents give only the numbers, general type, and general arrangement of the instruments to be supplied by the Contractor.
4. All instrumentation operating on electrical or hydraulic systems shall be accompanied by individual test certificates, and shall be tested in the presence of the Engineer-in-Charge prior to installation, unless specifically stated otherwise.
5. All instruments shall be installed to the lines and elevations shown on the Drawings or as established by the Engineer-in-Charge as the work progresses during construction.
6. The installation of instruments may interfere with the overall construction progress. The Contractor shall make provision for such or any such interference in his construction planning. He will not be entitled to any compensation or extension of the Time for Completion by reason of any such delays, including repair and replacement of damaged instruments.
7. No instruments or any of their components shall be purchased prior to Engineer-in-Charge's approval. However, approval by the Engineer-in-Charge of the Contractor's proposals and drawings or data shall not relieve the Contractor from his sole responsibility to meet all the requirements under this Contract.

16.2 Submittals

1) The contractor shall submit the following into his bid
   - The name of the instrumentation vendor who shall supply, install, maintain and monitor (taking readings, interpretations and preparation of reports) the instrument during the period of project execution along with evidence of the successful performance of the instrumentation proposed for installation.
   - The method statement on installation
2) Within 112 days after the day of receipt of the Notice to Commence, the Contractor shall submit further details of the instruments proposed for the installation. These shall be consistent with the general information on the instrumentation submitted by the Contractor with his Tender as well as with any modifications subsequently agreed to by the Engineer-in-Charge and the Contractor, and shall include:
   - Detailed description of all instrumentation, cabling and accessories including any ancillary measuring equipment he proposes to install

- Manufacturer's instructions for the installation, testing and operation of the instruments
- Details of the layout of all equipment and accessories to be installed in each switchbox and terminal structure
- Details of the terminal structures, concrete surrounds, recesses in concrete structures, etc. proposed for the installation of instrumentation and switchboxes

3) During the execution of the Works, the Contractor shall submit any further details regarding the instrumentation required by the Engineer-in-Charge. The Contractor shall prepare surveys and furnish "as-built" drawings for all installed instruments.

16.3 Skilled Personnel

1) The whole of the instrumentation work shall be carried out under the direct supervision of a senior supervisor, approved by the Engineer-in-Charge, and employed by the Instrumentation vendor who is well experienced in all types of instrumentation and installation work and who understands the purpose and function of all instruments being installed.

2) Installation and calibration of measurement instrumentation shall be carried out by skilled technicians, acceptable to the Engineer-in-Charge, well experienced in the installation of embedded instruments in hydro-projects and who have a thorough understanding of the purpose and function of the particular instruments being installed.

16.4 Installation

1) The Contractor shall install and calibrate all instrumentation conform to the supplier’s instructions and shall, where necessary, expose all partially installed instruments, cables and tubes to continue their installation, including carrying out all survey work required to locate such instruments. The Contractor shall tag all cables and tubes with identification tags approved by the Engineer-in-Charge to provide continuous identification.

2) Instrumentation shall be installed and calibrated in the presence of the Engineer-in-Charge, and when he considers it desirable, instruments shall be installed only during daylight hours. At all times, the Contractor shall ensure that adequate lighting is available, whether by natural or artificial means, to ensure proper execution of the work.

3) Cables and tubes shall be installed in the maximum lengths practicable. Splicing and coupling shall be performed in accordance with the manufacturer's recommendations. Calibration readings shall be taken prior to and immediately after splicing. Open ends of all incomplete lines of tubing and casing shall be kept plugged or sealed and the Contractor shall at all times during installation keep the insides of casings and tubes free from foreign matter. Cables and tubes shall be protected from mechanical damage. They shall be placed loosely at the base of the trench approx. 600 mm deep, protected above and below with 150 mm of stone-free material.

4) The instrumentation shall be put in operation at the earliest practicable period during construction in order to obtain information pertaining to the performance of the surface structures and underground works.

16.5 Care of Instrumentation

1) The Contractor shall protect all instruments and connections from damage and displacement during the progress of the work. If damage or displacement of the instruments or connections occurs during the progress of the work, they shall be repaired or replaced immediately by the Contractor.

2) The Contractor shall be fully responsible for the maintenance and repair of all instrumentation for the duration of the contract period.

16.6 Reading Instruments

1) An initial set of readings on all instruments installed at any particular elevation will be taken immediately after their installation, and the Contractor shall not place fill over the instruments or tubes or cables at this location until these readings have been taken.

2) The Contractor, after consultation with the Engineer-in-Charge, shall program his work and make all necessary arrangements to allow the reading of instruments as soon as possible after their installation. Such arrangements shall include, where necessary, the provision of temporary read out points.

16.7 Borehole Standpipe Piezometers

1) The Contractor shall supply and install standpipe piezometers in pre-drilled boreholes of the diameter and length, and in the locations shown on the Drawings or as directed by the Engineer-in-Charge.
2) Borehole standpipe piezometers shall consist of a plain PVC standpipe tube, of minimum internal diameter 30 mm and minimum wall thickness 3 mm, with either a ceramic piezometer tip or with only perforated tube sections, as shown in the drawings or as determined by the Engineer-in-Charge. The uppermost 3.0 m of the piezometers shall be protected by an outer galvanised mild steel tube. Piezometers shall be provided with a screw-on lockable cap for sealing the end, requiring the use of special tools for its release. A ventilation hole shall be provided.
3) Perforated piezometer sections shall contain 2 mm slots covering at least 5 percent of the piezometer surface area. In fine grained soils, an outer filter mesh of bronze or plastic shall be provided, where directed by the Engineer-in-Charge.
4) After piezometer installation, the borehole may require to be backfilled with sand and gravel filter of an approved grading. Sealing of the borehole with cement grout may be required at any depth.
5) Depth of the standpipe piezometer shall be of the order of 20 m.
6) Measurement shall be by water level sounder. Electrical probes or any other method approved by the Engineer-in-charge.

16.8 Water Level Measuring Gauge

1) The Contractor shall supply and install water level measuring gauge at locations as per drawings and as determined by the Engineer-in-Charge.
2) The height range to be covered by the gauges shall be about 15 metres.
3) The gauges shall be of enamelled ironware with melamine resin coating, and shall be subject to the approval of the Engineer-in-Charge. The principal division shall be in metres above sea level, which will be further divided into centimetres. The lettering shall be every 10 cm with large, clearly legible letters.
4) The Contractor shall set the gauges by accurate levelling from a designated benchmark. The gauges shall be fixed to the concrete walls by means of stainless steel expansion bolts (e.g. Nelson or Hilti).

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16.9 Accessories

16.9.1 Cables

Suitable cables shall be used to connect all electrical instruments to junction/switch boxes. Based upon the drawings showing layout of instruments and location of Observation room, the Contractor shall decide the optimum requirements of different types of cables and submit cable routing details for approval of the Engineer-in-charge.

16.9.2 Cable splicing Kit

Cable splicing kit shall be suitable to make a water resistant sealed joint between two cable ends of four-core cable properly gripping cable ends. It shall be of heavy-duty stainless steel construction and supplied with requisite amount of cable jointing compound.

Switch cum junction boxes for cabled instruments 10 position switch box suitable for connecting and switching inputs from up to 10 sensors to the readout unit/DAS. Switch box should be of aluminium die cast body protected to IP-65 with ‘O’ ring provided between the enclosure and the cover to prevent ingress of water.

16.9.3 Portable Readout Units

The Contractor shall supply portable readout units suitable to read digitally in engineering units all cabled instruments and store data with time and date. The readout units should be light, robust and durable.

16.10 Measurement and payment

16.10.1 General

1) The unit price entered in the BOQ against the relevant items shall include all cables , read out units , dial gauges and all accessories , etc. complete .
2) The Unit price for Instruments / Instrumentation shall include the supply, installation, calibration and testing. The Unit price shall include forming necessary temporary and permanent protection and maintaining easy access to all readout locations.
3) The unit price shall also include for the regular reading of the instruments and reports during construction till the completion and handing over to the owner. All the instruments/equipment along with all accessories in proper working order shall be handed over as required by Engineer-in-charge.
4) Payment Schedule for all instrumentation works shall be 50% on installation of the respective instruments and balance 50% on satisfactory performance of the respective instruments for a period of one year.

CHAPTER – P.17 STONE PITCHING/RIP RAP

17.1Description

This work shall consist of furnishing and placing a protective covering of erosion resistant material as stone pitching/riprap protection on the locations shown on the plans for slopes of dykes. The work shall be done in accordance with the specifications and conformity with the lines, grades, thickness, and typical cross-sections shown on the drawings. The terms stone pitching and riprap are synonymous for these specifications. The areas to receive slope protection of any kind shall be dressed smooth to the slopes or shapes called for on the plans and shall be free from stumps, organic matter, or waste materials. The basecourse under pitching stone/riprap shall be provided as shown on Drawings. Toe trench and/or base material is to be constructed as specified and directed by the Engineer-in-Charge. All materials, regardless of type or kind, shall be placed as per lines and levels called for on the Drawings.

17.2 Material

The stone for dumping and pitching shall consist of natural rock, quarried from approved locations. The stone for pitching shall be well graded within the limits as specified.

17.3 Construction Requirements

- **Excavation**

The bed for the stone pitching/riprap shall be excavated to the required depths and compacted, trimmed and shaped to the entire satisfaction of the Engineer-in-Charge or as shown on the plans.

- **Placing**

a) Toe Trench

The stone shall be set in a toe trench as shown on the Drawings. The toe trench shall be filled with stone of the same class as the one specified for the pitching/riprap, unless otherwise specified. All toe trenches and excavations shall be approved by the Engineer-in-Charge with firm sub-grade or base prior to placement of stones. Stones shall be placed so as to provided minimum of voids. Larger stones shall be placed in the toe trench and on the outside surface of the slope.

b) Slopes

Stones placed below water line shall be distributed so that the minimum thickness of the pitching is not less than the specified. Stones above the water line shall be placed by hand. They shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with ends in contact. The pitching shall be thoroughly compacted as construction progresses and the finished surface shall present an even, tight surface. Interstices between stones shall be chinked with rock spalls firmly rammed into place.

The surface of riprap placed above the water line shall not vary from the theoretical surface by more than 8 cm (3 inches) at any point.

c) Dry Stone Pitching/Riprap

The dry-stone pitching/riprap unless otherwise directed shall be started from ground level and shall be placed in layers manually or other methods approved by the Engineer-in-Charge, all to secure a stable mass. Surface irregularities of the slope shall not vary more than 8 cm (3 inches) along the intended slope. All interstices, hollows and inequalities between stones shall be filled with sand, small pieces and wedged up tight with spawl driven in with slight hammering to the satisfaction of the Engineer-in-Charge.

d) Grouted Stone Pitching/Riprap

Stone for this purpose shall, as far as practicable, be selected of the size and shape so as to secure fairly large, flat-surfaced stone which will lay up with a true and even surface and a minimum of voids. The stones shall be placed first and roughly arranged in close contact, the larger stones being placed near the base of the slope. The spaces between the larger stones shall be filled with stones of suitable size, leaving the surface smooth, reasonably tight, and conforming to the contour required. In general, the stone shall be laid with a degree of care that will ensure for plane surfaces a maximum variation from a true plane of not more than 3%. Warped and curved surfaces shall have the same general degree of accuracy as specified above for plane surface. As each of the larger stones is placed, it

shall be surrounded by fresh mortar and adjacent stones shall be shoved into contact. After the larger stones are in place, all of the spaces or openings between them shall be filled with grout consisting of one part of Portland Cement and three parts of the fine aggregates, with sufficient water to produce a plastic mix and the smaller stones then placed by shoving them into position forcing excess mortar to the surface and ensuring that each stone is carefully and firmly bedded laterally. Mortar shall not be placed in temperature lower than five degree C. During hot, dry weather the work shall be protected from the sun and kept moist for a minimum of 3 days after placement. Stones shall be kept wet during placing of the mortar. After the work has been completed as above described, all excess mortar forced up shall be spread uniformly to completely fill all surface voids. All surface joins shall then be roughly pointed up either with flush joints or with shallow, smooth raked joints. Weep holes shall be provided through the riprap cover as shown on the plans or as directed by the Engineer-in-Charge.

CHAPTER – P.18 SURFACE PENSTOCK

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18.1 Corrosion Protection for Penstock

18.1.1 General

The portion of the penstocks that is exposed (both external and internal surfaces) shall be protected against corrosion by proving suitable coating. This section provides for protective coating with a coating of primer followed by the application of enamel. Minimum requirements of a suitable coating for steel pipelines should comprise a relatively high melting point coating of known permanent low water absorption, resistance to product spillage and high electrical resistivity conforming to the relevant portions of IS : 10221.

18.1.2 Materials

The materials, for coating pipelines shall conform to those elaborated in IS: 10221.

18.1.3 Approval of Materials

Prior to use, samples of all materials proposed to be used under these specifications shall be submitted to the Engineer-in-charge for test and analysis and no material shall be used until it has been approved by the Engineer-in-charge.

18.1.4 Application to External Surface

18.1.4.1 Method of Application

Coating of known permanent low water absorption, resistance to product spillage and high temperatures shall be applied at the site. Coating and wrapping of specials and bends shall be done by a suitable method to be approved by Engineer-in -charge depending upon the location, site and local weather conditions.

General Procedure of Application

The procedure of application of the coating materials shall generally conform to the relevant portions of IS:10221.

Workmanship

All work shall be done in a thorough workmanlike manner. The entire operation of priming the pipe, heating and applying the coating shall be performed under the supervision of experienced men skilled in the application of protective coating.

Equipment

The equipment for cleaning, priming, coating and wrapping shall be in such condition as to permit the applicator to follow the procedure and obtain results prescribed in this Specification.

Cleaning

Pipe surfaces shall be thoroughly cleaned and dried before the primer is applied, and shall be free of dirt, grease, oil, rust, scale or other foreign matter. The pipe shall be cleaned preferably by sand or shot grit blasting or any other suitable approved methods. Before sand or shot grit blasting, all oil and grease, if present on the metal surface, should be removed by using a suitable solvent and clean rags. The use of dirty, oily rags should not be permitted. All other foreign matter which cannot be removed by blast cleaning should be removed by suitable means. The surfaces then should be thoroughly cleaned by blast cleaning and the operation should remove all scale, rust or any other superficial impurities from the surfaces exposing base metal presenting a greyish matte appearance except that slight shadows,

streaks, or discoloration caused by rust stains or mill scale oxides need not be removed. Blasted surfaces should be cleaned before the priming coat has been applied on this superficial rust by wire brush or emery paper at the discretion of the Engineer. If the rust formation is heavy, that is if the pipes have been exposed overnight without priming, the same shall be re-blasted once again at the discretion of the Engineer. Adequate moisture separators should be used so as to remove effectively oil and moisture from the air supply of the blasting unit.

After cleaning the pipes shall be protected from and maintained free from all oil, grease and dust that may fall on the pipes from outside sources till the pipe has received its final coat of enamel. Any ferrule, that show deep pitting after blasting has been done, should be set aside pending examination by the Engineer for approval or for re-conditioning or rejection.

Priming

One uniform coat of primer, compatible with the type of enamel to be used and free from floods or runs, shall be applied immediately after pipe has been cleaned and dried. Primer coverage shall be such as to ensure maximum bond between the steel surface and the enamel coating. Atmospheric conditions, type and coverage of primer shall determine the drying time. If the primer coat is found to be unsatisfactory, the pipe shall be re-primed.

Coating

Thickness of coating shall be corresponding to extreme degree of corrosivity as specified in IS:10221. The primed pipe surface shall be free from moisture or any foreign matter immediately prior to the application of the hot coating. When the enamel has reached application temperature it should be applied to the primed pipe through a standard flood box. Enamel should not be applied to the primed pipe when the pipe metal temperature is below 7º C.

Electrical Inspection

All coated pipes shall be tested with an approved high voltage holiday detector equipped with a positive signalling device to indicate any faults, holes, breaks or conductive particles in the protective coating. The procedure of electrical inspection shall generally conform to the relevant portions of IS: 10221.

18.1.5 Interior Surface of Penstock

All interior surfaces of the Penstock shall be protected against corrosion. The Contractor shall furnish, prepare and apply all materials for cleaning, primer coating and painting of the liners. Cleaning, primer coating and painting may be performed to the penstocks subject to the approval of the Engineer, provided that the completed coatings shall in all respects conform to the detailed requirements of these Specifications at the time of Taking Over by the Employer.

Primer and coal tar epoxy: Before the application of Zinc rich primer the surface shall be cleaned by surface blasting to SA 2½ quality of Swedish standard or to any approved equivalent. Over the prepared surfaces, two coats of Zinc rich primer with epoxy resin, containing 90% zinc on the dry film shall be applied; each coat providing a dry film thickness of at least 25 microns. This shall be followed by application of two coats of coal tar epoxy paint; each coat providing a dry film thickness of 100 microns. The total dry film thickness of all the four coats shall not be less than 250 microns. Workmen skilled in the trade shall perform the application of zinc primer and epoxy paint and related operations under experienced supervision.

Purpose : Internal surfaces of Penstock, Bends and Bifurcations.

Surface Preparation : Dry blast clean according to ISO 8501-1 or Sand blasting (SA

2 ½ of Swedish standard)

Prime Coat : 2 x zinc rich primer

Dry film thickness: Nowhere less than 0.050 mm

Intermediate Coat - 1 x coal tar epoxy Dry film thickness: Nowhere less than 0.150 mm.

Finishing Coat :1 x coal tar epoxy.

Dry film thickness: Nowhere less than 0.150 mm.

Total Thickness (DFT) : 0.350 mm.

18.1.6 Repair of Primer And Finish Coats

For touching up, the same paint shall be used as for the original painting work. Repaired finish coats shall be of identical appearance with the original and no difference in the colour shall occur. Severely damaged coatings may be removed and repainted as per requirement of Engineer.

18.1.7 Quality Control

The minimum dry film thickness prescribed in these Specifications shall be observed. For each 100 m2, one area of 10m2 will be measured for dry film thickness. No measured thickness shall be less than the specified thickness.

Where the minimum thickness is not achieved, the coat shall be re-applied to reach the specified minimum dry film thickness as per the Specification.

The dry film thickness shall be measured by approved gauges, and the cost of two new electronic gauges shall be included in the Schedule of Prices Incidental Services for the use of Engineer.

For checks on porosity, the Contractor shall furnish a D.C. variable high-tension test instrument with built-in pore counter. The test voltage shall not exceed 2000 V. The tests shall not be performed within 0.5 m distance from uncovered, corrosion resistance surfaces.

Upon completion of each coat, the painter shall make a detailed inspection of the painting finish and shall remove from all adjoining works all splattering of paint material. He shall make good all damage that can be caused by such cleaning operations.

A detailed inspection of all painting work shall be made, and all abraded, stained, or otherwise disfigured portions shall be touched up satisfactorily or refinished as required to produce a first-class job throughout and to leave the entire work clean and acceptable condition.

CHAPTER – P.19 HYDRO MECHANICAL WORKS

TECHNICAL SPECIFICATIONS FOR RENOVATION, MODERNIZATION AND UPGRADATION OF INTAKE GATE INCLUDING TRASH RACK , DRAFT TUBE GATES , PRESSURE RELIEF VALVE (PRV) GATES AND THEIR HOISTING ARRASNGEMENTS

19.1 Scope of Work

These specifications cover the requirements of replacement, repairing, renovation, re-alignment, painting, replacement of worn out parts, concrete chipping/grouting and successful testing of the following equipments :

Intake fixed wheel gate (Face III) of size 3.96m X 3.96m: Gate leaf inspection/ repairing, replacement of wheels, seals and greasing of wheel bearing, inspection and repairing of embedded parts, replacement of existing hoist (mechanical and electrical) with new Rope Drum Hoist without hoist bridge, provision of hoist support structure , construction of shed over Rope Drum Hoist , replacement of gate seals, adjustment of limit switches including testing for its smooth functioning , dry as well as wet testing the operation of gate, painting of gate, hoist support and hoists.

Trash Rack for Intake: Inspection and replacement of existing trash rack with new one and painting, testing for its smooth functioning.

Draft tube gates 5.50 m X 2.30 m: Gate leaf inspection/ repairing; dismantling, cleaning replacing worn out parts ,i.e., bearings , seals etc., reassembly of wheel assembly; inspection and repairing of embedded parts , provision of steel hoist supporting structure , provision of Automatic lifting beam , provision of dogging / latching arrangements for gates with all accessories , replacement of gate seals including fasteners, adjustment of limit switches including testing of for its smooth functioning; dry as well as wet testing the operation of gate,

PRV gate 2.0m X 2.0m: Gate leaf inspection/ repairing; dismantling, cleaning replacing worn out parts i.e. bearing seals etc., reassembly of wheel assembly; inspection and repairing of embedded parts, provision of Automatic lifting beam , provision of dogging / latching arrangements for gates with all accessories , replacement of gate seals including fasteners, adjustment of limit switches including testing of for its smooth functioning; dry as well as wet testing the operation of gate,

Dry as well as wet tests are to be carried out by the supplier/contractor. Any defect noticed during testing or during the guarantee period (not less than 12 months) is to be removed by the supplier/contractor free of cost.

The contractor, when ordered in writing by the purchaser, shall perform extra work in furnishing material not covered by the specifications or included in the schedule but forming an inseparable part of the work contracted for. Extra work and materials will ordinarily be paid for at lumpsum or unit price agreed upon by the contractor and the purchaser as stated in the orders. Whenever in the judgement of the purchaser it is impracticable because of the nature of work or for any other reason to fix the price in the order, the extra work and material shall be paid for at actual cost as determined by the purchaser plus 10% allowance for superintendence, use of tools, tackles and shop etc.

19.2 Wastage of Steel

The wastage of steel sections, received from main producers, shall not be compensated to the contractor under price variation clause. The price variation will be reimbursed for the net weight of gates based on the sectional unit weight as per the table of standard sections (supplied by SAIL) and used in the gates. The weight of nuts, bolts, rivets, welding, etc. will not be considered in the net weight of the gates. All the wastage of steel sections supplied by the main producer will be at contractor's account and the contractor should consider this aspect while quoting the rates.

19.3 General Requirements

The tenderers shall carefully study the technical specifications and drawings and shall intimate the purchaser in case any error/omission is discovered. As a result of such interaction, if some corrections/ modifications are required, the same shall be brought to the notice of all the tenderers before the date of submission.

19.3.1 Drawings and Data to be Furnished by the Tenderers

While submitting the 1st part of the tender, each tenderer shall also append the following technical information/drawings:

(i) Preliminary designs and layout drawings for the equipment under scope of supply along with layout drawings indicating overall dimensions and weights of various components.

(ii) Type, size, make and ratings of various bought-out items proposed to be used. Details of various equipment, machinery and skilled personnel available with the tenderer/ his subcontractor.

(iv) Details of similar work executed by the tenderer/ his subcontrractor along with the copies of completion certificate for the same.

In case the tenderer proposes to make major changes in the design or arrangement of the equipment to be furnished under these specifications, the tenderer shall submit with his tender documents the drawings and the design calculations of his arrangements. The drawings shall be complete and give proposed changes in details. Acceptance of alternate proposal of the tenderer is not binding on the part of purchaser.

19.3.2 Drawings and Data to be Furnished by the Contractor

Within 30 (Thirty) calendar days after signing the agreement of the contract, the contractor shall submit to the purchaser for approval, the detailed proposal as per site requirement. In case new structural parts are to provided, three sets of detailed drawings of the various parts along with the computations to demonstrate fully the designs (including hoist capacity calculations) and show that the apparatus to be furnished conforms to the provision and intent of these specifications. The drawings or accompanying data shall show the specifications of the heat treatment where used. All drawings submitted will form a part of the contract. The sequence of submission of drawings will also form a part of the contract. The sequence of submission of all drawings shall be such that all information are available for checking each drawing, when it is received. The purchaser will return a copy of each drawing to the contractor marked either ‘approved’, ‘approved as noted’ or ‘returned for corrections’. The notation ‘approved’, ‘approved as noted’ shall authorise the contractor to proceed with the manufacture of the equipment covered by such drawings subject to the corrections, if any noted thereon. When prints of drawings have been returned for correction, the contractor shall revise the drawings as necessary and shall resubmit fresh prints for approval in the same routine as before. Any fabrication work performed prior to the approval of drawings will be at the contractor's risk. The purchaser shall have the right to ask the contractor to make changes in the design, which may be necessary in the opinion of the purchaser to make the equipment conform to the stated provisions and intent of the specifications, without any additional cost. Approval by the purchaser of the contractor's drawings shall not be held to relieve the contractor of any part of the contractor's obligation to meet all the requirements

of these specifications or the responsibility for the correctness of designs and drawings. The contractor shall furnish five complete sets of the prints of the final corrected assembly drawings of the various parts as per the opinion of the purchaser which may be required for erection, maintenance and repair, identification of parts and for making or ordering replacement of parts. The drawings shall show all changes and revision made up to the time that the equipment is completed and ready for despatch.

The design calculations shall be prepared by adopting the best engineering practices and shall be clear and easily understandable. All relevant references quoted in the calculations shall be supplied alongwith the design. Views of purchaser for any procedural dispute regarding practices to be adopted in the design shall be binding on the contractor and he will have to modify the design based on that, if warranted at no extra cost whatsoever.

19.3.3 Schedule and Progress

Within 30 calendar days after the receipt of approval of drawings/ proposal, the contractor shall submit to the purchaser for approval the schedule of restoration of the equipment so as to ensure its delivery within the specified period. The schedule shall clearly state all the stages of dismantling, repairing and reinstallation to enable the purchaser to plan his power plant running accordingly as stated in these specifications. The contractor shall also (during the course of fabrication) submit a monthly progress report along with photographs of work done to the purchaser, apprising him of the progress of equipment for the preceding month.

19.4 Delivery Period

Time of delivery at the project site is important and the supplier shall abide by the following time schedule, the time being reckoned from the date of approval of the drawings.

1	Dismantling the intake gate, PRV gates and draft tube gates	As shown in the Construction Schedule attached
2	Inspection and repairing of embedded parts, welding of seal seats, guide and roller track of intake gate, PRV gates and draft tube gates. Reparing of concrete.	-------Do---------
3	Repairing, greasing, replacement of worn parts, replacement of hoists, seals of intake gate, PRV gates and draft tube gates.	-------Do---------
4	Paint removal, cleaning of surfaces by sand blasting and repainting including applying of primer on gate leaf, exposed embedded parts, hoist support and hoist components intake gates, PRV gates and draft tube gates.	-------Do---------
5	Inspection and lubricating the wire rope, greasing, replacing of gear oil, testing of hoist, dry and wet testing, realignment etc. of intake gates, PRV gates and draft tube gates.	-------Do---------

19.5 Warranty

The contractor shall furnish warranty of the equipment for a minimum period of one year from the date of the acceptance of equipment or commissioning whichever is earlier. The contractor shall guarantee among other things the following items:

a. Quality and strength of the materials used.

b. Satisfactory operation of the equipment.

c. Safe stresses in all parts under all conditions of operation.

d. Protection of equipment against vibration and corrosion.

The contractor shall correct, at his own expense the defects if any, during the warranty period. The contractor shall assume all responsibility for direct damages causing personal injury or property damage caused by any manufacturing defect under these specifications.

19.6 Materials

The material required including bought out items are under the scope of the contractor. All the materials to be used for renovation of hydo-mechanical equiments shall be of tested quality, new, unused, free from defects and of the grade/classification envisaged in the designs. The contractor shall furnish the test certificate for each lot of material, if so required by purchaser. Plates with laminations discovered during welding or during inspection shall be rejected. Materials not supplied according to the approved designs/drawings shall be rejected, removed and replaced. Approval of purchaser shall not relieve the manufacturer of the responsibility of supply of suitable materials. All the bought out items shall be of standard quality and of BIS approved quality whereever applicable. Latest BIS codes shall be applicable.

Recommended materials for main components are given below:

Sl. No.	Component/Part	Recommended materials	Reference
1.	Skin plate	Stainless steel	IS :1570

Sl. No.	Component/Part	Recommended materials	Reference
			(Part V)
2.	All other structural members such as, Stiffeners, Horizontal Girders, arms, bracings, thrust blocks, trunnion girders, load carrying anchor flats, trunnion brackets, hoist connection brackets, sill beam ,wall plates seal seat bases, seal clamps, guides, etc	Structural Steel	IS:2062
3.	Trunnion pins, roller pins, lifting pins, etc.	Stainless Bronze	IS:1570 (Part-V)
4.	Seal seats	Stainless Steel	IS:1570 (Part-v)
5.	Guide rollers, trunnion hubs	Cast Steel / Forged Steel	IS:1030 IS:1875
6.	Seals	Natural or synthetic rubber	IS:11855
7.	Screws/Bolts for seals	Stainless Steel	IS:1570 (Part-v)

In all the reference cited above the latest revised edition of Indian Standard or equivalent shall be followed. Decision regarding adopting particular equivalent standard/ make shall be made by the purchaser or their authorised consultants and shall be binding on the contractor.

19.7 Manufacture

All the works shall be performed and completed in a thorough workman-like manner as per the best modern practice in vogue in the manufacture and fabrication of equipment of the type covered by these specifications. The work shall in all cases be of high grade and carefully performed to the satisfaction of the authorised representative of the purchaser. The contractor shall warrant all materials and workmanship furnished by him to be free from injurious and defective materials or workmanship and shall bear all cost of the repair in case of any error for which he is responsible. Workmanship shall conform to the relevant standards laid down by the Bureau of Indian Standards. All sharp corners, which can damage the matching parts, shall be rounded and chamfered.

19.7.1 Tolerances

Where tolerances or fits are not specified on the drawings, the contractor shall follow the best modern shop practices for apparatus of the type covered by these specifications and drawings, due consideration being given to the special nature of function of the parts and to the corresponding accuracy required to secure proper operation.

19.7.2 Machine Finish

Where finished surfaces are not specified on the drawings, the type of finish, shall be that most suitable for the part to which it applies and shall be as per IS:3073 (latest edition). A smooth finish (two delta, i.e., 1.6 to 6.3 microns) will be required for all surfaces in sliding or rolling contact and for surfaces in permanent contact, where a tight joint is required. A finish (single delta , i.e., 6.3 to 18.0 microns) shall be given to all other machined surfaces where selective assembly for matching parts is specified on the drawings or otherwise required. The parts shall be ground, if necessary, to obtain the limiting tolerances.

19.7.3 Castings

While making patterns for the castings, care shall be taken to avoid sharp corners or abrupt changes in cross section and ample fillets shall be used. All castings shall be true to patterns and the thickness of the metal shall not vary at any point by more than 5 mm from that shown in the drawings. Care shall be taken in the foundry to cool the castings properly so that they will not warp or twist. No casting will be accepted if it is warped or twisted to such an extent that machined surfaces cannot be properly finished to the dimensions shown on the drawings. All castings shall be sound, clean, and free from cracks, holes or sand holes and other defects. These shall have a workman like finish. Castings shall not be repaired, plugged or welded without the permission of the purchaser. Such permission shall be given only when the defects are small and do not affect the strength, use or machinability of the castings. No welding shall be done after the castings are finally annealed. No defect shall be removed and paint or oil shall not be applied

to the surface of any casting until the purchaser or his authorised representative has inspected it. The treatment for casting involves heating slowly upto a critical temperature, holding it at the temperature just only long enough for a uniform temperature to be attained throughout the casting and then allowing it to cool slowly in furnace. During the process the requisite annealing temperature shall not exceed and over heating shall be avoided. End products shall conform to the requirements of relevant Indian Standards. All castings shall be ultrasonically tested to ascertain their soundness. Acceptance criteria as specified by purchaser shall be binding.

19.7.4 Forging

All forging shall be done in accordance with the latest practice and shall exhibit physical and chemical properties envisaged in the corresponding Indian Standards. Only those forging shall be used whose working is well known without doubt.

19.7.5 Fabrication of Structural Steel

The contractors are supposed to perform fabrication in the best possible manner to meet the requirements of designs and drawings. However, some specific guidelines are given herein.

19.7.6 Straightening of Members

Before being laid off or worked in any manner, structural steel shall be straight, without twists, bends or kinks, and if straightening is necessary, it shall be done by a method which shall not injure the metal to ensure good welding and fittings of members. All steel shall be cleaned of dirt, mill scale and rust prior to fabrication.

19.7.7 Shearing, chipping and Gas cutting

Shearing, chipping and gas cutting shall be performed carefully and all portions of the work, which will be exposed to view, shall present a neat appearance. Finishing of sheared or cut edges of plates or shapes will not be required except as noted in these specifications.

19.7.8 Edges to be welded

The edges of plates and shapes to be joined by welding shall be properly formed to suit the type of welding selected. Where plates and shapes have been sheared, edges to be joined by welding shall be machined or chipped to sound metal. Plates and shapes to be field welded shall have their edges prepared in the shop for the type of weld selected.

19.7.9 Bent Plates and Shapes

Where bending or forming of plates or shapes is required, the plates or shapes shall be bent by cold forming. Heating and hammering to correct bends will not be permitted.

19.7.10 Welding

a. Welding Technique

Care shall be taken in designs that the welds when being made, are well accessible. Overhead welding is to be avoided, if possible and flat position is to be strived for.

Drawings should clearly indicate the joint position, shop or field welding, kind of welding, method of welding, welding sizes and other required points. Symbols to be shown on the drawing should conform to relevant Indian Standards.

All welding shall be done by the electric arc method by a process which will exclude the atmosphere from the molten metal, except where otherwise specifically permitted. All welding electrodes required shall be furnished by the contractor. Correct selection of electrodes shall be done taking due care of welding method and base metals of components. The welding electrodes shall be of the heavily coated type designed for all position welding. The make, type and size of all welding electrodes shall be subject to the approval of the purchaser.

In assembling and during welding the component, parts of built up members shall be held in place by sufficient clamps or other adequate means to keep all parts in proper position. The surface to be welded shall be cleared of scale, slag, rust, paint, and other foreign matter, except that thin coat of linseed oil need not be removed before welding. Where weld metal is deposited in two or more layers, each layer shall be brushed with a wire brush or otherwise cleaned before the subsequent layer is deposited. In welding, precautions shall be taken to minimise stresses due to heat by using the proper sequence in welding.

Upon completion, the welds shall be brushed with wire brush and shall show uniform section smoothness of weld metal. Edges and ends of fillets and butt joint welds shall indicate good fusion and penetration into base metals. Specific requirements for butt joints and fillet joints are given below. Radiographic tests shall be carried out for all critical full strength butt welds. Welded joints requiring radiographic testing shall be decided by the purchaser.

(i) Butt Joints

In principal butt joints should be made with back run. The joints in the skin plate shall be staggered & preferably located near the point of contraflexure .The edges of skin plate shall be prepared in shop. Skin plate of joined by butt welding shall be without any back plate so as to facilitate radiography. Joints, if required in horizontal girders and hoist bridge girders shall be located sufficiently away from location of maximum bending moments. They shall also be butt welded in such a way as to facilitate radiographic testing of welded joints .

(ii) Fillet Joints

All fillet welds shall be continuous. For the main members, no fillet welding should be made on members whose thicknesses differ substantially. Fillet weld at 'T' Joints should be made, as a rule, on each side of the joint, unless it is otherwise agreed due to some practical reasons. All fillet welds shall be checked by dye penetrant test for soundness.

b. Qualification of Welding Process

A specification of the welding process, that is proposed to be used, shall be established and recorded and, if required, a copy of such specification together with a certified copy of report of results of tests made in accordance with the process and specifications shall be furnished.

The qualification of the welding process shall be at least equal to that required by 'Standard Qualification Procedure' of the Indian Standards and the minimum requirement of the tests shall be at least as stated in the said, 'Standard Qualification Procedure'.

c. Qualification of Welders

The contractor shall be responsible for the quality of the work performed by his welding staff. All welders assigned to the work shall have passed qualification tests for welders. If at any time the work of any welder appears questionable, the welder shall be required to pass additional qualification tests to determine his ability to perform the type of work on which he is engaged.

19.7.11 Turned and Fitted Bolts

In cases where bolts have to be used but strength of a riveted connection is required, this can be obtained by using special bolts in special holes to a driving fit. The bolts are specially made from black round bars and turned down to the exact diameter. The inside of the head and flat face of the nut should be machined. The hole must be accurately drilled or reamed with a clearance of not more than 0.25 mm. The holes after assembly of the parts must be true throughout the thickness of all parts and perpendicular to axis of the member. Washers for turned and fitted bolts should be machined on both faces.

19.7.12 Stress Relieving

Stress relieving of welded parts, where required, shall be carried out after all welding is completed but before that part is machined or assembled into structure. Localised stress relieving will not be permitted for shop welded parts. The stress relieving of parts shall be done as per IS:2825, IS:10801 and IS:10234(latest edition). Provisions of IS:4623 shall also be fulfilled for stress relieving of gate components.

19.8 Painting

19.8.1 General

All paints, painting materials and accessories for painting shall be supplied by the contractor and shall be included in the price bid. The paints proposed by the contractor must be approved by the representative of the purchaser before application of the same. The analysis in respect of paint properties, paint composition and performance requirements of the paints shall be submitted by the contractor for examination and approval. The painting and surface preparation shall also conform to the relevant Indian Standard Specifications, IS: 14177 - Guidelines for Painting System for Hydraulic Gates and Hoists.

19.8.2 Preparation of Surface

Surface preparation shall be in accordance with the following procedure :

a. Weld spatters or any other surface irregularity shall be removed by any suitable means before cleaning.

b. All existing paints, oil, grease and dirt shall be removed from the surface by the use of clean mineral spirits, xylol or white gasoline (lead free) and clean wiping materials.

c. Following the solvent cleaning, the surfaces to be painted ,shall be cleaned of all rust, mill scale, and other lightly adhering objectionable substances by sand blasting or grit blasting to uniform bright base metal. Any grit or dust remaining after the cleaning operation shall be completely removed from the surface by wire brushing, air blowing, suction or other effective means before the surface is painted.

d. Surface of stainless steel, nickel, bronze and machined surface adjacent to metal work being cleaned or painted shall be protected by masking tape or by other suitable means during the cleaning and painting operations.

e. Primers shall be applied as soon as the surface preparation is complete and prior to the development of surface rusting. The time gap between the application of primer and surface preparation shall normally not exceed six hours. In case there is considerable time gap, the surface should be reblasted prior to priming.

19.8.3 Shop/ field Painting Details

a. Stainless steel and bronze surfaces shall only be cleaned but not painted.

b. All surfaces of the embedded parts, which are to come in contact with concrete, shall be cleaned as mentioned above and given two coats of cement latex to prevent rusting during shipment and while awaiting installation.

c. Two coats of zinc rich primer shall be applied to all unfinished surfaces of the embedded parts and gate to be exposed to atmosphere or water to obtain a dry film thickness of 75 microns, which shall be followed by two coats of coaltar blend epoxy resin paint to get dry film thickness of 150 microns in each coat. Total dry film thickness of paint shall not be less than 350 microns. Time interval between the coats shall be 24 hours.

d. All finished surfaces of ferrous metal including bolts, screw threads, etc that will be exposed during shipment or while awaiting installation shall cleaned and given a heavy uniform coating of gasoline, soluble rust preventive compound or equivalent.

e. Two coats of zinc phosphate primer shall be applied to all exposed surfaces of hoist, hoist support structure, hoist frame exposed to atmosphere or water to obtain a dry film thickness of 75 microns, which shall be followed by two finishing coats aluminium paint to obtain dry film thickness of 75 microns per coat. The total dry film thickness all coats including primer coating shall not be less than 225 microns. The interval between the coats shall be 24 hours.

19.8.4 Measures During Painting

a. Any bare spots or holidays shall be recoated with additional application of primer.

b. All runs, sags, floods, or drips shall be removed by scrapping and cleaning. The cleaned area should be retouched or all such defects shall be remedied by reblasting or repriming.

c. Special attention should be given to good coverage on rivets, welds and sharp edges and covers.

d. Suitable measures shall be taken to protect the applied primer from contact with rain, fog, mist, dust or other foreign matter until completely hardened and next coat is applied.

e. The air temperature at the time of application must not be below 10°C and relative humidity must not be above 90%.

19.8.5 Application Procedure

All paints and coating materials shall be in a homogeneously mixed condition at the time of application and shall not be thinned except as hereinafter specifically provided. Warming of the paint shall be performed by means of hot water bath. All surfaces to which paint shall be applied immediately after cleaning, and except otherwise specifically provided, shall be applied by either brushing or by airless spray. When paint is applied by spraying, a mechanical agitator type of paint pot shall be used. Means shall be provided for removing all free oil and moisture from the air supply line of all spraying equipment. Each coat of paint shall completely cover the surfaces and shall be free from

runs, sags, pinholes, and holidays. Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied.

All paints shall be applied by skilled workers in a workmanlike manner. Paint shall not be applied during damp weather and on the surfaces, which are not entirely free from moisture. Rust preventive compound shall be applied by any convenient method to ensure complete coverage of heavy coating. After the final application, the paint film shall be allowed to cure at least for 7 days.

19.9 Catalogues and Operating /Maintenance Instructions

Six sets of catalogues indicating the complete lists of parts and operating instructions in the English language, which may be needed or useful in operation, maintenance, repair, dismantling or assembling and for the repair and identification of parts for ordering the replacement, shall be supplied by the contractor to the purchaser. Such catalogues shall be in hard cover bound books and should have suitable jackets of thick polythene paper.

19.10 Instruction Plates

All gauges, meters and other instruments etc., shall have dials or scales calibrated in metric system. All name plates, instruction plates, warning signs, etc., shall be in English as well as in Hindi. All markings to be used shall be submitted to the purchaser for approval before the equipment is marked or labelled.

19.11 Shop Assembly and Test:

All gate frames and appurtenances shall be shop assembled so as to allow for adjustment of various dimensions to make them conform to the designed dimensions, fits, tolerances, surface finishes, clearances etc. In the event it is not possible to complete the gate leaf or any other equipment/component in the shop, they will be accurately assembled in the shop using temporary connections and various critical dimensions shall be verified. The embedded metalwork to be furnished under these specifications shall be shop assembled to the extent the possible. Special care shall be taken in all phases of work affecting the strength and rigidity of anchorages and embedded tie flats since the correct operation and stability of gates are largely dependent upon the strength and accuracy of these parts. The trunnion girders shall be completely fabricated in the shop. The cost of carrying out the tests, not including the cost of inspection by the government personnel, shall be borne by the contractor and included in the price bid in the schedule. However, at the discretion of the Engineer - in - charge the above tests shall be carried out by the contractor on the shop assembled parts and bought out items to the extent and in accordance with the instructions of the Engineer - in - charge.The fabricated parts and assembly of gates/gate frames and other equipment shall be inspected and operational tests observed by the purchaser or his authorised representative.

19.12 Preparation for Despatch

19.12.1 Unit Marking, Match Marking and Transportation Designation

Each part of the gates & hoists which is to be transported as a separate piece, shall be marked to show the unit of which it is a part and match marked to show its relative position in the unit to facilitate assembly in the field. Unit marks and match marks shall be made with heavy steel stamps and paint. Each piece, sub-assembly or package transported separately shall be labelled or tagged with transport designation consisting of the specifications number and the marks number of such pieces, number of parts grouped in such sub-assemblies or contained in package.

19.12.2 Weights

Before despatch, the contractor shall determine (by the most accurate means available) the net weight of each piece of assembly that is to be shipped as a unit exclusive of boxes crates or kits. The particulars listing the net weight shall be painted on the respective pieces of assemblies or stated on the tags attached thereto.

19.12.3 Packing

All parts shall be prepared for despatch so those slings for handling may be attached readily while parts are to be moved. Where it is unsafe to attach slings to the box, parts shall be packed with slings attached to the part and slings shall project through the box or crate so that attachment can be made easily. All parts shall be properly secured, packed to withstand handling during transportation. All packing shall allow for easy removal and checking at site. Special precautions shall be taken to prevent rusting of steel and iron parts during transit.

Suitable methods proposed to be adopted for protection against moisture shall be subject to the prior approval of the

purchaser. Each bale or package is to contain packing note quoting number and date of contractor's order and the name of office placing the order.

After delivery of material at site, all packing shall become property of the purchaser. Notwithstanding anything stated in this clause, the contractor shall be entirely responsible for loss, damage or depreciation to the stores due to faulty and insecure packing. The equipment shall be insured for loss or damage during transit at the cost of the contractor.

19.13 Erection

The equipment covered by these specifications shall be furnished and erected by the contractor at the project site. The contractor shall be required to furnish all erection drawings The contractor shall prepare a complete erection procedure, which shall describe the sequence of operations to be carried out, the method to be used, the measurements to be taken and the tolerances to be met, in the erection and alignment of the equipment. Such procedure shall have the approval of the purchaser prior to the commencement of fabrication and when approved shall form a part of the specification furnished by the contractor.

19.13.1 Installation of 2nd Stage Embedded Parts

Gate frames, rods, guides and gate frames, guides seal seats etc. shall be assembled and installed, brought to line, grade and plumb within erection tolerances and secured in place by anchorages as shown on the drawings or otherwise according to the best method in practice and as may be necessary for successful functioning of these units. The erection tolerances for the frames and guides shall be as indicated on the drawings or as per latest relevant BIS Codes. Extreme care shall be taken to ensure that their surfaces be in a true plane within the tolerance throughout their entire length The 2nd stage anchorages shall be strong enough to hold the tracks and guides securely in position while concrete is being placed.

19.13.2 Installation of Gates, Hoists & supporting structure

All the components of gate & hoist shall be erected perfectly, giving due cognizance to the unit and match marks on the components. All components shall be designed and assembled to fit snugly and shall be watertight. It is desirable to avoid the flood period to perform erection of gate. Should it be necessary to do so, due precautions should be taken for measures against floods since the gate may be submerged in water sustaining damages or the half erected gate may disturb the water flow causing damages to the civil structure.

19.13.3 Placing of Concrete

Concreting shall be done by the contractor and the contractor shall give a detailed Programme of fixing and aligning the embedded parts to the purchaser for this purpose. Before placing the concrete in any one lift and between placement of successive lifts, alignment tolerances shall be checked and remedial action taken by the contractor, if any displacement has occurred.

19.13.4 Erection Personnel

Except for the concreting, skilled as well as unskilled personnel shall be arranged by the contractor for erection of the equipment covered in these specifications.

19.13.5 Tools & Tackles

The contractor shall provide all tools & tackles used in the above erection work.

19.14 Inspection, Testing and Final Acceptance

19.14.1 Place of Manufacture & Inspection

The tenderer shall state in his tender the place of manufacture, testing and inspection of various portions of the work included in the contract. Authorised representatives of the purchaser may be present at the time of any or all tests and the tenderer shall provide all necessary facilities for the same. Representatives of the purchaser shall also be entitled to access to tenderer's / sub-contractor's work at any time during the working hours for the purpose of inspecting the manufacture of equipment and materials.

19.14.2 Inspection

All supplies (which include without limitation raw materials, components, intermediate assemblies and end products) shall be subject to inspection and test by the purchaser to the extent practicable at all times and places.

Inspection shall be carried out in accordance with relevant Indian standards.

If any inspection or test is made by the purchaser in the premises of the contractor or sub-contractor, the contractor without additional charge shall provide all reasonable facilities and assistance for the safety and convenience of inspectors in the performance of their duties. If on the request of the purchaser, inspection or test is made at a point other than the premises of the contractor or sub-contractor of the contractor, it shall be at the expense of the purchaser except as otherwise provided in the contract, provided that in case of rejection, the purchaser shall not be liable for any reduction in value of samples used in connection with such inspection and test. All inspection and tests by the purchaser shall be performed in such a manner as not to unduly delay the work. The purchaser reserves the right to charge the contractor any additional cost of inspection and test when supplies are not ready at the time of such inspection and test. Acceptance or rejection of the supplies shall be made as promptly as practicable after delivery except as otherwise provided in the contract but failure to inspect and accept or reject supplies shall not relieve the contractor of the responsibility for such supplies to be in accordance with the contract requirements. The inspection and test by the purchaser of any supplies or lots thereof does not relieve the contractor of any responsibility regarding defects or other failure to meet the contract requirements which may be discovered prior to the acceptance.

Except as otherwise provided in the contract, acceptance shall be conclusive except as regards latent defects, fraud or such gross mistakes as amount to fraud. The contractor shall provide and maintain the inspection system acceptable to the purchaser covering the supplies hereunder. Records of all such inspection work shall be kept complete by the contractor and made available to the purchaser during the performance of the contract and for such longer period as may be specified elsewhere in the contract.

19.14.3 Operational Test

The contractor shall carry out in the presence of project authorities such tests on the gate equipment to determine that the gate will fulfill the functions for which it has been designed. Tests shall be repeated, if necessary, until successfully carried out to the satisfaction of the purchaser. Leakage tests and operational tests shall be carried out at the convenience of the project authorities after completion of other portions of the work. The project authorities shall have the right to carry out such tests also when the reservoir is at a level other than design level.

19.14.4 Dry Test

Operational tests in dry shall be carried out as soon as possible after completion of erection. The tests shall include at least two complete traverses from the maximum raised position to the fully closed position. All adjustments, clearances etc., shall be checked for proper operation.

19.14.5 Wet Test

These tests should simulate the actual operating conditions as closely as possible. At least two complete traverses will be made from the fully closed position to the normal raised position of each gate as follows:

a. When gate is closed, raise gate to its normally open position in steps and observe the performance including vibration.

b. Lower the gate to the fully closed position in steps and observe the performance of the gate including vibration.

c. Check up the proper operation of limit switches.

19.14.6 Leakage Tests

Leakage tests shall be carried out with each gate lowered on to the sill. Before measuring the leakage, the gate shall be raised and lowered several times by a metre or so in order to dislodge any debris that may have lodged in the side seal seats. The leakage shall then be measured and recorded. The maximum permissible leakage shall not exceed 10 litres per min. per metre length of periphery of sealing surface.

19.14.7 Final Acceptance

The final acceptance of the equipment shall be based on the following:

a. Quality and workmanship of the equipment.

b. Satisfactory operation of the equipment after erection as required under these specifications.

c. All tests may be witnessed by the contractor or his Authorised representative. On successful completion of all tests, the equipment shall be accepted but all the responsibilities shall remain with the supplier within the

guarantee period.

19.14.8 Guarantee

Within one year after acceptance of the equipment, if any part of the gates, hoists and embedded parts is found defective because of workmanship or material or otherwise, the contractor shall at his own expense, furnish and install new parts and materials approved by the purchaser.

19.14.9 Failure to Meet Guarantee

Should any part of the equipment fail to meet the guarantee/ other requirements of the technical specifications within the time covered by the guarantees, the purchaser may direct the contractor to proceed at once to make alterations or furnish new parts as may be necessary to meet the requirements. All expense of furnishing, delivering and installing new parts or making alterations to existing parts and of tests made necessary by failure of the equipment to meet the guarantee and other requirements of the technical specifications, shall be borne by the contractor. If, after due notice, the contractor refuses to correct any failure of the equipment to meet the requirements of the technical specifications during the guarantee period, the purchaser may proceed at his own expense to correct such failure and to collect from the contractor an amount equal to actual expense so incurred, including overheads and all other incidental expenses.

19.14.10 Defective Equipment

In case any part of the equipment is found to be defective in materials or workmanship or develops defects or does not otherwise meet the requirements of the specifications including errors or omissions on the part of the contractor the following shall apply:

a. Defects Disclosed Prior to Final Acceptance:

Any defect in materials or workmanship or other failure to meet the requirements of these specifications including errors or omission on the part of the contractor, which are disclosed prior to final payment or prior to final acceptance tests, whichever occurs at a later date, shall, if so directed by the purchaser, be corrected entirely at the expense of the contractor.

b. Defects Disclosed After Final Acceptance:

Any latent defect not disclosed before date of final acceptance shall be corrected promptly by the contractor entirely at his expense provided that the total period during which the contractor is liable for replacement due to latent defects shall not exceed ten months after date of final acceptance of the equipment.

19.14.11 Operation of Unsatisfactory Equipment

The purchaser shall have the right to operate the equipment as soon as and as long as it is in operating condition, whether or not such equipment has been accepted. Such operation by the purchaser shall not lessen or impair any express or implied warranties concerning such equipment. All repairs or alterations required shall be made at such times as directed by the purchaser and in such a manner as will cause the minimum interruption in the use of the equipment by the purchaser.

Operation of the equipment pursuant to this section shall not relieve the contractor of his responsibility to supply all equipment in complete accordance of technical specifications. While unsatisfactory articles can be taken out of service, for correction of latent defects, errors or omissions, the period of such operation of any use pending the correction of latent defects, errors or omissions shall not exceed one year without mutual consent of the contractor and the purchaser.

19.15 Schedule of Price

Price bid shall be furnished in the format as shown in the BOQ’s for Hydromechanical works. Incomplete bid shall not be accepted.

Drawings

Please refer Volume – IV for Drawings

Site Data

The site is approachable via the Guwahati – Shillong Road (National Highway 40) from Guwahati upto Umsning town about 70 km from Guwahati Railway Station (about 95 km from Guwahati Airport) and then taking a right turn through a State PWD road .for a distance of 10 km to reach Zero Point village . The distance to Face – I Intake where the Link Tunnel starts from the Kyrdemkulai reservoir is about 1 km from this place (taking a left turn), while the distance to the exit of the 2.84 km long Link Tunnel in the Nongmahir Forebay (taking a right turn) is around 4 km from Zero Point village. The Power Station is located at a distance of about 8 km from Zero Point and other work sites are located in between Face – I Intake and the Power Station.

I . General :

i) Project Location ……. Kyrdemkulai (Zero Point) Village, Ri Bhoi District , Meghalaya

ii) Name of River …… Umtru

iii) Latitude …… 25º 41′

iv) Longitude …… 91º 48′

v) Nearest Airport …… Shillong Airport (34 km)
Guwahati Airport (108 km)

v) Nearest Railway Station …… Guwahati (83 km)

II. Meteorological :

i) Maximum Temperature…… 35º C

ii) Minimum Temperature …… 8º C

iii) Average Annual Rainfall ……. 2280 mm

III. Hydrological :

i) Catchment Area of Umtru River ……. 150 sq. km

ii) Lean season discharge ……..... 2 to 4 cumec

iii) Design Flood :

a) Kyrdemkulai Reservoir …… 1700 cumec

b) Nongmahir Forebay ……. 158.40 cumec

Supplementary Information

I. Kyrdemkulai Diversion Dam & Reservoir :

Type …….. Concrete Gravity
Length …… 106.70 m
Maximum Height ……. 27.50 m
Full Reservoir Level (FRL) …….. 679.70 m
Maximum Water Level ……681.23 m
Minimum Water Level ……675.14 m
Live Storage …… 2.78 Million Cum
Crest Gates ……. 3 No.x11.00 m x 8.20 m
Spillway Capacity ……...1700 cumec

II Kyrdenkulai Intake Structure :

Type ……. Portal with bell mouth and trash rack
Control ……. Fixed wheels vertical lift gate (3.05 m x 3.05 m)
Inlet Elevation ……. 669.04 m

III. Link Tunnel :

Type …….. Circular
Length …….. 2840 m
Diameter …… 3.05 m
Gradient …… 1 in 620
Discharge Capacity ……. 28.32 cumec
Outlet Elevation …….. 664.63 m

IV. Nongmahir Forebay Structures :

i) Nongmahir Main Dyke & Forebay

Type …… Earthen dyke
Length …… 150.00 m
Maximum Height …….. 50.00 m
Maximum Base Width ……. 207.90 m
Top Elevation (Road Level)…… 675.00 m
FRL …… 672.07 m
Minimum Water Level ……. 669.20 m
Live Storage ……... 2.16 Million cum

ii) Nongmahir Saddle Dykes

Dyke No. 1

Length …… 33.50 m
Height …… 5.03 m

Dyke No. 2

Length …… 39.00 m
Height …….. …… 9.15 m

Dyke No. 3

Length …… 33.50 m
Height …….. 6.70 m

Dyke No. 4

Length …… 42.70 m
Height …….. 10.40 m

Dyke No. 5

Length …… 68.50 m
Height …….. 18.30 m

V. Nongmahir Spillway :

Type …… Chute with weir
Clear waterway ……. 12.20 m
Crest Level ……. 672.07 m
Design Flood ……..158.40 cumec

VI. Low Pressure Tunnel :

i) Intake Structure

Type ……Portal with bell mouth and trash rack
Control …… Vertical Lift Fixed Wheels Gate
Inlet Elevation …… 661.60 m
Top Level of Intake Portal… 667.00 m

ii) Head Race Tunnel

Type …….. Circular
Length ……..……. 601.50 m
Diameter …… 3.96 m
Slope ……. 1 in 50
Capacity …… 50.97 cumec

VII. Penstock :

No. ……. 2 (two)
Type …….. Welded steel penstock with expansion joints
Diameter ……... 2.59 m
Length ……. 405.60 m

VIII. Power Station Building :

Type …… Surface
Generator Floor Size …. 41.25 m x 15.60 m
Auxiliary Building Size … 41,25 m x7.00 m
Height From Valve Floor to Roof …. 30.00 m

BIDDING DOCUMENTS

FOR

RENOVATION, MODERNIZATION AND UPGRADATION OF UMIAM-UMTRU STAGE- III HYDRO ELECTRIC POWER PROJECT

PACKAGE II

[Civil & Hydro Mechanical Works]

Volume – III

PART 3 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section VII - General Conditions of Contract

Section VIII - Particular Conditions of Contract

Section IX - Contract Forms

EMPLOYER: MEGHALAYA POWER GENERATION CORPORATION LIMITED
COUNTRY: INDIA
PROJECT: UMIAM - UMTRU STAGE III HEPP
LOAN NO. : ID-P 271

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Section VII – General Conditions of Contract

Section VII. General Conditions (GC)

CONDITIONS OF CONTRACT FOR CONSTRUCTION FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER

Multilateral Development Bank Harmonised Edition June 2010

General Conditions

FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS INTERNATIONAL FEDERATION OF CONSULTING ENGINEERS INTERNATIONALE VEREINIGUNG BERATENDER INGENIEURE FEDERACION INTERNACIONAL DE INGENIEROS CONSULTORES

DEFINITIONS LISTED ALPHABETICALLY

General Provisions

In the Conditions of Contract ("these Conditions"), which include Particular Conditions, Parts A and B, and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1 Definitions

1.1.1 The Contract

1.1.1.1 "Contract" means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.

1.1.1.2 "Contract Agreement" means the contract agreement referred to in Sub- Clause 1.6 [*Contract Agreement*].

1.1.1.3 "Letter of Acceptance" means the letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression "Letter of Acceptance" means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.

1.1.1.4 "Letter of Tender" means the document entitled letter of tender or letter of bid, which was completed by the Contractor and includes the signed offer to the Employer for the Works.

1.1.1.5 "Specification" means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.

1.1.1.6 "Drawings" means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract.

1.1.1.7 "Schedules" means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices.

1.1.1.8 "Tender" means the Letter of Tender and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.

1.1.1.9 "Bill of Quantities", "Daywork Schedule" and "Schedule of Payment Currencies" mean the documents so named (if any) which are comprised in the Schedules.

1.1.1.10 "Contract Data" means the pages completed by the Employer entitled contract data which constitute Part A of the Particular Conditions

1.1.2 Parties and Persons

1.1.2.1 "Party" means the Employer or the Contractor, as the context requires.

1.1.2.2 "Employer" means the person named as employer in the

Contract Data and the legal successors in title to this person.

1.1.2.3 "Contractor" means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title to this person(s).

1.1.2.4 "Engineer" means the person appointed by the Employer to act as the Engineer for the purposes of the Contract and named in the Contract Data, or other person appointed from time to time by the Employer and notified to the Contractor under Sub-Clause 3.4 [*Replacement of the Engineer*].

1.1.2.5 "Contractor's Representative" means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub- Clause 4.3 [*Contractor's Representative*], who acts on behalf of the Contractor.

1.1.2.6 "Employer's Personnel" means the Engineer, the assistants referred to in Sub-Clause 3.2 [*Delegation by the Engineer*] and all other staff, labour and other employees of the Engineer and of the Employer; and any other personnel notified to the Contractor, by the Employer or the Engineer, as Employer's Personnel.

1.1.2.7 "Contractor's Personnel" means the Contractor's Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works.

1.1.2.8 "Subcontractor" means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor, for a part of the Works; and the legal successors in title to each of these persons.

1.1.2.9 "DB" means the person or three persons appointed under Sub-Clause 20.2 [*Appointment of the Dispute Board*] or Sub-Clause 20.3 [*Failure to Agree on the Composition of the Dispute Board*].

1.1.2.10 "FIDIC" means the Fédération Internationale des Ingénieurs-Conseils, the international federation of consulting engineers.

1.1.2.11 "Bank" means the financing institution (if any) named in the Contract Data.

1.1.2.12 "Borrower" means the person (if any) named as the borrower in the Contract Data

1.1.3 Dates, Tests, Periods and Completion

1.1.3.1 "Base Date" means the date 28 days prior to the latest date for submission of the Tender.

1.1.3.2 "Commencement Date" means the date notified under Sub-Clause 8.1 [*Commencement of Works*].

1.1.3.3 "Time for Completion" means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [*Time for Completion*], as stated in the Contract Data (with any extension under Sub-Clause 8.4 [*Extension of Time for Completion*]), calculated from the Commencement Date

1.1.3.4 "Tests on Completion" means the tests which are specified in the

Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [*Tests on Completion*] before the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.5 "Taking-Over Certificate" means a certificate issued under Clause 10 [*Employer's Taking Ove*r].

1.1.3.6 "Tests after Completion" means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.7 "Defects Notification Period" means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [*Completion of Outstanding Work and Remedying Defects*], which extends over 365 days except if otherwise stated in the Contract Data (with any extension under Sub-Clause 11.3 [*Extension of Defects Notification Period*]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [*Taking Over of the Works and Sections*].

1.1.3.8 "Performance Certificate" means the certificate issued under Sub-Clause 11.9 [*Performance Certificate*]

1.1.3.9 "day" means a calendar day and "year" means 365 days.

1.1.4 Money and Payments

1.1.4.1 "Accepted Contract Amount" means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

1.1.4.2 "Contract Price" means the price defined in Sub-Clause 14.1 [*The Contract Price*], and includes adjustments in accordance with the Contract.

1.1.4.3 "Cost" means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

1.1.4.4 "Final Payment Certificate" means the payment certificate issued under Sub-Clause 14.13 [*Issue of Final Payment Certificate*].

1.1.4.5 "Final Statement" means the statement defined in Sub-Clause 14.11 [*Application for Final Payment Certificate*].

1.1.4.6 "Foreign Currency" means a currency in which part (or all) of the Contract Price is payable, but not the Local Currency.

1.1.4.7 "Interim Payment Certificate" means a payment certificate issued under Clause 14 [*Contract Price and Payment*], other than the Final Payment Certificate.

1.1.4.8 "Local Currency" means the currency of the Country.

1.1.4.9 "Payment Certificate" means a payment certificate issued under Clause 14 [*Contract Price and Payment*].

1.1.4.10 "Provisional Sum" means a sum (if any) which is specified in the Contract as a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [*Provisional Sums*].

1.1.4.11 "Retention Money" means the accumulated retention moneys which the Employer retains under Sub-Clause 14.3 [*Application for Interim Payment Certificates*] and pays under Sub-Clause 14.9 [*Payment of Retention Money*].

1.1.4.12 "Statement" means a statement submitted by the Contractor as part of an application, under Clause 14 [*Contract Price and Payment*], for a payment certificate.

1.1.5 Works and Goods

1.1.5.1 "Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Employer's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

1.1.5.2 "Goods" means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

1.1.5.3 "Materials" means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

1.1.5.4 "Permanent Works" means the permanent works to be executed by the Contractor under the Contract.

1.1.5.5 "Plant" means the apparatus, machinery and vehicles intended to form or forming part of the Permanent Works, including vehicles purchased for the Employer and relating to the construction or operation of the Works.

1.1.5.6 "Section" means a part of the Works specified in the Contract Data as a Section (if any).

1.1.5.7 "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

1.1.5.8 "Works" mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.6 Other Definitions

1.1.6.1 Contractor's Documents" means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.

1.1.6.2 "Country" means the country in which the Site (or most of it) is located, where the Permanent Works are to be executed.

1.1.6.3 "Employer's Equipment" means the apparatus, machinery and vehicles (if any) made available by the Employer for the use of the Contractor in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by the Employer.

1.1.6.4 "Force Majeure" is defined in Clause 19 [*Force Majeure*].

1.1.6.5 "Laws" means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.

1.1.6.6 "Performance Security" means the security (or securities, if any) under Sub-Clause 4.2 [*Performance Security*].

1.1.6.7 "Site" means the places where the Permanent Works are to be executed, including storage and working areas, and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

1.1.6.8 "Unforeseeable" means not reasonably foreseeable by an experienced contractor by the Base Date.

1.1.6.9 "Variation" means any change to the Works, which is instructed or approved as a variation under Clause 13 [*Variations and Adjustments*].

1.1.6.10 "Notice of Dissatisfaction" means the notice given by either Party to the other under Sub-Clause 20.4 [*Obtaining Dispute Board's Decision*] indicating its dissatisfaction and intention to commence arbitration

1.2 Interpretation

In the Contract, except where the context requires otherwise:

(a) words indicating one gender include all genders;

(b) words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be record in writing;

(d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record; and

(e) the word "tender" is synonymous with "bid", and "tenderer" with "bidder" and the words "tender documents" with "bidding documents".

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

In these Conditions, provisions including the expression "Cost plus profit" require this profit to be one-twentieth (5%) of this Cost unless otherwise indicated in the Contract Data.

1.3 Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

(a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Contract Data; and

(b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Data. However:

(i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and

if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be

unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be

1.4 Law and Language

The Contract shall be governed by the law of the country or other jurisdiction stated in the Contract Data.

The ruling language of the Contract shall be that stated in the Contract Data.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

1.5 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

(a) the Contract Agreement (if any),

(b) the Letter of Acceptance,

(c) the Letter of Tender,

(d) the Particular Conditions - Part A,

(e) the Particular Conditions - Part B,

(f) these General Conditions,

(g) the Specification,

(h) the Drawings, and

(i) the Schedules and any other documents forming part of the Contract.

If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall enter into a Contract Agreement within 28 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

(a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and

may, as security in favour of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract

1.8 Care and Supply of

The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, two

Documents

copies of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9 Delayed Drawings or Instructions

The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub- Clause 3.5 [*Determinations*] to agree or determine these matters.

However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit

1.10 Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive

royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This licence shall:

(a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,

(b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and

(c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause

1.11 Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidential Details

The Contractor's and the Employer's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation.

Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

(a) the Employer shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and

(b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence

1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture, consortium or other unincorporated grouping of two or more persons:

(a) these persons shall be deemed to be jointly and severally liable to the Employer for the performance of the Contract;

(b) these persons shall notify the Employer of their leader who shall have authority to bind the Contractor and each of these persons; and

(c) the Contractor shall not alter its composition or legal status without the prior consent of the Employer

1.15 Inspections and Audit by the Bank

The Contractor shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the Contractor's accounts and records relating to the performance of the Contract and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank.

2. **Employer**

2.1 Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Specification. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the programme submitted under Sub-Clause 8.3 [*Programme*].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause

3.5 [*Determinations*] to agree or determine these matters.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit

2.2 Permits, Licences or Approvals

The Employer shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

(a) copies of the Laws of the Country which are relevant to the Contract but are not readily available, and

(b) any permits, licences or approvals required by the Laws of the Country:

i. which the Contractor is required to obtain under Sub-Clause 1.13 [*Compliance with Laws*],

ii. for the delivery of Goods, including clearance through customs, and

ii. for the export of Contractor's Equipment when it is removed from the Site

2.3 Employer's Personnel

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site:

(a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [*Co-operation*], and

(b) take actions similar to those which the Contractor is required to take under sub- paragraphs (a), (b) and (c) of Sub-Clause 4.8 [*Safety Procedures*] and under Sub-Clause 4.18 [*Protection of the Environment*].

2.4 Employer's Financial Arrangements

The Employer shall submit, before the Commencement Date and thereafter within 28 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [*Contract Price and Payment*]. Before the Employer makes any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars.

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 his notice of the extent to which such funds will be available

2.5 Employer's Claims

If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Employer or the Engineer shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [*Electricity, Water and Gas*], under Sub-Clause 4.20 [*Employer's Equipment and Free-Issue Material s*], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 28 days after the Employer became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers himself to be entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [*Extension of Defects Notification Period*].

This amount may be included as a deduction in the Contract Price and Payment Certificates. The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

3. The Engineer

3.1 Engineer's Duties and Authority

The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of the Employer before exercising a specified authority, the requirements shall be as stated in the Particular Conditions. The Employer shall promptly inform the Contractor of any change to the authority attributed to the Engineer.

However, whenever the Engineer exercises a specified authority for which the Employer's approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Except as otherwise stated in these Conditions:

(a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer;

(b) the Engineer has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract;

(c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances; and

(d) any act by the Engineer in response to a Contractor's request except as otherwise expressly specified shall be notified in writing to the Contractor within 28 days of receipt.

The following provisions shall apply:

The Engineer shall obtain the specific approval of the Employer before taking action under the following Sub-Clauses of these Conditions:

(A) Sub-Clause 4.12: agreeing or determining an extension of time and/or additional cost.

(B) Sub-Clause 13.1: 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.

Sub-Clause 13.3: approving a proposal for Variation submitted by the Contractor in accordance with Sub-Clause 13.1 or 13.2

(C) Sub-Clause 13.4: specifying the amount payable in each of the applicable currencies.

Not with standing the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he 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 approval 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, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Employer

3.2 Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until

copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Engineer shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [*Determinations*].

Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*].

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

(a) any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials;

if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction

3.3 Instructions of the Engineer

The Engineer may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13 [*Variations and Adjustments*] shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer or a delegated assistant:

(a) gives an oral instruction,

(b) receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and

(c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation

then the confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be)

3.4 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer. If the Contractor considers the intended replacement Engineer to be unsuitable, he has the right to raise objection against him by notice to the Employer, with supporting particulars, and the

Employer shall give full and fair consideration to this objection

3.5 Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars, within 28 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [*Claims, Disputes and Arbitration*].

4. The Contractor

4.1 Contractor's General Obligations

The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Engineer's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

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 Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer

If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Particular Conditions:

(a) the Contractor shall submit to the Engineer the Contractor's Documents for this part in accordance with the procedures specified in the Contract;

(b) these Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [*Law and Language*

], and shall include additional information required by the Engineer to add to the Drawings for co-ordination of each Party's designs;

(c) the Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the Contract; and

(d) prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer the "as-built" documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [*Taking Over of the Works and Section*s] until these documents and manuals have been submitted to the Engineer.

4.2 Performance Security

The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount 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 an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

The Contractor shall deliver the 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 Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract.

The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

The Employer shall return the Performance Security to the Contractor within 21 days after receiving a copy of the Performance Certificate.

Without limitation to the provisions of the rest of this Sub-

Clause, whenever the Engineer determines an addition or a reduction to the Contract Price as a result of a change in cost and/or legislation, or as a result of a Variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage

4.3 Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of Sub-Clause 6.9 [*Contractor's Personnel*], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer's prior consent, and the Engineer shall be notified accordingly.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [*Instructions of the Engineer*].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause 1.4 [*Law and Language*]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer

4.4 Subcontractors

The Contractor shall not subcontract the whole of the Works

The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

(a) the Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Subcontractor is named in the Contract;

(b) the prior consent of the Engineer shall be obtained to other proposed Subcontractors; the Contractor shall give the Engineer not less than 28 days' notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site; and

(c) each subcontract shall include provisions which would entitle the Employer to require the subcontract to be assigned to the Employer under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Employer].

The Contractor shall ensure that the requirements imposed on the Contractor by Sub- Clause 1.12 [*Confidential Details*] apply equally to each Subcontractor

Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors

4.5 Assignment of Benefit of Subcontract

If a Subcontractor's obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to the Employer, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for the work carried out by the Subcontractor after the assignment takes effect

4.6 Co-operation

The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

(a) the Employer's Personnel,

(b) any other contractors employed by the Employer, and

(c) the personnel of any legally constituted public authorities,

who may be employed in the execution on or near the Site of any work not included in the Contract.

Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

If, under the Contract, the Employer is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such documents to the Engineer in the time and manner stated in the Specification

4.7 Setting Out

The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contract or

notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

The Employer shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced contractor could not reasonably have discovered such error and avoided this delay and/or Cost, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub- Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

4.8 Safety Procedures

The Contractor shall:

(a) comply with all applicable safety regulations,

(b) take care for the safety of all persons entitled to be on the Site,

(c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,

(d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [*Employer's Taking Over*], and

(e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

4.9 Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract

4.10 Site Data

The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

(a) the form and nature of the Site, including sub-surface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,

(d) the Laws, procedures and labour practices of the Country, and

(e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

4.11 Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

(a) have satisfied himself as to the correctness and sufficiency of the Accepted Contract Amount, and

(b) have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [*Site Data*].

Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the remedying of any defects

4.12 Unforeseeable Physical Conditions

In this Sub-Clause, "physical conditions" means natural physical conditions and man- made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall

give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [*Variations and Adjustments*] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost, which shall be included in the Contract Price

Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub- paragraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favourable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer shall take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which shall be made available by the Contractor, but shall not be bound by the Contractor's interpretation of any such evidence

4.13 Rights of Way and Facilities

Unless otherwise specified in the Contract the Employer shall provide effective access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works

4.14 Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference

4.15 Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes

Except as otherwise stated in these Conditions:

(a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;

(b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;

(c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;

(d) the Employer does not guarantee the suitability or availability of particular access routes; and

Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor

4.16 Transport of Goods

Unless otherwise stated in the Particular Conditions:

(a) the Contractor shall give the Engineer not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site;

(c) the Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and

(d) the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17 Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the

consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site

4.18 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws

4.19 Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specification. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [*Employer's Claims*] and Sub-Clause 3.5 [*Determinations*]. The Contractor shall pay these amounts to the Employer

4.20 Employer's Equipment and Free-Issue Materials

The Employer shall make the Employer's Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

(a) the Employer shall be responsible for the Employer's Equipment, except that

(b) the Contractor shall be responsible for each item of Employer's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it or in possession or control of it.

The appropriate quantities and the amounts due (at such stated prices) for the use of Employer's Equipment shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [*Employer's Claims*] and Sub-Clause 3.5 [*Determinations*]. The Contractor shall pay these amounts to the Employer.

The Employer shall supply, free of charge, the "free-issue materials" (if any) in accordance with the details stated in the Specification. The Employer shall, at his risk and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them, and shall promptly give notice to the Engineer of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, the Employer shall immediately rectify the notified

shortage, defect or default

After this visual inspection, the free-issue 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

4.21 Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include

(a) charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Clause 5 [*Nominated Subcontractors*]),

(b) photographs showing the status of manufacture and of progress on the Site;

(c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:

(i) commencement of manufacture,

(ii) Contractor's inspections,

(iii) tests, and

(iv) shipment and arrival at the Site;

(d) the details described in Sub-Clause 6.10 [*Records of Contractor's Personnel and Equipment*];

(e) copies of quality assurance documents, test results and certificates of Materials;

(f) list of notices given under Sub-Clause 2.5 [*Employer's Claims*] and notices given under Sub-Clause 20.1 [*Contractor's Claims*];

(g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

(h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.22 Security of the Site

Unless otherwise stated in the Particular Conditions:

(a) the Contractor shall be responsible for keeping unauthorised persons off the Site, and

(b) authorised persons shall be limited to the Contractor's Personnel and the Employer's Personnel; and to any other personnel notified to the Contractor, by the Employer or the Engineer, as authorised personnel of the Employer's other contractors on the Site

4.23 Contractor's Operations on Site

The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required.

Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract

4.24 Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost, which shall be included in the Contract Price

After receiving this further notice, the Engineer shall proceed in accordance with Sub- Clause 3.5 [*Determinations*] to agree or

determine these matters.

5. Nominated Subcontractor

5.1 Definition of "nominated Subcontractor"

In the Contract, "nominated Subcontractor" means a Subcontractor:

(a) who is stated in the Contract as being a nominated Subcontractor, or

(b) whom the Engineer, under Clause 13 [*Variations and Adjustments*], instructs the Contractor to employ as a Subcontractor subject to Sub-Clause 5.2 [*Objection to Notification*].

5.2 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless the Employer agrees in writing to indemnify the Contractor against and from the consequences of the matter:

(a) there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength;

(b) the nominated Subcontractor does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, his agents and employees; or

(c) the nominated Subcontractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:

(i) undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge his obligations and liabilities under the Contract,

(ii) indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities, and

(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 5.3 [*Payment to nominated Subcontractors*].

5.3 Payments to nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts shown on the nominated Subcontractor's invoices approved by the Contractor which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-clause 13.5 [*Provisional Sums*], except as stated in Sub-Clause 5.4 [*Evidence of Payments*].

5.4 Evidence of Payments

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request

the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

(a) submits this reasonable evidence to the Engineer, or

(b) (i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and

(ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Employer may (at his sole discretion) pay, direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

6. Staff and Labour

6.1 Engagement of Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, feeding, transport and, when appropriate, housing.

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.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about 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, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws

6.3 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal

rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:

(a) otherwise stated in the Contract,

(b) the Engineer gives consent, or

(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer.

6.6 Facilities for Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

6.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

HIV-AIDS Prevention. The Contractor shall conduct an HIV-AIDS awareness programme via an approved service provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

The Contractor shall throughout the contract (including the

Defects Notification Period): (i) conduct Information, Education and Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Subcontractors and any other Contractor's or Employer's personnel, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behaviour with respect to, of Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labour as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counselling and referral to a dedicated national STI and HIV/AIDS programme, (unless otherwise agreed) of all Site staff and labour.

The Contractor shall include in the programme to be submitted for the execution of the Works under Sub-Clause 8.3 an alleviation programme for Site staff and labour and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation programme shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the programme shall detail the resources to be provided or utilised and any related sub-contracting proposed. The programme shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this programme shall not exceed the Provisional Sum dedicated for this purpose.

6.8 Contractor's Superintendence

Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.

Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [*Law and Language*]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works

6.9 Contractor's Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced 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 if applicable, who

(a) persists in any misconduct or lack of care,

(b) carries out duties incompetently or negligently,

(c) fails to conform with any provisions of the Contract, or

(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be

	appointed) a suitable replacement person
6.10 Records of Contractor's Personnel and Equipment	The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works
6.11 Disorderly Conduct	The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site
6.12 Foreign Personnel	The Contractor may bring in to 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 his 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
6.13 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
6.14 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.
6.15 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.
6.16 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.
6.17 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.

6.18 Festivals and Religious Customs	The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.
6.19 Funeral Arrangements	The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.
6.20 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
6.21 Child Labour	The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labour laws of the Country have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.
6.22 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 Equipmen*t].
6.23 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
6.24 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 this Sub-Clause's requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination

7. Plant, Materials and Workmanship

7.1 Manner of Execution

The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:

(a) in the manner (if any) specified in the Contract,

(b) in a proper workmanlike and careful manner, in accordance with recognised good practice, and

(c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract

7.2 Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:

(a) manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and

(b) additional samples instructed by the Engineer as a Variation.

Each sample shall be labelled as to origin and intended use in the Works.

7.3 Inspection

The Employer's Personnel shall at all reasonable times:

(a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and

(b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the

Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost

7.4 Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [*Variations and Adjustments*], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours' notice of the Engineer's intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause3.5 [*Determinations*] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

7.5 Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor

shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Engineer requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub- Clause 2.5 [*Employer's Claims*] pay these costs to the Employer

7.6 Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor to:

(a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,

(b) remove and re-execute any other work which is not in accordance with the Contract, and

(c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c).

If the Contractor fails to comply with the instruction, the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [*Employer's Claims*] pay to the Employer all costs arising from this failure

7.7 Ownership of Plant and Materials

Except as otherwise provided in the Contract, each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer at whichever is the earlier of the following times, free from liens and other encumbrances:

(a) when it is incorporated in the Works;

when the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [*Payment for Plant and Materials in Event of Suspension*]

7.8 Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

(a) natural Materials obtained from outside the Site, and

(b) the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8. Commencement, Delays and Suspension

8.1 Commencement of Works

Except as otherwise specified in the Particular Conditions of Contract, the Commencement Date shall be the date at which the

following precedent conditions have all been fulfilled and the Engineer's notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor:

(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.

If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [*Termination by Contractor*]

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

8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

(a) achieving the passing of the Tests on Completion, and

(b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking- over under Sub-Clause 10.1 [*Taking Over of the Works and Sections*].

8.3 Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [*Commencement of Works*]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each programme shall include:

(a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,

(b) each of these stages for work by each nominated Subcontractor (as defined in Clause 5 [*Nominated Subcontractors*],

(c) the sequence and timing of inspections and tests specified in the

Contract, and

(d) a supporting report which includes:

(i) a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and

(ii) details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

Unless the Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.

The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [*Variation Procedure*].

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

8.4 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [*Taking-Over of the Works and Sections*] is or will be delayed by any of the following causes:

(a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [*Variation Procedure*]) or other substantial change in the quantity of an item of work included in the Contract,

(b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,

(c) exceptionally adverse climatic conditions,

(d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or

(e) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub- Clause 20.1 [*Contractor's*

Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.5 Delays Caused by Authorities

If the following conditions apply, namely:

(a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country,

(b) these authorities delay or disrupt the Contractor's work, and

(c) the delay or disruption was Unforeseeable,

then this delay or disruption will be considered as a cause of delay under sub- paragraph (b) of Sub-Clause 8.4 [*Extension of Time for Completion*].

8.6 Rate of Progress

If, at any time:

(a) actual progress is too slow to complete within the Time for Completion, and/or

(b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [*Programme*],

other than as a result of a cause listed in Sub-Clause 8.4 [*Extension of Time for Completion*], then the Engineer may instruct the Contractor to submit, under Sub- Clause 8.3 [*Programme*], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [*Employer's Claims*] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 below:

Additional costs of revised methods including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.4 [*Extension of Time for Completion*] shall be paid by the Employer, without generating, however, any other additional payment benefit to the Contractor.

8.7 Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [*Time for Completion*], the Contractor shall subject to notice under Sub-Clause 2.5 [*Employer's Claim*s] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [*Termination by Employer*] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

8.8 Suspension of Work

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub- Clauses 8.9, 8.10 and 8.11 shall not apply

8.9 Consequences of Suspension

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions under Sub-Clause 8.8 [*Suspension of Work*] and/or from resuming the work, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [*Suspension of Work*]

8.10 Payment for Plant and Materials in Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/or Materials which have not been delivered to Site, if:

(a) the work on Plant or delivery of Plant and/or Materials has been suspended for more than 28 days, and

(b) the Contractor has marked the Plant and/or Materials as the Employer's property in accordance with the Engineer's instructions

8.11 Prolonged Suspension

If the suspension under Sub-Clause 8.8 [*Suspension of Work*] has continued for more than 84 days, the Contractor may request the Engineer's permission to proceed. If the Engineer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [*Variations and Adjustments*] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice

of termination under Sub-Clause 16.2 [*Termination by Contractor*]

8.12 Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer an instruction to this effect under Clause 13 [*Variations and Adjustments*]

9. Tests on Completion

9.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [*Testing*], after providing the documents in accordance with sub- paragraph (d) of Sub-Clause 4.1 [*Contractor's General Obligations*].

The Contractor shall give to the Engineer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

9.2 Delayed Tests

If the Tests on Completion are being unduly delayed by the Employer, Sub-Clause 7.4 [*Testing*] (fifth paragraph) and/or Sub-Clause 10.3 [*Interference with Tests on Completion*] shall be applicable.

If the Tests on Completion are being unduly delayed by the Contractor, the Engineer may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3 Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [*Rejection*] shall apply, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions

9.4 Failure to Pass Tests on

If the Works, or a Section, fail to pass the Tests on Completion

Completion

repeated under Sub- Clause 9.3 [*Retesting*], the Engineer shall be entitled to:

(a) order further repetition of Tests on Completion under Sub-Clause 9.3;

(b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub- paragraph (c) of Sub-Clause 11.4 [*Failure to Remedy Defects*]; or

(c) issue a Taking-Over Certificate, if the Employer so requests

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be

agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.5 [*Employer's Claims*] and Sub-Clause 3.5 [*Determinations*]

10. Employer's Taking Over

10.1 Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [*Failure to Pass Tests on Completion*], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [*Time for Completion*] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section

The Engineer shall, within 28 days after receiving the Contractor's application:

issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or

(a) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking- Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works

The Engineer may, at the sole discretion of the Employer, issue a Taking-Over Certificate for any part of the Permanent Works.

The Employer shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if the Employer does use any part of the Works before the Taking-Over Certificate is issued:

(a) the part which is used shall be deemed to have been taken over as from the date on which it is used,

(b) the Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the Employer, and

(c) if requested by the Contractor, the Engineer shall issue a Taking-Over Certificate for this part.

After the Engineer has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

If the Contractor incurs Cost as a result of the Employer taking over and/or using a part of the Works, other than such use as is specified in the Contract or agreed by the Contractor, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to payment of any such Cost plus profit, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine this Cost and profit.

If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [*Delay Damages*], and shall not affect the maximum amount of these damages

10.3 Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Employer is responsible, the Employer shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

The Engineer shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer shall require the Tests on Completion to be carried out by giving 14 days' notice and in accordance with the relevant provisions of the Contract.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine these matters.

10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11. Defected Liability

11.1 Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

(a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and

(b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Employer

11.2 Cost of Remedying Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [*Completion of Outstanding Work and Remedying Defects*] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

(a) any design for which the Contractor is responsible,

(b) Plant, Materials or workmanship not being in accordance with the Contract, or

(c) failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer, and Sub-Clause 13.3 [*Variation Procedure*] shall apply

11.3 Extension of Defects Notification Period

The Employer shall be entitled subject to Sub-Clause 2.5 [*Employer's Claims*] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [*Suspension of Work*] or Sub-Clause 16.1 [*Contractor's Entitlement to Suspend Work*], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired

11.4 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause

11.2 [*Cost of Remedying Defects*], the Employer may (at his option):

(a) carry out the work himself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [*Employer's Claims*] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;

(b) require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [*Determinations*]; or

if the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and

returning Plant and Materials to the Contractor

11.5 Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6 Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Engineer may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 28 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [*Cost of Remedying Defects*], for the cost of the remedial work.

11.7 Right of Access

Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with the Employer's reasonable security restrictions.

11.8 Contractor to Search

The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [*Cost of Remedying Defects*], the Cost of the search plus profit shall be agreed or determined by the Engineer in accordance with Sub-Clause 3.5 [*Determinations*] and shall be included in the Contract Price

11.9 Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to the Employer.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works

11.10 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11 Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 28 days after receipt by the Contractor of the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer

12. Measurement and Evaluation

12.1 Works to be Measured

The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [*Application for Interim Payment Certificates*], 14.10 [*Statement on Completion*] and 14.11 [*Application for Final Payment Certificate*] the quantities and other particulars detailing the amounts which he considers to be entitled under the Contract

Whenever the Engineer requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

(a) promptly either attend or send another qualified representative to assist the Engineer in making the measurement, and

(b) supply any particulars requested by the Engineer

If the Contractor fails to attend or send a representative, the measurement made by (or on behalf of) the Engineer shall be accepted as accurate.

Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

If the Contractor examines and disagrees the records, and/or does not sign them as agreed, then the Contractor shall give notice to the Engineer of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Engineer shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Engineer within 14 days after being requested to examine the records, they shall be accepted as accurate.

12.2 Method of Measurement

Except as otherwise stated in the Contract and notwithstanding local practice:

(a) measurement shall be made of the net actual quantity of each

item of the Permanent Works, and

(b) the method of measurement shall be in accordance with the Bill of Quantities or other applicable Schedules.

12.3 Evaluation

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work.

Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately

However, a new rate or price shall be appropriate for an item of work if:

(a) (i) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bill of Quantities or other Schedule,

(i) this change in quantity multiplied by such specified rate for this item exceeds 0.25% of the Accepted Contract Amount,

(ii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and

(iii) this item is not specified in the Contract as a “fixed rate item”;

or

(b) (i) the work is instructed under Clause 13 [*Variations and Adjustments*],

(ii) no rate or price is specified in the Contract for this item, and

(iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned work commences

12.4 Omissions

Whenever the omission of any work forms part (or all) of a Variation, the value of which has not been agreed, if:

(a) the Contractor will incur (or has incurred) 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;

(b) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and

(c) this cost is not deemed to be included in the evaluation of any substituted work;

then the Contractor shall give notice to the Engineer accordingly, with supporting particulars. Upon receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine this cost, which shall be included in the Contract Price

13. Variations and Adjustments

13.1 Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

(a) changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),

(b) changes to the quality and other characteristics of any item of work,

(c) changes to the levels, positions and/or dimensions of any part of the Works,

(d) omission of any work unless it is to be carried out by others,

(e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or

(f) changes to the sequence or timing of the execution of the Works

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

13.2 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [*Variation Procedure*].

If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

(a) the Contractor shall design this part,

(b) sub-paragraphs (a) to (d) of Sub-Clause 4.1 [*Contractor's General Obligations*] shall apply, and

(c) if this change results in a reduction in the contract value of this part, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine a fee, which shall be included in the Contract Price. This fee shall be half (50%) of the difference between the following amounts:

(i) such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause 13.7 [*Adjustments for Changes in Legislation*] and Sub-Clause 13.8 [*Adjustments for Changes in Cost*], and

(ii) the reduction (if any) in the value to the Employer of the varied works, taking account of any reductions in quality, anticipated life or operational efficiencies.

However, if amount (i) is less than amount (ii), there shall not be a fee.

13.3 Variation Procedure

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

(a) a description of the proposed work to be performed and a programme for its execution,

(b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [*Programme*] and to the Time for Completion, and

(c) the Contractor's proposal for evaluation of the Variation.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub- Clause 13.2 [*Value Engineering*] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt.

Each Variation shall be evaluated in accordance with Clause 12 [*Measurement and Evaluation*], unless the Engineer instructs or approves otherwise in accordance with this Clause.

13.4 Payment in Applicable Currencies

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected

currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

13.5 Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed. For each Provisional Sum, the Engineer may instruct:

(a) work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-Clause 13.3 [*Variation Procedure*]; and/or

(b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause 5 [*Nominated Subcontractors*] or otherwise; and for which there shall be included in the Contract Price:

(i) the actual amounts paid (or due to be paid) by the Contractor, and

(ii) a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule. If there is no such rate, the percentage rate stated in the Contract Data shall be applied.

The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation

13.6 Daywork

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

(a) the names, occupations and time of Contractor's Personnel,

(b) the identification, type and time of Contractor's Equipment and Temporary Works, and

(c) the quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor. The Contractor shall then submit priced statements of these resources

to the Engineer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [*Application for Interim Payment Certificates*].

13.7 Adjustments for Changes in Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine these matters.

Not with standing 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 13.8 [*Adjustments for Changes in Cost*].

13.8 Adjustments for Changes in Cost

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

$$Pn = a + b\frac{Ln}{Lo} + c\frac{En}{Eo} + d\frac{Mn}{Mo} + ...$$

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 for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the "currency of index" is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable.

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favourable to the Employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

14. Contract Price and Payment

14.1 The Contract Price

Unless otherwise stated in the Particular Conditions:

(a) the Contract Price shall be agreed or determined under Sub-Clause 12.3 [*Evaluation*] and be subject to adjustments in accordance with the Contract;

(b) the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [*Adjustments for Changes in Legislation*];

(c) any quantities which may be set out in the Bill of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities:

(i) of the Works which the Contractor is required to execute, or

(ii) for the purposes of Clause 12 [*Measurement and Evaluation*]; and

(d) the Contractor shall submit to the Engineer, within 28 days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Engineer may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.

Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts therefor, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

14.2 Advance Payment

The Employer shall make an advance payment, as an interest-free loan for mobilisation and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the Contract Data.

Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Contract Data, this Sub-Clause shall not apply.

The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [*Application for Interim Payment Certificates*]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [*Performance Security*] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee 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 or in another form

approved by the Employer.

The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressi

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ely reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless stated otherwise in the Contract Data, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub-Clause 14.6 [*Issue of Interim Payment Certificates*], as follows:

(a) deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount less Provisional Sums; and

(b) deductions shall be made at the amortisation rate stated in the Contract Data of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.

If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [*Termination by Employe*r], Clause 16 [*Suspension and Termination by Contractor*] or Clause 19.6 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [*Termination by Employe*r], except for Sub-Clause 15.5 [*Employer's Entitlement to Termination for Convenience*], payable by the Contractor to the Employer.

14.3 Application for Interim Payment Certificates

The Contractor shall submit a Statement in six copies to the Engineer after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.21 [*Progress Reports*].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the

Contract Price is payable, in the sequence listed:

(a) the estimated contract value of the Works executed and the Contractor's Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);

(b) any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [*Adjustments for Changes in Legislation*] and Sub-Clause 13.8 [*Adjustments for Changes in Cost*];

(c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Contract Data to the total of the above amounts, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Contract Data;

(d) any amounts to be added for the advance payment (if more than one instalment) and to be deducted for its repayments in accordance with Sub- Clause 14.2 [*Advance Payment*];

(e) any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [*Plant and Materials intended for the Works*];

(f) any other additions or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [*Claims, Disputes and Arbitration*]; and

(g) the deduction of amounts certified in all previous Payment Certificates

14.4 Schedule of Payments

If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

(a) the instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [*Application for Interim Payment Certificates*];

(b) Sub-Clause 14.5 [*Plant and Materials intended for the Works*] shall not apply; and

(c) if these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Engineer may proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works

14.5 Plant and Materials intended for the Works

If this Sub-Clause applies, Interim Payment Certificates shall include, under sub- paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [*Application for Interim Payment Certificates*]

If the lists referred to in sub-paragraphs (b)(i) or (c)(i) below are not included in the Schedules this Sub-Clause shall not apply.

The Engineer shall determine and certify each addition if the following conditions are satisfied:

(a) the Contractor has:

(i) kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and submitted a statement of the Cost of acquiring and delivering the Plant and Materials to the Site, supported by satisfactory evidence;

and either:

(b) the relevant Plant and Materials:

(i) are those listed in the Schedules for payment when shipped,

(ii) have been shipped to the Country, en route to the Site, in accordance with the Contract; and

(iii) are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with evidence of payment of freight and insurance, any other documents reasonably required, and a bank guarantee in a form and issued by an entity approved by the Employer in amounts and currencies equal to the amount due under this Sub-Clause: this guarantee may be in a similar form to the form referred to in Sub-Clause 14.2 [*Advance Payment*] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;

or

(c) the relevant Plant and Materials:

(i) are those listed in the Schedules for payment when delivered to the Site, and

(ii) have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The additional amount to be certified shall be the equivalent of eighty percent (80%) of the Engineer's determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and of the contract value of the Plant and Materials.

The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub- Clause 14.3 [*Application for Interim Payment Certificates*]. At that time, the Payment Certificate shall

include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials

14.6 Issue of Interim Payment Certificates

No amount will be certified or paid until the Employer has received and approved the Performance Security. Thereafter, the Engineer shall, within 28 days after receiving a Statement and supporting documents, deliver to the Employer and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Engineer on the Statement if any.

However, prior to issuing the Taking-Over Certificate for the Works, the Engineer shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated in the Contract Data. In this event, the Engineer shall give notice to the Contractor accordingly.

An Interim Payment Certificate shall not be withheld for any other reason, although:

(a) if any thing supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or

(b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or satisfaction

14.7 Payment

The Employer shall pay to the Contractor:

(a) the first instalment of the advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub-Clause 14.2 [Advance Payment], whichever is later;

(b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents; 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 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

(c) the amount certified in the Final Payment Certificate within 56 days after the Employer receives this Payment Certificate; 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]

Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract

14.8 Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, or if not available, the interbank offered rate, and shall be paid in such currency.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy

14.9 Payment of Retention Money

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].

Unless otherwise stated in the Particular Conditions, 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 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 under the second paragraph of this Sub-Clause. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate

If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it 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 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

14.10 Statement at Completion

Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer six copies of a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates], showing:

(a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,

(b) any further sums which the Contractor considers to be due, and

(c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Engineer shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

14.11 Application for Final Payment Certificate

Within 56 days after receiving the Performance Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

(a) the value of all work done in accordance with the Contract, and

(b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require within 28 days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed. This agreed statement is referred to in these Conditions as the “Final Statement”.

However if, following discussions between the Engineer and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [

Obtaining Dispute Board's Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to the Employer (with a copy to the Engineer) a Final Statement.

14.12 Discharge

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date

14.13 Issue of Final Payment Certificate

Within 28 days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall deliver, to the Employer and to the Contractor, the Final Payment Certificate which shall state:

(a) the amount which he fairly determines is finally due, and

(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, the balance (if any) due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be.

If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 28 days, the Engineer shall issue the Final Payment Certificate for such amount as he fairly determines to be due

14.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

(a) in the Final Statement and also

(b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

However, this Sub-Clause shall not limit the Employer's liability under his indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

(a) if the Accepted Contract Amount was expressed in Local Currency only:

(i) the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;

(ii) payments and deductions under Sub-Clause 13.5 [Provisional

Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be made in the applicable currencies and proportions; and

(iii) other payments and deductions under sub-paragraphs (a) to (d) of Sub- Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub-paragraph (a)(i) above;

(b) payment of the damages specified in the Contract Data shall be made in the currencies and proportions specified in the Schedule of Payment currencies;

(c) other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;

(d) if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and

(e) if no rates of exchange are stated in the Schedule of Payment Currencies, they shall be those prevailing on the Base Date and determined by the central bank of the Country.

15. Termination by Employer

15.1 Notice to Correct

If the Contractor fails to carry out any obligation under the Contract, the Engineer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2 Termination by Employer

The Employer shall be entitled to terminate the Contract if the Contractor:

(a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],

(b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,

(c) without reasonable excuse fails:

(i) to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or

(ii) to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub- Clause 7.6 [Remedial Work], within 28 days after receiving it,

(d) subcontracts the whole of the Works or assigns the Contract without the required agreement,

(e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or

(f) 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:

(i) for doing or forbearing to do any action in relation to the Contract, or

(ii) for showing or forbearing to show favour or disfavour to any person in relation to the Contract,

or if any of the Contractor's Personnel, agents or Subcontractors gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.

In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub-paragraph (e) or (f), the Employer may by notice terminate the Contract immediately.

The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works

After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor

The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor

15.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [*Termination by Employer*] has taken effect, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract

15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:

(a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims],

(b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or

(c) recover from the Contractor any losses and damages incurred by

the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor

15.5 Employer's Entitlement to Termination for Convenience

The Employer shall be entitled to terminate the Contract, at any time for the Employer's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice or the Employer returns the Performance Security. The Employer shall not terminate the Contract under this Sub-Clause in order to execute the Works himself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor under Clause 16.2 [Termination by Contractor].

After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination]

[*For contracts financed by the African Development Bank:*] For the purposes of this Sub-Clause

(a) "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in the contract execution; and

(b) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of the Contract to the detriment of the borrower, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the borrower of the benefits of free and open competition.

15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [*Termination by Employe*r].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub- Clause 6.9 [*Contractor's Personnel*].

16. Suspension and Termination by Contractor

16.1 Contractor's Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer's Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days' notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment

Certificate, reasonable evidence or payment, as the case may be and as described in the notice. 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.

The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [*Contractor's Entitlement to Suspend Wor*k] in respect of a failure to comply with Sub-Clause 2.4 [*Employer's Financial Arrangements*],

(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,

(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [*Payment*] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [*Employer's Claims*]),

(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,

(e) the Employer fails to comply with Sub-Clause 1.6 [*Contract Agreement*] or Sub-Clause 1.7 [*Assignment*],

(f) a prolonged suspension affects the whole of the Works as described in Sub- Clause 8.11 [*Prolonged Suspension*],

(g) the Employer becomes bankrupt or insolvent, goes into

liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,

(h) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [*Commencement of Works*].

In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Employer, terminate the Contract. However, in the case of sub- paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

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.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

[*For contracts financed by the Asian Development Bank:*] For the purposes of this Sub-Clause

(a) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

(b) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(c) coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(d) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

16.3 Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub- Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

(a) cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works,

(b) hand over Contractor's Documents, Plant, Materials and other

work, for which the Contractor has received payment, and

(c) remove all other Goods from the Site, except as necessary for safety, and leave the Site

16.4 Payment on Termination

After a notice of termination under Sub-Clause 16.2 [*Termination by Contractor*] has taken effect, the Employer shall promptly:

(a) return the Performance Security to the Contractor,

(b) pay the Contractor in accordance with Sub-Clause 19.6 [*Optional Termination, Payment and Release*], and

(c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

17. Risk and Responsibility

17.1 Indemnities

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

(a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and

(b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2 Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [*Taking Over of the Works and Sections*]) for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section

or part shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [*Employer's Risks*], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking- Over Certificate has been issued and which arose from a previous event for which the Contractor was liable

17.3 Employer's Risks

The risks referred to in Sub-Clause 17.4 [Consequences of Employer's Risks] below, insofar as they directly affect the execution of the Works in the Country, are:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country,

(c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel,

(d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity,

(e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,

(f) use or occupation by the Employer of any part of the Permanent Works, except as may be specified in the Contract,

(g) design of any part of the Works by the Employer's Personnel or by others for whom the Employer is responsible, and

(h) any operation of the forces of nature which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventive precautions

17.4 Consequences of Employer's Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims]

to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (f) and (g) of Sub-Clause 17.3 [Employer's Risks], Cost plus profit shall be payable.

After receiving this further notice, the Engineer shall proceed in accordance with Sub- Clause 3.5 [*Determinations*] to agree or determine these matters

17.5 Intellectual and Industrial Property Rights

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

(a) an unavoidable result of the Contractor's compliance with the Contract, or

(b) a result of any Works being used by the Employer:

(i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or

(ii) in conjunction with any thing not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6 Limitation of Liability

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, other than as specifically provided in Sub-Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remedying Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [

Indemnities]; Sub-Clause 17.4(b) [Consequences of Employer's Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Employer's Equipment and Free-Issue Materials], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than one) to the Accepted Contract Amount, as stated in the Contract Data, or (if such multiplier or other sum is not so stated), the Accepted Contract Amount

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

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 his own cost, rectify the loss or damage to the satisfaction of the Engineer

18. Insurance

18.1 General Requirements for Insurances

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub- Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms approved by the Employer. These terms shall be consistent with any terms 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.

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 any terms 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.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage.

Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within the respective periods stated in the Contract Data (calculated from the Commencement Date), submit to the other Party

(a) evidence that the insurances described in this Clause have been effected, and

(b) copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable

The Contractor shall be entitled to place all insurances relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

18.2 Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional

fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph

(a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability]).

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

(a) shall be effected and maintained by the Contractor as insuring Party,

(b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,

(c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Employer's Risks],

(d) shall also cover, to the extent specifically required in the bidding documents of the Contract, loss or damage to a part of the Works which is attributable to the use or occupation by the Employer of another part of the Works, and loss or damage from the risks listed in sub-paragraphs (c), (g) and (h) of Sub-Clause 17.3 [Employer's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the Contract Data (if an amount is not so stated, this sub-paragraph (d) shall not apply), and

(e) may however exclude loss of, damage to, and reinstatement of:

(i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),

(ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,

(iii) a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and

(iv) Goods while they are not in the Country, subject to Sub-Clause

14.5 [Plant and Materials intended for the Works].

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to the Employer, with supporting particulars. The Employer shall then (i) be entitled subject to Sub-Clause 2.5 [*Employer's Claims*] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [*General Requirements for Insurances*]

18.3 Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

This insurance shall be for a limit per occurrence of not less than the amount stated in the Contract Data, with no limit on the number of occurrences. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

(a) shall be effected and maintained by the Contractor as insuring Party,

(b) shall be in the joint names of the Parties,

(c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and

(d) may however exclude liability to the extent that it arises from:

(i) the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,

(ii) damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and

(iii) a cause listed in Sub-Clause 17.3 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4 Insurance for Contractor's Personnel

The Contractor shall effect and maintain 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.

The insurance shall cover the Employer and the Engineer 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.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for compliance with this Clause

19. Force Majeure

19.1 Definition of Force Majeure

In this Clause, "Force Majeure" means an exceptional event or circumstance:

(a) which is beyond a Party's control,

(b) which such Party could not reasonably have provided against before entering into the Contract,

(c) which, having arisen, such Party could not reasonably have avoided or overcome, and

(d) which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

(i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(ii) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,

(iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,

(iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and

(v) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

19.2 Notice of Force Majeure

If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract

19.3 Duty to Minimise Delay

Each Party shall at all times use all reasonable endeavours to minimise

any delay in the performance of the Contract as a result of Force Majeure.

A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure

19.4 Consequences of Force Majeure

If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub- paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment].

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters

19.5 Force Majeure Affecting Subcontractor

If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause

19.6 Optional Termination, Payment and Release

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under

Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include:

(a) the amounts payable for any work carried out for which a price is stated in the Contract;

(b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;

(c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;

(d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's works in his country (or to any other destination at no greater cost); and

(e) the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

19.7 Release from Performance

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

(a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and

(b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20. Claims, Disputes and Arbitration

20.1 Contractor's Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all these records, and shall (if instructed) submit copies to the Engineer.

Within 42 days after the Contractor became aware (or should have

become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

(a) this fully detailed claim shall be considered as interim;

(b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require; and

(c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer and approved by the Contractor, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the Engineer does not respond within the timeframe defined in this Clause, either Party may consider that the claim is rejected by the Engineer and any of the Parties may refer to the Dispute Board in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision].

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub- Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause

20.2 Appointment of the Dispute Board

Disputes shall be referred to a DB for decision in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision]. The Parties shall appoint a DB by the date stated in the Contract Data.

The DB shall comprise, as stated in the Contract Data, either one or

three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of construction involved in the Works and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons.

If the Parties have not jointly appointed the DB 21 days before the date stated in the Contract Data and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members has been agreed by the Parties and is included in the Contract, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may jointly refer a matter to the DB for it to give its opinion. Neither Party shall consult the DB on any matter without the agreement of the other Party.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the discharge referred to in Sub-Clause 14.12 [Discharge] shall have become effective

20.3 Failure to Agree on the Composition of the Dispute Board

If any of the following conditions apply, namely:

(a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of Sub-Clause 20.2 [Appointment of the Dispute Board],

(b) either Party fails to nominate a member (for approval by the other Party), or fails to approve a member nominated by the other Party, of a DB of three persons by such date,

(c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or

(d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member

or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, then the appointing entity or official named in the Contract Data shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

20.4 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Engineer, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Engineer. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the Works in accordance with the Contract.

If either Party is dissatisfied with the DB's decision, then either Party may, within 28 days after receiving the decision, give a Notice of Dissatisfaction to the other Party indicating its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give a Notice of Dissatisfaction to the other Party.

In either event, this Notice of Dissatisfaction shall state that it is given under this Sub- Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in Sub-Clause 20.7 [Failure to Comply with Dispute Board's Decision] and Sub-Clause 20.8 [Expiry of Dispute Board's Appointment], neither Party shall be entitled to commence arbitration of a dispute unless a Notice of Dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no Notice of Dissatisfaction has been given by either Party within 28 days after it received the DB's decision, then the decision shall become final and binding upon both Parties

20.5 Amicable Settlement

Where a Notice of Dissatisfaction has been given under Sub-Clause 20.4 above, both Parties shall attempt to settle the dispute amicably

before the commencement of arbitration. However, unless both Parties agree otherwise, the Party giving a Notice of Dissatisfaction in accordance with Sub-Clause 20.4 above should move to commence arbitration after the fifty-sixth day from the day on which a Notice of Dissatisfaction was given, even if no attempt at an amicable settlement has been made.

20.6 Arbitration

Any dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.5 above and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Arbitration shall be conducted as follows:

(a) if the Contract is with foreign contractors,

(i) for contracts financed by all participating Banks except under sub- paragraph (a)(ii) below:

international arbitration (1) with proceedings administered by the arbitration institution designated in the Contract Data, and conducted under the rules of arbitration of such institution; or, if so specified in the Contract Data, (2) international arbitration in accordance with the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL); or (3) if neither an arbitration institution nor UNCITRAL arbitration rules are specified in the Contract Data, with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

(ii) for contracts financed by the Asian Development Bank:

international arbitration (1) with proceedings administered by the arbitration institution specified in the Contract Data and conducted under the rules of arbitration of such institution unless it is specified in the Contract Data that the arbitration shall be conducted under the rules of the United Nations Commission on International Trade Law (UNCITRAL) and if UNCITRAL Rules are so specified then the named arbitration institution shall be the appointing authority and shall administer the arbitration); or (2) if an arbitration institution is not specified in the Contract Data, with proceedings administered by the Singapore International Arbitration Centre (SIAC) and conducted under the SIAC Rules, by one or more arbitrators appointed in accordance with the said arbitration rules.

(b) if the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country.

The place of arbitration shall be the neutral location specified in the Contract Data; and the arbitration shall be conducted in the language for communications defined in Sub- Clause 1.4 [Law and Language].

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on

any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

20.7 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a final and binding DB decision, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under Sub-Clause 20.6 [*Arbitration*]. Sub-Clause 20.4 *[Obtaining Dispute Board's Decision*] and Sub-Clause 20.5 [*Amicable Settlement*] shall not apply to this reference.

20.8 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DB in place, whether by reason of the expiry of the DB's appointment or otherwise:

(a) Sub-Clause 20.4 [Obtaining Dispute Board's Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply, and

(b) the dispute may be referred directly to arbitration under Sub-Clause 20.6 [Arbitration].

APPENDIX

General Conditions of Dispute Board Agreement

1 Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

(a) the "Employer";

(b) the "Contractor"; and

(c) the "Member" who is defined in the Dispute Board Agreement as being:

(i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or

(ii) one of the three persons who are jointly called the "DB" (or "Dispute Board") and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract

2 General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

(a) the Commencement Date defined in the Contract,

(b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or

(c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Agreement shall terminate upon the expiry of this period

3 Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is:

(a) experienced in the work which the Contractor is to carry out under the Contract,

(b) experienced in the interpretation of contract documentation, and

(c) fluent in the language for communications defined in the Contract

4 General Obligations of the Member

The Member shall:

(a) have no interest financial or otherwise in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;

(b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they

signed the Dispute Board Agreement;

(c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;

(d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);

(e) comply with the annexed procedural rules and with Sub-Clause 20.4 of the Conditions of Contract;

(f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;

(g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;

(h) ensure his/her availability for all site visits and hearings as are necessary;

(i) become conversant with the Contract and with the progress of the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;

(j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and

be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any)

5 General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

(a) be appointed as an arbitrator in any arbitration under the Contract;

(b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or

(c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is

shown to have been in bad faith

The Employer and the Contractor hereby jointly and severally indemnify and hold

the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph

Whenever the Employer or the Contractor refers a dispute to the DB under Sub-Clause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6 Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

(a) a retainer fee per calendar month, which shall be considered as payment in full for:

(i) being available on 28 days' notice for all site visits and hearings;

(ii) becoming and remaining conversant with all project developments and maintaining relevant files;

(iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and

(iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

(b) a daily fee which shall be considered as payment in full for:

(i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);

(ii) each working day on Site visits, hearings or preparing decisions; and

(iii) each day spent reading submissions in preparation for a hearing.

(c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;

(d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar.

months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub-Clause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7 Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect

8 Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 (a) - (d) above, he shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the non-compliance and shall, without prejudice to their other

	rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply
9 Disputes	Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration

Annex PROCEDURAL RULES

1 Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the Site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

2 The timing of and agenda for each Site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of Site visits is to enable the DB to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavour to prevent potential problems or claims from becoming disputes.

3 Site visits shall be attended by the Employer, the Contractor and the Engineer and shall be co-ordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each Site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

4 The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

5 If any dispute is referred to the DB in accordance with Sub-Clause 20.4 of the Conditions of Contract, the DB shall proceed in accordance with Sub-Clause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:

(a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and

(b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

6 The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

7 Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Engineer, and to proceed in the absence of any party who the DB is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.

8 The Employer and the Contractor empower the DB, among other things, to:

(a) establish the procedure to be applied in deciding a dispute,

(b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it,

(c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Rules,

(d) take the initiative in ascertaining the facts and matters required for a decision,

(e) make use of its own specialist knowledge, if any,

(f) decide upon the payment of financing charges in accordance with the Contract,

(g) decide upon any provisional relief such as interim or conservatory measures, and

(h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.

9 The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with Sub-Clause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

(a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;

(b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and

(c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:

- either the Employer or the Contractor does not agree that they do so, or
- the absent Member is the chairman and he/she instructs the other Members not to make a decision.

Section VIII. Particular Conditions of Contract (PC)

Particular Conditions (PC)

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

Part A - Contract Data (CD)

Conditions	Sub-Clause	Data
Employer's name and address	1.1.2.2 & 1.3	Meghalaya Power Generation Corporation Limited (MePGCL) , .Lumjingshai, Shillong – 793001
Engineer's name and address	1.1.2.4 & 1.3	Chief Engineer (C) , HP&HC, Meghalaya Power Generation Corporation Ltd., Lumjingshai, Shillong – 793001.
Bank's name	1.1.2.11	The Japan International Cooperation Agency (JICA)
Borrower's name	1.1.2.12	The President Of India
Time for Completion	1.1.3.3	730 Days (24Months)
Defects Notification Period	1.1.3.7	365 days
Sections	1.1.5.6	N/A
Profit	1.2	N/A
Electronic transmission systems	1.3	**Email/ Web site of employer**
Contractor's name and address	1.3	[*insert Contractor's name and address*]
Governing Law	1.4	India
Ruling language	1.4	English
Language for communications	1.4	English
Time for the Parties to enter into a Contract Agreement	1.6	28 days from issue of letter of acceptance
The Contractor's Liabilities as to the payment of taxes and duties:	1.13(b)	All Duties, Taxes, and Levies are payable by the Contractor.
Time for access to, and possession of all parts of, the Site	2.1	*"By the Commencement Date"*
Engineer's Duties and Authority	3.1(B)(ii)	Variations resulting in an increase of the Accepted Contract Amount in excess of 3% shall require approval of the Employer.
Performance Security	4.2	The Performance Security shall 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.
Contractor's	4.3	[*Insert the name of the Contractor's Representative agreed by the*

Conditions	Sub-Clause	Data
Representative's Name		*Employer prior to Contract signature.*]
Normal working hours	6.5	8.00 Hour to 12.00 Hour and 13.00 Hour to 17 .00Hour
Commencement of Works	8.1(c)	*30 days from the commencement date.*
Delay damages for the Works	8.7	0.1 % of the Accepted Contract Amount per day
Maximum amount of delay damages	8.7	10% of the Accepted Contract Amount
Provisional Sums	13.5(b)(ii)	N/A.
Adjustments for Changes in Cost	13.8	Period "n" applicable to the adjustment multiplier "Pn.
Total advance payment	14.2	10% of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable The first installment of 50% of the advance payment shall be due within 28 days after signing of agreement on furnishing of equivalent bank guarantee. The second installment of 50% of the advance payment shall be due when Engineer determines that the 1**0 %** work of Civil and HM package contract amount have completed and upon furnishing equivalent Bank Guarantee.
Repayment amortization rate of advance payment	14.2(b)	15 %
Percentage of Retention	14.3(c)	10%
Limit of Retention Money	14.3(c)	10% of the Accepted Contract Amount
Plant and Materials	14.5(b)(i)	*N/A*
	14.5(c)(i)	*N/A*
Minimum Amount of Interim Payment Certificates	14.6	01% of the Accepted Contract Amount
The Disbursement Procedure	14.7	Local currency. [The brochures describing JICA's Disbursement Procedures are available at : [*https://www.jica.go.jp/english/our_work/types_of_assistance/oda_loans/oda_op_info/procedure*]
Maximum total liability of the Contractor to the Employer.	17.6	*The product of 1.5 times the accepted contract amount.*
Insuring Party & submission of insurance: a) Evidence of insurance.	18.1	The contractor will be the Insuring Party. 28 days

Conditions	Sub-Clause	Data
b) Relevant policies		45 days
Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	Rupees 10 (Ten) lakh only [*insert maximum amount of deductibles*]
Minimum amount of third party insurance	18.3	Rupees 10,00,000 (Rupees Ten Lakh) only per occurrence [*Insert amount of third party insurance; this minimum amount per occurrence should be commensurate with the risk of damage specific to the Contract.*]
Date by which the DB shall be appointed	20.2	90 days after the commencement date.
The DB shall be comprised of	20.2	One Sole Member
Appointment (if not agreed) to be made by	20.3	President , Institution of Engineers (India) , Shillong /Meghalaya Chapter / FIDIC or Recommended by FIDIC
Arbitration:	20.6(b)	Conducted in accordance with the laws of the Employer's country.

Table 1: Summary of Sections

Section Name/Description (Sub-Clause 1.1.5.6)	Time for Completion (Sub-Clause 1.1.3.3)	Delay Damages (Sub-Clause 8.7)
NA	-	-
NA	-	-
NA	-	-
NA	-	-

Table 2: Partial Site Access and Possession

Part	Detailed Description	Number of Days for Site Access and Possession (calculated from Commencement Date)
NA	-	-
NA	-	-
NA	-	-
NA	-	-

Part B - Specific Provisions (SP)

Sub-Clause 1.1.1 The Contract	Delete the entire Sub-Clause 1.1.1.4 and substitute: "1.1.1.4 "Letter of Tender" means the document(s) entitled letter of bid, or letters of technical bid and price bid, as appropriate, which was/were completed by the Contractor and include(s) the signed offer to the Employer for the Works."
Sub-Clause 1.15 **Inspections and Audit by the Bank**	Delete the entire Sub-Clause 1.15.
Sub-Clause 1.16 The Contractor's Liabilities as to the payment taxes and duties	Add the following as a new Sub-Clause: **"1.16 The Contractor's Liabilities as to the payment taxes and duties** The Contractor shall be liable to the payment of taxes and duties, unless otherwise stated in the Contract Data. In this context; (A) duties, taxes and levies listed in the Contract Data shall be exempted. Such exemptions are fallen into two categories, namely: (i) "No Pay" category: The Contractor shall be entitled to exemption from duties, taxes and levies falling into this category, without having to make any payment arising from or out of or in connection with such liabilities; or "Pay & Reimburse" category: The Contractor shall be entitled to exemption from duties, taxes and levies, falling into this category, provided that he first makes all payments arising from or out of or in connection with such liabilities and then applies for their reimbursement from the relevant authority, following the procedure prescribed by such authority; or (B) duties, taxes and levies shall be paid by the Employer on behalf of the Contractor: If the lists referred to in sub-paragraph (A) or (B) are not included in the Contract Data, this Sub-Clause shall not apply."
Sub-Clause 4.1 Contractor's General Obligations	In the third paragraph, delete "have their origin in any eligible source country as defined by the Bank" and substitute: "meet the requirements specified in the Annex to Part B: JICA Specific Provisions – Eligible Source Countries of Japanese ODA Loans hereto.".
Sub-Clause 5.1 Definition of "Nominated Subcontractor"	In sub-paragraph (b), delete "[*Objection to Notification*]" and substitute "[*Objection to Nomination*]".

Sub-Clause 6.7 Health and Safety

Delete the following last sentence of the last paragraph:

"Payment to the Contractor for preparation and implementation this programme shall not exceed the Provisional Sum dedicated for this purpose.".

Sub-Clause 13.5 Provisional Sums

Add the following at the end of Sub-Clause 13.5:

"As an exception to the above, the Provisional Sum for the cost of the DB shall be used, in accordance with Sub-Clause 20.2 [*Appointment of the Dispute Board*], for payments to the Contractor of the invoices of the DB for its Regular Cost and one-half of its Non-Regular Cost.

No prior instruction of the Engineer shall be required with respect to the work of the DB.

The following shall apply to payments under the Provisional Sum of the cost of the DB:

(A) Requests for any payment under the Provisional Sum shall be included in those Statements submitted under Sub- Clause 14.3 [*Application for Interim Payment Certificates*] together with all necessary substantiations including:

invoices prepared by the DB members and provided to the Contractor for payment/ reimbursement of their fees and/or expenses; and

(i) evidence of payment of such invoiced amounts in full.

(B) The Contractor's overhead, profit, etc., shall not be included in the Provisional Sums for the cost of the DB.

(C)The Engineer's certification of such Statements under Sub- Clause 14.6 [*Issue of Interim Payment Certificates*] shall be based upon the invoices of the DB and evidence of payment of such invoiced amounts in full by the Contractor.

Sub-Clause 14.5 Issue of Interim Payment Certificates

Delete "Schedules" in the second paragraph, in the sub- paragraph (b) (i) and in the sub-paragraph (c) and substitute "Contract Data" respectively

Sub-Clause 14.6 Issue of Interim Payment Certificates

Add the following at the end of the first paragraph:

"and shall include any amounts due to or from the Contractor in accordance with a decision by the DB made under Sub-Clause

20.4 [*Obtaining Dispute Board's Decision*]."

Sub-Clause 14.7 Payment

Delete sub-paragraphs (b) and substitute:

"(b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents including any amounts due in accordance with a decision by the DB which have been included in the Interim Payment Certificate ; or, at a time when the Bank's loan (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"

Delete the last paragraph of this Sub-Clause and substitute:

"Payment of the amount due in:

(A) local currency, payable from the proceeds of the Loan, shall be made through as stated in the Contract Data; and

(B) foreign currency, payable from the proceeds of the Loan, shall be made through as stated in the Contract Data.

Payment of the amount due in each currency, payable from any source of finance other than the Loan Agreement such as the Employer's own funds, shall be made directly into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

Any charges or fees associated with or incidental to remittance of funds from JICA/ Employer to the Contractor's account including but not limited to those for opening and amendment commissions of the Letter of Credit shall solely be borne by the Employer."

Sub-Clause 14.15 Currencies of Payment

Delete the entire Sub-Clause 14.15 and substitute:

"The Contract Price shall be paid in the currency or currencies in which the bid price was expressed in the Letter of Price Bid or Letter of Bid, as appropriate. If more than one currency is so named, payments shall be made as follows:

(a) payment of the damages specified in the Contract Data, shall be made in the currencies and proportions specified in the Letter of Bid or Letter of Price Bid as applicable;

(b) other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;

(c) if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and

(d) the applicable rates of exchange shall be those prevailing on the Base Date and determined by the central bank of the Country."

Delete the entire Sub-Clause 15.6 and substitute:

Sub-Clause 15.6 Corrupt or Fraudulent Practices

"If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt or fraudulent practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days' notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [*Termination by Employer*].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt or fraudulent practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [*Contractor's Personnel*].

The Contractor is required to comply with JICA's policy in regard to corrupt and fraudulent practices as declared in the Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans."

Delete the six paragraph and substitute:

Sub-Clause 20.2 Appointment of the Dispute Board

"The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment. The Employer shall be responsible for paying the Regular Cost and one-half of the Non-Regular Cost and the Contractor shall be responsible for paying one-half of the Non-Regular Cost.

For the purposes of this Sub-Clause:

(a) "Regular Cost" means retainer fees of DB members, daily fees of the DB members for regular Site visits and all expenses of regular Site visits of the DB members.

(b) "Non-Regular Cost" means all fees and expenses of the DB other than the Regular Cost."

Delete the entire Sub-Clause 20.6 and substitute:

Sub-Clause 20.6 Arbitration

"Any dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.5 above and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Arbitration shall be conducted as follows:

(a) if the Contract is with a foreign contractor (or if the lead partner is a foreign contractor, in case of JV), international arbitration (1) with

proceedings administered by the arbitration institution designated in the Contract Data, and conducted under the rules of arbitration of such institution; or, if so specified in the Contract Data, (2) with proceedings administered by Japan Commercial Arbitration Association (JCAA) and conducted under the arbitration rules of JCAA; or

(3) if neither an arbitration institution nor arbitration rules are specified in the Contract Data, with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

(b) if the Contract is with a domestic contractor (or if the lead partner is a domestic contractor, in case of JV), arbitration with proceedings conducted in accordance with the laws of the Country.

The place of arbitration shall be a neutral location determined in accordance with the applicable rules of arbitration; and the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [*Law and Language*].

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works."

Sub-Clause 20.7 Failure to Comply with Dispute Board's Decision

Delete the entire Sub-Clause 20.7 and substitute:

"In the event that a Party fails to comply with any decision of the DB, whether binding or final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself directly to arbitration under Sub-Clause

20.6 [*Arbitration*] in which case Sub-Clause 20.4 [*Obtaining Dispute Board's Decision*] and Sub-Clause 20.5 [*Amicable Settlement*] shall not apply to this reference. The arbitral tribunal (constituted under Sub-Clause 20.6 [*Arbitration*]) shall have the power, by way of summary or other expedited procedure, to order, whether by partial award, an interim or provisional measure or award (as may be appropriate under applicable law or otherwise), the enforcement of that decision."

Sub-Clause 20.8 No Dispute Board in Place

Change the title of the Sub-Claus from "20.8 Expiry of Dispute Board's Appointment" to "20.8 No Dispute Board in Place"

Delete the entire Sub-Clause 20.8 and substitute:

"If a dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DB in place (or no DB is being constituted), whether by reason of the expiry of the DB's appointment or otherwise:

(a) Sub-Clause 20.4 [*Obtaining Dispute Board's Decision*] and Sub-Clause 20.5 [*Amicable Settlement*] shall not apply, and

(b) the dispute may be referred by either Party directly to arbitration under Sub-Clause 20.6 [*Arbitration*] without prejudice to any other rights the Party may have."

Clause 6 Payment

Appendix

General Conditions of Dispute Board Agreement

Delete the third and fourth paragraphs from the end and substitute:

"The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of the amount which the Employer is responsible for these invoices (the Regular Cost and one-half of the Non-Regular Cost). The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of the amount which the Contractor is responsible for, including any additional excess of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub- Clause 14.8 of the Conditions of Contract."

Annex to Part B: Specific Provisions - Eligible Source Countries of Japanese ODA Loans.

All countries except Pakistan and Chin**a.**

Section IX. Contract Forms

Letter of Acceptance

[*insert letterhead paper of the Employer*]

[*insert date*]

To: [*insert name and address of the Contractor*]

This is to notify you that your Bid dated [*insert date*] for execution of the [*insert name of the Contract and identification number, as given in the Contract Data*] for the Accepted Contract Amount of the equivalent of [*insert amount in words and figures*] [*insert name of currency*], as corrected and modified in accordance with the Instructions to Bidders, is hereby accepted by [*insert name of Employer*].

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section IX, Contract Forms, of the Bidding Document.

Authorized Signature :_____

Name and Title of Signatory : _____

Name of Agency : _____

Attachment: Memoranda (*Insert list of memoranda (if any) as referred in* Sub-Clause 1.1.1.3)

[Option A: Two-Envelope Bidding]

Contract Agreement

THIS AGREEMENT made the [*insert day*] day of [*insert month*], [*insert year*], between [*insert name of the Employer*] (hereinafter "the Employer"), of the one part, and [*insert name of the Contractor*] (hereinafter "the Contractor"), of the other part:

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

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
   (a) the Letter of Acceptance;
   (b) the Letter of Technical Bid;
   (c) the Letter of Price Bid;
   (d) the addenda, if any;
   (e) the Particular Conditions;
   (f) the General Conditions;
   (g) the Specification;
   (h) the Drawings;
   (i) the completed Schedules; and
   (j) the Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loans.
3. In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed on the day and year first above written.

Signed by

for and on behalf of the Employer in the presence of:

Signed by

for and on behalf the Contractor in the presence of:

Witness;	Witness;
Name :	Name :
Signature :	Signature :
Address :	Address:

Performance Security

Demand Guarantee

[*insert Guarantor letterhead or SWIFT identifier code*]

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

Date: [*insert date of issue*]

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

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

We have been informed that [*insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture*] (hereinafter called "the Applicant") has entered into Contract No. [*insert reference number of the contract*] dated [*insert date*] with the Beneficiary, for the execution of [*insert name of the contract and brief description of the Works*] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of [*insert amount in figures*] ([*insert amount in words*])1, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for its demand or the sum specified therein.

This guarantee shall expire and be returned to us, no later than the [*insert the day*] day of [*insert month*], [*insert year*]2, and any demand for payment under it must be received by us at this office indicated above on or before that date.

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

[*signature(s)*]

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

[1] *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance 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.*

Advance Payment Security

Demand Guarantee

Notes for the Employer

The Employer should note that in the event of an extension of the Time for Completion, 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.

[*insert Guarantor letterhead or SWIFT identifier code*]

Beneficiary: [*insert name and address of the Employer*]

Date: [*insert date of issue*]

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

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

We have been informed that [*insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture*] (hereinafter called "the Applicant") has entered into Contract No. [*insert reference number of the contract*] dated [*insert date of the contract*] with the Beneficiary, for the execution of [*insert name of contract and brief description of Works*] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum [*insert amount in figures*] ([*insert amount in words*]) is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of [*insert amount in figures*] ([*insert amount in words*])3 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.

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

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire and be returned to us, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the [*insert day*] day of [*insert month*], [*insert year*],4 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.*]

[3] *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*
[4] *Insert the expected expiration date of the Time for Completion*

Retention Money Security

Demand Guarantee

[*insert 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 " Applicant") has entered into Contract No. [*insert reference number of the contract*] dated [*insert date*] with the Beneficiary, for the execution of [*insert name of contract and brief description of* Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, payment of [*insert the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security*] is to be made against a Retention Money guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of [*insert amount in figures*]

([*insert amount in words*])5 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 show grounds for its demand or the sum specified therein.

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

This guarantee shall expire and be returned to us no later than the [*insert day*] day of [*insert month*], [*insert year*]6, 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.*]

[5] *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 amountguaranteed 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.*

5 *Insert the same expiry date as set forth in the Performance Security, representing the date twenty-eight days after the completion date*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					24
IMPLEMENTATION SCHEDULE HM & Civil Package								Power House shutdown Units I & II (April, 2025 to April, 2026)																					
																													13
Preparation works																													
Site clearance and mobilization																													1
De-mobilization																													1
Nongmahir dyke and reservoir																													
Dyke renovation, re-arrangement of scattered boulders																													2
Overflow type spillway renovation																													1
Renovation of Stage III Face III Intake Hoist including motors, gearbox, etc																													6
Installation of transformer, HT & LT cables, poles etc for Face III Intake , Face 2																													3

including lightings at Main Dyke for security purposes.	TIOI				SATION & U					ATION OF UMIUM-UMTRU ST HYDRO ELECTRIC PI																			
Tunnel																													
Link tunnel																													8
Head Race Tunnel																													3
Penstock																													12
Power house																													
Power house renovation, reinforcement & sanitary facility																													6
Fire fighting system																													3
Draft tube gate and PRV gate																													2
Oeration facility		monsoonRoad to be renovated prior to the transportation of E&M equipmentProject																											
Road renovation –																													6
Operation house renovation																													18
Other Civil works																													20