BIDDING DOCUMENT

for

THE PROCUREMENT OF

Chandragiri Municipality Office Building Construction

National Competitive Bidding (NCB)

Single-Stage: Two-Envelope Bidding Procedure

IFB No: 04/ch.na.pa./075/76

Contract ID: 04/ch.na.pa./075/76

Chandragiri Municipality,Kathmandu

Issued on: 10-07-2019 00:00

Abbreviations

BD ... .Bidding Document

BDF ... . Bidding Forms

BDS ... . Bid Data Sheet

BOQ ... . Bill of Quantities

COF ... . Contract Forms

DP ... . Development Partners

DoLIDAR ... . Department of Local Infrastructure Development and Agricultural Roads

ELI ... . Eligibility

EQC ... . Evaluation and Qualification Criteria

EXP ... . Experience

FIN .... Financial

GCC ... . General Conditions of Contract

GoN ... . Government of Nepal

ICC ... . International Chamber of Commerce

IFB ……. Invitation for Bids

ITB ... . Instructions to Bidders

JV ... . Joint Venture

LIT ... . Litigation

NCB ... . National Competitive Bidding

PAN ... . Permanent Account Number

PPA ... . Public Procurement Act

PPMO ..... . Public Procurement Monitoring Office

PPR ... . Public Procurement Regulations

PL ... .Profit & Loss

SBD ... . Standard Bidding Document

SCC ... . Special Conditions of Contract

TS ... .Technical Specifications

VAT ... . Value Added Tax

WRQ ... . Works Requirements

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Invitation for Bids

Government of Nepal (GoN)

Chandragiri Municipality,Kathmandu

Invitation for Bids for the Chandragiri Municipality Office Building Construction

IFB No: 04/ch.na.pa./075/76

Contract Identification No: 04/ch.na.pa./075/76

Date of publication: 10-07-2019 00:00

1. The Government of Nepal [GoN] has allocated funds towards the cost of Chandragiri Municipality Office Building Construction and intends to apply part of the funds to cover eligible payments under the Contract for Chandragiri Municipality Office Building Construction (Contract No: 04/ch.na.pa./075/76). Bidding is open to all eligible bidders as per Section V of Bidding Document

2. Chandragiri Municipality,Kathmandu invites electronic bids from eligible bidders for the construction of Chandragiri Municipality Office Building Construction, Balambu Kathmandu under National Competitive Bidding – Single Stage Two Envelope Bidding procedures.

   Only eligible bidders with the following key qualifications should participate in this bidding:

   Minimum Average Annual Construction Turnover of the best 3 years within the last 10 years: Minimum average annual construction turnover of NRs 160 Million calculated as total certified payments received for construction contracts in progress or completed, within best three years out of last ten years.
   Minimum Work experience of similar size and nature: Participation as Prime contractor, management contractor, or subcontractor, in at least 2 Contracts within the last ten (10) years, each with a value of at least NRs 170 Million that have been successfully or are substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size, complexity, methods, technology or other characteristics as described in Section VI, Works Requirements.

3. Under the Single Stage, Two Envelope Procedure, Bidders are required to submit simultaneously two separate sealed envelopes, one containing (i) the Technical Bid and the other (ii) the Price Bid, both in turn enclosed in one sealed envelope as per the provision of ITB 21 of the Bidding Document.

4. Eligible Bidders may obtain further information and inspect the Bidding Documents at the office of Chandragiri Municipality,Kathmandu, Balambu, Kathmandu, Nepal or may visit PPMO e-GP system www. bolpatra.gov.np/egp.

5. If hard-copy is allowed then a complete set of Bidding Documents may be purchased from the office Chandragiri Municipality,Kathmandu, Balambu, Kathmandu, Nepal by eligible Bidders on the submission of a written application, along with the copy of company/firm registration certificate, and upon payment of a non-refundable fee of 10000.0 NRs. till 10-07-2019 00:00 during office hours.

   Or

   Bidder who chooses to submit their bid electronically may purchase the hard copy of the bidding documents as mentioned above or may download the bidding documents for e-submission from PPMO's e-GP system www. bolpatra.gov.np/egp. Bidders, submitting their bid electronically, should deposit the cost of bidding document in the Project's Rajaswa (revenue) account as specified below

   Information to deposit the cost of bidding document in Bank:

Name of the Bank:	NIC Asia Bank Ltd.
Name of the Office:	Chandragiri Municipality,Kathmandu
Office Code no:	
Office Account no:	10CA050686752404

Rajaswa (revenue) Shirshak no:

6. Pre-bid meeting shall be held at Chandragiri Municipality,Kathmandu
Balambu
Kathmandu
Nepal at 24-07-2019 14:00 hours.

7. Sealed or electronic bids must be submitted to the office Chandragiri Municipality,Kathmandu, Balambu, Kathmandu, Nepal by hand/courier or through PPMO's e-GP system www.bolpatra.gov.np/egp on or before 09-08-2019 12:00. Bids received after this deadline will be rejected.

8. The bids will be opened in the presence of Bidders' representatives who choose to attend at 09-08-2019 14:00 hours at the office of Chandragiri Municipality,Kathmandu
Balambu
Kathmandu
Nepal. Bids must be valid for a period of 120 days after bid opening and must be accompanied by a bid security or scanned copy of the bid security in pdf format in case of e-bid, amounting to a minimum of NRs. 5300000 which shall be valid for 30 days beyond the validity period of the bid.

9. If the last date of purchasing and /or submission falls on a government holiday, then the next working day shall be considered as the last date. In such case the validity period of the bid security shall remain the same as specified for the original last date of bid submission.

10. Evaluation and Qualification Criteria:

Nationality:

Nationality in accordance with ITB sub-clause 4.2
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined must meet requirement.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Letter of Technical Bid Forms ELI –1; ELI –2 with attachments.

Conflict of Interest:

No conflicts of interest in accordance with ITB Sub-Clause 4.3.
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined existing or intended JV must meet requirement.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Letter of Technical Bid.

Government/DP Eligibility:

Not having been declared ineligible by government/DP, as described in ITB Sub-Clause 4.4.
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined must meet requirement.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Letter of Technical Bid.

UN Eligibility:

Not having been declared ineligible based on a United Nations resolution or Employer's country law, as described in ITB Sub-Clause 4.8.
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined existing or intended JV must meet requirement.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Letter of Technical Bid.

Government-owned Entity:

Bidder required to meet conditions of ITB Sub-Clause 4.5.
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined existing or intended JV must meet requirement.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Forms ELI - 1, ELI - 2, with attachments.

Other Eligibility : Firm Registration Certificate:

Firm Registration Certificate
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined not applicable.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Document attachment.

Other Eligibility : Business Registration Certificate:

Business Registration Certificate
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined not applicable.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Document attachment.

Other Eligibility : Tax Clearance Certificate/Tax return submission evidence/evidence of time extension for the F/Y (Only for domestic bidders):

Tax Clearance Certificate/Tax return submission evidence/evidence of time extension for the F/Y 2074/75 (Only for domestic bidders)
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined not applicable.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Document attachment.

Other Eligibility : VAT and PAN Registration certificate (only for domestic bidders):

VAT and PAN Registration certificate (only for domestic bidders)
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined not applicable.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Document attachment.

Other Eligibility : Additional requirements:

Additional requirements
Single Entity must meet requirement.
In case of joint ventures
All Partners Combined not applicable.
Each Partner must meet requirement.
One Partner not applicable.
Documents Submission Requirements: Document attachment.

Corruption Charges:

If Case Filed and Pending Please choose Non-Complied

Adequacy of Technical Proposal:

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity, to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in

Section VI (Works Requirements).

Multiple Contracts:

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

Works are grouped in multiple contracts and pursuant to Sub-Clause 35.4 of the Instructions to Bidders, the Employer will evaluate and compare Bids on the basis of a contract, or a combination of contracts, or as a total of contracts in order to arrive at the least cost combination for the Employer by taking into account discounts offered by Bidders in case of award of multiple contracts.

If a bidder submits several successful (lowest evaluated substantially responsive) bids, the evaluation will also include an assessment of the Bidder's capacity to meet the aggregated requirements regarding:

- Specific Construction Experience
- Average Annual Construction Turnover
- Financial Resources, Equipment to be allocated, and
- Personnel to be fielded.

Pending Litigation:

All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than 70 percent of the Bidder's net worth.
For Single Entity : must meet requirement by itself or as partner to past or existing JV
For joint Venture :Each partner must meet requirement by itself or as partner to past or existing JV. All partner combined and one partner -> not applicable.
Documents Submission Requirements : Form LIT - 1
Note:
The percentage should normally be within the range of 50% to 100% of the Bidder's net worth.

General Construction Experience:

Experience under construction contracts in the role of contractor, subcontractor, or management contractor for at least the last 5 years prior to the applications submission deadline.
For Single Entity : Must meet requirement
For joint Venture : Each Partner Must meet requirement. All partner combined and one partner not applicable.
Documents Submission Requirements : Form EXP - 1
Note:
(1) Insert number of years in words and figures. The time period is normally 5 years or more, but may be reduced to not less than 3 years, according to the nature of works.

Contracts of Similar Size and Nature:

Participation as Prime contractor, management contractor, or subcontractor, in at least 2 Contracts within the last ten (10) years, each with a value of at least NRs 170 Million that have been successfully or are substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size, complexity, methods, technology or other characteristics as described in Section VI, Works Requirements.

Construction Experience in Key Activities:

For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum construction experience in the following key activities :
RCC Works(M25):- at least 1450.0 cum in RCC work in a government building
Bulding with basement construction
For Single Entity : Must meet all requirement
For joint Venture : All partners combined must meet all requirements. Each Partner not applicable. One partner not applicable.
Documents Submission Requirements : Form EXP - 2(b)
List the production rate(s) for the key activity (ies) in the subject contract. The rates should be about 80% of the estimated production rates of the key activity(ies) in the subject contract as needed to meet the expected construction schedule with due allowance for adverse climatic conditions.

Historical Financial Performance:

Submission of audited balance sheets and income statements, for the last 5 years to demonstrate the current soundness of the Bidder's financial position. As a
minimum, a Bidder's net worth calculated as the difference between total assets and total liabilities should be positive.
Note:
(1) The financial information provided by a Bidder should be reviewed in its entirety to allow a truly informed judgment, and the pass-fail decision on the financial position of the Bidder should be given on this basis. Balance sheet of the past three to five years period which shall be decided according to the nature of the work.
For Single Entity : Must meet requirement
For joint Venture : Each partner Must meet requirement. All partner combined and one partner -> not applicable.
Documents Submission Requirements : Form FIN - 1 with attachments

Average Annual Construction Turnover:

Minimum average annual construction turnover of NRs 160 Million calculated as total certified payments received for construction contracts in progress or completed, within best three years out of last ten years.

Financial Resources:

Using Forms FIN - 3 in Section IV (Bidding Forms) the Bidder must demonstrate access to, or availability of, financial resources in the form of "Lines of Credit",
The following cash - flow requirement, ... (5).....
For Single Entity : Must meet requirement
For joint Venture : All partners combined Must meet requirements, Each partner Must meet (6) of the requirement, One partner must meet (7) of the requirements.
Documents Submission Requirements : Form FIN - 3
Note:
(5) Construction cash flow requirement for a number of months (to the nearest half-month), determined as the total time needed by the Employer to pay a contractor's invoice, allowing for (a) the actual time consumed for construction, from the beginning of the month invoiced, (b) the time needed by the Project Manager to issue the monthly payment certificate, (c) the time needed by the Employer to pay the amount certified, and (d) a contingency period of one month to allow for unforeseen delays. The total period should not exceed six months. The assessment of the monthly amount should be based on a straight-line projection of the estimated cash flow requirement over the particular contract period, neglecting the effect of any advance payment and retention monies, but including contingency allowances in the estimated contract cost.
(6) Usually not less than 25 %
(7) Usually not less than 40 %

Part I: Bidding Procedures

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Section I: Instructions to Bidders

A. General	
1. Scope of Bid	1.1 In connection with the Invitation for Bids indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section VI (Works Requirements). The ***name, identification, and number*** of Contracts of the National Competitive Bidding (NCB) are **provided in the BDS.**
	1.2 Throughout this Bidding Document: (a)the term "in writing" means communicated in written form and delivered against receipt; (b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and (c) "day" means calendar day.
2. Source of Funds	2.1 GoN Funded: In accordance with its annual program and budget, approved by the GoN, the implementing agency **indicated in the BDS** plans to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued. Or Public Entities' own Resource Funded: In accordance with its annual program and budget, approved by the public entity, the implementing agency **indicated in the BDS** plans to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued. Or DP Funded: The GoN has applied for or received financing (hereinafter called "funds") from the Development Partner (hereinafter called "the DP") **indicated in the BDS** toward the cost of the project named in the BDS. The GoN intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.
	2.2 DP Funded: Payment by the DP will be made only at the request of the GoN and upon approval by the DP in accordance with the terms and conditions of the financing agreement between the GoN and the DP (hereinafter called the "Loan/Grant Agreement"), and will be subject in all respects to the terms and conditions of that Loan/Grant Agreement. No party other than the GoN shall derive any rights from the Loan Agreement or have any claim to the funds.
3. Fraud and Corruption	3.1 Procuring Entities as well as Bidders, suppliers and contractors and their sub-contractors shall adhere to the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this:; (a) the Employer adopts, for the purposes of this provision, the terms as defined below:

	(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party; (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party. v) "obstructive practice" means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an investigation; (b) making false statements to investigators in order to materially impede an investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (e) materially impeding GoN/DP's contractual rights of audit or access to information; and vi) "integrity violation" is any act which violates Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of GoN/DP sanctions, retaliation against whistleblowers or witnesses, and other violations of Anticorruption Policy, including failure to adhere to the highest ethical standard. (b) the Employer will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the contract;
	(c) DPwill cancel the portion of the financing allocated to a contract if it determines at any time that representative(s) of the GoN or of a beneficiary of DP-financing engaged in corrupt, fraudulent, collusive, or coercive practices or other integrity violations during the procurement or the execution of that contract, without the GoN having taken timely and appropriate action satisfactory to DP to remedy the situation. (d) DP will impose remedial actions on a firm or an individual, at any time, in accordance with DP's Anticorruption Policy and related Guidelines (as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate in DP-financed, -administered, or -supported activities or to benefit from an DP-financed, -administered, or -supported contract, financially or

	otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and (e) The Contractor shall permit the GoN/DP to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the GoN/DP, if so required by the GoN/DP.
	3.2 The Bidder shall not carry out or cause to carry out the following acts with an intention to influence the implementation of the procurement process or the procurement agreement : (a) give or propose improper inducement directly or indirectly, (b) distortion or misrepresentation of facts, (c) engaging in corrupt or fraudulent practice or involving in such act, (d) interference in participation of other competing bidders, (e) coercion or threatening directly or indirectly to cause harm to the person or the property of any person to be involved in the procurement proceedings, (f) collusive practice among bidders before or after submission of bids for distribution of works among bidders or fixing artificial/uncompetitive bid price with an intention to deprive the Employer the benefit of open competitive bid price, (g) Contacting the Employer with an intention to influence the Employer with regards to the bids or interference of any kind in examination and evaluation of the bids during the period from the time of opening of the bids until the notification of award of contract.
	3.3 PPMO, on the recommendation of the Procuring Entity may blacklist a Bidder for a period of one (1) to three (3) years for its conduct including on the following grounds and seriousness of the act committed by the bidder: (a) if convicted by a court of law in a criminal offence which disqualifies the Bidder from participating in the contract, (b) if it is established that the contract agreement signed by the Bidder was based on false or misrepresentation of Bidder's qualification information, (c)if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for, or in executing, a GoN/DP-financed contract. (d) if the Successful Bidder fails to sign the Contract.

	3.4 A bidder declared blacklisted and ineligible by the GoN, Public Procurement Monitoring Office (PPMO) and/or the DP in case of DP funded project, may be ineligible to bid for a contract during the period of time determined by the GoN, PPMO and/or the DP. 3.5 In case of a natural person or firm/institution/company which is already declared blacklisted and ineligible by the GoN, any other new or existing firm/institution/company owned partially or fully by such Natural person or Owner or Board of director of blacklisted firm/institution/company; shall not be eligible bidder.
	3.6 Furthermore, Bidders shall be aware of the provisions of GCC (GCC 28.3 and 72.3(j).
4. Eligible Bidders	4.1 A Bidder may be a natural person, private entity, or government owned entity subject to ITB 4.5 or any combination of them in the form of a Joint Venture (JV) under an existing agreement, or with the intent to constitute a legally-enforceable joint venture. In the case of a JV: (a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms. Maximum number of JV shall be as **specified in the BDS.** and (b) the JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during Contract execution.
	4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section V (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed sub-contractors or suppliers for any part of the Contract including related services.
	4.3 A Bidder shall not have a conflict of interest. A Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process, if any of, including but not limited to, the following apply: (a) they have controlling shareholders in common; or (b) they receive or have received any direct or indirect subsidy from any of them; or (c) they have the same legal representative for purposes of this bid; or (d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or (e) a Bidder participates in more than one bid in this bidding process either individually or as a partner in a joint venture. This will result in the disqualification of all Bids in which it is involved. However, subject to

	any finding of a conflict of interest in terms of ITB 4.3 (a)-(d) above, this does not limit the participation of the same subcontractor in more than one bid; or (f) a Bidder or any of its affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or (g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer as Engineer for the Contract.
	4.4 A firm that is under a declaration of ineligibility by the GoN in accordance with ITB 3, at the date of the deadline for bid submission or thereafter, shall be disqualified. A firm shall not be eligible to participate in any procurement activities under an DP-financed, -administered, or -supported project while under temporary suspension or debarment by DP pursuant to the DP's Anticorruption Policy (see ITB 3), whether such debarment was directly imposed by the DP, or enforced by other DPs pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a temporary suspended or debarred firm will be rejected.
	4.5 Enterprises owned by Government shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the GoN.
	4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.
	4.7 Firms shall be excluded in any of the cases, if (a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Nepal prohibits any import of goods or Contracting of works or services from that country or any payments to persons or entities in that country. Where Nepal prohibits payments to a particular firm or for particular goods by such an act of compliance, that firm may be excluded; (b) DP Funded: as a matter of law or official regulation, Nepal prohibits commercial relations with that country, provided that the DP is satisfied that such exclusion does not preclude effective competition for the supply of goods or related services required; (c) DP Funded: a firm sanctioned or temporarily suspended by the DP in relation to their guidelines or appropriate provisions on preventing and combating fraud and corruption in projects financed by them. (d) If the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV shall not be eligible to participate in procurement process till the concerned Court has not issued the

	decision of clearance against the Corruption Charges.
	4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.
5. Eligible Materials, Equipment and Services	5.1 The materials, equipment and services to be supplied under the Contract shall have their origin in any source countries as defined in accordance with Section V (Eligible Countries) and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.
	5.2 For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.
B. Contents of Bidding Documents	
6. Sections of Bidding Document	6.1 The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8. PART I Bidding Procedures Section I Instructions to Bidders (ITB) Section II Bid Data Sheet (BDS) Section III Evaluation and Qualification Criteria (EQC) Section IV Bidding Forms (BDF) Section V Eligible Countries PART II Requirements Section VI Works Requirements (WRQ) Section VII Bill of Quantities (BOQ) PART III Conditions of Contract and Contract Forms Section VIII General Conditions of Contract (GCC) Section IX Special Conditions of Contract (SCC) Section X Contract Forms (COF)
	6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.
	6.3 The Employer is not responsible for the completeness of the Bidding Document and their Addenda, if they were not obtained directly from the source stated by the Employer in the Invitation for Bids.
	6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document and to furnish with its bid all information and documentation as is required by the Bidding Documents. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.
7. Clarification of	7.1 A prospective Bidder requiring any clarification of the Bidding Document

Bidding Document, Site Visit, Pre-Bid Meeting	shall contact the Employer in writing at the Employer's address **indicated in BDS** or raise any question or curiosity 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 within the period as mentioned in ITB 7.5. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 22.2.
	7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a Contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
	7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
	7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if **provided for in the BDS**. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
	7.5 The Bidder is requested, to submit any questions in writing, to reach the Employer as **mentioned in BDS.**
	7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
	7.7 Non attendance 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 agenda.
	8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document

	from the Employer in accordance with ITB 6.3.
	8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2
C. Preparation of Bids	
9. Cost of Bidding	9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
10. Language of Bid	10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language **specified in the BDS**. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language **specified in the BDS**, in which case, for purposes of interpretation of the Bid, such translation shall govern.
11. Documents Comprising the Bid	11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope. 11.2 The Technical Bid shall comprise the following: (a) Letter of Technical Bid; (b) Bid Security in accordance with ITB 19; (c) alternative Technical Bid, at Bidder's option and if permissible, in accordance with ITB 13; (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2; (e) documentary evidence in accordance with ITB 17, establishing the Bidder's qualifications to perform the contract; (f) Technical Proposal in accordance with ITB 16; (g) Bids submitted by a Joint Venture shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement. The Joint Venture agreement, or letter of intent to enter into a Joint Venture including a draft agreement shall indicate at least the parts of the Works to be executed by the respective partners; and (h) any other required documents, which is not against the provision of Procurement Act/Regulation/Directives and Standard Bidding Document issued by PPMO as specified in the **BDS**.

	11.3 The Price Bid shall comprise the following: (a) Letter of Price Bid; (b) completed Bill of Quantities(BoQ), in accordance with ITB 12 and ITB 14, or as stipulated in the BDS; (c) alternative price Bids, at Bidder's option and if permissible, in accordance with ITB 13; (d) Any other document required in the **BDS**.
	11.4 The Bidder is solely responsible for the authenticity of the submitted documents.
12. Letter of Bid and Schedules	12.1 The Letters of Technical Bid and Price Bid, Schedules, and all documents listed under ITB 11, shall be prepared using the relevant forms in Section IV (Bidding Forms) and in Section VII (Bill of Quantities). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.
13. Alternative Bids	13.1 Unless otherwise **specified in the BDS**, alternative bids shall not be considered.
	13.2 When alternative times for completion are explicitly invited, a statement to that effect will be **included in the BDS**, as will the method of evaluating different times for completion.
	13.3 When specified in the BDS pursuant to ITB 13.1, and subject to ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price the Employer's design as described in the Bidding Document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.
	13.4 When **specified in the BDS**, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be **identified in the BDS** and described in Section VI (Works Requirements). The method for their evaluation will be stipulated in Section III (Evaluation and Qualification Criteria).
14. Bid Prices and Discounts	14.1 The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Schedules shall conform to the requirements specified below.
	14.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section VII (Bill of Quantities). In case of Unit Rate Contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.

	14.3 The price to be quoted in the Letter of Price Bid shall be the total price of the Bid, excluding any discounts offered. Absence of the total price in the Letter of Price Bid or the Bid Price in the Bill of Quantities shall result in 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 If so indicated in ITB 1.1, bids are invited for individual Contracts or for any combination of Contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all Contracts are submitted and opened at the same time.
	14.6 Unless otherwise **provided in the BDS** and the Conditions of Contract, the prices quoted by the Bidder shall be fixed. If the prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Table of Adjustment Data in Section IV (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.
	14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total bid price submitted by the Bidder.
15. Currency of Bid and Payment	15.1 The currency of the bid and payment shall be in Nepalese Rupees.
16. Documents Comprising the Technical Proposal	16.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section IV (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.
17. Documents Establishing the Qualifications of the Bidder	17.1 To establish its qualifications to perform the Contract in accordance with Section III (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section IV (Bidding Forms).
18. Period of Validity of Bids	18.1 Bids shall remain valid for the period **specified in the BDS** after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
	18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in

	writing. If a bid security is requested in accordance with ITB 19, it shall also be extended 30 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 and to include any additional conditions against the provisions specified in Bid Documents.
19. Bid Security	19.1 The Bidder shall furnish as part of its bid, in original form, a bid security as **specified in the BDS**. In case of e-submission of bid, the Bidder shall upload scanned copy of Bid security letter at the time of electronic submission of the bid. The Bidder accepts that the scanned copy of the Bid security shall, for all purposes, be equal to the original. The details of original Bid Security and the scanned copy submitted with e-bid should be the same otherwise the bid shall be non-responsive.
	19.2 The bid security shall be, at the Bidder's option, in any of the following forms: (a) an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law or; (b) a cash deposit voucher in the Employer's Account as **specified in BDS**. 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 Form acceptable to the employer. The form must include the complete name of the Bidder. The bid security shall be valid for minimum thirty (30) days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.
	19.3 The bid security issued by any foreign Bank outside Nepal must be counter guaranteed by Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.
	19.4 Any bid not accompanied by an enforceable and substantially compliant bid security shall be rejected by the Employer as nonresponsive. In case of e- Submission, if the scanned copy of an acceptable Bid Security letter is not uploaded with the electronic Bid then Bid shall be rejected.
	19.5 The bid security of unsuccessful Bidders shall be returned within three days, once the successful Bidder's furnishing of the required performance security and signing of the Contract Agreement pursuant to ITB 40.1 and 41.1
	19.6 The bid security shall be forfeited if: GoN funded : (a) a Bidder requests for withdrawal or modification of its bid, except as provided in ITB 18.2: (i) during the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid, in case of electronic submission; (ii) from the period twenty-four hours prior to bid submission deadline up

	to the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid, in case of hard copy submission. (b)a Bidder changes the prices or substance of the bid while providing information pursuant to clause 27.1; (c) a Bidder involves in fraud and corruption pursuant to clause 3.1; (d) the successful Bidder fails to: (i) furnish a performance security in accordance with ITB 40.1; (ii) sign the Contract in accordance with ITB 41.1; or (iii) accept the correction of arithmetical errors pursuant to clause 33.1 DP funded: The bid security shall 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, except as provided in ITB 18.2; or (b) if the successful Bidder fails to (i) furnish a performance security in accordance with ITB 40.1; or (ii) sign the Contract in accordance with ITB 41.1; (iii) accept arithmetical corrections in accordance with ITB 33.1;
	19.7 The Bid Security of a Joint Venture shall be in the name of the Joint Venture that submits the bid. If the Joint Venture has not been legally constituted at the time of bidding, the Bid Security shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.
20. Format and Signing of Bid	20.1 The Bidder shall prepare one original set of the Technical Bid and one original of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it **"ORIGINAL – TECHNICAL BID"** and **"ORIGINAL – PRICE BID**." Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked **"ALTERNATIVE".** In addition, the Bidder shall submit copies of the bid in the number specified in the BDS, and clearly mark each of them **"COPY."** In the event of any discrepancy between the original and the copies, the original shall prevail. In case of e-submission of bid, the Bidder shall submit his bid electronically in PDF or web forms files as specified in ITB Clause 21.1(b).
	20.2 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as **specified in the BDS** and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid, except for un amended printed literature, shall be signed or initialed by the person signing the bid.
	20.3 Any amendments such as interlineations, erasures, or overwriting shall be

	valid only if they are signed or initialed by the person signing the bid.
D. Submission and Opening of Bids	
21. Sealing and Marking of Bids	21.1 Unless otherwise **specified in BDS**, Bidders shall submit their bids by electronic or by mail/by hand/by courier. Procedures for submission, sealing and marking are as follows: (a) Bidders submitting bids by mail, by hand or by courier shall enclose the original of the Technical Bid, and the original of the Price Bid and each copy of the Technical Bid and Price Bid, including alternative bids, if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as **"ORIGINAL TECHNICAL BID", "ORIGINAL – PRICE BID", "ALTERNATIVE" and "COPY No. – TECHNICAL BID" and "COPY NO. PRICE BID"** These envelopes containing the original and the copies shall then be enclosed in one single envelope. (b) Bidders submitting Bids electronically shall follow the electronic bid submission procedure specified in this clause. i. The bidder is required to register in the e-GP system https://www.bolpatra.gov.np/egp following the procedure specified in e-GP guideline. ii. Interested bidders may either purchase the bidding document from the Employer's office as specified in the Invitation for Bid (IFB) or bidders may download the IFB and bidding document from e-GP system. iii. The registered bidders need to maintain their profile data required during preparation of bids. iv. In order to submit their bids the cost of the bidding document can be deposited as specified in IFB. In addition, electronic scanned copy (.pdf format) of the bank deposit voucher/cash receipt should also be submitted along with the technical bid. v. The bidder can prepare their technical and price bids using data and documents maintained in bidder's profile and forms/format provided in bidding document by Employer. The bidder may submit bids as a single entity or as a joint venture. The bidder submitting bid in joint venture shall have to upload joint venture agreement along with partner(s) Bolpatra ID provided during bidder's registration. vi. Bidders (all partners in case of JV) should update their profile data and documents required during preparation and submission of their technical bids. vii. In case of bid submission in JV, the consent of the partners shall be obtained through the confirmation link sent to the registered email address and the partners shall have to acknowledge their confirmation. **The required forms and documents shall be part of technical bids.**

No.	Document	Requirement	Remarks
1.	Letter of Technical Bid	Mandatory	PDF

2.	Bid Security/Bank Guarantee	Mandatory	PDF
3.	Company registration	Mandatory	PDF
4.	VAT registration	Mandatory for domestic bidders	PDF
5.	Business Registration Certificate	Mandatory	PDF
6.	Tax clearances certificate or evidence of tax return submission	Mandatory for domestic bidders	PDF
7.	Power of Attorney of Bid signatory	Mandatory	PDF
8.	Bank Voucher for cost of bid document	Mandatory	PDF
9.	Joint venture agreement	Mandatory in case of JV Bids Only	PDF
10.	Qualification Documents	Mandatory	Using profile data(financial details, contract details etc.) and Technical Proposal
11.	Additional documents] specified in ITB 11.2 (h)	If applicable	PDF

The required forms and documents shall be part of price bids.

No.	Document	Requirement	Remarks
1.	Letter of Price Bid	Mandatory	PDF
2.	Completed Bill of Quantities (BoQ)	Mandatory	Online Forms
3.	Price Adjustment Table	If applicable	Online Forms
4.	Additional Documents specified in ITB 11.3 (d)	If applicable	PDF

Note: The documents specified as "Mandatory" should be included in e-submission and non-submission of the documents shall be considered as non-responsive bid. .

viii. After providing all the details and documents, two separate bid response documents i.e technical bids and price bids will be generated from the system. Bidders are advised to download and verify the response documents prior to bid submission.

ix. For verifying the authentic user, the system will send one time password (OTP) in the registered e-mail address of the bidder. System will validate the OTP and allow bidder to submit their bid.

x. Electronically submitted bids can be modified and/or withdrawn through system. The bidder may modify their bids multiple times online within bid submission date and time specified in e-GP system. Once a Bid is withdrawn, bidder won't be able to submit another bid response for the same bid.

xi. The Bidder / Bid shall meet the following requirements and conditions for e-submission of bids;

aa) The e-submitted bids must be readable through PDF reader.

	bb) The facility for submission of bid electronically through e-submission is to promote transparency, non-discrimination, equality of access, and open competition in the bidding process. The Bidders are fully responsible to use the e- submission facility properly in e-GP system as per specified procedures and in no case the Employer shall be held liable for Bidder's inability to use this facility. cc) When a bidder submits electronic bid through the PPMO e-GP portal, it is assumed that the bidder has prepared the bid by studying and examining the complete set of the Bidding documents including specifications, drawings and conditions of contract. 21.2. The inner and outer envelopes shall: (aa) bear the name and address of the Bidder; (bb) be addressed to the Employer as provided in BDS 22.1; (cc) bear the specific identification of this bidding process indicated in BDS 1.1; and 21.3 The outer envelope and the inner envelope containing Technical Proposal shall bear a warning not to open before the time and date for the opening of Technical Bid in accordance with ITB 25.1. 21.4 The inner envelope containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 25.7 21.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.
22. Deadline for Submission of Bids	22.1 Bids must be received by the Employer at the address and no later than the date and time indicated **in the BDS**. In case of e-submission, the standard time for e-submission is Nepal Standard Time as set out in the server. The e-procurement system will accept the e-submission of bid from the date of publishing of notice and will automatically not allow the e-submission of bid after the deadline for submission of bid.
	22.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
23. Late Bids	23.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.
24. Withdrawal, and Modification of Bids	24.1 A Bidder may withdraw, or modify its bid- Technical or Price - after it has been submitted either in hard copy or by e-submission. Once a Bid is withdrawn, bidder shall not be able to submit another bid for this bidding process. Procedures for withdrawal or modification of submitted bids are

	as follows: (i) Bids submitted in Hard Copy GoN Funded: a) Bidders may withdraw or modify its bids by sending a written notice in a sealed envelope, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2. The corresponding modification of the bid must accompany the respective written notice. All notices must be: (aa)prepared and submitted in accordance with ITB 20 and ITB 21,and in addition, the respective envelopes shall be clearly marked "**WITHDRAWAL", "MODIFICATION;"** and (bb) received by the Employer twenty four hour prior to the deadline prescribed for submission of bids, in accordance with ITB 22. DP Funded: A Bidder may withdraw or modify its Bid – Technical or Price – after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2, (except that withdrawal notices do not require copies). The corresponding modification of the Bid must accompany the respective written notice. All notices must be i) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," and "MODIFICATION;" and ii) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 22. ii) E-submitted bids. a) Bidder may submit modification or withdrawal prior to the deadline prescribed for submission of bids through e-GP system by using the forms and instructions provided by the system.
	24.2 Bids requested to be withdrawn in accordance with ITB 24.1 shall not be opened. In case of hard copy submission, the Bid will be returned unopened to the Bidders.
	24.3 The following provisions apply for withdrawal or modification of the Bids: GoN Funded: (i) In case of bids submitted in hard copy no bid shall be withdrawn or modified in the interval between 24 hours prior to the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof. (ii) In case of e-submitted bids no bids shall be withdrawn or modified in the interval between deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid or any extension thereof. DP Funded: No Bid may be withdrawn 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.

	24.4 Except in case of any modification or correction in bid document made by procuring entity, Bidder may submit request for withdrawal or modification only one time. 24.5 In case of hard copy bid, no bid may be withdrawn if the bid has already been modified; except in case of any modification or correction in bid document by procuring entity.
	24.6 Request for withdrawal or modification must be made through the same medium of submission. Request for withdrawal or modifications through different medium shall not be considered.
25. Bid Opening	25.1 The Employer shall open the Technical Bids in public at the address, on the date and time **specified in the BDS** in the presence of Bidders` designated representatives who choose to attend. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and Price Bid are submitted together in one envelope, the Employer shall reject the entire Bid.
	25.2 The Employer shall download the e-submitted Technical Bid. The e-GP system allows the Employer to download the e-submitted technical bid only after bid opening date and time after login simultaneously by at least two members of the Bid Opening Committee.
	25.3 Electronically submitted Technical Bid shall be opened at first in the same time and date as specified above. Electronic Bids shall be opened one by one and read out. The e-submitted technical bids must be readable through open standards interfaces. Unreadable and or partially submitted bid files shall be considered incomplete.
	25.4 Thereafter, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be Permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening. Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding bid. 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 and recorded at bid opening. Only the Technical Bid, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original and Modification, will remain unopened in accordance with ITB 25.1.
	25.5 All other envelopes holding the Technical Bid shall be opened one at a time, reading out: the name of the Bidder; whether there is a modification; the presence of a bid security and any other details as the Employer may consider appropriate. Only Technical Bids read out and recorded at bid opening shall be

	considered for evaluation. No bid shall be rejected at opening of Technical Bids except for late bids, in accordance with ITB 23.1.
	25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, or modification; and the presence or absence of a bid security. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.
	25.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given at least 7 days notice for the opening of Price Bids.
	25.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially nonresponsive to the requirements of the Bidding Document and return their Price Bids unopened.
	25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders` representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.
	25.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded: (a) the name of the Bidder; (b) whether there is a modification; (c) the Bid Prices, including any discounts and alternative offers; and (d) any other details as the Employer may consider appropriate. Only Price Bids, discounts, modifications, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.
	25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum, the name of the Bidder, the Bid Price (per lot if applicable), any discounts, modifications and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.
E. Evaluation and Comparison of Bids	

26. Confidentiality	26.1 Information relating to the examination, evaluation, comparison, and post-qualification of bids and recommendation of Contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.
	26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.
	26.3 Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.
27. Clarification of Bids	27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33. In case of e-submission of bid, upon notification from the employer, the bidder shall also submit the original of documents comprising the Technical and Price Bid as per ITB 11.2 and ITB 11.3 for verification of submitted documents for acceptance of the e-submitted bid.
	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. Examination of Technical Bid	29.1The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted.
	29.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected. (a) Letter of Technical Bid;

	(b) written confirmation of authorization to commit the Bidder; (c) Bid Security; and (d) Technical Proposal in accordance with ITB 16
30. Determination of Responsiveness of Technical Bid	30.1 The Employer's determination of a Bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB11.2.
	30.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that, (a) if accepted, would: (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or (ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.
	30.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section VI (Works Requirements) have been met without any material deviation, reservation or omission.
	30.4 If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.
	30.5 In case of e-submission bids, the Employer evaluates the bid on the basis of the information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 27.1, the bid shall not be considered for further evaluation.
	30.6 If the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded during the evaluation. 30.7 Except in case of e-submission, the Financial Bid of the bidder, which is evaluated as substantially non-responsive in technical bid, shall be returned to the respective bidders.
31. Nonconformities Errors, and	31.1 Provided that a bid is substantially responsive, the Employer may waive any non-conformities in the bid that do not constitute a material deviation,

Omissions	reservation, or omission.
	31.2 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.
	31.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the methods indicated in Section III (Evaluation and Qualification Criteria).
	31.4 If the monetary value of such non-conformities is found to be more than fifteen percent of the Bid Price of the bidder pursuant to ITB **31.3**, such bid shall be considered nonresponsive and shall not be involved in evaluation.
32 Qualification of the Bidder	32.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether Biddersmeet the qualifying criteria specified in Section III (Evaluation and Qualification Criteria).
	32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17.1.
	32.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.
33. Correction of Arithmetical Errors	33.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis: (a) only for unit price Contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected; (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; (c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Price Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected.

	(d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a), (b) and (c) above.
	33.2 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be disqualified and its bid security shall be forfeited.
34 Subcontractors	34.1 In case of Prequalification, the Bidder's Bid shall name the same subcontractor as submitted in the prequalification application and approved by the Employer. In case of Post-qualification, the Employer may permit subcontracting for certain specialized works as indicated in Section III When subcontracting is permitted by the Employer, the sub-contractor shall meet the qualifications criteria as indicated in section III. Sub-contractors' qualification and experience will not be considered for evaluation of the Bidder. The Bidder on its own (without taking into account the qualification and experience of the sub-contractor) should meet the qualification criteria. Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as **specified in the BDS.**
35. Evaluation of Price Bids	35.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.
	35.2 To evaluate a Price Bid, the Employer shall consider the following: (a) the bid price, excluding Value Added Tax , Provisional Sums, and the provision, if any, for contingencies in the Summary Bill of Quantities**,** for Unit Rate Contracts, or Schedule of Prices for lump sum Contracts, but including Day work items, where priced competitively; (b) price adjustment for correction of arithmetic errors in accordance with ITB 33.1; (c) price adjustment due to discounts offered in accordance with ITB 14.4; (d) adjustment for nonconformities in accordance with ITB 31.3; (e) application of all the evaluation factors indicated in Section III (Evaluation and Qualification Criteria);
	35.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

	35.4 If this Bidding Document allows Bidders to quote separate prices for different Contracts, and to award multiple Contracts to a single Bidder, the methodology to determine the lowest evaluated price of the Contract combinations, including any discounts offered in the Letter of Price Bid, is specified in Section III (Evaluation and Qualification Criteria).
	35.5 if the bid for an Unit Rate Contract, which results in the lowest Evaluated Bid Price is seriously unbalanced or front loaded **or extremely low** in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analysis 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 analysis, 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 as **mentioned in BDS** to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract **or may consider the bid as non-responsive**.
	35.6 In case of e-submission bids, the Employer evaluates the bid on the basis of the information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 27.1, the bid shall not be considered for further evaluation.
	35.7 If the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded during the evaluation.
36. Comparison of Bids	36.1 The Employer shall compare all substantially responsive bids in accordance with ITB 35.2 to determine the lowest evaluated bid.
37. Employer's Right to Accept Any Bid, and to Reject Any or All Bids	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 contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.
F. Award of Contract	
38. Award Criteria	38.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

39. Letter of Intent to Award the Contract/Notification of Award	39.1 The Employer shall notify the concerned Bidder whose bid has been selected in accordance with ITB 38.1 within seven days of the selection of the bid, in writing that the Employer has intention to accept its bid and the information regarding the name, address and amount of selected bidder shall be given to all other bidders who submitted the bid.
	39.2 If no bidder submits an application pursuant to ITB 42 within a period of seven days of the notice provided under ITB 39.1, the Employer shall, accept the bid selected in accordance with ITB 38.1 and Letter of Acceptance shall be communicated to the selected bidder prior to the expiration of period of Bid validity, to furnish the performance security and sign the contract within fifteen days.
	39.3 If the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be rejected.
40. Performance Security	40.1 Within Fifteen (15) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security in accordance with the Conditions of Contract, subject to ITB 35.5, as specified below from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal using Sample Form for the Performance Security included in Section X (Contract Forms), or another form acceptable to the Employer. The performance security issued by any foreign Bank outside Nepal must be counter guaranteed by Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal. i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price. ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows: **Performance Security Amount = [(0.85 x Cost Estimate –Bid Price) x 0.5] + 5% of Bid Price.** The Bid Price and Cost Estimate shall be inclusive of Value Added Tax.
	40.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily. The process shall be repeated according to ITB 39.
41 Signing of Contract	41.1 The Employer and the successful Bidder shall sign the Contract Agreement within the period as stated ITB 40.1.
	41.2 At the same time, the Employer shall affix a public notice on the result of the award on its notice board and make arrangement for causing such

	notice to be affixed on the notice board also of the ***District Coordination Committee, District Administration Office, Provincial Treasury and Controller Office and District Treasury and Controller Office.*** The Employer may make arrangements to post the notice into its website, if it has; and if it does not have, into the website of the Public Procurement Monitoring Office, identifying the bid and lot numbers and the following information: (i) the result of evaluation of bid; (ii) date of publication of notice inviting bids; (iii) name of newspaper; (iv) reference number of notice; (v) item of procurement; (vi) name and address of bidder making contract and (viii) contract price
	41.3 Within thirty (30) days from the date of issuance of notification pursuant to ITB 39.1 unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, requests for debriefing.
	41.4 If the bidder whose bid has been accepted fails to sign the contract as stated ITB 40.1, the Public Procurement Monitoring Office shall blacklist the bidder on recommendation of the Public Entity.
42. Complaint and Review	42.1 If a Bidder is dissatisfied with the Procurement proceedings or the decision made by the Employer in opening of the price bid or the intention to award the Contract, it may file an application to the Chief of the Public Entity or Public Procurement Monitoring Office or office established as per Clause 145(a) of the Public Procurement Regulation within Seven (7) days of providing the notice under ITB 25.8 and ITB 39.1 by the Public Entity, for review of the proceedings stating the factual and legal grounds.
	42.2 Late application filed after the deadline pursuant to ITB 42.1 shall not be processed.
	42.3 The chief of Public Entity shall, within five (5) days after receiving the application, give its decision with reasons, in writing pursuant to ITB 42.1: (a) whether to suspend the procurement proceeding and indicate the procedure to be adopted for further proceedings; or (b) to reject the application. The decision of the chief of Public Entity shall be final for the Bid amount up to the value as stated in 42.4.
	42.4 If the Bidder is not satisfied with the decision of the Public Entity in accordance with ITB 42.3, is not given within five (5) days of receipt of application pursuant to ITB 42.1, it can, within seven (7) days of receipt of such decision, file an application to the Review Committee of the GoN, stating the reason of its disagreement on the decision of the chief of Public Entity and furnishing the relevant documents, provided that its Bid amount ,equal or more than Rupees Six Million (NRs. 6,000,000). The application may be sent by hand, by post, by courier, or by electronic media at the risk of the Bidder itself.

	42.5 Late application filed after the deadline pursuant to ITB 42.4 shall not be processed.
	42.6 Within three (3) days of the receipt of application from the Bidder, pursuant to ITB 42.4, the Review Committee shall notify the concerning Public Entity to furnish its procurement proceedings, pursuant to ITB 42.3.
	42.7 Within three (3) days of receipt of the notification pursuant to ITB 42.6, the Public Entity shall furnish the copy of the related documents to the Review Committee.
	42.8 The Review Committee, after inquiring from the Bidder and the Public Entity, if needed, shall give its decision within one (1) month of the receipt of the application filed by the Bidder, pursuant to ITB 42.4.
	42.9 The Bidder, filing application pursuant to ITB 42.4, shall have to furnish a cash amount or Bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law equivalent to zero point one percent (0.10%) of its quoted Bid amount with the validity period of at least ninety (90) days from the date of the filing of application pursuant to ITB 42.4.
	42.10 If the claim made by the Bidder pursuant to ITB 42.4 is justified, the Review Committee shall have to return the security deposit to the applicant, pursuant to ITB 42.9, within seven (7) days of such decision made.

SECTION-II

Bid Data Sheet

A. General

ITB 1.1	The number of the Invitation for Bids is : 04/ch.na.pa./075/76
ITB 1.1	The Employer is : Chandragiri Municipality,Kathmandu
ITB 1.1	The number and identification of lots comprising this bidding process is: 04/ch.na.pa./075/76
ITB 2.1	The name of the Project is: Chandragiri Municipality Office Building Construction The Development Partner(DP) is : NA The implementing agency is: NA GoN Funded or DP Funded: NA
ITB 4.1(a)	Maximum number of partner in a joint venture shall be :3

B. Bidding Document

ITB 7.1	For clarification purposes only, the Employer's address is: Attention: Sanjeev Ganwali Address: Balambu Kathmandu Telephone: 9841531015 Facsimile number: Electronic mail address: chandragirimun@gmail.com
ITB 7.4	A pre bid meeting shall be held. Pre-Bid meeting will take place at the following date, time and place:
	Date and Time:24-07-2019 14:00
	Address :Chandragiri Municipality,Kathmandu Balambu Kathmandu Nepal
ITB 7.4	A site visit shall not be organized by the Employer.
ITB 7.5	Time for request: Requests for clarification should be received by the Employer no later than 10 days prior to the deadline for submission of bids.

C. Preparation of Bids

ITB 10.1	The language of the bid is: English / Nepali
ITB 11.2 (h)	The Bidder shall submit with its Technical Bid the following additional documents:

SL No	Document Name
1	N/A

ITB 11.3 (b)	In accordance with ITB 12 and ITB 14, the following schedules shall be submitted with the bid, including the priced Bill of Quantities for Unit Rate Contracts and Schedule of Prices for lump sum contracts:	
	SL No	Document Name
	1	N/A
ITB 11.3 (d)	The Bidder shall submit with its Price Bid the following additional documents :	
	SL No	Document Name
	1	N/A
ITB 13.1	Alternative bids shall not be permitted.	
ITB 13.2	Alternative times for completion shall not be permitted. If alternative times for completion are permitted, the evaluation method will be as specified in Section III (Evaluation and Qualification Criteria).	
ITB 13.4	Alternative technical solutions shall not be permitted for the following parts of the Works	
ITB 14.6	The prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract. Bidder shall submit the Table of Price Adjustment Data as a part of price bid.	
ITB 18.1	The bid validity period shall be 120 days.	
ITB 19.1	The Bidder shall furnish a bid security, from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law with a minimum of 5300000.00 NPR, which shall be valid for 30 days beyond the validity period of the bid.	
ITB 19.2(b)	Bank Name: NIC Asia Bank Ltd. Branch Name: Kalanki Bank Address: Kathmandu, 0, Kathmandu, Kathmandu Office Name: Chandragiri Municipality Account Number: 10CA050686752402 Office Code: n/a	
ITB 20.1	In addition to the original of the bid, the number of copy/ies is/are:	
	SL No	Document Name
	1	Not Applicable
ITB 20.2	The written confirmation of authorization to sign on behalf of the Bidder shall indicate: (a) The name and description of the documentation required to demonstrate the authority of the signatory to sign the Bid such as a Power of Attorney; and (b) In the case of Bids submitted by an existing or intended JV, an undertaking signed by all parties (i) stating that all parties shall be jointly and severally liable, and (ii) nominating a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.	

D. Submission and Opening of Bids

ITB 21.1	Bidders shall have the option of submitting their bids by electronic only.
ITB 22.1	For bid submission purposes only, the Employer's address is : Attention : Chandragiri Municipality,Kathmandu Balambu Kathmandu Nepal

	Address :	Chandragiri Municipality,Kathmandu Balambu Kathmandu Nepal
	The deadline for bid submission is :	09-08-2019 12:00
ITB 25.1	The Technical Bid opening shall take place at :	
	Address :	Chandragiri Municipality,Kathmandu Balambu Kathmandu Nepal
	Date :	09-08-2019 14:00

E. Evaluation and Comparison of Bids

ITB 34.1	Sub-contracting for this procurement is: Not Applicable
ITB 35.5	The amount of the performance security be increased by 8 percent of the quoted bid price.

SECTION-III

Evaluation and Qualification Criteria

1. Evaluation

1.1 Adequacy of Technical Proposal

Sl. No.	Criteria Title	Criteria Description
1	Adequacy of Technical Proposal	Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity, to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section VI (Works Requirements).

1.2 Multiple Contracts

Sl. No.	Criteria Title	Criteria Description
1	Multiple Contracts	Pursuant to Sub-Clause 35.4 of the Instructions to Bidders, if Works are grouped in multiple contracts, evaluation will be as follows: Works are grouped in multiple contracts and pursuant to Sub-Clause 35.4 of the Instructions to Bidders, the Employer will evaluate and compare Bids on the basis of a contract, or a combination of contracts, or as a total of contracts in order to arrive at the least cost combination for the Employer by taking into account discounts offered by Bidders in case of award of multiple contracts. If a bidder submits several successful (lowest evaluated substantially responsive) bids, the evaluation will also include an assessment of the Bidder's capacity to meet the aggregated requirements regarding: • Specific Construction Experience • Average Annual Construction Turnover • Financial Resources, Equipment to be allocated, and • Personnel to be fielded.

1.5 Quantifiable Non-conformities and Omissions

Sl. No.	Criteria Title	Criteria Description
1	Quantifiable Non-conformities and Omissions	Subject to ITB 14.2 and ITB 35.2, the evaluated cost of quantifiable nonconformities including omissions, is determined as follows: [Insert in bidding document: "Pursuant to ITB 31.3, the cost of all quantifiable nonmaterial nonconformities shall be evaluated, but excluding omission of prices in the Bill of Quantities. The Employer will make its own assessment of the cost of any nonmaterial nonconformities and omissions for the purpose of ensuring fair comparison of bids."]

2. Qualification

2.1 Eligibility

Sl. No.	Criteria Title	Criteria Description
1	Nationality	Nationality in accordance with ITB sub-clause 4.2 Single Entity must meet requirement. In case of joint ventures All Partners Combined must meet requirement. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Letter of Technical Bid Forms ELI –1; ELI –2 with attachments.

Sl. No.	Criteria Title	Criteria Description
2	Conflict of Interest	No conflicts of interest in accordance with ITB Sub-Clause 4.3. Single Entity must meet requirement. In case of joint ventures All Partners Combined existing or intended JV must meet requirement. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Letter of Technical Bid.
3	Government/DP Eligibility	Not having been declared ineligible by government/DP, as described in ITB Sub-Clause 4.4. Single Entity must meet requirement. In case of joint ventures All Partners Combined must meet requirement. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Letter of Technical Bid.
4	UN Eligibility	Not having been declared ineligible based on a United Nations resolution or Employer's country law, as described in ITB Sub-Clause 4.8. Single Entity must meet requirement. In case of joint ventures All Partners Combined existing or intended JV must meet requirement. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Letter of Technical Bid.
5	Government-owned Entity	Bidder required to meet conditions of ITB Sub-Clause 4.5. Single Entity must meet requirement. In case of joint ventures All Partners Combined existing or intended JV must meet requirement. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Forms ELI - 1, ELI - 2, with attachments.
6	Other Eligibility : Firm Registration Certificate	Firm Registration Certificate Single Entity must meet requirement. In case of joint ventures All Partners Combined not applicable. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Document attachment.
7	Other Eligibility : Business Registration Certificate	Business Registration Certificate Single Entity must meet requirement. In case of joint ventures All Partners Combined not applicable. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Document attachment.
8	Other Eligibility : Tax Clearance Certificate/Tax return submission evidence/evidence of time extension for the F/Y (Only for domestic bidders)	Tax Clearance Certificate/Tax return submission evidence/evidence of time extension for the F/Y 2074/75 (Only for domestic bidders) Single Entity must meet requirement. In case of joint ventures All Partners Combined not applicable. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Document attachment.

Sl. No.	Criteria Title	Criteria Description
9	Other Eligibility : VAT and PAN Registration certificate (only for domestic bidders)	VAT and PAN Registration certificate (only for domestic bidders) Single Entity must meet requirement. In case of joint ventures All Partners Combined not applicable. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Document attachment.
10	Other Eligibility : Additional requirements	Additional requirements Single Entity must meet requirement. In case of joint ventures All Partners Combined not applicable. Each Partner must meet requirement. One Partner not applicable. Documents Submission Requirements: Document attachment.
11	Corruption Charges	If Case Filed and Pending Please choose Non-Complied

2.2 Pending Litigation

Sl. No.	Criteria Title	Criteria Description
1	Pending Litigation	All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than 70 percent of the Bidder's net worth. For Single Entity : must meet requirement by itself or as partner to past or existing JV For joint Venture :Each partner must meet requirement by itself or as partner to past or existing JV. All partner combined and one partner -> not applicable. Documents Submission Requirements : Form LIT - 1 Note: The percentage should normally be within the range of 50% to 100% of the Bidder's net worth.

2.3 Financial Situation

Sl. No.	Criteria Title	Criteria Description
1	Historical Financial Performance	Submission of audited balance sheets and income statements, for the last 5 years to demonstrate the current soundness of the Bidder's financial position. As a minimum, a Bidder's net worth calculated as the difference between total assets and total liabilities should be positive. Note: (1) The financial information provided by a Bidder should be reviewed in its entirety to allow a truly informed judgment, and the pass-fail decision on the financial position of the Bidder should be given on this basis. Balance sheet of the past three to five years period which shall be decided according to the nature of the work. For Single Entity : Must meet requirement For joint Venture : Each partner Must meet requirement. All partner combined and one partner -> not applicable. Documents Submission Requirements : Form FIN - 1 with attachments

Sl. No.	Criteria Title	Criteria Description
2	Average Annual Construction Turnover	Minimum average annual construction turnover of NRs 150 Million, calculated as total certified payments received for construction contracts in progress or completed, within best three years out of last ten years. Only the net amount shall be calculated after deducting the amount for VAT and such amount shall be adjusted wholesale price index of Nepal Rastra Bank. For Single Entity : Must meet requirement For joint Venture : All combined partner Must meet requirements, Each partner Must meet 3 of the requirement, One partner must meet 4 of the requirements. Documents Submission Requirements : Form FIN -2 Note: (2) The amount stated should normally not be less than 1.5 x V/T, the estimated annual turnover in the subject contract based on a straight-line projection of the Employer's estimated cost (V), over the contract duration (T) in year. Contract duration less than one year shall be considered one year. The multiplier of 1.5 may be reduced up to1 (one) in accordance with the size, nature and complexity of contracts. (3) Usually not less than 25 % (4) Usually not less than 40 %
3	Financial Resources [Note: If the bid evaluation process and the decision for the award of the Contract takes more than one (1) year from the date of bid submission, Bidders shall be asked to resubmit their current contract commitments and latest information on financial resources supported by latest audited accounts or audited financial statements, or if not required by the law of the Bidderï¿½s country, other financial statements acceptable to the Employer, and the Biddersï¿½ financial capacity shall be reassessed on this basis.]	Using Forms FIN - 3 in Section IV (Bidding Forms) the Bidder must demonstrate access to, or availability of, financial resources in the form of "Lines of Credit", The following cash - flow requirement, ... (5)..... For Single Entity : Must meet requirement For joint Venture : All partners combined Must meet requirements, Each partner Must meet (6) of the requirement, One partner must meet (7) of the requirements. Documents Submission Requirements : Form FIN - 3 Note: (5) Construction cash flow requirement for a number of months (to the nearest half-month), determined as the total time needed by the Employer to pay a contractor's invoice, allowing for (a) the actual time consumed for construction, from the beginning of the month invoiced, (b) the time needed by the Project Manager to issue the monthly payment certificate, (c) the time needed by the Employer to pay the amount certified, and (d) a contingency period of one month to allow for unforeseen delays. The total period should not exceed six months. The assessment of the monthly amount should be based on a straight-line projection of the estimated cash flow requirement over the particular contract period, neglecting the effect of any advance payment and retention monies, but including contingency allowances in the estimated contract cost. (6) Usually not less than 25 % (7) Usually not less than 40 %

2.4 Experience

Sl. No.	Criteria Title	Criteria Description

Sl. No.	Criteria Title	Criteria Description
1	General Construction Experience	Experience under construction contracts in the role of contractor, subcontractor, or management contractor for at least the last 5 years prior to the applications submission deadline. For Single Entity : Must meet requirement For joint Venture : Each Partner Must meet requirement. All partner combined and one partner not applicable. Documents Submission Requirements : Form EXP - 1 Note: (1) Insert number of years in words and figures. The time period is normally 5 years or more, but may be reduced to not less than 3 years, according to the nature of works.
2	Contracts of Similar Size and Nature	Participation as Prime contractor, management contractor, or subcontractor, in at least 2 CONTRACT OF GOVERNMENT BUILDING construction of minimum total floor area of 2400 sq.m Contracts within the last ten (10) years, each with a value of at least NRs 160 million that have been successfully or are substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size, complexity, methods, technology or other characteristics as described in Section VI, Works Requirements. Only the net amount shall be calculated after deducting the amount for VAT and such amount shall be adjusted to present value by applying wholesale price index of Nepal Rastra Bank. For Single Entity : Must meet requirement For joint Venture : All partners combined, must meet requirement. Each partner and one partner not applicable. Documents Submission Requirements : Form EXP - 2(a) Note: (2) Insert number of contracts, the range should be one to two, depending on the size and complexity of the subject contract, the exposure of the risk to the Employer by contractor's default. (3) Insert amount in Nepalese rupees, which is usually 80% of the estimated value of the subject contract.
3	Construction Experience in Key Activities	For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum construction experience in the following key activities : RCC Works(M25):- at least 1450.0 cum in RCC work in a government building Bulding with basement construction For Single Entity : Must meet all requirement For joint Venture : All partners combined must meet all requirements. Each Partner not applicable. One partner not applicable. Documents Submission Requirements : Form EXP - 2(b) List the production rate(s) for the key activity (ies) in the subject contract. The rates should be about 80% of the estimated production rates of the key activity(ies) in the subject contract as needed to meet the expected construction schedule with due allowance for adverse climatic conditions.

2.5 Personnel

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

Sl. No.	Position	Required No	Academic Qualification	Total Work Experience (in years)	Experience in Similar Work(in years)
1	Contract Manager	1	Bachelor in Civil Engineering	10	5
2	Site Engineer	1	Bachelor in Civil Engineering	5	3
3	Site Supervisor	1	Diploma In Civil Engineering	5	3
4	Lab Technician	1	Intermediate Level or Equipment	5	3

In case the bidder proposes to consider Personnel that may be spared from committed/ongoing contracts for evaluation, the bidder shall provide details of personnel which will be spared from such committed/ongoing contracts based on the physical progress at the date of bid submission.

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Information Forms included in Section IV (Bidding Forms).

2.6 Equipment

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

Sl. No.	Equipment Type Characteristics	Minimum number required
1	Excavator	1
2	Tipper/Truck	2
3	Needle Vibrator	4
4	Water Pump	3
5	Generator	3
6	Total Station/Theodolite	1
7	Auto Level	1

In case the Bidder proposes to consider Equipment that may be spared from committed/ongoing contracts for evaluation, the Bidder shall provide details of Equipment which will be spared from committed / ongoing contracts clearly demonstrating the availability of such equipment with respect to the physical progress of the ongoing contracts on the date of bid submission.

In case of Equipment to be leased/hired the same procedure as mentioned above shall apply.

The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section IV (Bidding Forms)

2.7 Subcontractors

The experience and financial capacity of the sub-contractors shall not be added to those of the Bidder for purposes of qualification of the Bidder.

The sub-contractors proposed shall be fully qualified for their work proposed, and meet the following criteria:

SECTION-IV
Bidding Forms

Letter of Technical Bid

The Bidder must accomplish the Letter of Bid in its letterhead clearly showing the Bidder's complete name and address.

Date: .....

Name of the contract: .....

Invitation for Bid No.: .....

To:…….....

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) Clause 8.

(b) We offer to execute in conformity with the Bidding Documents the following Works:

(c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of ***[insert validity period as specified in ITB 18.1 of the BDS]*** days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(d) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries in accordance with ITB 4.2 and meet the requirements of ITB 3.4, 3.5 & 4.7(d),

(e) We are not participating, as a Bidder or as a subcontractor, in more than one Bid in this bidding process in accordance with ITB 4.3(e), other than alternative offers submitted in accordance with ITB 13.

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

(g) We are not a government owned entity/We are a government owned entity but meet the requirements of ITB 4.5;[1]

(h) We declare that, we including any subcontractors or suppliers for any part of the contract do not have any conflict of interest in accordance with ITB 4.3 and we have not been punished for an offense relating to the concerned profession or business.

(i) We declare that we are solely responsible for the authenticity of the documents submitted by us. The document and information submitted by us are true and correct. If any document/information given is found to be concealed at a later date, we shall accept any legal actions by the Employer.

(j)

(k) We agree to permit the Employer/DP or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors

appointed by the Employer.

(l) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section III (Evaluation and Qualification Criteria) and our technical proposal, or as otherwise agreed with the Employer.

(m)

Name: .....

In the capacity of .....

Signed ……...

Duly authorized to sign the Bid for and on behalf of ……

Date ……....

Letter of Price Bid

The Bidder must accomplish the Letter of Bid in its letterhead clearly showing the Bidder's complete name and address.

Date: .....

Name of the contract: .....

Invitation for Bid No.: .....

To:…….....

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) Clause 8;

(b) We offer to execute in conformity with the Bidding Documents the following Works:

(c) The total price of our Bid, excluding any discounts offered in item (d) below is: NRs. ……..; or when left blank is the Bid Price indicated in the Bill of Quantities[1].

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

(e) Our bid shall be valid for a period of ***[insert validity period as specified in ITB 18.1]*** days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

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

(g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:[2]

Name of Recipient	Address	Reason	Amount
.....	.....	.....	.....
.....	.....	.....	..... .

(h) We understand that this bid, *together with your written acceptance thereof i*ncluded **i**n your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;

[1]Absence of the total price in the Letter of Price Bid or in the Bill of Quantities shall result in rejection of the Bid.

[2] If none has been paid or is to be paid, indicate "None".

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

(j) We declare that we are solely responsible for the authenticity of the documents submitted by us.

(k) We agree to permit the Employer/DP or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Employer.

Name: .....

In the capacity of .....

Signed ……...

Duly authorized to sign the Bid for and on behalf of ……

Date ……....

Table of Price Adjustment Data

[To be used if Price Adjustment is applicable as per GCC 53.1]

Code	Index Description	Source of Index*	Base Value and Date	Employer's Proposed Weighting Range (coefficient)	Bidder's Proposed Weighting (coefficient)**
1	2	3	4	5	6
	Non - Adjustable (A)			0.15	0.15
	Labor (b)				
	Materials (c)				
	Equipment usage (d)				
		Total			1.00

*Normally following source of index shall apply. Public Entity shall choose applicable Index for each item.

(a) Labor: "National Salary and Wage Rate Index"- "Construction Labor" of Nepal Rastra Bank or rate fixed by District Rate Fixation Committee

(b) Material:"National Wholesale Price Index" - Construction Materials" of Nepal Rastra Bank

(c) Equipment usage: "National Wholesale Price Index" - "Transport Vehicles and Machinery Goods" of Nepal Rastra Bank or "Fuel" Price fixed by Nepal Oil Corporation.

** Bidders proposed weightings should be within the range specified by the Employer in column - 5

Table of Price Adjustment Data

[To be used if Price Adjustment is applicable as per GCC 53.6]

Code	Construction Material*	Unit	Base Price (NRs/Unit) (Ex-factory)	Source (Factory)**
1	2	3	4	5

* Major construction materials to be specified by Employer in column - 2.

** Base Price and source normally to be specified by Employer (or alternatively informed to be proposed by bidder) in column 4 and 5.

Note:

The base prices of the construction materials shall be taken as of 30 days before the deadline for submission of the Bid as quoted by the Bidder and verified by the Employer. For the purpose of calculation of price adjustment, the Ex-factory price of the same source shall be taken into consideration.

Bid Security

Bank Guarantee

Bank's Name, and Address of Issuing Branch or Office

(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

Beneficiary: ..... **name and address of Employer** ……
Date: ……Bid Security No.: .....
We have been informed that. ……. ***[insert name of the Bidder]*** (hereinafter called "the Bidder")intends to submit its bid (hereinafter called "the Bid") to you for the execution of ……...***name of Contract*** . …… under Invitation for Bids No. …… ("the IFB").
Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.
At the request of the Bidder, we……. . ***name of Bank*** …….. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . ……...***amount in figures*** ……. ***(. ……..amount in words ……..)*** upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) has withdrawn or modifies its Bid:

i) during the period of bid validity specified by the Bidder on the Letter of Technical and Price Bid, in case of electronic submission

(ii) from the period twenty-four hours prior to bid submission deadline up to the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid, in case of hard copy submission; or

(b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or

(c) changes the prices or substance of the bid while providing information pursuant to clause 27.1 of ITB; or

(d) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB.

(e) is involved in fraud and corruption in accordance with the ITB

This guarantee will remain in force up to and including the date ……***number***……days after the deadline for submission of Bids as such deadline is stated in the instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not letter than the above date.

This Bank guarantee shall not be withdrawn or released merely upon return of the original guarantee by the Bidder unless notified by you for the release of the guarantee.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 758.

. . .Bank's seal and authorized signature(s) . . .

Note:
The bid security of ……..……. has been counter guaranteed by the Bank ……..……..…… on ……..…….……. (Applicable for Bid Security of Foreign Banks).

Letter of Commitment for Bank's Undertaking for Line of Credit

Bank's Name, and Address of Issuing Branch or Office
(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

Invitation for Bids No: Date:

Contract No:

Name of Contract :

To:

[*Name and address of the Procuring Entity*]

CREDIT COMMITTMENT No: [*insert number*]

We have been informed that *[name of Bidder]* (hereinafter called "the Bidder") intends to submit to you its Bid (hereinafter called "the Bid") for the execution of the Works of ***[description of works]*** under the above Invitation for Bids (hereinafter called "the IFT").

Furthermore, we understand that, according to your conditions, the Bidder's Financial Capacity i.e. Liquid Asset must be substantiated by a Letter of Commitment of Bank's Undertaking for Line of Credit.

At the request of, and arrangement with, the Bidder, we *[name and address of the Bank]* do hereby agree and undertake that [*name and address of the Bidder*] will be provided by us with a revolving line of credit, in case awarded the Contract, for execution of the Works viz. [*insert name of the works*], for an amount not less than NRs …….[*in figure*] (*in words*) for the sole purpose of the execution of the above Contract. This Revolving Line of Credit will be maintained by us until issuance of "**Taking-Over Certificate**" by the Procuring Entity.

In witness whereof, authorised representative of the Bank has hereunto signed and sealed this Letter of Commitment.

Signature Signature

Technical Proposal Format

Personnel

Equipment

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Others

Personnel

Form PER - 1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements for each of the positions listed in Section III (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

No.	Name	Position*	Academic Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
1.					
2.					
3.					
4.					
5.					

* As listed in Section III (Evaluation and Qualification Criteria).

Form PER - 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below. Fields with asterisk (*) shall be used for evaluation.

Position*		
Personal Information	Name	Date of Birth
	Professional qualifications	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager/personnel officer)
	Fax	E-mail
	Job title	Years with present employer

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

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

Note:

In case of e-submission the Resume of Proposed Personnel shall be submitted on notification by the Employer as per ITB 27.

Equipment

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

(i) For the equipment under Bidder's ownership

No.	Equipment Type and Characteristics	Total Nos. of Equipment under Bidder's Ownership	No. of Equipment engaged/proposed for ongoing/committed contracts	Nos. of Equipment proposed for this contract
1.				
2.				
3.				
4.				
5.				

(ii) For the Equipment to be leased/hired

No.	Equipment Type and Characteristics	Total Nos. of Equipment under the ownership of lease/hire provider	No. of Equipment engaged/committed for other works	Nos. of Equipment proposed to be leased/hired for this contract
1.				
2.				
3.				
4.				
5.				

Type 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	

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

Owner	Name of owner

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

The Bidder shall be solely responsible for the data provided. However, this shall not limit the right of Employer to verify the authenticity of submitted information.

Note:

In case of e-submission the "Agreements" shall be submitted on notification by the Employer as per ITB 27.1

Bidder’s Qualification

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

Form ELI - 1: Bidder’s Information Sheet

Bidder's Information	
Bidder's legal name	
In case of JV, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents.	
1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2. 2. Authorization to represent the firm or JV named in above, in accordance with ITB 20.2. 3. In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1. 4. In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.	

Form ELI - 2: JV Information Sheet

Each member of a JV must fill in this form

JV / Specialist Subcontractor Information	
Bidder's legal name	
JV Partner's or Subcontractor's legal name	
JV Partner's or Subcontractor's country of constitution	
JV Partner's or Subcontractor's year of constitution	
JV Partner's or Subcontractor's legal address in country of constitution	
JV Partner's or Subcontractor's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents.	
1. articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2. 2. Authorization to represent the firm named above, in accordance with ITB 20.2. 3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.	

Form LIT - 1: Pending Litigation

Each member of a JV must fill in this form

Pending Litigation			
🗀 No pending litigation in accordance with Criteria 2.2 of Section III (Evaluation and Qualification Criteria) 🗀 Pending litigation in accordance with Criteria 2.2 of Section III (Evaluation and Qualification Criteria)			
Year	**Matter in Dispute**	**Value of Pending Claim in NRS**	**Value of Pending Claim as a Percentage on Net Worth**

Form FIN - 1: Financial Situation

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

Financial Data for Previous 3 Years [in NRS]		
Year 1 :	**Year 2 :**	**Year 3 :**

Information from Balance Sheet

Total Assets			
Total Liabilities			
Net Worth			
Current Assets			
Current Liabilities			

Information from Income Statement

Total Revenues			
Profit Before Tax			
Profit After Tax			

- Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three or above years, as indicated above, complying with the following conditions.
- All such documents reflect the financial situation of the Bidder or partner to a JV, and not sister or parent companies.
- Historic financial statements must be audited by a certified auditor.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Note:

In case of e-submission the attachments should not be uploaded but shall be submitted on notification by the Employer as per ITB 27.1

Form FIN - 2: Average Annual Construction Turnover

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

The information supplied should be the Annual Turnover of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for work in progress or completed to NRs at the end of the period reported.

Annual Turnover Data for the Last 10 Years (Construction only)	
Year	Amount Currency

- **Average Annual Construction Turnover (Best three years within the last 10 years)**

Form FIN - 3: Financial Resources

Specify proposed sources of financing, as "lines of credit", available to meet the total construction cash flow demands of the subject contract or contracts as indicated in Section III (Evaluation and Qualification Criteria).

Financial Resources		
No.	**Source of financing**	**Amount (in NRS)**
1		
2		
3		

Note : The letter from the Bank must be Unconditional in the format and stated details/terms and conditions as per the Bid Forms "Letter of Commitment for Bank's Undertaking for Line of Credit"

Form FIN - 4: Bid Capacity

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

Bid Capacity = [(4 x A) – B]

A = Average Annual Construction Turnover of last five years.

B = Average Annual Value of the existing commitments and works (ongoing) to be completed, calculated from **FIN-5.**

SN	Name of Bidder	Pan No.	A, in Million	B, in Million	Bid Capacity, in Million
1					
2					
3					

Total Bid Capacity :

Signature of Bidder

Form FIN-5: Current Contract Commitments / Works in Progress

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

Current Contract Commitments (For Calculation of B with reference of FIN-4)									
No.	**Name of Contract**	**Name of the Contractor/s**	**Employer's Contact Address, Tel, Fax**	**Contract Share % (a)**	**Contract Amount in Millions (b)**	**Contract Date (yyyy-mm) (c)**	**Initial or Revised Contract Duration (months) (d)**	**Value of outstanding works [In Millions, NRS]# (e)**	**Estimated Time in Month to Complete the outstanding works (f) = (c) + (d) – Date of Invitation of Bid**
1									
2									
3									
4									

Signature of Bidder

The Outstanding Works means Contract Price (excluding Vat) minus Work Evaluated by Employer till the reference date.

Note 1: "B" shall be calculated as : $B = \sum \left[\frac{(e) \times (a)}{(f)} \right] x12$ **, If (f) is less than 12, then value of (f) shall be taken as 12.**

Note 2: If Initial or Revised Contract Date is run out with respect to Date of Invitation of Bid, the Estimated Time in Month to Complete the outstanding works shall be taken equal to 12 months.

Form EXP - 1: General Construction Experience

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

General Construction Experience				
Starting Month Year	**Ending Month Year**	**Year**	**Contract Identification and Name and Address of Employer Brief Description of the Works Executed by the Bidder**	**Role of Bidder**

Form EXP - 2(a): Specific Construction Experience

Fill up one (1) form per contract.

Contract of Similar Size and Nature			
Contract No…… of…..	**Contract Identification**		
Award Date		**Completion Date**	
Role in Contract	🗀 **Contractor**	🗀 **Management Contractor**	🗀 **Subcontractor**
Total Contract Amount	🗀 **NRS ……..**		
If Partner in a JV or subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**	
Employer's Name **Address** **Telephone/Fax** **Number** **E-mail**			
Description of the similarity in accordance with Criteria 2.4.2 (a) of Section III			
Note : ***The Employer should insert here contract size, complexity, methods, technology, or other characteristics as described in Section VI (Work Requirements) against which the bidder demonstrates similarity in the box on the right-hand-side.***			

Description of the similarity in accordance with Criteria 2.4.2 (a) of Section III
Participation as Prime contractor, management contractor, or subcontractor, in at least . Contracts within the last ten (10) years, each with a value of at least NRs ... that have been successfully or are substantially completed and that are similar to the proposed works.The similarity shall be based on the physical size, complexity, methods, technology or other characteristics as described in Section VI, Works Requirements.Single entity must meet requirements. In case of joint venture, all partners combined must meet requirements.Document required: Form EXP-2(a)

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

Fill up one (1) form per contract.

Contract of Similar Size and Nature			
Contract No…… of……..	**Contract Identification**		
Award Date		**Completion Date**	
Role in Contract	🗀 **Contractor**	🗀 **Management Contractor**	🗀 **Subcontractor**
Total Contract Amount	🗀 **NRS ……..**		
If Partner in a JV or subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**	
Employer's Name **Address** **Telephone/Fax** **Number** **E-mail**			
Description of the similarity in accordance with Criteria 2.4.2 (a) of Section III			
Note : *The Employer should insert here production rate(s) for the key activity (activities) subject contract against which the bidder demonstrates in the box on the right-hand-side production rates achieved by him on previous contracts.*			

Description of the similarity in accordance with Criteria 2.4.2 (b) of Section III
For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum construction experience in the following key activities : RCC Works(M25):- at least 1450.0 cum in RCC work in a government building Bulding with basement construction For Single Entity : Must meet all requirement For joint Venture : All partners combined must meet all requirements. Each Partner not applicable. One partner not applicable. Documents Submission Requirements : Form EXP - 2(b)

Price Adjustment : Table A - Local Currency

Sl No.	Index Description	Source of Index	Base Value	Base Date	Employer's Proposed Weighting coefficient Range from	Employer's Proposed Weighting coefficient Range to	Bidder's Proposed Weight
1	Non-Adjustable(A)				0.15	0.15	
2	Labor (b)	NRB	0	Bid Submission date - 30 days	0.0125	0.13	
3	Materials (c)	NRB	0	Bid Submission date - 30 days	0.65	0.69	
4	Equipment usage (d)	NRB	0	Bid Submission date - 30 days	0.025	0.03	
						Total	1

SECTION-V

Eligible Countries

ELIGIBLE COUNTRIES

For the purpose of ITB 4.2:

Nepal

For the purpose of Country of Origin ITB 5.1 and GCC 79.2:

All Countries

Part II: Bidding Procedures

Table of Clauses

SECTION-VI

Works Requirements

B: Particular Technical Specification

CONTENTS

PART II: PARTICULAR TECHNICAL SPECIFICATIONS

1. DRAWINGS AND BILL OF QUANTITIES

1.1 DRAWINGS

The drawings related to the major works of the project are given in Volume III of the Bidding Documents.

During the course of the contract, the Engineer may issue supplementary drawings in respect of the structures, installation and finishing to be constructed in addition to the drawings included in the Bidding Document. It shall be the contractor's own responsibility to prepare from this information such working drawings as he may require for the proper setting out and construction of such structures, work shall not commence on an individual structure or parts until the relevant working documents have been approved by the Engineer.

Within 15 days of the date of written acceptance of the Bid, the contractor shall submit to the Engineer a schedule of working drawings listing the anticipated dates upon which they will be submitted for approval by the Engineer. The submission dates shall be spaced at reasonable intervals to enable the Engineer to give the information due consideration.

All dimensions shall be in metric units and each drawing shall be properly lettered and numbered to indicate the contractor's name, or sub-contractor, the title of the drawing, scale, and date of issue. Only A4 or multiple size sheets preferably A2 size, shall be used.

The Contractor shall make any changes or modifications to the Working Drawings that the Engineer considers desirable and the work executed accordingly without additional cost to the Employer. The Contractor shall supply two copies of all such approved Working Drawings to the Engineer. The cost of preparing and providing all Working Drawings shall be included in the Contract Rates.

No examination by the Engineer of any document submitted by the Contractor or of the Contractor's Working Drawings, nor the approval expressed by the Engineer in regard thereto, either with or without modification, shall absolve the Contractor from the obligation liability imposed upon him by any provisions of the Contract. Notwithstanding the Engineer's approval of the Working Drawings shall relieve the Contractor from responsibility for any dimensional or other errors.

Such Working Drawings as have been selected by the Engineer shall be correctly modified for inclusion in the final record drawings taking into consideration, inter alia, such variations to the Works as may have been ordered and executed. Such Drawings shall show the arrangement of all items of equipment installed under the Contract and shall be submitted to the Engineer for approval. After approval and before issue of the Certificate of Completion for the whole of the Works, the Contractor shall provide one reproducible and two photocopies of all Working Drawings as modified for record purposes.

Each set of prints of such Drawings shall be substantially bound with durable covers and a title page and index page. The title page shall be as per the approval of the Engineer's Representative.

1.1.1 Discrepancies in Drawings and BOQ

a) All work shall be carried out according to the approved drawings and instructions of the Engineer. The Contractor shall bring to the immediate notice of the Engineer any discrepancies and contradictions in the drawings and Bill of Quantities and the Engineer will make necessary revisions to correct the discrepancies and contradictions.

b) The Contractor shall review the drawings and Bill of Quantities well in advance of the execution of the work to ensure all discrepancies, contradictions and any other questions or issues are resolved prior to commencing the work. No claim will be accepted for any loss due to discrepancies and contradictions in the drawings and Bill of Quantities.

1.1.2 Layouts and Schedules Provisional

The locations, levels and dimensions as shown on the Drawings or given in the design data or structure schedules are subject to amendment. Details of any such amendment or confirmation of the original design will be given by the Engineer or the Engineer's Representative during the course of construction.

1.1.3 Survey and Datum for Levels

Prior to the start of the Works the Contractor will receive from the Employer a list of Project Benchmarks and their values and reference points on the site.

Thereafter, the Contractor shall establish all setting out necessary for the performance of the work, to the approval of the Engineer including levels of the original ground surface at the Site and final surveys of the completed Works for the final measurement. Levels shall close within 2.4 mm times the square root of the length of the circuit in km.

Ground levels shall be taken jointly by the Contractor and the Engineer's Representative both prior to commencing and after completion of earthworks.

Where cross sections are ordered these shall be at 10 m intervals or at such other spacing as may be ordered by the Engineer's Representative on Site. The location of the first cross section shall be approved by the Engineer's Representative and each cross section shall extend a minimum distance of 10 m beyond the limits of the new works.

From the centerline and grades established, the Contractor shall furnish and place all additional stakes, templates and bench marks necessary for marking and maintaining points, lines and sections for layout of the Works.

The Contractor's methods of recording survey data shall be subject to approval and field books and tabulated data shall be well maintained and made available for inspection and checking by the Engineer's Representative when ordered.

Instruments and equipment for surveys shall be subject to rigorous inspection by both the Contractor and the Engineer's Representative and any item found to be defective, in the opinion of the Engineer, shall be promptly replaced, repaired or adjusted as directed. All surveying shall be done under the direct supervision of a qualified surveyor or engineer who, as an employee of the qualified surveyor or engineer who, as an employee of the Contractor shall be subject to the approval of the Engineer at all times during the progress of the work in accordance with Clause 16 of the Conditions of Contract.

1.2 PROGRAMME

In amplification of the requirements in Clause 14 of the Conditions of Contract, the particulars supplied by the Contractor with the programme shall include the following details: -

i) The statement giving the numbers and categories of supervisory and technical staff and skilled and unskilled labor to be employed on the Works;

ii) The list and type details of major Constructional Plant (including vehicles) which the contractor proposes to employ on the Works stating whether they are to be acquired from inside or outside Nepal, including programmed dates for order and delivery.

iii) Details of the Contractor's methods of working for all operations including construction of different installations.

iv) The statement and outline layouts giving the proposals for location or locations and sizes of construction camps, accommodation, offices, workshops and stores at the Site.

v) Details of the programme for the Works from the date of receipt of the Engineer's order to commence the Works, including a complete resource allocation showing the number of units and allotted times for each unit of Constructional Plant, materials and labor allocated for each part of the Works.

The Contractor shall notify the Engineer from time to time of any revisions to the approved programme, which he considers necessary if the Works are to be completed within the time, stipulated in the Bid.

1.2.1 Notice of Operations

The Contractor shall give full and complete written notice of all important operations including setting out to the Engineer sufficiently in advance to enable the Engineer to make such arrangements as the Engineer may consider necessary for inspection and for any other purpose. The Contractor shall not start any import operation without the written approval of the Engineer.

1.2.2 Water Supply

Not less than fourteen days before commencing any portion of the Works, the Contractor, if ordered, shall submit to the Engineer for his approval complete drawings of all Temporary Works the contractor may require for the construction of that part of the Works.

Notwithstanding approval by the Engineer of any design for the Temporary Works the contractor shall be entirely responsible for their efficiency, security and maintenance and for all obligations and risks in regard to such Temporary Works which are specified or implied in the Contract.

Except where specific items are provided in the Bill of Quantities, the cost of all Temporary Works of every description, including dewatering, temporary diversions of canals, drains, roads, telephone lines and all services shall be included in the Contract Rates.

The Contractor shall make his own arrangements for the supply of water, including potable water, for the purposes of the Contract. The quality of the water shall be to the approval of the Engineer and suitable for the purpose for which it is intended.

Wastewater shall be disposed of clear of the Site to the satisfaction of the Engineer so as to cause no damage or nuisance to the Environment and the surrounding areas.

1.2.3 Latrines

The Contractor shall provide throughout the period of construction of the Works and shall maintain and clean suitable and sufficient latrines for use by his employees; he shall ensure that his employees do not foul the Site but make proper use of the latrines.

1.2.4 Contractor's Camps, Workshop, Stores, Offices etc.

The Contractor shall construct, guard and look after the camp or camps for his workmen together with workshops, stores, offices etc. The sites of the camp and other buildings shall be approved by the Engineer and the standard of accommodation, ablution and canteen facilities and amenities shall be to the satisfaction of the Engineer. The camp and other buildings shall be kept in a seemly and hygienic state until the conclusion of the Contract. On Completion of the Contract, all buildings in the camp should be demolished and the sites left clean and tidy with all materials and debris removed from the site.

1.2.5 Medical Arrangements

The contractor shall make arrangements for treatment on the site of casualties and sick persons in first-aid units or in such other wards as may be necessary in accordance with the appropriate regulations.

Notwithstanding the minimum requirements prescribed above, the Contractor shall be responsible for the adequacy of all the arrangements made as per the provisions of the Contract.

1.2.6 Contractor's Power Supply

The contractor shall make his own arrangements for the supply of electric power for the purposes of the Contract.

1.2.7 Supply of Fuel Oils

The Contractor shall be responsible for arranging and ensuring that adequate supplies of high speed diesel oil, motor spirit, kerosene, lubricants and other petroleum products are available at all times to meet his requirements for the purposes of or in connection with the Contract; the Contractor's particular attention is drawn to this requirement as from time to time shortages and interruptions in the supply of fuel oils, etc. occur in the region.

1.2.8 Supply of Cooking Fuel and Firewood

The Contractor shall be responsible for and supply adequate quantity of cooking fuel as liquid petroleum gas, kerosene and firewood required for the cooking of food for his employers, staff and any other purpose as provided in the Contract. The Contractor shall prevent cutting of trees, bushes by his

employees and for the purpose of the Contract. Any unauthorized cutting of trees or deforestation by the Contractor or his employees shall be subject to the jurisdiction of the related authority.

1.2.9 Clauses Not Applicable

Any Clause in the Specification, which relates to work or materials not required by the Bill of Quantity or subsequently ordered in accordance with Clause 51 of the Conditions of Contract shall be deemed not to apply.

1.2.10 Provisional Items

All provisional items in the Schedule shall be carried out at the discretion of the Engineer, and may or may not form part of the Contract. In case the Contractor carries out the provisional items the rates shall be settled as for extra items as stated in the Conditions of Contract.

1.3 ASSISTANCE TO ENGINEER

1.3.1 Meetings and Reports

Approved representative of the Contractor shall attend formal meetings at the office of the Engineer on site or in the Clients office or in the Project Area, when called upon, for the purposes of Contract Administration.

The contractor shall submit in duplicate to the Engineer each month a report in a manner approved by the Engineer on his progress in the performance of the contract. Such reports shall include information regarding delivery, manufacture, and installation etc.

1.3.2 Photographic Records

1. Still Photographs

   The Contractor shall supply negative and unmounted positive prints of photographs, postcard size, of such proportions of the works, in progress and completed, as may be directed by the Engineer and specified herein. The photographs shall be of two categories:

   a) Progress photographs
   b) Record photographs

   The photograph shall be indexed with date and short description of the object of the photograph. The photographs as ordered by the Engineer shall be supplied in one negative and two prints, having signatures of the Contractor and the Engineer of the Consultant on the back of the photograph for the purpose of attestation.

   The contractor shall provide such type of photographs to the consultant covering all the daily site activities being done during construction works. The contractor shall provide set of photographs as mentioned above along with the albums one in a week.

2. Digital Photographic Record
   The contractor shall supply a high resolution Digital Camera with 8 GB memory card with capacity for the consultant’s engineer for the keeping records of different construction activities as the site engineer's requirements. The Digital Camera shall be accompanied with complete set of cables, Battery (2 set) and battery charger of good quality.

3. Video Record
   The contractor shall supply a set of Handy Cam of Sony Brand for the use of consultant engineer's use for the keeping vediographic records of necessary (specially completed and new type of works) construction works for future technology transfer purposes. The contractor shall supply necessary cables, battery (2 sets) and a set of battery charger along with the camera.

1.3.3 General Assistance

The Contractor shall supply such assistance and plant as may be required in performing operations in connection with the execution, examination, inspection and measurement of the Works including the installation and surveying of bench marks and survey stations and marks wherever and whenever the

Engineer shall deem necessary. The Contractor shall also supply such labor, either continuously or from time to time, as may be required by the Engineer for the operation and maintenance of the laboratory, as messengers in connection with the Works and as watchman over the Engineer's office at site.

1.3.4 Scaffolding, etc. for Inspection

The Contractor shall provide safe access when requested by means of scaffolding, slings, etc. for the Engineer to inspect at close quarters those portions of the Works not safely accessible by other means.

1.4 FACILITIES FOR THE ENGINEER'S REPRESENTATIVE

1.4.1 General

The Contractor shall provide and maintain the well equipped (with Drinking Water, Electricity, Telecommunication, TV Cable) site office, laboratory, vehicle, furnishings and equipment for use of the Engineer as described herein. Unless the Engineer agrees otherwise all facilities provided for his use shall be new. The full details of the facilities, which the Contractor proposes to provide for the Engineer, shall be submitted, for the Engineer's approval, within 7 days of the Letter of Acceptance.

The Contractor shall not complete any arrangements, nor place orders for the purchase of any items, nor start work on the installation of the Engineer's facilities until he has received the approval of the Engineer.

During the construction period the Contractor shall provide such temporary facilities as may be required by the Engineer in the execution of his duties under the Contract. Alternatively the Engineer may make his own arrangements for temporary facilities in which case the Contractor shall reimburse the Engineer for the costs so incurred.

On completion of the Works in accordance with the Conditions of Contract the Engineer will instruct the Contractor to remove those facilities not required during the Defects Liability Period. At the end of the Defects Liability Period the Contractor shall remove the remaining facilities from site in accordance with the Condition of Contact. All buildings, fittings, and furnishings provided for the use of the Engineer except rented vehicle and laboratory equipment and those items provided by the Contractor for the proper maintenance of the facilities or rented accommodation, shall become the property of the Contractor at the end of the Contract.

1.5 INSURANCE

The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance coverage from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract Data for the following events that are due to the Contractor's risks:

(a) loss of or damage to the Works and Materials;
(b) loss of or damage to Equipment;
(c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and personal injury or death caused by the Contractor’s act or omissions for:
    (i) anyone authorized to be on site
    (ii) third parties who are not authorized to be on site.

Policies and certificates for insurance are to be delivered by the Contractor to the Engineer for his approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance that the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

Alterations to the terms of insurance shall not be made without the approval of the Engineer.

Both parties shall comply with all conditions of the insurance policies.

1.6 QUALITY ASSURANCE PLAN

The Contractor shall submit the Quality Assurance Plan (QAP) of the Works for the approval of the Engineer.

The Quality Assurance Plan should clearly set out working procedures, equipment, materials, workmanship, tests requirements, testing frequency the Contractor will adopt in carrying out the works so that the material and works are in compliance to the requirements of contract and as per the Technical Specifications. Only after receiving approval from the Engineer the Contractor shall proceed with the work.

The cost of this item will be borne by contractor himself.

2. SITE WORK

2.1 SITE CLEARANCE

2.1.1 Site Inspection by the Contractor

The bidder is recommended to carefully examine the site and to ascertain for himself the nature there of and the type of materials to be excavated.

2.1.2 Investigation of Site by the Contractor

The bidder may make any sub-surface exploration he desires prior to the Contract Agreement. Limited sub-soil investigations have been made by the Engineer. However, the Engineer makes no guarantee of the accuracy of the information. Its corrections shall not affect the provisions of the Contract.

2.1.3 Clearance of Site

The Contractor shall clear the parts of the Site subsequently to be occupied by the Works and shall maintain them clear of vegetation.

The Contractor shall not clear the Site of any structure without prior written permission of the Engineer.

Prior to the general clearance of Site the Contractor shall clear the Site to the extent required by the Engineer's Representative for checking the Works and setting out of the Works.

The Contractor shall fill and make good with appropriate materials those cavities and losses of soil which result from clearing the parts of the Site not subsequently to be occupied by the Works.

2.1.4 Disposal of Vegetation and Plants

The Contract shall dispose of the vegetation and plants obtained from the site clearance under Sub-Clause 2.1.3 above as approved by the Engineer. The disposal shall not be made in any instance to the river or lake or any other place which may cause pollution to the air, soil and water.

2.2 SITE PROTECTION

The Contractor shall enclose the entire work area allocated for construction and material storage with fencing suitable to prevent any unauthorized entrance to the site. The type of fence and location shall be approved by the Engineer.

The Contractor, at his own expense, shall supply and install a signboard conspicuously located at an approved site for public information regarding the project. The signboard shall be approximately 1200 x 2000 mm in size and contain the following information: the name of the Project, the names of the Employer, the Contractor and the Design and Supervising Consultant and the names of any specialized consultant or other information as directed by the Engineer.

The Contractor shall clear the building area and 6 metres beyond the foundations of all obstructions, loose stones and material, rubbish and brush before starting construction. The Contractor shall dress the ground surrounding the building/s to a distance of 6 metres from the foundations cutting raised areas and filling holes and hollows up to maximum 300 mm. The Contractor, at the completion of the project, shall leave the Works clean and free of all blemishes and shall remove all rubbish and debris whether

construction waste or otherwise and dispose of as directed by the Engineer. No extra charges will be assessed for the removal of debris and dressing unless otherwise specified.

No tree or other plants, except brush, shall be cut without the explicit approval of the Client. The removal of any tree or plant shall be considered an extra item and paid for as such providing the tree or plant be not less than 900 mm in circumference measured 300 mm from the ground.

2.3 TEMPORARY PROTECTION

The Contractor will make all necessary provisions to effectively protect trenches, walls, newly laid concrete and other works from any damage due to inclement weather or accidents. All provisions to protect the work will be at the Contractor's own expense.

2.4 MATERIAL SPECIFICATION

2.4.1 General

2.4.1.1 Quality

All materials and equipment shall be the best quality available and shall conform to the requirements of above Specifications or, in case of ambiguity, Engineer's decision will be final. All material and equipment supplied and used in the Works shall be new, unless otherwise specified or permitted in writing by the Engineer and shall be fabricated, handled and used to the best standards and practices currently prevailing. Workmanship shall conform to the best practices currently prevailing and only those craftsmen capable of working with best practice methods shall be engaged in this Project.

2.4.1.2 Sources

The use of any kind or class of material from more than one source is prohibited, except by written permission of the Engineer. Such permission, if granted, will set forth the conditions under which the change may be made. The sources or kinds of materials shall not be changed at any time without written permission of the Engineer. If the product from any source proves unacceptable at any time, the Contractor shall make such arrangements as may be necessary to assure acceptable material, either by alterations in plant operations or by a change of source. Claims for increased costs, which maybe occasioned by such alterations or changes, will not be given consideration unless the source of the unacceptable material was designated in the Contract as a source of material. When any manufactured product, either new or used, is furnished by the Employer, the location at which such material will be delivered to the Contractor will be designated in the Contract. In such cases the Contractor shall transport the materials from the designated delivery point to point of use, and cost for such transportation will be considered included in the Contract unit price for placing the materials in the finished work

2.4.1.3 Brand Names

Certain articles or materials to be incorporated in the work may be designated under a brand name or the name of a manufacturer or from a particular catalogue. The use of an alternative article or material that is of equal quality and of the required characteristics for the purpose intended will be permitted subject to the following requirements.

a. Contractor has to proof that materials/products are not being manufactured any more or any other valid reason.
b. The burden of proof as to the quality and suitability of alternatives shall be on the Contractor and he shall furnish all information necessary as required by the Engineer to verify. The Engineer shall be the sole judge as to the quality and suitability of all alternative articles or materials and his decision shall be final.
c. whenever the Specifications permit the substitution of a similar or equivalent material or article, no tests or action relating to the approval of such substitute material will be made until the Contractor submits in writing a request for substitution and submits all relevant information needed to verify the quality and suitability of the material or article proposed. Such request shall be made in ample time to permit approval without delaying the work.

3. MATERIAL AND EQUIPMENT SAMPLES AND TESTING - GENERAL

The Contractor shall keep records of all tests conducted in connection with compliance with the specification and shall supply copies of the results of such tests to the Engineer when required.

The quality of concrete and its constituent materials will be monitored by tests carried out in the Engineer's laboratory on samples provided by the Contractor or taken by the Engineer, all as detailed in Clause 3.5 hereof. In particular, the Engineer shall test for compliance of concrete under the terms of Clause 6.12 hereof and shall keep the register of test results so obtained for each class of concrete.
Samples required for tests in the Engineer's laboratory, or a nominated laboratory, shall be supplied and delivered by the Contractor in appropriate containers, suitably packed and labeled.

The Contractor shall examine all material and equipment and satisfy himself that the material and equipment conforms to the specified requirements before submitting to the Engineer for approval.

The Contractor shall submit samples of all material and equipment together with the manufactures' specifications and test certificates to the Engineer's for his approval prior to commencement of the Works. At his discretion the Engineer's Representative may order independent tests to verify the quality of any particular item submitted for use in the Works by the Contractor, whether the manufacturer's test certificate has been submitted or not. Cost of such tests will be borne by the contractor.

The Contractor, at his own expense, shall provide all samples and facilities to the Engineer as may be required to collect, forward and test, either at the site or at any other testing facilities nominated by the Engineer, samples identified for verification. The Contractor shall not incorporate into the work the materials represented by the samples until the tests have been made and the materials are found to comply with the requirements of the Specifications, except that any materials that have a satisfactory record of compliance with the Specifications may, at the discretion of the Engineer, be used until the tests are completed. If the material fails to pass the tests, no further use thereof shall be made until the Contractor has taken steps approved by the Engineer to correct the deficiencies. Materials actually delivered to the site for incorporation in the work must conform to the standard of the approved samples and any deviation will be ground for re-testing at the Contractor's own expense.

3.1 TESTING REQUIREMENTS

The Contractor shall carry out all tests listed below or in any section of the Conditions of Contract and specification at his own cost in the laboratory specified by the Engineer:

i) Concrete Testing (the part and clause numbers refer to the tests or procedures as specified in BS 1881): -
   (a) Aggregate moisture tests for determination of water cement ratio
   (b) Slump tests
   (c) Compacting factor test
   (d) Making and curing test cubes
   (e) Compression testing of test cubes

ii) Cement Testing (the section numbers refer to the tests in BS 4550 Part 3): -
   (a) Compressive strength (mortar cubes)

iii) Fine and Coarse Aggregate Testing (the part and paragraph numbers refer to the tests as specified in BS 812): -
   (a) Silt, clay and dust fraction
   (b) Flakiness index
   (c) Elongation index
   (d) Water absorption
   (e) Particle size and grading
   (f) Silt content by field settling test
   (g) Aggregate crushing value
   (h) 10 per cent fines value
   (i) Soundness
   (j) Alkali-aggregate reactivity
   (k) Shrinkage
   (l) Soluble sulphates

iv) Water Testing
   (a) Organic and inorganic matter in solution and suspension
   (b) Sulphate content
   (c) Alkali bicarbonate/carbonate

3.2 INSPECTION AND ACCEPTANCE OF MATERIALS AND EQUIPMENT

Final inspection and acceptance of materials will be made only at the site of the work. The Engineer reserves the right to sample, inspect and test materials throughout the duration of the work, and to reject any materials which are found to be unsatisfactory at the time of use. A preliminary inspection of materials may be made at the source for the convenience of the Contractor, but the presence of Engineer's or his representative at the source shall not relieve the Contractor of the responsibility of furnishing materials that comply with these Specifications. The Engineer and his representative shall have free entry at all times to those parts of any plant that concern the manufacture or production of the materials ordered.

3.3 DEFECTIVE MATERIALS AND EQUIPMENT

All materials and equipment that do not conform to the requirements of the Contract will be rejected whether in place or not. They shall be removed immediately from the site unless otherwise permitted by the Engineer. No rejected material shall be used in the work unless approved in writing by the Engineer. In the event the Contractor fails to comply promptly with any order by the Engineer to remove and replace the rejected material, the Engineer may remove the rejected materials by other means and deduct the cost thereof from any moneys due to the Contractor.

3.4 CONTRACTOR'S EQUIPMENT

All equipment including survey, measuring, testing and laboratory equipment; concrete mixers; concrete vibrators; mechanical compactors; measuring boxes; formwork and shuttering; props etc. shall be new or in 'like new' condition and maintained in 'like new' condition for the duration of the work under the scope of this Contract. Any equipment that has been damaged during the execution of work or declared unfit for service by the Engineer shall be replaced promptly with the same type of equipment in new or 'like new' condition.

3.5 STORAGE AND PROTECTION

All materials, equipment etc. shall be delivered in a manner as approved by the Engineer. The Contractor shall be responsible for the proper care and protection of all his materials, equipment etc. delivered at site. The contractor shall protect and be responsible for any damage to his work or material, from the date of the agreement until final certificate is made and shall make good without cost to the employer any damage or loss that may occur during this period. The Contractor shall handle all material as directed so that it may be inspected by the Engineer. All materials that may be affected by the weather shall be protected to keep them free from damage while they are being transported to the site. Should any material be found defective or in any way contrary to the contract, this material, no matter in what stage of completion, may be rejected by the Engineer and shall be removed from the premises at once.

3.6 MATERIAL STORAGE

The Contractor, at his own expense, shall provide safe, dry and proper storage facilities to protect material from damage, contamination and theft. Cement storage facilities at the site should be specially protected from any dampness and should accommodate minimum of 250 bags of cement. Reinforcing and structural steel must be protected from dampness and other corrosive elements. Sand and aggregate must be stored in the shed with brick paved floor, roof covering and side walls, so as to protect the material from rain and contamination by soil, leaves or any other foreign matter.

3.7 CONCRETE SAMPLING AND TESTING

The Contractor shall be responsible for providing samples of Concrete and its constituent materials either for testing by himself on behalf of the Engineer or for testing at the Engineer's or a nominated laboratory. For these purpose concrete test cubes which shall be made in accordance with BS 1881, Part 3, Clause 2, shall be deemed to be samples. All sampling of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard, and all sampling of fresh and

of hardened concrete shall be carried out in accordance with the provisions of BS 1881 unless such provision is at variance with the Specification.

The tests at the Engineer's or a nominated laboratory for which samples are required are those listed in Clause 3.03 (i), (ii), (iii), and (iv) above. Details of all such samples shall be recorded by the Contractor and passed to the Engineer. The frequency with which such samples are to be delivered to the laboratory shall be given by the Contractor in the form of a sampling plan. The Engineer will make available to the Contractor the results of each test carried out on the samples so provided.

The tests which the Contractor is required to undertake himself on behalf of the Engineer are those to be carried out on fresh concrete at the place of final deposit, or elsewhere on the Site as directed by the Engineer. These tests comprise slump tests to BS 1881, Part 2, Section 2. The contractor shall keep records of all such test results and supply copies of same to the Engineer. The frequency with which these tests are carried out shall be as directed by the Engineer in the form of a testing plan.

The Contractor shall also test aggregates for moisture content and so determine the water/cement ratio of the fresh concrete. Determinations of water/cement ratio shall be carried out as required by the Engineer and the results and calculations submitted to him.

From each such sample three concrete cubes shall be made; each cube shall be marked indelibly for identification when it is in the mould. After retention at the site of the structure for 24 hours the cubes shall be delivered to the Engineer's laboratory for removal from their moulds, curing and testing. Moulds will be returned to the Contractor for re-use. Sampling fresh concrete for such cubes shall be carried out by the Contractor in accordance with a sampling plan. The principles of this sampling plan shall be as follows:

The frequency of sampling for each class of concrete from each batching centre in each active day to be at the rate of:

(a) one sample from one batch of every 10 batches, or
(b) one sample per 10 cubic metres of concrete, or
(c) one sample

whichever involves the greatest number of samples. Where more than 20 cubic metres from one batching centre is placed in one location in one day, the rate of sampling may be decreased with the approval of the Engineer to one sample from one batch of every 20 batches or one sample per 20 cubic metres of concrete, whichever involves the greater number of samples. The actual rate of sampling may vary to the approval of the Engineer according to the random selection of batches to be sampled and shall be increased when ordered by the Engineer in appropriate circumstances. This will depend on size of batch for example from 10/7 cft drum type mixes to a batching plant of 30 m 3 / Hour capacity. Therefore, minimum 5 Batch is O.K.

In addition to his other duties in connection with the sampling and testing of concrete the Contractor shall provide the instruments for, and record the temperatures of concrete, concrete materials and the atmosphere, as required by the Engineer, and copies of such records shall be supplied to the Engineer.

3.8 SAMPLES OF MATERIALS AND WORKS

The Contractor shall furnish for the approval of the Engineer any samples required by the Specifications or that may be requested by the Engineer, of any and all materials, equipment and works proposed for use in the project. All finished work shall conform to the approved samples and the requirements of the specification. The sample shall be maintained at the site for reference.

The Contractor shall provide for the approval of the Engineer samples of all construction materials and manufactured items required for the Permanent Works, if ordered. All samples rejected by the Engineer shall be removed from Site. All approved samples shall be stored on Site by the Contractor for the duration of the Contract, and any materials or manufactured items subsequently delivered to Site for incorporation in the Permanent Works shall be of a quality at least equal to the approved sample.

3.9 RESPONSIBILITY FOR SAMPLING AND TESTING

With regard to sampling, testing and the costs thereof, nothing in the foregoing shall be deemed to derogate from the responsibilities placed on the Contractor under the terms of Clause 33 of the Conditions of Contract.

3.10 PROPRIETARY ARTICLES

Where articles to be supplied from a particular manufacturer are specified, the Contractor may propose an alternative manufacturer if, at his own expense, he can prove to the Engineer's satisfaction that the articles to be supplied are of an equal or better quality. The Engineer's approval to an alternative manufacturer will not be unreasonably withheld.

3.11 PACKAGING

All materials, articles and items of fabricated and finished work of whatever description or kind for use in the Works shall be suitably packed for delivery to the satisfaction of the Inspecting Engineer. Each piece, package, bundle and crate shall be clearly marked before dispatch with its weight and description, together with the appropriate shipping mark.

3.12 INSPECTION, SAMPLING AND TESTING COSTS

Notwithstanding the provisions of Clause 34 of the Conditions of Contract all costs, except for the Inspecting Engineer's fees, incurred by the Contractor, in connection with inspection and sampling of materials and items shall be deemed to included and covered by the Contract Rates.

Notwithstanding the provisions for payment in respect of testing given in Clause 34 of the Conditions of Contract all costs in connection with conducting tests and delivery of samples to an approved laboratory shall be deemed to be included and covered by the Contract Rates for the following categories of tests:

i) Tests conducted at the premises of the Contractor, sub-contractor, manufacturer or supplier which are normally of customarily carried out at such premises for the items or materials being supplied for the Works;

ii) Tests which are normally or customarily conducted on the items or materials being supplied for the Works by the Contractor, sub-contractor, supplier or manufacturer but which have to be conducted at an approved laboratory because the necessary testing facilities are not available on the premises of the actual contractor, sub-contractor, supplier or manufacturer.

iii) Tests on locally obtained materials or items either on the Site or at an approved laboratory for the purposes of obtaining the approval of the Engineer to the classification, use and compliance with the Specifications of such items or materials.

iv) Routine quality control tests conducted by the Contractor to ensure compliance with the Specification.

v) Regular testing of concrete as specified in Chapter 8 of the Specification.

vi) Shop and Site acceptance tests, including trial assemblies, of mechanical equipment.

3.13 INSPECTING ENGINEER

The Engineer may appoint Inspecting Engineers to inspect and test materials and articles on his behalf prior to their dispatch to the Site. The Inspecting Engineer will examine, test and if necessary analyze all materials and articles to be used in the Works including all items of fabricated or finished work unless the Engineer shall direct otherwise. The Inspecting Engineer shall be granted free access at all reasonable times to the premises of the Contractor and/or any sub-contractor and shall be afforded every facility for making inspections, making tests, which it is normal or customary to undertake at the premises of the Contractor or sub-contractor and for taking samples for testing and analysis.

The Contractor and/or sub-contractor shall provide to the satisfaction of the Inspecting Engineer all appliances, apparatus and equipment required for the testing at his convenience of the materials and articles at their premises, and shall supply such samples and test pieces as may be necessary to enable tests and analyses to be made at the Inspecting Engineer's laboratory.

The Contractor and/or sub-contractors shall give adequate notice to the Engineer or the Inspecting Engineer as to when any materials, articles or fabricated work will be ready for inspection and shall take into account the possibility of delays in postal communications when giving such notice. Belated

requests by telephone or telex for an immediate inspection of particular items scheduled for shipment which cannot be met will be sufficient reason for waiving inspection thereof and the Contractor shall be held solely responsible for all consequences arising out of any delay resulting from his failure to give adequate notice.

3.14 NOTICE OF INSPECTION AND PROGRESS

The Engineer and the Inspecting Engineer shall be kept properly informed of the progress of any work being carried out on materials and articles being prepared or supplied by the Contractor or any sub-contractor for use in the Works to enable them to make such arrangements for inspection, testing and analysis as they may consider appropriate.

3.15 INSPECTION AGAINST APPROVED DRAWINGS

The inspection of all items of fabricated or finished work will be carried out only against drawings that have been approved by the Engineer and that bear his endorsement of approval.

Neither the Engineer nor the Inspecting Engineer will undertake the inspection of any item of fabricated or finished work until such time as the Contractor shall have forwarded to the Engineer the two paper prints and one unreduced transparency of the approved working or shop drawings covering the items to be inspected, together with two copies of the appropriate orders and sub-orders.

3.16 SAMPLES OF MATERIALS

In addition to any special provision made herein as to sampling and testing materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the Works may be called for at any time by the Engineer and these shall be furnished without delay by the Contractor at his own cost. Approved samples will be retained by the Engineer who will be at liberty to reject all materials and workmanship that are not equal in quality and character to such approved samples.

3.17 TESTS AT SITE

Notwithstanding the results of any examination or tests that may have been carried out on any materials and articles before dispatch to the Site, the Engineer's Representative will be at liberty to carry out any further tests after delivery of such materials at the Site, and to reject any materials which fail to comply with the required quality or conditions.

3.18 PASSING CERTIFICATES

No materials, articles or items of fabricated or finished work to be supplied by the Contractor or by Sub-contractors which have been inspected and tested by the Engineer or the Inspecting Engineer shall be dispatched unless a passing certificate has been issued to the effect that the same are approved. Neither the Contractor nor Sub-contractors shall make use of any materials or articles ordered by them for the purpose of fabrication until such time as a passing certificate covering the said materials and articles shall have been issued by the Inspecting Institutions.

3.19 MATERIALS TO BE DELIVERED AT SITE IN ORIGINAL SHAPE

All materials shall be delivered on site intact in their original shape with manufacturers level, seal, packing etc. These materials are due for inspection by the Engineer and only after approval can be used in the respective works. All materials that has not approved shall be immediately removed from the site.

4. EARTHWORKS

4.1 EARTHWORKS EXCAVATION IN ANY MATERIALS

4.1.1 General

The Contractor shall make excavations in any material for the several parts of the Works and shall dispose of the excavated materials as shown on the Drawings, or ordered by the Engineer.

4.1.2 Scope

Earthwork in excavation in trenches, raft foundation, etc., in soil including dressing of sides, ramming of bottom, lift up to 2.0 meter stacking of excavated materials at least 4 meter clear from the building area and refilling with excavated soil in 150mm layers when required in plinth, under floors, sides of foundation, laying and depositing in layers by watering and ramming and then disposing of all surplus excavated soil as directed.

4.1.3 Workmanship

The foundation shall be dug to the dimensions and depth shown on the drawings except that the Engineer may direct the excavation to continue to a greater depth until, in his opinion, stratum of firm, stable soil is reached.

The excavation shall be carefully made to the levels, shapes and dimensions as shown or figured on the Drawings or as directed by the Engineer to receive the concrete work. Should any material be removed below the specified levels, the Contractor shall fill such excavation at his own expense with M10 concrete rammed in place up to the specified level. Filling with excavated material will not be allowed for this purpose.

If foundations are made broader or longer than directed, the extra length and breath, the Contractor, at his own cost, shall refill only after the foundations are built and the earth rammed hard.

The Contractor, at his own expense and without extra charge shall, make provision for all extra excavation in slope, pumping, dredging or bailing out water and these trenches shall be kept free from water while the foundation work is in progress.

The Contractor at his own cost shall remove such portions of boulders or rocks and the remains of the old dismantled structures as are required to make the bottom of the trench horizontal and level, Nothing extra shall be admissible separately in the Bill of Quantities. The Engineer shall inspect the excavations before any foundations are started and record the trench level. The filling in of side of trench excavations can be done in not more than 150mm layers. Each layer shall be watered and rammed hard before adding the next layer. Refilling shall be brought to the ground level without extra charge and shall form part of the item of excavation.

4.2 NOTICE TO BE GIVEN BEFORE COMMENCING EARTHWORKS

The Contractor shall give to the Engineer at lest seven days written notice of his intention to commence earthworks on any part of the Site. The earthworks shall not be commenced until the Contractor has received written approval from the Engineer.

4.3 EXCAVATIONS TO DIMENSIONS

Excavation shall be to the dimensions and depths indicated on the Drawings or to such lesser or greater depths as the Engineer may deem necessary and so instruct the Contractor. Bottoms of all excavations for foundations shall be in sound soil. Bearing for all foundations, unless noted otherwise, shall be leveled.

4.4 STRIPPING AND REPLACEMENT OF TOPSOIL

Areas to be excavated or filled as well as borrow areas where material for filling is to be excavated, shall be stripped of topsoil containing organic or other unsuitable matter to a depth of at least 150 mm or to such greater depth as may be shown on the Drawings or as may be determined by the Engineer's Representative, including grubbing up of roots. The topsoil shall be stockpiled and preserved in separate dumps or spoil banks for re-use as necessary.

4.5 EXTENT OF EXCAVATIONS

The extent of excavations shall be the minimum practicable in the opinion of the Engineer for the construction of the Permanent Works.

The construction of trenches for pipelines shall at any one time be limited to lengths previously approved by the engineer in writing. Except with the written approval of the Engineer, work on each approved

length shall be completed to the satisfaction of the Engineer before work on any new length is commenced.

4.6 EXCAVATION OF UNSOUND MATERIAL

If any unsound material occurs in the bed of foundations, the Contractor shall remove and dispose of it to the satisfaction of the Engineer. Unsound material shall include roots, organic matters mud, gypsum, sand and deleterious substances. Unless otherwise specified or ordered by the Engineer, the Contractor shall fill the voids so formed with concrete Grade M10 for major structures and with compacted fill material for minor structures.
If the Contractor encounters any material, which in his opinion may be unsound, he shall immediately inform the Engineer who will instruct the Contractor in writing as to whether or not the said material shall be treated as unsound.

4.7 SLIPS AND FALLS

The Contractor shall exercise the greatest possible care and take all necessary precautions to prevent slips and falls of material from the sides of the excavation.

In the event of slips and falls occurring the Contractor shall make good all earthworks and associated works and execute any requisite modifications of the works to the satisfaction of the Engineer.

4.8 OVER EXCAVATION

Should the excavation be carried below required depths, it shall be filled to proper elevation only with concrete in accordance with Chapter - V. The additional costs under this requirements shall be at the Contractor's expense. Other excavations carried below required depth shall be filled to the proper grade as specified herein for filling and back filling.

4.9 TIMBERING OF FOUNDATION

Whenever the risk of collapse exists such as in deep excavations or in loose, unstable soil, the sides of the trenches shall be protected by erecting timber shoring and structuring. Timbering shall be close or open depending on the nature of the soil and work. The arrangement of timbering, sizes and spacing of members shall be as directed by the Engineer. Nothing extra on this account shall be admissible which require special treatment for the purpose of excavation, and it shall be deemed to be included in the rate for excavation in soil. Ordinary pebbles or canker shall be taken under soil for which nothing extra shall be paid.

4.10 SHORING OF EXCAVATION AND PROTECTION

4.10.1 General

Excavations shall be shored and braced where necessary to prevent accident to persons, damage to structures, injurious caving or erosion. Remove shoring during back filling in a manner to prevent caving.

4.10.2 Implementation

Where necessary to do shoring, the Contractor shall be responsible for the design of shoring for proper excavation. Shoring shall be of sufficient strength to resist side pressure ensuring safety from slips, prevent damage to work and property and injury to persons. It shall be removed as directed after all the items for which it is required are completed. Near towns and all frequented places, foundation pits, well pits and similar excavation shall be securely fenced and marked with red lights at night in charge of watchmen to avoid accidents. Adequate protective measures shall be taken to see that the foundation excavation does not affect or damage adjoining structures. All measures required for the safety of the excavation, the people working in and near the foundation trenches, property and the people in the vicinity shall be the responsibility of the Contractor. The Contractor shall be entirely responsible for any injury to life and damage to property caused by his negligence or accidents due to his constructional operations.

No extra shall be paid in this connection unless otherwise specified.

4.11 PUMPING GROUND WATER AND RAIN WATER

4.11.1 General

Pumping and draining of ground water, surface water and rainwater shall be carried out as required during excavation and foundation work to keep the work free from standing water.

4.11.2 Implementation

Water pumping out from excavation for basement or any other water should be made as per site condition.

The Contractor shall not be paid extra for bailing out or pumping out of all water which may accumulate in the excavation during the progress of the work either from seepage, springs, rain or any other source and shall be removed after their purpose is served.

Pumping water from any foundation enclosure or trenches shall be generally in such a manner as to preclude the possibility of any damage to the foundation trenches, concrete or masonry or any adjacent structures. The excavation shall be kept free from water (i) during inspection and measurement, (ii) when concrete and / or masonry works are in progress and till they come above the natural water level and (iii) till the Engineer considers that the mortar is sufficiently set. If this work has not been implemented during construction works the reasonable amount of cost will be deducted from the claimed sum of contractor's bill.

4.12 FILL, BACKFILL FREE FROM ORGANIC MATTER

All organic matter, debris and refuse from earth obtained by site excavation shall be removed before using for fill and backfill. Use this material outside building only.

4.13 BORROW PITS

No borrow pits will be allowed to be opened on the site unless otherwise in writing by the Engineer.

4.14 LEVEL OF EXCAVATIONS (TRIMMING AND LEVELING)

4.1.4.1 General

No excavations or bottom of excavations shall be filled in or covered up until all measurements necessary have been made, inspected and approved by the Engineer.

4.14.2 Implementation

The bottom of all foundation should be trimmed and leveled in accordance with the Drawings. Bottom of the foundation shall be rammed and watered before concrete is deposited.

(i) Measurement to 2 Meters Depth

All excavations shall be measured correct to 10mm and be the product of the exact length and width of the lowest step of the footings according to the drawings or the Engineer’s instructions and the depth measured vertically. Where the ground is not level, average depth shall be taken. Rate shall be inclusive of all the Works described above.

(ii) Measurement Greater than 2 Meters Depth

Separate payment will be made for extra lift from 2 -10 meters. Measurement shall be the exact length, breath and depth greater than 2.0 meters.

4.15 COMPACTION OF FILL, BACKFILL

4.15.1 General

All fill within the buildings shall be compacted to 95% modified proctor density and all fill and backfill outside the building to a density of 90% at optimum moisture content.

4.15.2 Implementation

Filling in plinth with imported materials in 150mm layers under floors including watering, ramming, consolidation and dressing, all complete.

Imported fill shall be approved by the Engineer prior to delivery at the site. The rate for imported fill shall include the cost for transport from a source up to 10 km from the project site. The sand shall be either pit sand or river sand as approved by the Engineer.

The work shall be done with earth/sand fill in 150mm layers, each layer being watered and rammed thoroughly. It shall include excavation of earth/sand, transportation, screening, if necessary, filling and the cost of labor, all complete.

4.15.3 Measurement

The measurement shall be taken for the consolidated thickness of earth/sand and paid in cubic meters. Pit or stack measurements shall not be taken for the purpose of payment. Quantity of earth fill under this item shall be arrived at by deducting the total quantity involved in foundation excavation from the total of earth filling required in trenches around foundations, over raft, under floors or any other filling.

4.16 METHODS OF COMPACTION OF FILLS

Fill shall be deposited in horizontal, uniform layers or such thickness as required by the nature of the soil or as directed, but not exceeding fifteen (15) centimeters uncompacted thickness. Compact each layer to uniform solid mass by rolling, tamping or other approved means. Compact each layer until no weaving or creeping takes place.

4.17 MOISTURE CONTENT OF FILL

The moisture content of the compacted fill shall be controlled to insure maximum density by either the addition of water or by harrowing and working the fill prior to compacting. No puddling will be permitted.

4.18 RECORD OF SOIL STRATA

Records of the nature of the strata penetrated shall be kept and every facility and assistance shall be provided to the Engineer to obtain complete information concerning the type of material at each excavation.

4.19 STARTING LEVEL

The starting level for excavations shall be deemed to be ground level or the reduced level or bench marks provided.

4.20 MATERIALS FOR SUB DRAINAGE

The materials shall consist of one or a mixture of the followings natural gravel, crushed gravel, crushed quarry stone, and natural sand. The materials shall be graded with 30% to 80% passing the No. 8 sieve, 90% passing the 40 mm sieve and not more than 40% passing the No. 200 sieve by weight. The materials shall be free draining even when thoroughly compacted.

4.21 DRAINAGE LAYERS

The drainage layer shall be continuous and shall be so placed that mingling with fill will be prevented. If required, planks or other suitable separators that can be withdrawn as the work progresses shall be kept between the drainage materials and the fill. The minimum thickness of the drainage layer shall be 30 cms unless otherwise shown on the Drawings.

4.22 DRAINAGE LAYER AROUND PIPES

Drainage layer surrounding drain pipes shall be placed in loose lifts not exceeding 15 cms and hand tampered to avoid damaging pipe.

4.23 FILTER LAYERS AND WEEP HOLES

The inlet and or all weep holes and drains shall be covered with filter materials to prevent migration of finer materials. Filter layers may be required between the drainage layer and fine-grained fill material as directed by the Engineer. Filter layer shall be a layer of successively finer granular materials, which can be placed behind coarser materials, the coarsest materials against the structure being gravels of size up to 75mm.

4.24 DRAINAGE LAYER IN CONTACT WITH WATER PROOFED SURFACES

In the event that a drainage layer is in contact with a waterproofed surface, a 10 cm layer of sand shall be placed between the surface and the drainage layer.

4.25 SITE CLEARANCE

4.25.1 General

Site clearance shall mean leveling and removal of all grass, shrubs, rubbish and any other plant, waste or foreign matter of any kind. The maximum depth of excavation or fill shall be 300mm.

The area extending 6 meters from the foundations around the building shall be dressed and leveled properly with an outward slope of 1 in 100. The surplus excavated material shall be disposed as directed. Removal of any trees or hedges shall be measured and paid separately.

4.25.2 Measurement

No extra payment

5. CONCRETE WORKS

5.1 GENERAL

5.1.1 Standards and Codes of Practice

All concrete work shall be carried out in accordance with British Standard Code of Practice 110 or IS 456 or equivalent NS unless otherwise specified herein.

5.1.2 Costs of Testing and Sampling of Concrete and Concrete Materials

The cost of all sampling, transport of samples and testing in connection with the concrete shall be in accordance with Clause 3.05 and where such costs are to be borne by the Contractor they shall be included in and covered by the Contract Rates for concrete.

5.1.3 Failure to Meet Specified Requirements

If the specified requirements have not been met, the Contractor shall take such remedial action as the Engineer or Engineer's Representative may order, and shall, before proceeding further with concreting, submit for their approval details of the action proposed to ensure that the concrete still to be placed in the works will comply with the specification.

5.2 CEMENT FOR CONCRETE

a) Cement

The cement used shall be ordinary Portland cement and shall conform in all respects with B.S.12 or IS 269. White or colored cement shall be of approved quality and chemical composition shall conform with IS 269.

b) Packing

The cement shall be packed in six-ply paper bags or as approved in plastic bags of approved quality and the net mass of each bag shall be not less than 50 kg. The permissible tolerance on the mass of cement supplied in bags shall be + 2.5% per bag with an overall tolerance of + 0.5% per 10 tones wagon load of bagged cement.

c) Delivery of cement and storage

The cement shall be delivered in the manufacturer's sealed and branded bags in quantities sufficient to insure that there is no suspension or interruption of the concrete work and stored separately in dry weatherproof, well-ventilated stores raised above ground level and shall at all times be carefully protected from moisture. The Cement shall be stored in such manner that each consignment may be easily inspected and identified and used in the order of its delivery.

d) Records, certificates and Samples

Prior to the delivery to the site, the contractor shall supply the manufacturer's test certificates shall be furnished to the Engineer, and as directed by the Engineer, the contractor shall furnish, free of cost, test certificates relating to the cement to be used on the work. Each certificates shall indicate that the sample has been tested by an approved firm and that it conforms in all respects with the relevant specification BS12 or IS 269-1967. Analysis of the cement shall be shown.

The Contractor shall forward a weekly report to the Engineer's Representative giving full particulars of the various consignments in store.

The Contractor shall maintain a record available for inspection by the Engineer's Representative of the locations of concrete made from each consignment.

The Contractor shall supply samples of cement for test and send them for testing by the inspecting Engineer when requested by the Engineer's Representative both from the Contractor's store on Site and from the place of manufacture.

5.3 AGGREGATES

(a) Supply and Classification

The Contractor shall make his own arrangements for procuring, crushing, grading and delivering aggregate for the works as required from sources to be approved by the Engineer's Representative.

Separate fine and coarse aggregates shall be used for the manufacture of concrete. The term 'fine aggregate' is used to designate aggregate mainly passing a 5.00 mm, BS 410 test sieve and containing only so much coarser materials as is permitted for the various grading zones given in Table 5.2. The term 'coarse aggregate' is used to designate well graded aggregate mainly retained on a 5.00 mm BS 410 test sieve and mainly passing a 37.50 mm, BS 410 test sieve and only containing much coarser or finer materials as is given in Table 5.1.

Coarse aggregate shall be supplied in the following primary sizes:

Size designation	Nominal size range
10	5 mm to 10 mm
20	5 mm to 20 mm
40	20 mm to 40 mm

Aggregates shall be graded to produce workable dense concrete.

(b) Quality

All aggregates to be used in concrete shall be clean, hard, dense, sound, chemically inert, of limited porosity and uncoated particles as free clayey or organic matter.

- Grading: in accordance with Tables 5.1 and 5.2 herein
- Mechanical Properties: when tested in accordance with BS 812, part 3, the 'Ten per cent Fines Value' shall be not less than 5 Kg.
- Silt, Clay and Dust Fraction: when determined in accordance with the decantation method given in BS 812, Part 1 the silt, clay and dust fraction by weight shall not exceed 1% for coarse aggregates, 3% for natural sand or crushed sand and 15% for crushed sand.
- Water Absorption: when tested in accordance with BS 812 Part 2 the water absorption after 24 hours shall not exceed 4%.
- Aggregate impact Value: when determined in accordance with BS 812 Part 3 shall not exceed 45%.
- Soundness: when tested in accordance with the sodium sulphate soundness test specified in ASTM C88 the aggregate shall have a percentage loss of less than 15.

- Alkali-aggregate Reactivity: when tested in accordance with ASTM C -289 aggregate exhibiting evidence of alkali aggregate reactivity will not be acceptable unless the Contractor can show that the proposed cement aggregate combination, when tested in accordance with ASTM C277 of other tests, will not produce deleterious alkali-aggregate reactivity, as to which the Engineer shall be the sole judge.
- Shrinkage: when determined in accordance with the BRE Digest 35 test the drying shrinkage shall not exceed 0.065%.
- Mica Content: shall not exceed 0.5% by weight or as otherwise approved by the Engineer.

(c) Testing

Testing of aggregates is to be in accordance with BS 812 or as specified herein.
For each source of aggregate and at least four weeks prior to the preparation of trial mixes samples of aggregates together with the results of the tests listed below shall be submitted to the Engineer's Representative for approval of the sources of aggregate and quality:

- Grading analysis to BS 812, Part 1.
- Mechanical properties. Ten per cent Fines Value Test to BS 812 Part 3.
- Silt, clay and dust fraction in both fine and coarse aggregates decantation method to BS 812, Part 1.
- Specific gravity and water absorption to BS 812 Part 2.
- Sodium sulphate soundness test to ASTM C227 and/or ASTM 289.
- Chloride content test to BS 812, Part 4.
- Mica content (method to be notified)
- Flakiness and elongation indices to BS 812, Part 1.
- Shrinkage test to BRE Digest 35 (2nd series).

Approval of a source of aggregate by the Engineer's Representative shall not be construed as constituting the approval of all materials to be taken from that source and the Contractor shall be responsible for the specified quality of all such materials used in the Works. The Contractor shall not obtain aggregates from sources which have not been approved by the Engineer or given in the Bill of Quantities. The maximum size of coarse aggregate in concrete for any part of the Works shall be the largest of the sizes given in Table 5.1 the use of which is practical from the standpoint of satisfactory workability and consolidation of the concrete. The Contractor shall obtain the approval of the Engineer's Representative to the maximum size of aggregate for each section of the Works.

(d) Storage

The contractor shall provide means of storing the aggregates at each point where the concrete is made such that (a) each nominal size of coarse aggregate and the fine aggregate shall be kept separated at all times (b) contamination of the aggregates by the ground or other foreign matter shall be effectively prevented at all times and (c) each heap of aggregate shall be capable of drain freely.

The contractor shall ensure that the graded coarse aggregates are tipped, stored and removed from the store in a manner that does not cause segregation.

Wet fine aggregate shall not be used until, in the opinion of the Engineer, it has drained to a constant and uniform moisture content, unless the Contractor measures the moisture content of the fine aggregate continuously and adjusts the amount of fine aggregate and the added water in each batch of concrete mixed to allow for the water contained in the fine aggregate. If necessary to meet the requirements of this clause, the Contractor shall protect the heaps of fine aggregate against inclement weather and floor to be made of brick and sloping outwards.

The contractor shall make available to the Engineer such samples of the aggregate as he requires. Such samples shall be collected at the point of discharge of the aggregate to the batching plant. If any such sample does not conform with the specification, the aggregate it represents shall be promptly removed from the site and the contractor shall carry out such modifications to the storage arrangements as may be necessary to secure compliance with the specification.

(e) Coarse Aggregates

Coarse aggregate shall consist of crushed rock. Friable and flaky pieces such as mica and shale shall not be present. Coarse aggregates shall be well graded within grading given in Table 5.1 and to the satisfaction of the Engineer's Representative.

TABLE 5.1: Grading of Coarse Aggregates

Percentage by Weight Passing Standard Sieves BS 410

Standard	10mm to 5 mm	20mm to 5mm	40mm to 5mm
75.0	-	-	100
37.5	-	100	95-100
20.0	100	95-100	35-70
10.0	85-100	30-60	10-40
5.0	0-25	0-10	0-5

(f) Fine Aggregates

Fine aggregate shall consist of natural sand or a mixture of natural sand and crushed gravel or crushed rock. The Engineer's Representative will permit the addition of crushed gravel or crushed rock fine aggregate to the natural sand only where in his opinion it is impracticable to obtain the required fine aggregate grading otherwise than by such addition.

The grading of the fine aggregate shall lie within one of the grading zones as set out in Table 5.2 below and specified in BS 882

TABLE 5.2: Grading of Fine Aggregates

Percentage by Weight Passing Standard Sieves

BS 410 Standard Zone Mesh	Grading Zone 1	Grading Zone 2	Grading Zone 3	Grading Zone 4
10.00 mm	100	100	100	100
5.00 mm	90-100	90-100	95-100	90-100
2.36 mm	60- 95	75-100	85-100	95-100
1.18 mm	30- 70	55- 90	75-100	90-100
600 µm	15- 34	35- 59	60- 79	80-100
300 µm	5- 20	8- 30	12- 40	15- 50
150 µm	0- 10	0- 10	0- 10	0- 15

5.4 WATER FOR MAKING CONCRETE, ETC.

Water used in mixing concrete, mortar or grout shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or steel. The water shall be to the approval of the Engineer's Representative and in accordance with BS 3148, including Appendix B thereof.

The Contractor shall, at least four weeks prior to the making of the trial mixes, sample the water he proposes to use and carry out test and deliver the test certificate the Engineer's Representative.

5.5 CHEMICALS IN CONCRETE

The total sulphate content, whether as gypsum or more soluble salts, of the concrete ingredients when measured as sulphur trioxide shall not exceed 4% of the weight of cement in the concrete.

The chloride of the concrete ingredients when measured as chloride ion shall not exceed 0.2% of the Weight of cement in the concrete.

If instructed by the Engineer's Representative the Contractor shall obtain samples from the concrete for testing, all in accordance with BS 1881, Part 6. The cost of sampling and transport shall be covered by the Contract Rates for concrete.

5.6 ADDITIVES

5.6.1 General

Concrete shall be made from cement, aggregates and water as specified. No other ingredient shall be mixed with the concrete or mortar without the Engineer's approval.

If the use of retarding or workability agents is approved by the Engineer their use shall be subject to the following conditions:

- there shall be no reduction in characteristic strength at 28 days compared with additive free concrete of the same grade and class
- there shall be no reduction of minimum cement content specified and
- the use of the admixture shall be strictly in accordance with the manufacturer's instructions in respect of the conditions at the Site. Admixtures shall be introduced to the concrete by approved dispenser.

The contractor may use a retarder to facilitate the preparation of construction joints subject to the approval of the Engineer of the composition of the retarder and its method of application.

5.7 ADMIXTURE

Admixture shall mean material added to the concrete materials during mixing for the purpose of altering the properties of the concrete mix.

If the contractor wishes to use admixtures, otherwise than as expressly ordered by the Engineer, he shall first obtain the Engineer's written permission. The methods of use and the quantities of admixture used shall be subject to the Engineer's approval, which or otherwise shall in no way limit the contractor's obligations under the Contract to produce concrete with the specified strength and workability

Technical Specification of Silica Cement Admixture
Product Name: Silica Cement Admixture
Materials: Natural Volcano Ash
Chief ingredient: SiO2 above 85%
Characteristic of the Material: Amorphous (shapeless)
Particle size: 0.4 um
Specific surface area by Blaine: 60,000 cm2/gram
Colour: White
Ratio: 5% amount of Cement

5.8 PRE-CONSTRUCTION ANTI-TERMITE CHEMICAL TREATMENT (NOT APPLICABLE)

5.9 STEEL REINFORCEMENT

5.9.1 Scope

Supplying and fixing deformed high strength steel reinforcement in reinforced cement concrete (RCC) work including supply, storage, cutting, bending, binding with wire, placing in position including the cost of binding wire, all complete as per design and the instructions of the Engineer.

Supplying and fixing mild steel reinforcement grade 1 conforming to IS 432-1966 in reinforced cement concrete (RCC) work including supply, storage, cutting, bending, binding with wire, placing in position including the cost of binding wire, all complete as per design and the instructions of the Engineer.

5.9.2 General

Reinforcement shall be free from pitting due to corrosion, loose rust, mill scale, paint, oil, grease, adhering earth, ice or other materials that may impair the bond between the concrete and the reinforcement or that may in the opinion of the Project Engineer cause corrosion of the reinforcement or cement grout.

5.9.3 Bar Reinforcement

Bar reinforcement described as "Mild Steel" shall be plain round hot rolled steel bars. Bar reinforcement described as "Deformed Steel" shall be hot rolled deformed bars and cold twisted. With respect to manufacture, quality, physical properties and related requirements, reinforcement bar of the foregoing descriptions shall comply with appropriate parts of IS & BS Standards for Mild Steel and Deformed Steel respectively.

5.9.4 Quality

Steel for the reinforcement of concrete shall be hot-rolled bars or cold twisted bars complying with latest revising BS 4449, 1139 - 1966 or IS 432 and IS 1786 for mild steel, tor-steel and TMT respectively.

5.9.5 Testing and Test Certificates

Reinforcing steel ordered from the mills shall be examined at the mills by the Inspecting Engineer and, wherever possible, and unless otherwise approved shall be tested in his presence in accordance with BS 4449. Two copies of all works tests certificates relating thereto shall be forwarded to the Inspecting Engineer.

In the case of steel not tested in the presence of the Inspecting Engineer, whether ordered from the mills or from stockholders, copies of works test certificates shall be supplied as prescribed herein and the Engineer or the Inspecting Engineer reserves the right to carry out such further tests as he may consider necessary.

Copies of the Inspecting Engineer's test certificates or works test certificates in respect of each consignment of steel reinforcement delivered to site shall be supplied to the Engineer's Representative prior to delivery of reinforcement to the Site. Every consignment and its related test certificates shall carry reference markings such that they are uniquely identified.

The Contractor shall supply samples of reinforcement from the stocks on Site when required by the Engineer's Representative and shall forward the samples to the Inspecting Engineer for testing as directed at the cost of Contractor.

5.9.6 Storage and shape of supply

Reinforcement shall be stored clear of the ground and supported to prevent distortion.

At the time of incorporation in the Works, reinforcement shall be clean and free from defects, oil or grease, loose mill scale and loose rust, or any other substance, which may adversely affect the steel, concrete or reduce bond.

Bars, which have become bent, shall not be straightened or re bent for incorporation in the Works. All bars should be supplied in straight form from the manufacturing plant. Bars in coils or folded shall not be used in the permanent works unless otherwise specifically approved by the Engineer.

5.9.7 Dimensions of Reinforcement Bars

The diameter of reinforcement bars described on the Working Drawings or elsewhere shall be the minimum and the rolling margin and other tolerances shall be above this size. The length of a reinforcement bar shall be not less than the length on the drawing or elsewhere specified and shall not be more than 50 mm in excess of that length. The Contractor shall prepare a bar-bending schedule based on the design and submit for approval to the Engineer prior to executing the work. The cost for preparing the bar-bending schedule is deemed to be included in the rate for steel reinforcement and no extra shall be paid for this work.

5.10 CLASSES AND GRADES OF CONCRETE

The concrete used in the Works shall be of the grades or classes shown on the Drawings or indicated in the Bill of Quantities or ordered by the Engineer.

The characteristics of the mixes of concrete to be used in the works shall be as given in Table 5.3 UNLESS OTHERWISE APPROVED BY THE ENGINEER.

5.11 MAXIMUM SIZES OF AGGREGATE TO BE USED

Unless shown on the Drawings or given in the Bill of Quantities the maximum size of coarse aggregate in concrete for any part of the Works shall be the largest of the sizes given in Table 5.3 the use of which is practical from the standpoint of satisfactory workability and consolidation of the concrete.

5.12 MIXES OF CONCRETE

The concrete strengths shown in the Bill of Quantities are the strengths required for the various items of work. These strengths shall be strictly adhered to. Quantity of water shall be adjusted to compensate for the moisture content in aggregates.

The Contractor, at his own expense, shall prepare a mix design prior to starting any concrete work. Only those materials approved by the Engineer for use in the work shall be used to produce a mix design. The Contractor shall provide at his own cost sufficient quantity of approved materials to the Engineer to prepare 15 test cubes and for independent testing of the approved mix. The compressive strength results shall meet the requirement indicated in sub-clause 2.4. In case the strength requirement is not met, the source of materials shall be changed until the requirement is met without changing the proportions. If the source of materials is changed further laboratory tests shall be carried out.

During casting, test cube samples shall be made in sufficient number to test at 3, 7, and 28 days. At least cubes are required for each day of testing. In no case shall the 28 days cube strength be less than that mentioned in the Bill of Quantities. At least nine cubes shall be taken for each element of structure, e.g., footing, column and beam. Additional cube tests to be carried out shall be at the discretion of the Engineer's Representative.

5.13 COMPRESSIVE STRENGTH COMPLIANCE

The compressive strength of the concrete shall be based on the compression testing of 150 mm concrete cubes, made and tested in accordance with Chapter 3 of this Specification.

The compressive strength of the concrete is specified by the characteristic compressive strength; Table 5.3 lists the values for each grade of concrete.

The characteristic compressive strength of the concrete is the value of the cube compressive strength, when tested at an age of 28 days, below which not more than 5% of results shall fall.

The concrete in the Works shall be considered to comply with the commotion as to which the Engineer's Representative shall be the judge; but lifts shall not normally exceed 1.5m for members more than 1.5m in height.

Where steps, splays and kickers occur these shall be cast in one continuous sequence with the slab/ beam and additional care shall be taken during vibration and finishing to ensure that thorough compaction is achieved.

All concrete shall be compacted to produce a dense homogeneous mass.

Any concrete, which has reached a temporary set or has become so stiff that proper placing without tempering cannot be assured, shall not be used.

Concrete having required characteristic strengths greater than 10 N/Sq. mm shall be compacted by mechanical vibrator. Vibration shall not be applied by way of the reinforcement and every care shall be taken to avoid contact with the reinforcement. The Contractor shall provide sufficient vibrators, in serviceable condition, so that standby vibrators are always available in the event of breakdowns. The number and type of vibrators used on concrete placement shall be to the approval of the Engineer's Representative.

Where immersion type vibrators are used, they shall have a minimum frequency of vibration of 7000 revolutions per minute when immersed in the concrete. Form vibrators shall be securely fastened to the forms and shall operate at speeds of at least 8000 revolutions per minute when vibrating concrete. Concrete shall not be subjected to vibration between it taking its initial set and 24 hours after compaction. Vibrators shall not be used to move concrete along the forms. Over vibration causing segregation, surface laitance and leakage through formwork shall be avoided.

Concrete having required characteristic strengths not greater than 10 N/sq.mm may be compacted by hand but shall be deposited in layers not exceeding 300 mm in thickness and shall be well worked with special tools and rods until it has settled closely in place and is free from air bubbles.

Except where otherwise directed concrete shall not be placed unless the Engineer's Representative or his representative is present and has previously examined and approved the positioning, fixing and

condition of the reinforcement and of any other items to be embedded, and the cleanliness alignment and suitability of the containing surfaces. At least 24 hours notice shall be given in writing to the Engineer's Representative of the placing of concrete and request for approval to concrete.

Strength Requirements:
Where ordinary Portland cement conforming to IS: 269 - latest revision or Portland cement- Furnace Slag cement conforming to IS: 455 - (latest revision) is used, the compressive strength requirements for various grades of concrete shall be as shown in Table - IV and shall apply to both controlled concrete and ordinary concrete.

The acceptance of strength of concrete shall be as per clause 5.4 “Sample size and Acceptance Criteria” of IS: 456 - latest revision subject to the stipulations and/or modifications stated elsewhere in this specification.

The Contractor, at his own cost, shall dismantle and replace as per specification all work found unsuitable. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall be made good free of charge by the Contractor to the satisfaction of the Engineer.

Compressive strengths for different grades of concrete are specified in Table - IV and shall always refer to the cube strength. Other requirements of concrete strength as may be desired by the Engineer shall be in accordance with IS: 456 (latest revision).

Strength Requirement of Concrete

	Compressive strength of 15 cm. cube at 28 days after mixing in accordance with IS: 456 - latest revision	
Grade of Concrete	Preliminary tests N/mm^2	Work test N/mm^2
M 15	20	15
M 20	26	20
M 25	32	25

With permission of the Engineer, for any of these above mentioned grades of concrete shall also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for the additional cement will be made.

5.14 WORKABILITY

The workability of the concrete shall be checked at frequent intervals by slump test. Where facilities exist and if required by the Engineer, alternatively, the compacting factor test in accordance with IS: 1199 - (latest revisions), shall be carried out. The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and around on the type and nature of structure shall be based on experience and tests within the preferred limits of consistency as specified in Table below for various types of structures.

Limits of Consistency

Degree of Workability	Slump in mm		Use for which Concrete is Suitable
	Min.	Max.	
Low	20	40	Mass concrete foundations without vibrations, simple reinforced section with vibration.
Medium	50	100	Normal reinforced beams, columns, slabs without heavily reinforced section with vibration.
High	100	150	Section with congested reinforcement not normally suitable for vibration.

Note: The slump to be obtained for work in progress shall be as per the instruction of the Engineer.

5.15 LOAD TEST

Load test of structural members may be required by the Engineer when the strength of job control cubes falls below the required strength and is not acceptable as per “Acceptable Criteria” of IS: 456 - (latest revision). If the load testing is decided by the Engineer, the member under consideration shall be subjected to a superimposed load equal to one and quarter (1.1/4) times the specified superimposed load used for design and this load shall be maintained for a period of 24 hours before removal. The detailed procedure of the test is to be decided by the Engineer.

If the member shows evident failure, such changes as are necessary to make the structure adequately strong shall be made free of cost. If on the other hand, the failure becomes evident, the Engineer under special circumstances (with the approval of the designer), can retain the portion of the structure under test, provided suitable modification for strengthening and/or dispersion of design load is feasible. Cost of such modification of dispersion of load shall be borne by the Contractor.

The entire cost of load testing shall be borne by the Contractor. If a portion of the structure is found to be unacceptable it shall be dismantled and replaced by a fresh structure as per specification. The cost of dismantling and the cost of concrete, formwork and reinforcement involved in the dismantled portion shall not be paid to the Contractor.

If in the course of dismantling, any damage is done to the embedded items and or other adjacent structures the same shall be made good free of charge by the Contractor to the satisfaction of Engineer.

5.16 WORKMANSHIP

General: All workmanship shall be according to the latest and best possible standards.

5.16.1 Mixing of Concrete

The proportion of fine and coarse aggregate, cement and water shall be as determined by the preliminary tests or according to fixed proportions in case of ordinary concrete and shall always be approved by the Engineer. The quantities of fine and coarse aggregates shall be determined by weight. The water shall be measured accurately after giving proper allowance for surface water present in the aggregates for which the Contractor shall make regular checks. Due allowance shall be made for bulking in case of volume batching in accordance with IS 2386 (Part III) - (latest revision).

Concrete shall be always mixed in a mechanical mixer unless specifically approved by the Engineer for concrete to be used in unimportant structures. Unless otherwise approved by the Engineer, the water shall not be poured into the drum of the mixer until all the cement and aggregates constituting the batch are already in the drum and mixed for at least one minute. Mixing of each batch shall be continued until there is uniformity in color and consistency, but in no case shall mixing be done for less than two minutes and at least forty revolutions after all the materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer. The mixer shall not be loaded above its rated capacity as this prevents thorough mixing.

The entire contents of the drum shall be discharged before the ingredient for the next batch is fed into the drum. No partly set, re-mixed or excessively wet concrete shall be used and it shall be immediately removed from site.

Each time the work is stopped, the mixer shall be thoroughly cleaned and when the next mixing commences, the first mix shall have 10% additional cement at no extra cost to allow for loss in the drum.

When hand mixing is permitted by the Engineer for concrete in unimportant structures, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in color and consistency. In case of hand mixing, 10% extra cement shall be added to each batch with no extra cost.

5.16.2 Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of final deposit as rapidly as practicable by approved means before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the ingredients. If segregation does occur during transport, the concrete shall be re-mixed. During very hot or cold weather, the Engineer may specify deep containers in which the concrete shall be transported to reduce water loss of by evaporation and loss of heat. Conveying equipment for concrete shall be well maintained and thoroughly cleaned before commencement of concrete mixing. Such equipment shall be kept free from set concrete.

5.16.3 Placing Concrete

Prior to placing any concrete the Contractor shall obtain approval in writing from the Engineer for the formwork and reinforcement. Concrete shall be placed in its final position without segregation. The forms shall be well wetted and all shavings, dirt, water and foreign matter that may have collected at the bottom shall be removed before concrete is placed. The interval between adding the water to the dry materials in the mixer and the completion of the final placing inclusive of compaction of the concrete shall be not more than initial setting time of the cement, normally 30 minutes for ordinary Portland cement. The concrete shall be well placed in the formwork by means approved by the Engineer and shall not be dropped from a height or handled in a manner that may cause segregation. Any drop above 180 cm shall have to be approved by the Engineer. Once the concrete is placed in its final position, it shall not be disturbed. After the concrete has been placed, it shall be spread and thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures into the concrete form and shape. Vibration shall not be used to spread the concrete. Vibration must be operated by experienced personnel and over vibration shall not be permitted. Hand tamping in some cases may be allowed subject to the approval of the Engineer.

Concrete shall not be placed in open areas during a period of rainfall. If there has been any sign of separation of cement and sand by washing, the concrete shall be entirely removed immediately. Suitable precautions shall be permitted on freshly laid concrete to prevent any rainwater damage. Slabs, beams and similar members shall be poured in one operation normally. Bleeding of under layer, if any shall be effectively removed. Moulding, throating, drip coarse, etc. shall be poured as shown on the drawing or as directed by the Engineer. Holes shall be provided and bolts sleeve, anchors fastenings or other fixtures shall be embedded in concrete as shown on the approved drawings or as directed by the Engineer. Any deviation from the drawing shall be set right by the Contractor at his own expense as instructed by the Engineer.

5.16.4 Construction Joints

When the work is to be interrupted, the concrete shall be rebated at the joint to such shape and size as may be required by the Engineer or as shown on the drawing. All vertical construction joints shall be made with step boards that are rigidly fixed and slotted to allow for the passage of the reinforcing steel. If desired by the Engineer keys and/or dowel bars shall be provided at the constriction joints. In the case of water retaining structures water stops of approved material shall be provided if so specified in the drawings or desired by the Engineer. Construction joints shall be provided in positions as described, the joints shall be in accordance with the followings:

In a column, the joints shall be formed about 75mm below the lowest soffit of the beams forming into it.

Concrete in a beam shall be placed throughout without a joint, but if the provision of a joint is unavoidable, the joint shall be vertical at the point of balanced moment along the span. A joint in a suspended floor slab shall be vertical at the face of balanced moment and at right angles to the principal reinforcement. The locations of construction joints shall be planned by the contractor well in advance of pouring and will have to be approved by the Engineer.

Before fresh concrete is placed the cement skin of the partially hardened concrete shall be thoroughly removed and surface made rough by hacking, sand blasting, water jetting, air jetting or any other method as directed by the Engineer. The rough surface shall be thoroughly wetted for about two hours and shall be dried and coated with 1:1 freshly mixed cement sand slurry before placing the new concrete. The new concrete shall be worked against the prepared surface before the slurry sets. Special care must always be taken to see that the first layer of concrete placed after a construction joint is cold.

Joints during pour shall be treated with 1:1 freshly made cement sand and bonding agent. Slurry only after removing all loose materials. Bonding agent type and make has to be approved by the Engineer.

5.16.5 Protection and Curing of Concrete

Newly placed concrete shall be protected by approved means from rain, sun and wind. As soon as the concrete has hardened sufficiently for the surface to be marked, it shall be covered either with sand, hessian, canvas or similar materials and kept continuously wet for at least fourteen days after final setting. This period may be extended at the discretion of the Engineer.

5.16.6 Control Tests on Concrete

The Contractor shall cast nine test cubes for each type of work for each 8-hour period or less of concreting. If the value of concrete poured is less than 20 cubic meters on any day per mixing plant, the Engineer may exempt or reduce the number of test Cubes. The samples of concrete shall be tested in an approved laboratory in presence of the Engineer and the test results shall be submitted in triplicate to the Engineer. The Contractor shall carry out the sampling and testing according to the provisions of this specification at his own cost. No payment shall be made for the concrete cast in test cubes.

To control the consistency of concrete from every mixing plant, slump tests shall be carried out by the Contractor free of charge every two hours or as directed by the Engineer. The amount of mixing water shall not be changed without prior approval of the Engineer. Slump of the concrete for each test cube shall be recorded for reference. The Engineer if so desires may order special tests to be carried out on cement, sand or coarse aggregates, water, reinforcing steel, or traverse tests in accordance with ISI recommendations. If the materials tested is found to be suitable for the intended use, the cost of these special tests shall be borne by the Employer. If the material is found not suitable for the intended use the cost of these special tests shall be borne by the Contractor. Further, during the progress of the work if the Engineer has any doubt about the quality of any material in use he may instruct suspension of its use until the material is found acceptable by approved testing methods. Any consequent loss arising out of the suspension shall be borne by the Contractor.

5.16.7 Exposed Surface

The Contractor shall patch, immediately after stripping formwork, with 1:1mortar mix and rub smooth with carborundum stone surfaces having honeycomb or cavities in areas where strength is not critical. The Contractor shall also remove fins and projections and rub smooth the concrete surface all to the satisfaction of the Engineer. In sections critical to the stability of the structure, the Engineer shall determine the extent of the defects and may either direct the work to be replaced or direct it to be repaired by pressure grouting. In the case where the Engineer determines that pressure grouting is sufficient to rectify the work, the Contractor shall engage a professional company approved by the Engineer to undertake the work all at the Contractor's own cost.

5.17 BENDING SCHEDULES

The Contractor shall ascertain for himself from the information given on the Drawings and in the Specification the precise requirements of steel reinforcement to be obtained for the Permanent Works. From the information provided the Contractor shall prepare Working Reinforcement Drawings and Bending Schedules and shall submit these to the Engineer for his approval at least one month prior to commencement of fixing the reinforcement. In preparing the Working Reinforcement Drawings the Contractor shall keep laps to the minimum number and length required. No additional payment will be made for laps, which in the opinion of the Engineer are unnecessary for construction of the Works.

5.18 CUTTING, BENDING AND FIXING REINFORCEMENT

Reinforcement shall be cut from straight bars and cold bent, using a bending machine approved by the Engineer. Cutting, bending and marking shall be in accordance with BS 4466 unless otherwise specified, or ordered by the Engineer.

The Contractor shall place and fix reinforcement accurately in the positions shown on the approved reinforcement detail drawings, and shall ensure that it remains in position during the placing of concrete.

Reinforcement projecting from previously cast concrete must not be bent without the prior approval of the Engineer.

All reinforcement shall be supplied in the full lengths indicated on the Drawings. No splicing of bars, other than in locations shown on the Drawings, will be permitted without the approval of the Engineer.

All reinforcement left exposed for future work shall be protected against exposure and corrosion to the approval of the Engineer.

5.19 COVER TO REINFORCEMENT

The cover to reinforcement shall be at least 50 mm unless shown otherwise on the Drawings. Cover shall be maintained by the use of concrete blocks or approved spacers. Concrete spacer blocks shall be

made from cement, sand and small aggregate to match the mix proportions of the surrounding concrete as far as is practicable to ensure comparable strength, durability and appearance.

The cost of spacer blocks and steel chairs shall be included in the contract Rates for concrete.

5.20 MECHANICAL SPLICERS IN REINFORCEMENT

Mechanical compression and tension splicer shall not be used without the prior approval of the Engineer. Where such splicers are approved they shall be fitted strictly in accordance with the manufacturer's recommendations.

5.21 CONCRETING IN ADVERSE CONDITIONS

The Contractor shall not place concrete in the Works:

- during heavy rains or dust storms;
- when the (shade) air temperature exceeds 38°C;
- when the air temperature is less than 2°C;
- if the temperature of the concrete is less than 4°C or more than 30°C without taking the necessary measures to ensure acceptable concrete temperatures all to the approval of the Engineer's Representative;
- when the (shade) air temperature exceeds 30°C, without taking precautions to the approval of the Engineer's Representative to ensure that the maximum internal temperature of the concrete does not exceed 38°C during the initial set; and
- When the temperature of the formwork or reinforcement exceeds 30°C

5.22 ANCHOR BOLTS, ANCHORS, OPENINGS, SLEEVES, INSETS AND OTHER BUILT-IN FIXTURES

The Contractor shall leave all openings, grooves, chases etc. in concrete work as shown on the drawings or as specified by the Engineer. He shall build into the concrete work all the materials noted below and shall embed and secure the same as and when required. The materials to be supplied by the Contractor shall be of best quality available of approved manufacture and shall be approved by the Engineer.

Materials to be embedded:

- Inserts, hangers, anchors, opening frames, manholes, covers, floor clips, sleeves and conduits.
- Anchor bolts and plates for machinery, equipment and for structural steel work.
- Dowels bars, etc. for concrete work falling under scope of future works.
- Lugs or plugs for door and window frames occurring in concrete work,
- Flashing and jointing in concrete work.
- Any other built-in-fixtures as may be required.

Correct location, exact alignment, etc. of all these shall be entirely the responsibility of the Contractor.

5.23 CURING AND PROTECTION

The Contractor shall for not less than 7 days protect the concrete from the harmful effects of frost, wind, sun, high and low temperatures, rapid temperature changes, premature loading, deflection, impact, running water and aggressive groundwater. Protruding steel shall be kept cool.

All exposed concrete surfaces be kept continuously moist for not less than 7 days after casting, by watering, by covering with hessian or sacking which shall be kept fully saturated at all times or by other methods approved by the Engineer's Representative.

Curing membranes approved by the Engineer shall be applied in conformity with the manufacturer's instructions. They shall be applied to unshuttered surfaces as soon as the moisture film has disappeared from the concrete, but while the surface is still damp and shall incorporate an approved reflecting agent. Surfaces with applied curing membrane shall be shaded from the sun.

5.24 BUILT IN ITEMS

Where pipes, sleeves, water stops or other items are built into concrete, they shall be rigidly secured in position to prevent movement and shall be free from external coatings which might adversely affect the

bond. The Contractor shall take precautions as approved or directed by the Engineer's Representative to prevent the formation of air pockets, voids or other defects whilst the concrete is being placed around built-in items.

5.25 CONCRETE RECORDS

The Contractor shall furnish daily to the Engineer's Representative a record, in a form to be approved by the Engineer's Representative, showing the quantities of cement, the number and volume of mixings of each grade of concrete used in each section of the Works and in Temporary Works and details of sampling and testing.

5.26 SURFACE FINISHES

The types of finishes required on the various concrete surfaces shall be as specified below unless indicated otherwise in the Specification or on the Drawings.

Where a surface is partly below and partly above the final ground level, the finish for the exposed surface shall extend for 0.5 m below the final ground level.

All permanently exposed arises shall be formed with a 20 mm x 20 mm chamfer unless otherwise shown on the Drawings.

A concrete surface, which in the opinion of the Engineer's Representative, fails to achieve the required standard shall render that section of concrete, the member of which it is a part, or in extreme cases the whole structure, liable to be rejected by the Engineer's Representative. No remedial Work to defective concrete surfaces shall be started before the defective section has been inspected by the Engineer's Representative. If remedial work is permitted as an alternative to reconstruction, the Contractor shall submit his proposals in respect of the repair to the Engineer's Representative for his approval.

Finishes for surfaces formed by shuttering shall be:

Back
Finish for surfaces against which backfill or further concrete will be placed. It shall be formed using sawn boards, sheet metal or any other suitable material, which will prevent the loss of any constituents when the concrete is vibrated. Surfaces shall be free from voids, honeycombing or other large blemishes. This surface will, in general require no treatment after the removal of formwork other than curing and the repair of defective concrete if approved.

Face
Finish for surfaces prominently exposed to view and where accurate alignment and density and soundness of surface are of importance to prevent the destructive effects. The finish shall be obtained by the use of forms having a hard, smooth surface. The resulting concrete surfaces shall be smooth with true, clean arises. Only very minor surface blemishes shall be permitted and there shall be no staining or discolouring from the release agent.

Joints between panels shall be arranged as far as possible to coincide with architectural features or changes in direction of the surface and shall be vertical and horizontal unless otherwise directed. Joints between slab soffit panels shall be parallel to the supports. If the Engineer's Representative considers it necessary, the surface shall be sack-rubbed to fill small pits and air holes. Sack-rubbing shall be done as soon as the forms have been removed but after any approval of repairs have been carried out. The sack rubbing shall be carried out in an approved manner. After surface treatment has been carried out the specified curing shall continue.

Finishes for unshuttered concrete surfaces shall be:

Screed
This finish shall be used unless otherwise specified for the surfaces of roadways, footpaths, foundations, base slabs and structural units to be covered by backfill, subsequent stages of construction, bonded concrete toppings or mortar beds. It shall be obtained by levelling and screeding the concrete to produce an even, uniform plan or lightly ribbed surface without laitance, and surplus concrete shall be struck off by a straight edge immediately after completion. Screeded finish is the first stage of subsequent grades of finish.

Before carrying out this finish on roads and footpaths the Contractor shall obtain the approval of the Engineer's Representative as to the direction of the ridges on the surface and the method of screeding.

Trowelling
This is a hard smooth finish for surfaces of concrete pavings, tops of walls, coping and unformed surfaces or architectural features including precast units, for surfaces of beds and slabs to receive thin flexible sheet and the pavings bedded in adhesive and seatings for metal items.

Finishing shall initially be screeded and floated. Floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as the screeded surface has hardened sufficiently and shall be the minimum necessary to produce a uniform surface free from screed marks. Floating shall continue until a small amount of mortar without excess water is brought to the surface so as to permit effective trowelling. Trowelling shall not commence until the moisture film has disappeared and the concrete has hardened sufficiently to prevent excess fine material from being worked to the surface. The surface shall be trowelled under firm pressure such as will flatten the sandy mixture of the surface and produce a dense uniform surface free from blemishes and trowel marks.

Finishing of concrete surfaces shall be performed only by skilled workmen and in the presence of the Engineer's Representative.

No extra payment shall be made for finishing to unshuttered concrete surfaces.

5.27 FORMWORK

5.27.1 Scope

Supply, erection and removal of all types of formwork (centering and shuttering) for concrete work including the erection of all supporting structures such as props, struts etc.; placing, leveling and aligning forms, applying form oil; sealing to prevent leakage of grout; and removal of forms all complete.

5.27.2 General

The terms formwork and shuttering shall be interpreted as meaning one and the same thing. Formwork shall include all temporary or permanent forms required to obtain the profiles and finishes as specified and shown on the Drawings.

Falsework shall be interpreted as meaning all temporary or permanent work required to support the formwork such that it shall remain rigid during the placing and setting of the concrete and such that dimensional deviations in the finished concrete structure do not exceed the specified limits.

All formwork shall be designed and detailed by the Contractor. All designs and details shall be submitted to the Engineer for approval 15 days for ordinary and 30 days for major structures prior to the commencement of the construction.

The Engineer's approval of the formwork shall not relieve the Contractor of his responsibilities under the Contract for any damage or injury that might result from any inadequacy in the formwork.

Falsework shall be designed to withstand the worst combination of self-weight, formwork weight, formwork forces, reinforcement weight, wet concrete weight, construction and wind loads, together with all incidental dynamic effects caused by placing, vibrating and compacting the concrete.

Joints between sections of formwork shall be sufficiently tight to prevent loss of grout or mortar from the forms.

Top formwork shall be provided to concrete faces where the slope exceeds one in three unless otherwise approved by the Engineer's Representative.

Re-use of formwork shall be at the discretion of the Engineer's Representative having regard to the specified surface finish.

Prior to the inspection by the Engineer's Representative for approval for concreting the formwork shall be thoroughly cleaned to remove all dirt, debris and standing water.

Surfaces, which will be in contact with concrete, shall be treated with on approved non-staining release agent applied strictly in accordance with the manufacturer's instructions. Release agent shall not be allowed to come into contact with adjacent concrete or the reinforcing steel.

Temporary openings to facilitate cleaning and inspection shall be provided at the base of column, wall and deep beam formwork. Formwork for walls and other thin sections of considerable height shall be provided with openings, to the approval of the Engineer's Representative, for placing and compacting the concrete.

5.27.3 Formwork Material

All shuttering material shall 19mm water-resistant plywood/ readymade pre fabricated board, plastic coated plywood in new or like new condition and bottom or side supporting runners shall be either of wood, mild steel pipe (40mm) or adjustable steel truss-type. The runners shall be absolutely straight on the face supporting the shuttering. Props, struts and other supporting members shall be standard adjustable 50mm mild steel pipe supports. The props shall be clean the adjusting mechanism well lubricated and in proper working order.

5.27.4 Tie-bolts, etc.

Formwork shall be designed and constructed such that concrete can be properly placed and thoroughly compacted without any deflection in the formwork. Formwork shall be firmly supported and adequately strutted, braced, or tied. It shall be erected in such manner as to facilitate adjustment to conform to the lines and dimensions of the finished concrete. It shall be sufficiently strong to resist without distortion any loads to which it may be subjected including pressure of concrete during placing and compaction. The formwork shall be durable and not vulnerable to distortion or other damaging effects of the weather. When concrete is to be vibrated special care shall be taken to ensure that the formwork will remain stable and the joints tight. The safety and adequacy of centering and shuttering shall be the sole responsibility of the Contractor.

The Contractor, at the discretion of the Engineer, shall supply design drawings and calculations for the formwork he proposes to use.

5.27.5 Deflection and Camber

The Contractor shall make allowance for any settlement or deflection of the formwork that is likely to arise during construction, such that the finished concrete conforms accurately to the specified line and level. The Contractor shall also make allowance in the formwork for any camber specified by the Engineer to allow for the elastic deflection of structural members and deflection due to creep of the concrete. In the absence of any specified camber, the soffit of all beams and slabs shall be given a camber equal to 1/240 of the span length to ensure that the structure has the prescribed shape after removal of the forms.

5.27.6 Supports

Formwork shall be constructed in such a manner as to allow the formwork on vertical faces to be removed without disturbing the soffit formwork or its supports. Props and supports must have a mechanism to allow the formwork to be adjusted accurately to line and level and to be erected and removed in an approved sequence without damage to the concrete. The supporting structure shall rest on solid foundation or other construction work that is sufficiently strong to resist all loads without any damage whatsoever to any portion of the structure. This may require in some cases that the supporting structure be carried down to the foundations or other suitable bases. Props and bracing shall be provided for the temporary support of composite construction where separately specified.

5.27.7 Joints and Edges

All joints in the formwork shall be close fitting to prevent leakage of grout from the concrete. At construction joints formwork shall be tightly secured against previously cast or finished concrete to prevent the formation of steps or ridges in the concrete. Formwork shall be constructed to provide straight and true angles, rises and edges. Where chambers are required to provide a smooth and continuous accurate alignment at sides and provide a clean line at construction joints in the concrete, these shall be fixed with their joints either vertical or horizontal unless otherwise specified.

5.27.8 Sundries

Formwork shall be provided to the top surface of concrete where the slope or the nature of the work is such that concrete would not retain its proper shape and dimensions during placing and compaction unless the formwork is provided. Provision shall be made for forming holes and chases to install service lines, pipes, conduits and other fixings as shown on the drawings. The material and position of any formwork ties passing through the concrete shall be to the approval of the Engineer. Except where corrosion of a metal tie is unimportant, ties shall removed such that no part of it remaining embedded in the concrete shall be nearer to the finished surface of the concrete than the specified thickness of cover to the reinforcement. Any holes left after removing ties shall be filled with concrete or mortar of approved composition.

5.27.9 Cleaning and Treatment of Formwork

Space to be occupied by concrete shall be absolutely clean and free of all rubbish, chipping, shaving, sawdust, dirt, tying wire, water, etc., before concrete is placed. The formwork to be in contact with the concrete shall be cleaned and treated with suitable non-staining form oil or other approved releasing agent. Care shall be taken that oil or agent is kept away from contact with the reinforcement or with concrete at any construction joints. Surface retarding agents shall not be used except with the permission of the Engineer. Formwork shall be thoroughly cleaned after each use. Bent, dented, warped or otherwise damaged or distorted formwork shall not be used.

5.27.10 Tie-bolts, etc.

Tie-bolts or other formwork devices built into concrete shall be approved by the Engineer. Only tie bolts, which avoid embedding any metal parts permanently within the specified cover to reinforcement, will be permitted.

Tie-bolt holes shall be filled with suitable fine aggregate cement mortar to match the colour of the surrounding concrete. The mortar shall be well worked in and thoroughly cured.

5.27.11 Striking and Removal of Formwork

The Engineer's Representative shall be informed in advance when the Contractor intends to remove any formwork. The time at which the formwork is removed shall be the Contractor's responsibility.

Formwork shall be removed with the permission of the Engineer's Representative and the work of removing it after receipt of such permission shall be carried out under the personal supervision of a competent foreman. Great care shall be exercised during the removal to avoid shocks to or reversal of stress in the concrete. No part of the formwork or falsework shall fall on the concrete surface from a height more than 0.5m.

Provided the concrete strength is confirmed by tests on cubes stored under the same conditions, formwork supporting cast-in- situ concrete in flexure may be removed when the cube strength is 10 N/sq. mm, or twice the stress to which it will then be subjected, whichever is the greater.

Formwork shall not be removed where unacceptable deflections are likely to result. The Contractor shall supply the Engineer's Representative with the necessary calculations in support of the above.

Materials and plant shall not be stored on any newly constructed member without the permission of the Engineer.

In the absence of cube test results, Table 5.6 below shall be followed for the minimum period before removing formwork for concrete using ordinary Portland cement and admixtures.

Unless soffit formwork has been designed so that it can be removed without disturbing the props, it shall be retained in position for the minimum period given in Table 5.3 for the removal of the props.

TABLE 5.3: Minimum Period Before Removing Formwork

Minimum Period since casting of concrete for removal of formworks

Vertical Columns, Walls and Beams		24 hours
Soffit	Slabs	7 days
Soffit	Beams	14 days
Props	Slabs	14 days
Props	Beams	21 days

Where cements other than ordinary Portland are used, or surface temperatures differ significantly from those shown or for any other reasons the periods may be adjusted at the discretion of the Engineer's Representative.

5.27.12 Tolerances

The formwork shall be so made as to produce a finished concrete true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerances unless otherwise specified elsewhere in this specification or drawings or directed by the Engineer.

a. Sectional dimension - 5 mm
b. Plumb - 1 in 1000 of height
c. Levels - 3 mm before any deflection has taken place

5.27.13 Reusing Forms

Formwork that in any way has been damaged in removal, handling or storage, or shuttering that is not absolutely clean and free of foreign matter and old concrete shall not be reused unless approved by the Engineer. Formwork shall not be used or reused if declared unfit or unserviceable by the Engineer.

5.27.14 Rate

Rate shall include the supply and storage of all material, equipment and labor to erect, align, apply form oil, seal and remove formwork for any shape, size and quantity of concrete work as specified in the design and bill of quantities, all complete.

5.27.15 Measurement

Measurement for payment shall be the length and width of the area in contact with the finished concrete.

5.28 DIMENSIONAL DEVIATIONS IN SITU CONCRETE WORK

Deviations from the specified dimensions locations and levels for the various classes of insitu concrete finish shall not exceed the limits shown in Table 5.4. Deviations exceeding these limits will render the structure, member or section of a member concerned liable to rejection by the Engineer's Representative.

TABLE 5.4: Dimensional Deviations in In-Situ Concrete Work

Typical Structure	Type of Deviation	Maximum Permissible Deviation for Classes of Finish, mm			
		Back	Face	Screeded	Trowelled
Buried concrete in foundations, retaining walls, etc.	Departure from alignment and level	+25 - 10	-	+10	-
	Variations in cross sectional dimensions (1)	+10 -5			
	Deviation from template in long dimensions (2)	+10 -5	-	+10	-
	Abrupt (3)	+10 -5	-	+10 -5	-
Exposed concrete in piers, columns, retaining walls, etc.	Departure from alignment and.level	-	±5	-	±5
	Variations in cross sectional dimensions (1)	-	+10 -5	-	-
Floor slabs, bridge	Deviation from template in	-	+5	±3	±3

Typical Structure	Type of Deviation	Maximum Permissible Deviation for Classes of Finish, mm			
		Back	Face	Screeded	Trowelled
decks, waterways, etc.	long dimensions (2)				
	Abrupt (3)	-	±5	±3	±3
Floor slabs to receive finishes	Departure from alignment	±10	-	-	-
Bridge docks	Departure from longitudinal level	-	-	+10 -5	-
	Departure form transverse cross sectional template	-	-	+10 -5	-
	Deviation from 3m straight edge on longitudinal section	-	-	+10 -5	-

Note: The numbers in brackets under the type of deviation refer to:

(1) The cross sectional dimensions of structural members such as walls, columns, beams, etc. where, for structural or other reasons, it is necessary to keep the tolerances within closer limits than those for alignment and level.
(2) Gradual deviations caused by misalignment of formwork from the dimensions shown on the Drawings and measured from a 3 m long template.
(3) Offsets and fins caused by displaced or misplaced formwork sheathing, lining or support by loose knots in forms or by otherwise defective form work.

5.29 JOINTS IN CONCRETE

(a) General

Joints shall only be formed in the positions as per Standard and approved by the Engineer. Construction, contraction and expansion joints shall be formed to the details shown on the Drawings and as specified herein, and from the specified materials.

(b) Construction Joints

Whenever concrete is placed on or against previously placed concrete which has become so hard that the new concrete cannot be monolithically compacted therewith the resulting place of separation shall be defined as a construction joint.

Where the locations of construction joints have not been shown on the Drawings then the Contractor shall decide the locations of construction joints to suit the concreting programme. The positions of construction joints shall be to the approval of the Engineer's Representative, which shall be obtained before any concreting takes place. The contractor shall submit to the Engineer drawings showing the positions of constructions of construction joints. Construction joints shall be located so that in conjunction with the programme for concreting, the effects of shrinkage and temperature are minimized. Construction joints shall be formed in straight lines at right angles to the general direction of the member and shall take account of shear and other stresses, and as far as is practical shall be located at points of least shear. Construction joints shall be formed with clean sharp arises.

Construction joints shall be formed using rigid shuttering or other approved method, with joint lines at exposed surfaces of concrete being straight and continuous, plumb, level or inclined. Before placing new concrete against that which has already set, the latter shall be treated carefully to expose the aggregate over the full section and to leave a sound irregular clean surface free from laitance, loose and foreign matter obtained by green cutting using an air/water jet, by chipping or other approved means.

The cost of forming all construction joints shall be included in the Contract Rates for concrete except where the Engineer requires a water stop to be used in which case the cost of the water stop will be covered by a separate item included in the Bill of Quantities.

(c) Contraction Joints

Contraction Joints shall be located as per Standard and approved by the Engineer. The joints shall be made by forming with smooth forms the concrete on the side of the joint and allowing it to set before placing concrete on the other side of each joint shall be given two coats of approved bitumen before the concrete on the other side of the joint is placed.

(d) Expansion Joints and Isolation Joints

Expansion joints shall be constructed in the locations and to the details shown on the Drawings. Performed joint filler, bond breaker and joint sealing compound and water stops and bitumen coating shall be placed in the joints in accordance with the Standard and approved by the Engineer.

(i) Bitumen Boards:

Bitumen impregnated fiber of approved manufacture as per IS: 1838 - latest revision shall be used as fillers for expansion joints. It must be durable and waterproof. At the exposed end the joint shall sealed with approved sealing compound to a depth of 25 mm after application of an approved primer. The sealing compound and the primer shall be applied as specified by the manufacturer.

(ii) Bitumen Compound:

The cap for expansion joints shall be thoroughly cleaned and the bitumen compound laid as per manufacture specifications. The compound to be used shall be of approved manufacture and shall conform to the requirements of IS: 1834 - latest revision.

(iii) Separation Joints:

Strong and tough alkathene sheet or equivalent of about 1mm in thickness as approved by the Engineer shall be used. The Contractor shall ensure the concrete surface is clean and dry and shall attach the sheet to the surface by an approved adhesive to cover it fully. Fresh concrete shall be laid against the sheet avoiding any damage to the sheet in any way.

(iv) Rubber Pad:

Hard foundation quality rubber pads of required thickness and shape are to be placed below machine or other foundations wherever shown on the drawings or as directed by the Engineer. The rubber shall be the best quality from approved manufactures, durable and capable of absorbing vibration and must be chemically inert capable of withstanding deleterious effects of constant contact with moist or dry earth under normal conditions.

(e) Installation of Joint Sealer

The Contractor shall prepare the surfaces of the joint and shall fill or caulk the recess completely with the joint sealer strictly in accordance with the manufacturer's instructions. The application of joint sealer shall not be commenced without the Contractor having first obtained the approval of the Engineer's Representative.

Where a polysulphide joint sealer is used an approved bond breaker shall be provided between the joint filler and the sealer.

(f) Payment for Contraction and Expansion Joints

The cost of supplying and fitting all materials for contraction and expansion joints will be covered by separate items in the Bill of Quantities.

5.30 BORING HOLES INTO EXISTING CONCRETE FOR NEW FIXINGS, DOWELS, ETC.

The system and plant for boring holes in existing concrete for dowels, anchor bolts and special fixings shall be to the approval of the engineer and strictly in accordance with the recommendations of the manufacturer of the fixing. The method of boring holes shall leave a rough surface finish to the inside of the hole. The holes shall be cleaned out and temporarily sealed to prevent the ingress of debris and/or water, until the dowels, anchor or fixings are installed.

The positions of holes shall be accurately set out and maintained during drilling by strong templates or other approved means. Where the holes are being drilled in reinforced concrete the location of reinforcement shall be ascertained by an approved method in advance of drilling and the hole location shall be suitably adjusted to avoid the reinforcement.

5.31 EMBEDMENT OF STEELWORK, ETC.

Blockouts and gaps left for the installation of steelwork, machinery, brackets and other metal items shall be fitted with grout or mortar or fine concrete as shown on the Drawings or as directed by Engineer's Representative.

The concrete surfaces against which grout or mortar or fine concrete is to be placed shall be roughened by chipping to ensure a satisfactory bond between the first stage concrete and the filling material. Immediately prior to placing the filling material the concrete surfaces shall be cleaned with air/water jets.

The filling material shall contain a not-shrink additive manufactured by an approved manufacturer and used in strict accordance with the manufacturer's instructions.

5.32 CONCRETING OF MASSIVE STRUCTURES

In concrete masses intended to form a watertight curtain in the ground, the concrete shall be placed in one operation from the bottom of the trench up to ground level or up to general foundation level over the whole length between two pre-arranged construction joints.

In other structures the concrete is to be shuttered off in rectangular sections the width of the block sufficient for the day's work and each section must be completely filled in one continuous operation.

All lift joints in mass concrete structures shall be provided with shear keys unless otherwise ordered by the Engineer. Shear keys of minimum depth 0.15 m shall be formed in the lower lift.

5.33 PREVENTION OF CRACKING IN MASS CONCRETE

Without prejudice to the requirements of Clauses 5.20 and 5.31 for mass concrete the Contractor shall control the temperature of the mix and the setting concrete to the satisfaction of the Engineer to ensure a sound uncracked structure.

This shall be achieved by controlling the temperature (a) of the concrete ingredients and the concrete mix and (b) of the concrete during placing and curing. The temperature of the concrete during curing shall not exceed 50°C.

Concreting shall be carried out in alternative blocks. Lifts shall not exceed 1.50 m and shall be poured in 3 layers each starting at the upstream face.

The time interval between lifts shall not be less than two days or, in general, more than seven days. If the period between lifts exceeds ten days the height of the subsequent lift shall not exceed 0.75 m.

At any one time the difference in level between adjacent blocks shall not exceed 4.50 m.

5.34 WATERPROOFING

The materials shall conform to the respective American, BS and IS Code - latest revision, where applicable. The Contractor shall obtain the approval of the Engineer's for materials before procuring the items. The Engineer may require the Contractor to supply test certificates for the material and the Contractor shall comply with all such requests. The materials shall be of best quality available indigenous, fresh and thoroughly clean.

5.34.1 WATER PROOFING ADMIXTURE

(i) <u>In Concrete</u>

The admixture shall be of the type recommended for the job intended and procured fresh. The Contractor shall obtain the Engineer's approval for the type and brand of admixture (if it is other than specified) before procuring and incorporating in the work. The method of application and other details shall conform exactly to the manufacturer's specification. If required by the Engineer the Contractor shall ensure that the manufacturer provides supervisory services, at no extra cost, to advise and guide the Contractor in the correct procedure for using the admixture.

ii) <u>In Plaster</u>

The Contractor will ensure, to the Engineer's satisfaction, that all concrete surfaces to be plastered are roughened (hacked) sufficiently to develop a durable bond between the plaster and the concrete surface. The plaster shall be a mixture of cement and sand as approved by the Engineer. Contractor shall obtain the Engineer's approval for the type and brand of admixture (if it is other than specified) before procuring and incorporating in the work. The method of application and other details shall conform exactly to the manufacturer's specification. If desired by the Engineer, the Contractor shall have the work supervised by the manufacturer's supervisor at no extra cost.

5.34.2 Other Admixtures in Concrete

Other admixture in concrete shall be of type as specified and to be used as per the direction of the Manufactures and the Engineer.

Payment shall be made extra over the price on concrete on the actual quantity of admixture used at the landed cost of the admixture plus 15 percent to cover extra labor, tools, plant, profit, etc.

The contractor may also proposed to the Engineer for his approval to use any admixture other than specified.

5.35 MEASUREMENT AND RATES

All measurements shall be made in cubic meters calculated as per the drawing. The rates for items shall include the cost of all materials consumed in the work at all levels, hire charges of materials, tools and plant, cost of labor, insurance, all transport, taxes and levies, services, accommodations, supervision, storage, protection etc., all complete.

6 MASONRY WORKS

6.1 MATERIALS

a) Cement for mortar

Cement for masonry mortar and grout shall be ordinary Portland cement in accordance with the requirements of Section 5. All cement for mortar for exposed face work shall be of a uniform color as approved by the Engineer and confirm BS 12 or IS 269 or Equivalent NS.

b) Lime for mortar

Lime shall be freshly burnt quicklime or hydrated lime conforming to the requirements of BS 890, or IS 712 and as specified herein or indicated on the Drawings.

c) Sand and water for mortar

Sand and water used shall be in accordance with the requirements of chapter 5 and sand for exposed face work shall be of a uniform color as approved by the Engineer.

d) Bricks

The bricks shall be chimney-made hand cast bricks of first class quality. The bricks shall be of quality approved by the Engineer and free from grit and other impurities such as lime, iron and other deleterious salts. They shall be well burnt, sound, hard with sharp edges and shall emit a distinct ringing sound when struck with a mallet and shall be of uniform size. The bricks shall conform to IS 3495 and be tested in accordance with IS 1077.

Defects in bricks

Bricks shall be free from defects affecting strength and durability. The bricks and with manufacture cracks or cracks and chips due to handling shall be disposed of from the site and in any case shall not be used in brick works. The appearance of exposed brick surface and all face brick to be used on the work shall be an acceptable match with the samples approved by the Engineer.

Handling of bricks

Brick shall be carefully handled at all stages in delivery, stockpiling and construction to prevent breakage or surface damage. Bricks shall be carefully unloaded by hand without dropping it from a height or a distance of 10cm and shall not be dumped or thrown. Special care shall be taken with stacking and storage of brick on the site and with its delivery to the mason. Palette stacking or boxes shall be employed in transporting brick to the site if in the opinion of the Engineer, the brick is being mishandled or unduly damaged.

Make of bricks

All bricks shall be made of good quality brick earth and machine made, thoroughly burnt, and shall be of deep cherry red or copper colour. The bricks when made shall emit a clear ringing sound when struck together and shall not break when thrown on the ground or against other bricks from a height of 1 m. The bricks shall be wholly clean and free from flaw cracks and under burnt lumps of any kind. They shall be uniform in size and regular in shape and have square, straight and sharp edges and even surfaces. The Contractor shall submit to the Engineer sample bricks for approval before the bricks are supplied and all bricks used on the Works shall be equal to the samples approved. The nominal size of the bricks shall be 230 x 110 x 57 mm □□2% unless otherwise stated elsewhere in this specification and codes.

Sampling
Brick samples shall be randomly selected for testing in quantities not less than 5 bricks per one thousand for each lot supplied for the construction work.

Acceptance Criteria
1. Compressive Strength: The average compressive strength of the brick shall be minimum of 70 kg/sq.cm. The compressive strength of any individual brick shall not fall below the above mentioned minimum average compressive strength by more than 20 %.

2. Water Absorption: The average water absorption of the brick samples shall not be more than 15 percent over the dry weight after immersion in cold water for 24 hours.

3. Efflorescence: The rating of efflorescence shall not be more than “Slight”.

6.2 MORTARS FOR MASONRY

a) Color of mortar joints
The color and texture of all exposed mortar joints shall be subject to the approval of the Engineer and shall be kept uniform throughout the project by strict adherence to the approved mixes and samples.

b) Mortar mixes
Unless otherwise specified or shown on the Drawings the mix proportions by volume shall be as follows and sufficient water to produce the required consistency for use. For increased workability and where approved by the Engineer's Representative, dehydrated lime putty may be added, but shall not exceed 25% by volume of the dry cement.

1. Mortars for masonry and plaster works

a) Cement mortars ! Proportion of mix
CM 1:6 Cement - 1 part, Sand - 6 part
CM 1:4 Cement - 1 part, Sand - 4 part
CM 1:3 Cement - 1 part, Sand - 3 part
CM 1:2 Cement - 1 part, Sand - 2 part
CM 1:1 Cement - 1 part, Sand - 1 part

b) Cement - Lime - Sand mortar

CL 1:1:6	Cement - 1 part, Lime - 1 part, Sand - 6 part
CL 1:2:9	Cement - 1 part, Lime - 2 part, Sand - 9 part
CL 1:1:8	Cement - 1 part, Lime - 1 part, Sand - 8 part

2. Waterproof mortars for DPC and plaster works

WCM 1:4	Cement - 1 part, Sand - 4 part, Waterproof compound - 0.03 part
WCM 1:2	Cement - 1 part, Sand - 2 part, Waterproof compound - 0.03 part

3. Colored plaster

DCM 1:2	Cement - 1 part, Sand - 2 part, Pigment - 0.01 part
DCM 1:1	Cement - 1 part, Sand - 1 part, Pigment - 0.01 part
DCL 1:1:4	Cement - 1 part, Lime - 1 part, Sand - 4 part, Pigment - 0.01 part
DCM 1:1:2	Cement - 1 part, Lime - 1 part, Sand - 2 part, Pigment - 0.01 part

(c) Workability of mortar
The mortar shall be of a readily workable consistency with only enough water to obtain a plastic condition suitable for troweling.

(d) Workability of grout
Grout shall be of pourable consistency with a slump of 12cm when tested in accordance with "Slump Test for Mortar and Grout".

(e) Cement mortar mixing and using period
All cementitious materials and aggregate shall be mixed for a minimum of five (5) minutes in a mechanical batch mixer. Only as much water shall be added as compatible with convenience in using the mortar. If mortar begins to stiffen from evaporation or absorption of a part of the mixing water, the mortar shall be

retempered by adding water and remixed. All mortar and grout shall be used within 2.5 hours of the initial mixing and no mortar nor grout shall be used after it has begun to set.

(f) Hand mixing of mortar

Hand mixing shall be carried out on clean, watertight platforms with approved methods or as directed by the Engineer.

(g) Measurement of sand and its grading

Sand shall be measured in a damp loose condition. All sand for mortar used in 10mm joints shall pass a No. 16 sieve or as directed.

6.3 BRICK MASONRY

(a) Brick Masonry in Superstructure

a.1 Scope

This specification deals with the supply and installation of ordinary chimney-made first class brickwork (min. 230mm thickness) in superstructure work in cement mortar 1:6 (1 part cement to 6 parts sand), including testing; soaking; cutting and laying in any shape, size or quantity; preparation of mortar and curing, all complete.

a.2 Materials

Materials shall conform to the specifications of materials as described in section 3.1 above. In addition to the materials specified in section 3.1, 8mm deformed reinforcing bars conforming to IS 1786-1985 shall be provided for reinforcing the work.

Brick masonry shall comply with British Standard Codes of Practice 121, 101 (or equivalent).

Bricks shall be thoroughly soaked in water before use and shall be set in a full bed of mortar and grouted in every course. Solid brick masonry shall be in English or Flemish or other approved bond. The courses shall be laid level and with parallel neat and regular joints.

Brick masonry shall be carried up evenly and uniformly, no one portion being raised more than 1 m above another at any one time. Vertical joints shall be filled with cement mortar as the bricks are laid. Unfinished brick masonry shall be stepped back in course and immediately before new work is added the previous work shall be thoroughly cleaned. Any holes shall be filled in with bricks identical with those already incorporated in the framework.

The conditions governing the laying of brick masonry in unfavorable weather shall be as specified for concrete in Clause 5.20 hereof. Exposed faces of brick masonry shall be kept moist for ten days after construction.

a.3 Workmanship

The workmanship shall conform to the specifications as described in section 3.1 above. In addition to the workmanship as specified in 3.1, 8mm reinforcing bars, one number at each level, shall be placed horizontally in the brickwork six courses from the bottom and six courses from the top of the work. In the remaining vertical section between the top and bottom bars one bar shall be placed at each level at equal vertical spacing approximately, but not exceeding, 900mm. The bars shall be placed in the center of the width of the work unless otherwise specified. The ends shall be anchored in the end supports according to the following specification:

1. Concrete Columns – the bar shall be inserted at least 50mm into a hole drilled in the end column.
2. Brick Columns – the bar shall be hooked around the vertical bar in the brick column. The hook shall be a standard hook with the return length not less than 50mm.
3. Perpendicular walls – The bar shall be bent in an L-shape with the length of the ‘L’ not less than 200mm. The position of the ‘L’ shall be such that it sits in the center of the end wall.
4. Openings – The bar shall be curtailed 115mm from the face of any opening in the wall.

(b) Placing

All brickwork shall be placed only after the foundation surfaces have been prepared satisfactorily in accordance with these Specifications and instructions of the Engineer's Representative.

(c) Wetting of bricks

Bricks shall be well wetted for a minimum of three (3) hours in advance of being laid or as required so that the rate of absorption when laid does not exceed 1 cc/square centimeter per minute. The method of wetting shall be such that each brick be nearly saturated but surface remain dry when laid.

(d) Brick Laying

Bricks shall be laid in running bond with head joints in each course centered over the bricks in the course below and shall be plumb, level & true to line with full head and bed joints. The ends of brick shall be buttered with sufficient mortar to fill the head joints. The top of the joint mortar may be sloped toward the center of the wall to minimize the amount of mortar forced into the grout core space. Mortar protruding from bed joints into the core space shall be removed before pouring the grout, and no mortar shall be placed or allowed to remain in the core space.

(e) Jointing

Joints in brickwork shall be uniform and generally 10 mm wide for horizontal and 6 mm wide for vertical joints. Point joints to produce a dense, tooled V joint or as otherwise shown on the Drawings. Cut out defect joints and repoint them with mortar.

(f) Care for masonry

Extreme care shall be taken to prevent any concrete, grout, or mortar from staining the face of masonry. If any grout or mortar does contact the face it shall be immediately removed and the surface cleaned with clean water. Masonry work shall be protected against staining, tops of walls shall be covered with waterproof coverings as required when work is not in progress.

(g) Stopping the brick laying

All walls shall be carried up at the same time. In no case shall any walls be advanced more than six (6) brick courses above another. If it is necessary to "stop off" a horizontal run of masonry in pyramid form shall be adopted.

(h) New and old masonry joints

Where fresh masonry joints that is partially set or totally set, the exposed surface shall be cleaned and thoroughly wetted so as to obtain the best possible bond with the new work. Remove all loose masonry and mortar.

(i) No. log holes for scaffolding, formwork etc.

In no case shall put "log-holes" for the erection of scaffolding and formwork or for other construction procedures be made.

(j) Plumb Bob and Straight Edge

Where applicable brickwork shall be taken up truly plumb and each set of four bricklayers shall be provided with a plumb bob and straight edge.

(k) Progress

Brickwork shall be carried up regularly and no portion of the work shall be left more than 1 m lower than another. Temporary steps left during construction, shall be raked back and not toothed. Straight edges supplied to bricklayers shall have courses marked on them with saw cuts, or measuring rods provided, and heights of courses frequently checked so as to keep them level.

(l) Cleanliness

Care shall be taken to keep all brickwork free from mud splashing, mortar and bitumen dropping, etc., and it shall be well cleaned down before being handed over.

(m) Ducts and Nisches and opening in brick wall

Particular care shall be taken to provide for all necessary openings for passage of pipes, drains, ducts, conduits, utility lines, flashing, inserts, anchors, outlets, etc. Should such provision be overlooked, that portion of the work required to be dismantled and shall be rebuild to make the final result as good as if it had been done as the work progressed.

(n) Scaffolding

The Contractor is responsible for providing, erecting and dismantling and removing safe scaffolding wherever required.

(o) Protecting and Curing

Protecting and curing of brickwork shall be carried out in accordance with clause 5.21 hereof. The water used for curing shall be clean and in accordance with Clause 5.6 hereof.

(p) Repairing Brickwork

If, after the completion of brickwork, any of it is out of alignment or level, or shows a defective surface, it shall be removed and replaced by the Contractor at his own expense and to the satisfaction of the Engineer's Representative.

6.4 STONE MASONRY

6.4.1 Stonework in Foundation upto Ground Level

Scope

This specification covers the quality of material and workmanship in random rubble masonry in cement sand mortar for retaining walls and foundations and coursed random rubble masonry in sand cement mortar for superstructure walls.

General

Stone for masonry work in cement mortar shall be clean, hard, free of weathering and angular having plane faces and must be approved by the Engineer. Stones having round surfaces such as river boulders shall not be used in stone masonry work. The length of any stone shall not exceed three times its height. The breadth shall not exceed 150 mm or greater than three-fourths of the thickness of the wall. Projections on the exposed face shall not exceed 40mm from the plane surface. Spalls not exceeding two percent of the total surface area in plan of the wall may be used in a staggered pattern for filling voids and spaces between larger stones.

The work will be constructed on a prepared foundation-surface of lean concrete or random rubble foundation of large selected stones laid with the largest surface area in the horizontal plane. The walls shall be built true to plumb or to the specified incline and exact width. Mortar joints shall not exceed 25mm thickness. Face stones shall extend and bond into the backing. Their height shall not be more than the breadth or the depth. Filling stones shall be rubble stones of any shape and shall not be less than 150mm square or diameter and 100mm thick. Stones shall be individually placed to break joints and to minimize voids and thick mortar joints. The stones shall be well bedded and bonded to adjoining stones. Spaces between large stones shall be filled with spalls and securely rammed into place. Spalls shall not be used to bed large stones. The joints shall be finished in flush or raised pointing as specified or directed by the Engineer. Tops and sides of completed work shall be neatly finished with selected coping stones and a concrete cap as specified. The stones shall be cleaned with water and a brush before any mortar is sets. The work shall be cured by keeping it damp for a minimum of seven days after completion.

Plastering and pointing in between the joints of the stones shall not be admitted. Proper quality of work shall be maintained at the initial age of laying stones & mortar. Mortar joints will be thick enough to prevent stone to stone contact and shall be completely filled up.

Cement mortar shall be prepared from fresh Portland cement, 43 grade, and clean, course sand of proportion as indicated. The ingredients shall be accurately measured by volume and shall be well and evenly mixed together in a mechanical pan mixer. Water shall be added in amounts needed to produce a stiff plastic mixture, neither too much nor too less. River sand shall be used unless otherwise specified. If hand mixing is allowed then it shall be done in brick tanks. The gauged materials shall be put in the tank and mixed dry. Water will then be added and the whole mixed again until it is homogeneous and of uniform color. Mortar shall be prepared only in such a quantity as can be used before the initial set, usually in 30 minutes after adding water. The mix shall be clean and free from any soil, acid, organic matter or other deleterious substances.

Mortar test cubes shall be tested in accordance with IS 2250-1981. In general, one cube test for every 30m3 of mortar and one test of stone for each major masonry structure or at every source of stones yielding up to 100m3 deposit will be made to assess and check their compressive strengths.

Weep holes shall be provided in the work as shown on the drawing or as directed by the Engineer to allow water to drain from behind the structure. In stone masonry walls weep holes shall be 80mm wide by 150mm high. Weep holes shall extend though the full width of masonry structure with slope of about 1:20 towards the draining face. The spacing of weep holes shall be generally 1 m in either direction or

as shown in drawing with lowest at 150 mm above low water level or ground level whichever is higher or as directed by Engineer.

Deformed reinforcing bars conforming to IS 1786-1985 shall be incorporated into the work as specified in the design drawings or as directed by the Engineer.

The following table shows the compressive strength requirement of such stone masonry work.

Compressive Strength of Masonry

Mortar mixed by volume	Hardening time	Crushing Strength of Stones in MPa				
Cement/Sand	Days	10.5	14.1	28.1	31.1	35.2 or greater
		Permissible Compressive Strength of Masonry (MPa)				
1/3	7	1.1	1.2	1.7	2.1	2.5
1/4	14	0.9	1.1	1.5	1.9	2.2
1/5	14	0.9	1.0	1.4	1.7	2.0

The above compressive stresses hold good for course rubble masonry and block stone masonry. They do not hold good for random or uncoursed rubble masonry. Permissible tensile and shear stresses may be taken one-tenth of the above-tabulated values in each case.

Stone work in foundation upto ground level with random rubble stones approved size and quality, including wetting the stones, packing the joints and curing the work in all types and thickness of walls, columns, etc. in m^3.

i. in cement sand mortar (1:4)
ii. in cement sand mortar (1:6)
iii. in cement sand mortar (1:8)

(a) Materials

(i) **Stone** - The stone shall be hard, tough sound and durable No Stone shall be less than 15 CM (6") and more than 45 CM (18"). Stone less than 0/041 m^3 (1/2 cu. Ft) in size should not be used. Face stones shall be comparatively larger and uniform in size and colour to give a good appearance. Breadth of the face stones shall be greater than the height. Face stones should tail into wall to a sufficient depth to bond well. Stones shall be laid with broader face downwards to give a good bedding. Face joints shall be broken and face stones and dressed correct to angle and laid as header sand stretchers.

Random Rubble Masonry

In addition to the general specifications, the following are specific requirements for random rubble stonemasonry work and shall be incorporated in any work of this type.

The stones shall be hammer dressed on the faces, sides and beds and shall be roughly dressed on the beds and sides to a depth at least 25mm from the exposed face. The work shall include at least ten percent (by volume) of bond stones and at least one stone placed for every 0.5 square meters of the exposed surface of the wall. The bond stones shall be at least 150x150mm in cross-section and up to 600mm in length or the full thickness of the wall. The bond stones shall be placed spanning the full width of the wall from front to back. In cases where the wall is wider than the maximum length of the bond stones, pairs of stones should be laid in a line across the width of the wall such that they overlap by at least 150mm in their length. The bond stones shall be hammer/chisel dressed such that their bedding planes are parallel and at right angles to the direction of load.

Coursed Rubble Masonry

In addition to the general specifications, the following are specific requirements for random rubble stonemasonry work and shall be incorporated in any work of this type.

Stones shall be hammer dressed on all beds and joints so as to produce a rectangular shape and square corners on all sides. The joints shall be chisel dressed at least 50mm from the exposed face. Projections on the face shall not exceed 40mm from the plane surface on natural finish faces and 10mm on faces to be plastered.

The height of each course shall not exceed 150mm and be uniform within a tolerance of 50mm. Face stones shall be laid alternating between header and stretcher. No vertical bond stones

shall be placed in the exposed face of the work. The dimensions of the face stones shall such that the breadth is always greater than the height and at least one-third of the stones shall project into the width of the wall to a depth not less than twice their height or the full width of the wall, whichever is less. Bond stones, as specified in the general notes above, shall be placed every 1500 to 1800mm apart in each course. All work shall be raised together but where the work must be curtailed each course shall be stepped back at an angle of approximately 45 degrees. All bed joints shall be perfectly horizontal unless otherwise specified and the face joints shall not exceed 12mm thick. The joints on plaster faces shall be raked to a depth of 15mm and joints on natural face work pointed with raised pointing. The work shall be cleaned with a brush and water periodically to ensure the natural color of the stone is not discolored with cement.

(ii) **Mortar** - Cement mortar shall be as per specification (civil) article 18, and in the following proportions:

- 1:4 (1 Cement : 4 Sand)
- 1:6 (1 Cement : 6 Sand)
- 1:8 (1 Cement : 8 Sand)

The ingredients shall be accurately gauged by measure and shall be well and evenly mixed together in a mechanical pan mixer, care being taken not to add more water than is required. No mortar that has been set shall be used. River sand shall be used unless otherwise specified. If hand mixing is allowed then it shall be done in masonry tanks. The gauged materials shall be put in the tank and mixed dry. Water will be then added and the whole mixed again until is homogeneous and of uniform colour. Mortar shall be prepared in such quantity, at one time, which shall be consumed within half an hour of its mixing. The work shall be well watered for a fortnight.

(b) Joint

Joints shall not be thicker than 19mm (3/4"). Face joint shall be thicker. Interstices, if any, may be filled with pipes of spalls of stones embedded in mortar. Not more than 60 cm height of masonry shall be constructed at one time.

(c) Bond Stones

Through bond stones of one piece shall be provided one every 10.45 m 2 (5Sqft) of face. For walls thicker than 75 cm (2 1/2 feet) bond stones may be of two pieces placed side by side overlapping at least 15 CM (6"). Breadth of bond stones shall not be less than 1 1/2 times the height. All stones shall be thoroughly wetted before laying. At the end of a day's work, masonry shall be flooded with 2.5 CM (1") water at the upper surface with the help of fillets of mortar about 38 mm (1 1/2) height, made round in edges. The masonry shall be protected from sun, rain, frost and other weather effect.

6.5 PARTITION WALLS

(a) Laying

For 115 mm brick masonry and or Hollow concrete 100 mm partition walls fair faced one side, the masonry shall be laid in running bond with specified mortar, plumb level and true to line in accordance with Section 6 and as shown on the Drawings.

(b) Fastening of partition walls

Top and side ends of partition walls full height shall be securely fastened to beams, slabs and walls with pre- fixed metal fasteners or holdfasts spaced not greater than 75cm apart unless otherwise indicated. Clearance between top and ends of partition wall and beam, slab and walls shall be caulked as indicated or as directed by the Engineer to form a closed continuous joint.

6.6 BRICK PAVEMENT ON EDGE

The brickwork in paving in specified cement sand mortar with machine made bricks shall be laid in proper slope, levels and dimension and pointed with cement sand pointing (1:1) in the pattern and bonds as shown in the drawing or as directed by the Engineer.

All bricks shall be soaked in water in a tank for at least 3 hours before use. The surface of the base shall be roughened and watered. Mortar joints shall not exceed 12mm and fully packed with mortar. The brick pavement on-edge shall be laid over a layer of mortar of 12mm thickness. The brick pavement shall not be disturbed at least for 7 days as it is laid and shall be kept wet for minimum 14 days.

6.7 BRICK SOILING

Dry brick soling shall be laid flat over a compacted surface as specified. The dry brick soling shall be laid over a cushion of sand of 25mm thickness unless otherwise specified. All the joints shall be duly filled with sand to fill up all voids.

6.8 RATE

The rate shall include the supply of all material and labor to erect any size or shape of stonemasonry structure according to these specifications. The rate shall include the cost of labor for cutting, dressing and laying of stones; supply and placing of any reinforcement steel; supply of material and installation to form weep holes; mixing laying and finishing of concrete coping; labor and material for pointing joints; labor and equipment to clean the exposed face; supply of equipment and labor to erect scaffolding; and equipment, water and labor for curing, all complete.

6.9 MEASUREMENTS

The measurement of work shall be the product of length and thickness. All thickness of stone shall be measured and will be as per drawings. Deductions for doors, windows, and other openings including lintels shall be made to arrive at the net quantity of work. Nothing shall be paid extra for forming such openings. However, no deductions shall be made for areas less than 0.1 m^2. (1 Sq.ft) over all bearings of lintels, beams, girders, and hold fats blocks but nothing extra shall be paid for embedding these. Similarly, no deductions shall be allowed for rendering the flue opening specified. Stone work covering to the figures shown in the drawing. Unless otherwise specified nothing extra shall be admissible for cutting in stone works to suit R.C.C. structure, walls in any shape other than straight, any cutting necessary for shaping the walls to structural design.

7. METALWORK

7.1 MATERIALS FOR METAL WORKS

Materials shall be the best of their respective kinds for the services for which they are required. Materials not specifically described herein or shown on the Drawings shall comply with following standards:

a) Standards

Structural Steel Section	BS 4	IS: 800
Covered Electrodes for the Manual Metal-Arc Welding	BS 639	IS: 814
Mild Steel		IS:1442
Black Bolts, Screws and Nuts	BS 709	IS:1367
Cast Steel for General Engineering Purpose	BS 3100	IS:1056
Weldable Structural Steels	BS 4360	IS:2062
High Strength Friction Grip Bolts	BS 4395	IS: 3757
	BS 4604	IS: 4000
Hot-rolled Structural Steel Sections	BS 4548	IS: 808
Steel windows & doors	BS 990 or BS 1787	IS: 1938
Mild Steel Doors and windows		IS: 1038
Primer Paint	BS	IS:
Erection of Steel Structures	BS	IS:

(b) Welding

Welding shall be metal-arc welding complying with the requirements of BS 5135 or IS 815 as appropriate. All welds shall be continuous.

The Contractor shall supply samples to the Engineer when required for examination or test.

7.2 PRIMER PAINTS FOR METAL WORKS

Primer paint shall be material which will be compatible with the finish coats to be applied as recommended by the manufacturer for the surface to be painted. The contractor shall submit their proposal with manufacturers' recommendation to the Engineer for his approval.

7.3 METAL FIXTURES FOR DIFFERENT WORKS

All metal fixing devices, anchors, inserts, holdfasts, clips, sleeves, brackets, etc. shall conform to standard specifications and to the size and shapes shown in the drawings or directed by the Engineer. Samples, along with any relevant manufacturers' specifications or instillation instructions, shall be submitted to the Engineer for approval before installing. Fixtures and fittings shall be provided well in advance to facilitate timely installation in the work of other trades so as not to cause any delays to the work on other items. Fixtures and fittings must be embedded or otherwise installed as specified in the design drawings or as directed by the Engineer. Attaching or in any other way incorporating into the work after the work to which the item is to be incorporated has been completed is not acceptable.

7.4 DETAILS OF METAL WORKS

All exposed work shall be finished smooth and machined where required. Form metals to shape and size, with sharp lines and angles, and with smooth surfaces and faces. Thickness of metal and details of assembly and support shall provide ample strength and stiffness.

7.5 WELDED JOINTS FOR METAL WORKS

Welded joints shall be neatly made, smoothly filled, ground to flush level with the adjacent surfaces so that the resultant weld provides member of uniform thickness with all welds at intersecting members ground to sharp lines. Adequate means shall be employed for temporarily fastening the parts to be welded together until the joints are welded.

7.6 ERECTION OF METAL WORKS

All metal items shall be carefully erected in proper position, securely fastened, plumb in line and level. The completed installations shall be free of sharp edges and rough spots. All abrasions in prime coats and all metal cuts, bolts and nuts in ferrous shall be painted up with the approved priming material.

7.7 SHOP DRAWING FOR METAL WORKS

Shop drawings shall show gauges, thickness, sizes and construction of all members as well as the manner of assembling the various members which make up different items, show true profiles, connections, and relationship to adjoining work methods of anchoring and all other pertinent information. No work shall be fabricated until shop drawings have been approved by the Engineer.

The Contractor shall prepare and submit, for approval by the Engineer, all shop drawings of work to be fabricated before the fabrication is started. Shop drawings shall show gauges, thickness, sizes and construction of all members as well as the manner of assembling the various members which make up different items, show true profiles, connections, and relationships to adjoining work methods of anchoring and all other pertinent information.

7.8 PRIMER COAT AT DISSIMILAR CONTACT

Dissimilar metal contact or metal-to-masonry contact shall be separated by one (1) coat of bitumen paint or approved primer.

7.9 SUPPLY OF PAINT AND PAINTING AT SITE

All metal items shall be painted with one coat of anti-corrosive paint before dispatching to the site or, if fabricated at site, painted with one coat of anti-corrosive paint before erection. Any rust shall be completely removed before applying the primer coat.

Following installation of the Work, the Contractor shall repaint with primer any surfaces on which the primer has been scratched or otherwise damaged. After the primer has been retouched, two coats of enamel or other paint as may be specified in the design drawings or by the Engineer shall be applied to

the Work. Light sanding with fine grit sandpaper shall be applied between coats of paint to roughen the surface and improve adhesion of subsequent coats. Special attention shall be given to faces of adjoining members to ensure they are painted with one coat of anti-corrosive paint and two coats of enamel or other paint as specified before the members are joined. The Contractor will prepare the surfaces and apply the finishing coats of paint during erection at site.

The Contractor shall supply and deliver to the site a sufficient quantity of priming paint to make good any damage during delivery, handling and erection. The contractor shall also supply and deliver to the site sufficient enamel or other paint as specified for two finishing coats. The supply and delivery of the paint shall be in accordance with programs that the contractor shall have previously agreed with the Engineer having proper regard to the shelf life of the paints and all to the approval of the Engineer.

The paint shall be delivered in the paint manufacturer's drums with seals unbroken. Each drum shall be clearly and indelibly marked with a description of its contents, its date of manufacture, and the date before which it should be used. Each drum shall have a different serial number. The Contractor shall keep a record of the delivery dates of each drum and shall make copies of the record available for use or request by the Engineer.

7.10 METAL DOORS, WINDOWS, VENTILATORS AND GLAZING ETC.

Glazing units shall be made from mild steel sections free from rolling defects. All steel doors, windows and glazings shall conform to IS. 1038 unless otherwise directed. Steel sections shall be cold straightened and such as to be easily punched and welded.

7.11 WINDOW GRILLS, FENCES, RAILING

Mild steel grill, fences and railing of approved pattern and manufacture, finished with one coat or red lead primer followed by one coat of aluminum paint, all complete, as per drawing and shall comply with the requirements of IS 800.

The mild steel grill, fences and railing shall be made according to pattern as per drawing. Welded joints shall be neatly made, filed smooth and left clean. The Engineer is to be informed when the welded work is ready for inspection and any such work must be left unprimed until the Engineer gives his approval. The Contractor shall furnish at his own expense all necessary tools and all materials which he may require for the safe erection of the work, and remove the same when the work is completed. The Contractor shall be solely responsible for any damage done to the structure during. Non of the structure or other works are allowed bend or otherwise distort either before or after the erection. The grill work shall be finished with one coat of red lead followed by one coat of aluminium paint and fixed in the opening, as per instructions of the Engineer.

7.12 COLLAPSIBLE GATES, ROLLING SHUTTERS RAILING

These shall be double or single collapsible gates depending upon the size of the opening. These shall consist of vertical channels 20 x 5 mm and top and bottom rails of T-section 40 x 40 x 6 mm with 38 mm dia. steel pulleys or ball bearings in every 4th double channels unless otherwise specified. Where collapsible gate is provided with the opening and is fixed along the outer surface T-sections at the top may be replaced by flat iron 40 x 10 mm. The collapsible gate shall be provided with necessary bolts and nuts, locking arrangement, stoppers and handles. Any special fittings like springs, catches and locks, shall be provided as described in the nomenclature of item in the Schedule of Quantities.

Shall be "Swastik", "Standard" or equivalent approved manufacture suitable for fixing in the position ordered i.e. outside, inside, on or below lintel or between jambs,. Shutters upto 12 sq. meter in area shall be manually operated or push up type while bigger sizes shall be of reduction gear type mechanically operated by chain or handles.

Laths shall be of 18 gauge best quality mild steel 75 mm, wide strips interlocking, rolling centres, machine rolled and straightened with an effective bridge depth of 16 mm. Side guides and bottom rail shall be built up mild steel rolled section. The spring assembly shall be supported on strong mild steel or malleable cast iron brackets shaped to fit the lintel. The rolling springs shall be from tested unbreakable high tensile steel wire or strip of adequate strength to balance the shutter in all positions. The shutter shall be complete with door suspension shafts, locking arrangement, pulling hooks, handles and other accessories.

7.13 STRUCTURAL STEEL WORK

GENERAL

7.13.1 Description of work

This work shall consist of the material supply, Fabrication, Galvanization, Transportation, Erection at site and Completion of the work as detailed in BOQ and drawings.

7.13.2 Standard and Specification

If not otherwise specified, the standards for the work shall be as noted below:

- General Fabrication – IS 800 - 1984
- Welding – IS 816 - 1969

All the works specified otherwise in this specification should be carried out as per relevant IS codes.

7.13.3 Testing and Inspection

7.13.3.1 Test Certificates

The Mill Test Certificate of Steel used for the purpose shall be provided by the contractor, otherwise, shall be tested in a reputed laboratory and the report shall be submitted to the satisfaction of consultants.

7.13.3.2 Inspection by the consultant's Engineer

The Engineer will inspect, examine and test materials, workmanship and performance of any part of the works at the manufacture's works or the site of fabrication.

The Engineer will certify that all works up to the stage of fabrication shop painting after trial assembly have been carried out in accordance with these specifications and the approved shop drawings. The consultant's certificates shall not relieve the Contractor of any of his obligations under the Contract.

The contractor shall also provide necessary assistance required for the consultant whenever it desires to inspect the goods at any stage of execution.

7.13.3.2 Inspection by the Contractor

The Contractor shall himself inspect or have inspected all materials, shop work and field work to determine that the requirements of the Drawings and Specifications are met and that the Works are carried out in a first-class and workmanlike manner.

To maintain the quality, the contractor shall make a Quality Control Scheme to implement the Works. The contractor shall provide the system to the consultants and the all documents including the Logs of the internal inspections shall be allowed to the consultants for inspection at any stage and time of the implementation of the work.

7.13.4 Submittals:

Overall Schedule: The contractor shall submit an overall schedule meeting the requirement of clients within a week of signing the contract.

Production and Quality control Plan: The contractor shall submit the Production procedure and Quality Control Scheme for the project work within a week of signing the contract.

Shop drawings: The contractor shall submit two copies of shop drawings prior to start of the real fabrication. During submission of drawing contractor shall submit the design of connection system.

Erection Plan: The contractor shall submit the Erection plan showing the followings:

- Sequence of Erection
- Use of temporary supports/ scaffoldings.
- Type of equipment to be used in various stages of Erection

The Consultant's approval for above will not relieve the Contractor of his contractual obligations or of his responsibility for providing proper methods, and safety precautions, equipment and workmanship.

As-built drawings: The contractor shall submit two copies of As-built drawings within a month of completion of the project.

Necessary Approvals: All the submittals shall be get approved by the consultant.

7.14 MATERIAL AND WORKMANSHIP

7.14.1 Materials

Structural Steel: IS 2062 - 1984
Steel Tubes: IS 1161-1979
Steel Beams, Channels: IS 808-1957
Structural Fasteners: Hexagonal bolts, 4.6 Grade
Welding rod: Any make confirming grade E 6013 or equivalent.

7.14.2 Workmanship

The work shall be carried out by skilled manpower required for each activity. Necessary Jigs, Templates, Shop drawings etc. shall be used for standard fabrication processes.

7.14.3 Tolerance

The contractor shall, though appropriate planning and continuous measurements in the workshop and at the erection site ensure that the tolerance limits given in IS: 7215-1974.

7.15 CONSTRUCTION REQUIREMENTS

7.15.1 Fabrication:

7.15.1.1 Templates and Measurements

The contractor shall be fully responsible to supply all templates, jigs and other appliances necessary to ensure the accuracy of the work.

7.15.1.2 Straightening

All the material shall be checked and straightened as required prior to start fabrication work. Any corrective action shall be taken so that when assembled, adjacent surfaces shall be in close contact throughout. The methods adopted for the work above shall be such as not to damage, mark or impair the strength of the material.

7.15.1.3 Cutting

Cutting shall be done automatically or semi automatically. Hand cutting may be used exceptionally, if approved by the consultant.

Cutting by shearing machine can be used for plates not exceeding 12 mm in thickness provided that the plate edge be fully enclosed in a weld.

Gas and /or Plasma cutting may be used provided a smooth and regular surface free form cracks and notches is secured and provided that the roughness of gas and / plasma cut surfaces shall not be high.

All plate edges that will not be welded shall be ground to plainness and rounded to the appropriate radius for painting.

7.15.1.4 Holing

Holes for bolts shall be drilled. Punching of holes shall not be permitted. If not otherwise indicated on the drawings, the diameter of holes shall be in accordance of IS 800.

7.15.1.5 Welding

All welding shall be planned and executed using the most suitable materials and working method for particular purpose. Site welding will only be permitted for special condition after the approval of consultants.

Welding requirement shall be in respect to IS: 816

The contractor shall be fully responsible for the inspection and corrective measures for the physical as well as structural defects of welding. In no case, unmatched with the design concept and inferior connections shall be allowed.

7.15.1.6 Bolting

Bolting shall be done in accordance to the relevant Indian standard for high strength shear bolts. The tightening of the bolts shall also confirm the relevant codes.

7.15.4 Transportation and Erection:

7.15.4.1 Transportation of goods

The contractor shall be fully responsible to assure that the goods including its painting shall not be damaged in any form during any mode of transportation. Proper safety measures etc. shall be used during transportation of goods.

7.15.4.2 Erection

Erection at site shall be done manually with no disturbances to the existing structures.

7.16 PAINTING AND RUST PREVENTION PROCESS

7.16.1 Hot Dip Galvanizing

The material which has to hot dip galvanized shall be done so in accordance with the IS 2629 – 1966. The zinc used for the purpose shall be of not less than 95% purity.

The thickness of galvanization shall be 610 g/m2 for all surfaces. The fitness after galvanizing regarding all physical imperfections etc. shall be referred to IS 4759 – 1979.

7.16.2 Aviation Paint

Tower shall be painted by alternative strip of signal red and white color to warn the aero planes flying over the tower.

7.16.3 Storage of paints

The paints shall be stored in sealed containers in a store where it is not exposed to extreme temperatures. Any special storage conditions recommended by the manufacturer shall be observed.

Paint which has not been used within the ‘self life’ period specified on the containers or within 12 months of the date of manufacture, which is longer shall be replaced.

7.16.4 Application of Paints

The execution of the painting works shall be carried out in the most perfect and workmanlike manner by experienced labor using brush, spray or rollers to the satisfaction of the consultant. Furthermore, the application of the paints shall be carried out in accordance with the manufacturer’s recommendations.

Planning and execution of the painting work shall be in conformity with the supplier’s specifications in respect to minimum and maximum intervals between the applications of the individual coats.

Each coat shall be applied uniformly over the entire surface. Skips, sags, drips shall be avoided. When these occur, they shall be brushed out immediately or the material shall be removed and the surface re-

coated. Each coat shall be allowed to dry for the time specified by the manufacturer or as directed by the consultant before application of any succeeding coat.

The surface must be completely dry, and its temperature should be above the dew point. Paint should only be applied in suitable weather conditions and any fresh pain damaged by weather shall be repainted or replaced. Measures shall be taken to prevent dust or the extraneous matter from adhering to wet paint.

Brushes, when used, shall have sufficient body and length of bristle to spread the paint in a uniform film. Paint shall be evenly spread and thoroughly brushed out on all surfaces, which are inaccessible for painting, by regular means. Rollers, when used, shall be of a type which does not leave a stippled texture in the paint film.

The dry film thickness shall be measured in place with a calibrated film thickness gauges. Wet film gauges may be used for checking but shall not be permitted as a means of predicting the dry film thickness.

7.16.5 Thickness of coatings

The following shall be the thickness of coatings:

- Galvanization - Not less than 85 μm
- Wasp Primer - Not less than 15 μm
- Enamel Paint-1 - Not less than 35 μm
- Enamel Paint-2 - Not less than 35 μm for each coat

Touchup at site shall be done wherever necessary to the satisfaction of the consultant.

7.17 OTHERS

7.17.1 Method of measurement:

The all measurements shall be calculated by theoretical means and shall be followed relevant Indian standard of the method of measurement.

The measurement of structural steel work shall be done in Kg unit. The weight of Nuts, Bolts and washers shall also be measured in the same criteria and shall be in the item of Structural Steel in Bill of Quantities.

The galvanization and painting shall also be measured in the unit specified in Bill of Quantities.

8. ALUMINIUM WORK

8.1 GENERAL

The window shall be made out of extruded aluminum section (Al. Mg. Si.) and shall conform to IS – 63400, AA-6063 unless otherwise directed. Aluminum sections shall be anodized and the anodic film shall be 12-15 microns. The colours shall be as directed. The 2-3 tracks on outer frame of standard size otherwise directed shall be fixed in the position by using heavy duty plastic grips with necessary plugs and fillers. All the sliding shutters shall be provided with two ball bearing rollers and ratting pieces/guides one each at the top and bottom, weather strips all around. For openable window shall be double weather stripped, one strip shall be provided in outer frame and other shall be in the shutter frame. The hinges or stay hinges of openable window shall be strong. Pin of the hinges shall be of non-corroding materials, preferebly nylon/steel. All the joints shall be mechanically fixed. All the window shutter shall be provided with special locking arrangement. Glass shall be fixed in the shutter by means of rubber gaskets.

8.2 MATERIALS

8.2.1 Sections

All items shall be fabricated from aluminium sections conforming to alloy 50 SWP, IS 63400 (WP), AA: 6063 T6 (WP), and BS: HE 9 (WP) with a natural anodized finish of 25 micron thick of mat texture non-directional and non-specular.

All aluminum sections shall be Indal brand or equivalent conforming to the quality as above codes and standards and same size, shape, specified below.

Ref No	Description	Size & Thickness in mm	Weight kg/m
Sliding Windows			
4096	Side and top frame section	62.0 x 29.7 x 1.6	0.778
4095	Bottom frame section	62.0 x 29.7 x 1.6	0.875
9778	Interlock section	28.9 x 39.0 x 1.5	0.632
9777	Handle section	20.0 x 39.0 x 1.5	0.493
Casement Windows			
9152	Frame section	44.0 x 33.6 x 1.6	0.577
9838	Sash section	44.0 x 46.0 x 1.6	0.654
9846	Transom section	59.0 x 38.0 x 1.6	0.814
Flyscreen			
9774	Flyscreen frame section	14.9 x 43.0 x 1.2	0.435
	U-Channel	12.0 x 12.0 x 1.6	0.160
	Angle	12.0 x 12.0 x 1.6	0.100
	Louvers		
9809	Plain tube frame section	63.0 x 37.0 x 1.5	0.786

Main members shall be of such strength that a wind pressure of 1.16 kPa shall cause a deflection of not more than 1/240 of the span of the member. No permanent deflection shall result from such conditions of loading. Joints shall be sufficiently robust to withstand the above loading without causing failure or movement. The aluminum fabricator shall guarantee that all fabricated aluminum work shall comply with the above conditions.

8.2.2 Hardware, Glass and Accessories

All hardware shall conform to the brand name or foreign manufactured items listed below or of an equivalent quality brand. The responsibility of demonstrating equivalent quality for alternate brands shall rest on the fabricator.

1. Rollers — French polyamide-coated on needle bearings
2. Weather Strips — British 100 percent polypropylene weather piles
3. Locks — Japanese Reliance hook locks
4. Gaskets — Indian EPDM marine quality
5. Louvers — Indian ‘Wind-Roll’ sections
6. Flyscreen Net — Bangkok ‘Polymate Co.’ fiber net
7. Silicon — Wacker & Quilosa brand
8. Screws — Nickel-coated pan head
9. Rawal Plugs — Plastic ferruled grips 8mm diameter (Locally produced grips not acceptable)
10. Shims — Neoprene plastic shims
11. Clear Glass — Modi float glass 5mm thick
12. Opaque glass — Tribeni ‘figure glass’ 4mm thick

8.3 FABRICATION

Fabricated aluminum work covered by this specification shall be supplied and installed by the well-known local aluminum fabricators as approved by the Engineer. Before placing any orders the Contractor shall state the name of the window manufacturer he has selected from the list of approved manufacturers. The nominated manufacturer shall not be changed without prior approval of the Engineer.

Fabrication shall be according to best practices and all cutting and shaping shall be made with properly functioning machinery manufactured for the purpose of fabricating aluminium products. Hand cutting, shaping and slot cutting by hand will not be acceptable.

Joints shall be mitered or coped and shall be provided with extruded corner reinforcement. All joints shall be tight fitting, flush with the adjoining member, neat and sealed. Slots shall be provided in all vertical guides and sides of the bottom track to allow water to be flushed out.

All fabrication shall conform to the configuration of windows and ventilators shown in the design drawings or as directed by the Engineer. The size of individual windows and ventilators shall be measured after the rough openings have been plastered. The dimensions of the widows and ventilators shall allow a 5-7mm gap between the frame and rough opening to provide space to inject a silicon seal. The Contractor shall

assume full responsibility to ensure the dimensions of the windows and ventilators match size of the openings.

All surfaces shall be adequately protected during fabrication, transportation and storage to prevent any damage. Bent, dented or scratched sections and scratched glass will not be accepted and all such items shall be replaced.
The Contractor shall arrange for the preparation of complete workshop drawings of all fabricated aluminum work and shall submit same to the Engineer for approval.

8.4 ASSEMBLING

The whole assembling process is done in the factory on assembling tables. The frames and sash are assembled using screw and silicon in the corner joints to ensure perfect water proofing.

8.5 INSTALLATION

The fabricator shall be responsible for all window and ventilator installation and shall well-trained and competent staff for this work.

Before installation all rebates shall be fully painted with type and color of paint specified for the adjacent walls or ceiling. The tracks shall be installed with 40mm pan head screws and plastic grips at sufficiently close intervals to rigidly secure the tracks to the walls, lintels and sills. Neoprene plastic shims shall be placed on both the interior and exterior side between the aluminum tracks and the sides of the window opening at all screw locations. The tracks shall be perfectly plumb, level and square forming exact 90-degree angles at the corners and parallel with walls. The 5-7mm gap between the tracks and the rough opening shall be filled with a thermocol plastic filler and sealed with silicon in a neat, smooth bead flush with the face of the track. Following completion of the installation the aluminum section faces shall be cleaned of all silicon, finger marks and other matter and the tracks shall be vacuumed to remove all aluminium fillings, dust and other matter. The window and ventilator glass shall also be cleaned.

8.6 ASSEMBLING AND FITTING ACCESSORIES

- Architectural Silicon
- Backing Rod
- Plastic Wedges
- Stainless Screw

8.7 DETAILS OF EQUIPMENTS

- Elumatec Cutting Machine (TS 161).
- Elumatec Routing Machine (AS 70/44).
- Drilling Machines.
- Portable Cutting Machine.
- Assembling Tables.

8.8 MEASUREMENT

Windows shall not be measured but rate shall be based on a fixed cost for each style of window and ventilator. The rate shall include the cost of all material, fabrication, installation and cleaning, all complete.

9. CARPENTRY AND MILL WORK

9.1 SCOPE OF CARPENTRY WORK

Provide all labour, materials, equipment, transportation and operations necessary for and incidental to the completion of all woodwork as herein specified or shown the Drawings.

9.2 MATERIALS FOR CARPENTRY WORKS

Generally all hardwood timber used shall be of best quality salwood (Robusta shoria) or other species as shown on the Drawings or directed by the Engineer. Only heartwood shall be used, and sapwood shall be allowed. Softwood shall not be used anywhere unless specified or shown on the Drawings or as approved by the Engineer.

9.3 TIMBER

9.3.1 Quality

Timber shall generally conform to IS 287-1960. Timber to be used for the work shall be from the heartwood. It shall be uniform in substance, straight in fiber, free from large, loose, dead or cluster knots, flaws, shakes, warp, cup spring, twist, bends and defects of any kind. It should be free from spongy, brittle, flaky or brushy condition, sapwood and borer holes.

All timber shall be seasoned and be free from decay, harmful fungi and insect attacks and from any other damage of harmful nature which will affect the strength, durability, appearance or its usefulness for the purpose for which it is required.

Any timber rejected shall be removed immediately from the work site.

9.3.2 Type

The timber shall be of best quality timber as specified in the item. The samples of the approved timber to be used shall be deposited in the office of the Engineer for the future reference.

9.3.3 Colour

The color shall be uniform as far as possible. Darker colors among color species of timber are generally a sign of strength and durability.

9.4 SEASONED TIMBER

All timber shall be well-seasoned, air-dried or kiln-dried, to maximum allowable moisture content of 12% by weight. Generally seasoned timber shall be considered fit for carpentry work when it has lost 1/5 of its original weight and fit for millwork when 1/3 of its original weight has been lost in seasoning. At all times after the materials have been kiln-dried they shall be handled, stored, worked, transported and installed under conditions such that the moisture content provided by the dry kiln will be maintained.

9.5 STORAGE OF TIMBER AND WOODWORKS

General
All timber and assembled woodwork shall be protected from the weather and stored in such manner as to maintain not more than the maximum allowable moisture content, prevent attack from insects and decay and prevent physical injury.

Implementation
As soon as the foundation of buildings are laid, all necessary timber and scantlings shall be brought to site and stacked as laid down in IS. 401- 1967 till required.

Timber for the work shall not be brought to site until seen and approved by the Engineer. The Engineer may reject timber that has been plugged, painted, or otherwise altered to hide defects. Timber presented for inspection shall be clean and free from dust, mud, paint or other material that may conceal the defects. Cut ends may be protected after inspection with raw linseed oil or any other materials approved by the Engineer. No timber shall be painted with any substance without the previous permission of the Engineer.

9.6 VENEERS

Plywood, blackboard, chipboard, cork board, etc. shall be waterproof conforming to IS standards and as approved by the Engineer.

9.7 WOOD PARQUET

Wood parquet flooring shall be of best quality conforming to the quality and material mentioned above.

9.8 PRESERVATIVES FOR WOOD

Preservatives shall be of coal or creasote type or its variations conforming to IS 218 or approved wood primer.

9.9 FINISHING OF WOODWORKS

Finishing of woodwork shall be as specified in chapter 16 of this specification or as directed by the Engineer.

9.10 ADHESIVE FOR TIMBER

Adhesive or glue shall be synthetic resin of good, waterproof and high strength quality for load bearing joints or where damp conditions may be expected. For non-load bearing joints or where dry conditions are guaranteed resin or organic glues may be used.

9.11 WORKMANSHIP AND LAYOUT OF WOODWORK

All work shall be executed with best quality workmanship and shall conform in all aspects to approved assembled wood-work samples. The contractor shall also layout, fit, cut and erect framing for rough and finished work, blocking, nailing, furring and all other rough carpentry. All members shall be in true alignment, braced plumb and level closely fitted, and rigidly secured in place. Defects shall be removed and replaced.

9.12 SAWING AND SURFACE FINISH

All scantlings and boardings shall be accurately sown and shall be of uniform thickness and width throughout. Sawing shall be left with sawn surface except where exposed or indicated to be wrought and all millwork exposed surfaces shall be wrought and sanded to an approved finish suitable to the specified treatment.

9.13 PROVISION OF HARDWARE

The work shall be accurately set out in strict accordance with the Drawings and as specified herein and shall be framed together and securely fixed in the best possible manner with properly made joints. All necessary brads, nails, screws and bolts rough hardware etc. shall be provided as directed and approved.

The hardware materials shall be of brass of approved quality unless otherwise specified.

9.14 DOOR AND WINDOW HARDWARE

Providing and fixing all hardware in the doors and windows as specified in the design drawings.

Material

All hardware shall be new, of robust design and of the best quality as per instruction of Engineer. Tower bolts, aldrops, hooks, and sliding latches shall be of heavy-duty aluminium. Door handles and locks shall be the best quality Godrej or equivalent. Hinges shall be of heavy-duty steel. The buffer plate shall be fabricated from well-seasoned sal wood. All items shall conform to the size and description in the design drawings and BOQ and samples shall be approved by the Engineer before installation.

Installation

All fixtures shall be fixed to the jointing in a secure and efficient manner. Any of the fixtures damaged during fixing shall be removed and new ones fixed in their place and the surface of the joinery made good where affected at the Contractor's expense. Whenever the type of hardware is not mentioned on the drawing or BOQ the decision of the Engineer shall be followed. The fastening and fixtures shall be provided as per the fastening and fixture schedule.

Measurement

These items are not to be measured separately. The cost of all material and labor for these items shall be included in the rate for doors and windows.

9.15 TOLERANCES IN DIMENSIONS

Actual dimensions of scanting and boarding for carpentry work shall not vary from the specified dimensions by more than 1.5mm and must be uniform throughout. Dimensions for boards of 2.5 cm thickness or less

and for all millwork shall hold up to the specified sizes. All timbers shall be full length required with no joining to occur in any framing, shutter or bead member unless otherwise shown in the Drawings.

9.16 SETTING OUT FOR INSPECTION

All millwork shall be accurately set out on boards to full size for information and guidance to the artisans before commencing the respective works with all joints, fasteners, hardware and other work connected therewith fully delineated. Such setting out shall be inspected for approval before work commences.

9.17 JOINTS IN WOODWORK

All work shall be properly morticed, tenoned, housed, shouldered, dovetailed, notched, wedged, pinned, screwed bradded or glued as shown on the Drawings or as approved by and to the satisfaction of the Engineer. Joints must be as specified or detailed and so designed and secured as to resist or compensate for any stresses to which they may be subjected. Loose joints shall be made where provision must be made for shrinkage, glued joints where shrinkage need not be considered and where sealed joints are required.

9.18 JOINT BETWEEN WOOD AND OTHER WORKS

All doors, windows and partition frames, sills, etc. which are to be fixed to brickwork or concrete shall by means of grounds, lugs, holdfasts etc. bedded solid in mortar and pointed as directed. All portions of timber abutting or embedded shall be painted with hot coal tar or approved wood primer before installation. Any gaps between the frame and masonry or brickwork shall be shimmed and wedged and caulked as indicated on the Drawings or as approved by the Engineer. Generally joints 10 mm and less shall be caulked with suitable approved materials to form continuous weatherproof joints. Joints greater than 10 mm width shall be filled with continuous wood or other suitable material before caulking.

9.19 FASTENING OF DOORS AND WINDOWS

Doors, windows and partition of all frames shall be secured head, jambs and sill with screws, lugs or 40 x 12 mm wrought iron holdfasts or 12 mm bolts as indicated in the drawings unless otherwise indicated. All rough hardware shall be galvanized iron unless otherwise stated.

9.20 PAINTING OF WOODWORK

All millwork, trim and finish shall be primed and back painted thoroughly as indicated in the Drawings or as directed by the Engineer. All concealed surfaces of millwork shall be protected with two (2) coats of bitumen paint.

9.21 INSTALLATION OF WOODWORK

Wood grounds, nailors and similar items shall be provided as required for the support, proper erection or installation of the work, and blocking inserts cast into concrete shall be formed to accommodate the fastening requirements.

9.22 FITTING OF HARDWARE

Hardware shall be fitted prior to the application of finishes, removed during the finishing operation and rest after completion of the finish or shall be protected by using suitable wrappers against the staining of the hardware with the finishing materials and operation.

9.23 INSTALLATION OF HARDWARE

All hardware shall be accurately and securely installed. Metal knobs and handles shall be protected by wrappers of tough paper or cloth and maintained in place until acceptance of the work.

9.24 INSTALLATION OF HARDWARE NOT TO DAMAGE OTHER WORKS

During installations of items of hardware care shall be taken not to damage other works. Locations and positioning of hardware shall be in accordance with the Drawings and the directions of the Engineer.

9.25 BOARDINGS, ETC.

Cork surfaced bulletin boards, black boards, and other similar or miscellaneous items shall be in accordance with the details shown on the Drawings.

9.26 TIMBER STANDARDS

Grading and general requirements for timber shall conform to the Indian Standards.

9.27 SAMPLE OF WOODWORK AND HARDWARE

Before any work is started the contractor shall submit for approval representative samples of finished, assembled woodwork showing kind of wood, color, graining, finish and typical detailing and joints. All finished woodwork shall conform to the approved samples. The samples shall be maintained at the site for reference.

All finish hardware shall conform to approved samples. Samples shall be furnished by the Contractor for approval.

9.28 SHOP DRAWINGS OF MILLWORK

Shop drawing shall be furnished by the Contractor on all millwork except that shows full size on the drawings. Separate shop drawings shall be used to properly separate the work as it will be produced and used.

9.29 STORAGE OF MILLWORK

Particular care shall be taken to protect carpentry and millwork against dampness during the progress of the work. Store in well-ventilated space and where not exposed to extreme changes in temperature and humidity.

9.30 PROTECTION OF WOODWORK

Particular care shall be taken to protect woodwork against damage during installation, the progress of construction and cleaning operations. Woodwork shall be in perfect conditions and subject to the approval of the Engineer.

9.31 MAINTENANCE OF WOODWORK

Care shall be taken to maintain woodwork in clean state. All cleaning shall be carried out in a manner approved by the Engineer.

9.32 WOODEN HAND RAIL

Seasoned Seasam wood hand rail of approved pattern and quality including 3mm x 40mm mild steel flat connector to be welded to balusters with screws, nails and bolts all as shown in the drawings.

9.33 WOODEN DOOR SHUTTERS

9.33.1 General

The shutters shall conform to the relevant specification for the type and grade as specified in IS 2202-1973. The flush door shutters as specified shall be manufactured by a reputed factory such as Sitapur Plywood Flush Doors, Madras; the Indian Plywood manufacturing Co. LTD., Bombay or companies offering equivalent quality product and having hot press and all modern equipment. The shutters shall be produced from well-seasoned wood and shall have a factory warranty against warping, twisting and lamination separation. Samples shall be submitted for the approval of the Engineer.

Construction
The limping cum frame (style and rail) shall be 50mm wide of required thickness and shall be of an approved, good-quality, semi-hard wood such as sissom. There shall be three numbers of horizontal wooden spacers of 100mm width with one in middle. Lock block of 50mm wide shall be provided vertically

on both sides between the wooden spacers. Wooden batten shall also be provided. The shutter shall be of the size and dimensions shown in the drawing.

The veneer shall be of good quality commercial plywood, waterproof plywood or teak-faced plywood not less than 4mm thick as specified in the design drawings or as approved by the Engineer.

Bonding Medium
Liquid phenol formaldehyde synthetic resin shall be the bonding medium.

Finish
There shall be no visible joint of the plywood on the finished side. Shutters with chipped, cracked or other defective material or workmanship shall be rejected. The door shutters shall be hung in position with 3 nos. 150mm mild steel butt hinges. The shutter shall be finished with all necessary hardware as shown in drawing and mentioned in BOQ such as aluminium aldrops, aluminium tower bolts, magnetic door stoppers, aluminium kick plates, buffer plates etc.

Measurements
Shutters shall be measured in net length and width and the area calculated there from. The rate shall be inclusive of supply and installation of the shutter all specified hardware and fixtures per according to the design drawings.

Solid - core flush shutters shall be of waterproof and antitermite commercial or teak veneered type as specified in drawings and of approved quality. An approved sample shall be deposited in the office of the Engineer.

9.33.2 Types of Shutters

Teak wood paneled shutters: Solid 25 mm thick water and weather proof veneer finished with mechanically pressed 3 mm thick teak ply on both sides Wherever possible each panel shall be in a single width piece. But where two pieces are used, width of each piece should not be less than 12.5 cm. In order to avoid warping, splitting and cracking, normally pieces not exceeding 20 cm. in width should be used. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint and glued together and reinforced with metal dowels. The grains of solid panel shall run along the longer dimension of the panel. Panels shall be framed into grooves to the full depth of the groove leaving an air space of 1.6 mm and the faces shall be closely fitted to the sides of the grooves. Mouldings to the edge of panel openings shall be scribed at the joints.

Glazed shutters: They shall be similar to paneled shutters except that such parts as are directed shall be glazed with sheet or ground glass or plain glass as specified. Styles and rails shall be rebated 12 mm to receive glass, flash bars shall be moulded and rebated and metered on sides, to receive the glass. Glass panes shall be fixed with putty and beads.

Providing and fixing in position 38mm thick factory made solid core flush door shutters single or double leaf, including the supply and fixing of hardwood beading and all hardware – door handles and locks, tower bolts, door stoppers, hinges, aldrops, buffer plates and kicker plates.

Panel and Louver Doors
Providing and fixing in position 38mm thick panel door shutter single or double leaf, including the supply and fixing of all hardware – door handles and locks, tower bolts, door stoppers, hinges, aldrops, buffer plates and kicker plates. The fabrication and installation shall conform to IS 1003 Part I-1966 for door shutters.

Frame
The shutter frame shall be fabricated from top quality sal wood with side, top and intermediate members finished to a width of exactly 38mm and width of not less than 95mm. The bottom member shall be finished to an exact thickness of 38mm and width not less than 195mm. The internal edges shall be grooved as required to accept wooden panels or louvers as shown on the design drawings. The members of the frame shall be joined with mortise joints and secured with good quality wood glue and at least two wooden pins, minimum 8mm diameter, at each joint. All corners shall be square at exactly 90-degree angles.

Louvers
The wooden louvers shall be fabricated from top quality sal or sisau pieces 12mm thick and shall conform to the size and shape shown on the design drawings. The louver frame shall be of 12 x 30mm

sal or sisau joined at the corners by tongue and groove joint glued and nailed. The corners shall be square at exact 90-degree angles. The louver slats shall be attached to the frame with glue and nails at the specified gap and slope as shown in the design drawings. The louver assembly shall be set in the shutter frame and attached with flathead wood screws, countersunk and holes filled with wood filler. Vertical slats if required shall be provided as per instruction of the Engineer.

Panels
Shutter panels shall be Modi float glass of specified thickness or 19mm plywood, either waterproof or commercial as indicated on the design drawings. The glass panel shall be set either in the rebate cut into the frame or on the edge of the molding fixed to the frame by first placing a small bead of silicon in the rebate or on the edge of the molding to provide a uniform bearing and seal between the wood and glass. A silicon bead shall then be placed on the fixing side of the glass and a molding strip of the size and shape as indicated on the design drawings pressed into the silicon and nailed to the shutter frame. The plywood panel shall be set in the rebate cut in the shutter frame and attached with flathead wood screws. Molding of the shape and size indicated on the design drawing or as directed by the Engineer shall be attached at the joint of the frame and panel to cover the screws and gap between the panel and frame. The molding shall be attached with good quality wood glue and nails countersunk and holes filled with wood filler.

Installation
The door shutters shall be hung in position with 3 nos. 150mm mild steel butt hinges. The shutter shall be finished with all necessary hardware as shown in drawing and mentioned in BOQ such as aluminium aldrops, aluminium tower bolts, magnetic door stoppers, aluminium kick plates, buffer plates etc. All hardware shall be approved by the Engineer before installation. The clearance between the finished shutter and the doorframe and between any adjacent shutters shall not exceed 2mm unless otherwise specified in the drawing.

9.33.3 Glazing in Doors and Windows

Providing and fixing glass in clerestory and window ventilator shutter with silicon and wooden molding as shown in the drawing.

Material
Silicon shall be fresh and of the best quality available. The glass shall be Modi float glass or equivalent quality of the size, shape and thickness as specified in the design drawings or by the Engineer. The glass shall be free from shacks, bubbles, air holes, veins, blisters or any other defects. It shall be uniform thickness. Samples shall be approved prior to use.

Workmanship
All windows shall have glazing fixed outline and as shown on the Drawings with wooden beads and putty. The glass shall be cut to size to fit slightly loose. The molding shall be of sal wood or other hard wood as shown in the design drawings. Installation shall be executed by first placing a thin bead of silicon in the rebate and then pressing the glass into the bead to provide a uniform bearing. A bead of silicon is then placed at the edge of the glass and a wood molding is pressed into the silicon to obtain a uniform bearing and seal. The molding shall be fixed with panel pins spaced not more than 150mm apart.

Measurement
The measurement shall be in square meters calculated on the actual size of glass installed. The rate shall include the supply and installation of glass, silicon, moldings and panel pins, all complete.

9.33.4 Aluminium Protective Sheet

Providing and fixing aluminum protective sheet on door shutter as per the design drawings.

Material
The sheet shall be fabricated from 20 SWG aluminium sheet to the exact dimensions specified in the design drawings or BOQ. The edges of the plate shall be lightly ground with fine carborundum stone to remove all burrs and produce a smooth rounded edge.

Installation
The sheet shall be fixed such that the edges are flush with the edges of the door shutter. The aluminum sheet shall be fixed on the shutter with rubber cement and 25mm anodized screws placed at each corner and equally spaced along each edge at approximately 200mm intervals.

Measurement
This item is not to be measured separately. The cost of all material and labor for this item shall be included in the rate for door shutters.

9.33.5 Measurement

Shutters shall be measured in net length and width and the area calculated therefrom. The rate shall be inclusive of supply and installation of the shutter all specified hardware and fixtures per according to the design drawings.

10. MOISTURE PROTECTION WORKS

10.1 WATERPROOFING OF STRUCTURAL CONCRETE BY CRYSTALLIZATION

10.1.1 SCOPE OF WORK:

Waterproofing of Structural Concrete by Crystallization (non-polymeric, Water based treatment). The manufacturer of the waterproofing compound shall be of international repute acceptable to the Engineer.

The materials shall be applied in accordance with the instructions provided in the manufacturer's instructions manual and shall be carried out by an appropriate applicator licensed or authorized by the manufacturer to expertly carry out the installation. Supplementary products and other ancillary products shall also be used as may be necessary to ensure that treatment fully matches the quality standards specified and guaranteed by the manufacturer.

10.1.2 AREAS TO BE TREATED:

Basement Floor Slab and Retaining Wall areas, (Additionally, optional Treatment as may be required of horizontal P.C.C. slab area with one coat approved Concentrate-DS), RCC Drinking Water Reservoir Tank Walls and Floor areas, Roof and Terrace Slab areas, exposed Foam Concrete surface, Toilet and Kitchen/Pantry Floor areas, construction joint area, External Face of exposed areas of Beams and Columns, Shear Walls and other surfaces prior to commencing Brick or Metal cladding works, as well as additional areas where structural concrete is exposed and/or comes into direct contact with water or ambient moisture.

10.1.3 METHODOLOGY:

A. Mixes:

i. General: Mix waterproofing material by volume with clean water, which is free from salt and deleterious materials. Mix waterproofing material in quantities that can be applied within 20 – 30 minutes from time of mixing. As mixture thickens, stir frequently, but do not add additional water. Do not mix bonding agents or admixtures with crystalline waterproofing materials.

ii. Brush Application Mix: Measure dry powder and place in mixing container. Measure water and mix into the dry powder with a paddle on a slow speed electric drill (250 RPM) or other type mixer which is acceptable to manufacturer. Mixing proportions shall be as follows:

Coverage	**Proportions (by Volume)**
0.8 Kg/m2	5 powder to 2 water
1.0 Kg/m2	3 powder to 1 water

iii. Spray Application Mix: Mixing shall be same as specified for brush application except that mixture shall be thinner. Use following proportions as a guide only. Adjust proportions to match type of spray equipment and pressures used. Mixing proportions shall be as follows:

Coverage	**Proportions (by Volume)**
0.8 Kg/m2	5 powder to 3 water

iv. Dry-Pac Mixes: Using a trowel, mix 1 part clean water with 6 parts approved Concentrate powder for 10 - 15 seconds. It is acceptable that lumps may be present in mixture. Mix only as much as can be applied in 15 minutes.

B. Execution

1. Concrete Finish: Concrete surfaces to receive approved waterproofing treatment shall have an open capillary system to provide tooth and suction, and shall be free from scale, excessive form oil, laitance, curing compounds and foreign matter. Horizontal surface shall have a rough wood float or broom finish.
2. Surface Preparation: Smooth surfaces to be treated shall be thoroughly clean of deleterious materials, excessive form oils and other contaminants and shall be lightly sand blasted, water blasted or acid etched with muriatic acid as necessary to provide a clean, absorbent surface.
3. Repair of Concrete Defects: Surface defects such as rock-pockets, honeycombs, or other defects such as tie-holes, construction joints, cracks, etc., shall be repaired in accordance with manufacturer's instructions stated in its manuals.
4. Wetting Concrete: Prior to application of the waterproofing treatment, thoroughly saturate concrete surfaces with clean water as stated. In case of application on "Green" Concrete, light cleaning and pre-watering may be required to ensure the migration of necessary moisture and the subsequent treatment into the concrete.

C. Application:

1. Construction Joints: Apply approved Concentrate in slurry form @ 1.08 Kg./m2 to joint surfaces between concrete pours. For inaccessible joint surfaces, consult the manufacturer or the appropriate authority.
2. Sealing Strips and Coves: Prepare concrete surfaces that will come into Contact with sealing strips and coves by applying one coat of approved Concentrate in slurry form @ 0.8 Kg/m2. Then apply approved Concentrate in Dry-Pac form (for sealing strips) or approved Modified in mortar consistency (for cove) after the slurry coat has reached an initial set but is still "green". Where Coves are indicated on drawings, trowels apply and pack approved Modified mortar into a cove shape.
3. Surface Application: After repairs, surface preparation, treatment of construction joints and sealing strip placements have been completed in accordance with the manufacturer's product data and as specified herein, apply approved treatment uniformly to concrete surfaces with a semi stiff bristle brush or broom, or suitable spray equipment. Application rates and locations shall be as indicated in the drawings and in accordance with manufacturer's product data. When brushing, work slurry well into the surface of the concrete, filling surface pores and hairline cracks.

    i. First Coat (of one or two coat application): Apply approved Concentrate slurry coat to locations specified or indicated on drawings in accordance with manufacturer's product data.
    ii. Second Coat (of two coat application): As specified in the manufacturer's data or indicated on drawings, apply approved Modified slurry coat while first coat of approved Concentrate is still "green" but has reached an initial set. Lightly pre-water when rapid drying conditions exist.

D. Curing:

a. General: Begin curing as soon as approved coating has hardened sufficiently so as not to be damaged by a fine spray. Cure approved treatment with a mist fog spray of clean water three times a day for 2 – 3 days, or cover treated surfaces with damp burlap for the prescribed period. In warm climates, more than three sprayings per day may be necessary to prevent excessive drying of coating.
b. Air Circulation: Do not lay plastic sheeting directly on the waterproofing coating as air contact is required for proper curing. If poor circulation exists in treated areas, it may be necessary to provide fans or blown air to aid in curing of waterproofing treatment.
c. Holding Structures: For concrete holding structures such as swimming pools, reservoirs, water treatment tanks and wet wells, cure approved treatment for three days and then allow treatment to set for 12 days before filling structure with liquid. For structures holding hot or corrosive liquids, cure waterproofing treatment for three days and allow to set for 18 days before filling.
d. Protection: During curing period, protect treated surfaces from damage by wind, sun, rain and temperatures below 2 degree Centigrade. If plastic sheeting is used for protection, it must be raised off of waterproofing coating to allow sufficient air circulation.
e. Curing Agent: If moist curing is not possible, use a chemical curing agent that is specifically designed for or compatible with the approved crystalline waterproofing treatment. Curing agent shall have at least two years of successful field use and shall be approved by waterproofing manufacturer in writing.

TESTING REQUIREMENTS FOR CRYSTALLINE WATERPROOFING:

All materials and accessory products shall be supplied directly by the approved manufacturer, with its labels and instructions intact as per the manufacturer's instruction/specs. Manuals and shall rigidly conform, before commencing actual application works, for inspection and formal approval by the Engineer along with authentic Certification of Tests, conducted by internationally renowned independent laboratories, against the following quality test standards that are capable of meeting or exceeding the performance requirements as under:

i. **The Independent Laboratory undertaking such independent tests mentioned hereunder,** shall meet the standards set under ASTM E 329-95 and be certified by the US Bureau of Standards.
ii. **Concrete Permeability Test**: conforming to CRD-C-48-73 of the US Army Corps of Engineer
iii. **Chemical Resistance Test for Mortars and Concretes** as per ASTM C267-77 demonstrating Compressive strength increases.
iv. Freeze-Thaw and De-icing, and other **Chemical Resistance Test to De-scaling of Concrete Surfaces** exposed to such chemicals as per ASTM C672-76
v. **Radiation Exposure Test** Report as per "Protective Coating for the Nuclear Industry under US Standard, No. N69-1967
vi. **Potable Water Approval** shall conform to Independent testing conducted in accordance with NSF Standard 61 for use of waterproofing material on structures holding potable/drinking water.
vii. **Crystallization Penetration Test shall be evidenced by independent SEM (Scanning Electron Microscope) photographs documenting penetration of crystal-forming waterproofing material to a depth of minimum 50 mm.**
viii. Waterproofing material for Crystallization of concrete shall be **free of polymer and/or other solvents**. It shall be cement, silica sand and water mixing slurry based.
ix. Crystallization treated concrete shall comparatively exhibit marked **increase in comprehensive strength depending** on strength design and comparative analysis provided by the manufacturer.
x. Crystallization material shall be capable of withstanding extreme conditions of temperature within range –32 degrees C to +130 degrees C at constant temperature or within –185 degrees C to + 1530 degrees C periodic temperature.
xi. Crystallization material shall have no effect on its treatment resulting from extreme conditions of Humidity, Ultraviolet exposure, or Oxygen levels (oxidation).
xii. Resistance to Aggressive Chemicals shall be based on ASTM C-267-77 and shall be designed to resist chemical attack to protect concrete within pH range 3.0 to 11.0 constant contact or 2.0 to 12.0 periodic contacts.

10.2 WATERPROOFING OF STRUCTURAL CONCRETE BY USING MENBRANE

10.2.1 General

The waterproofing system in basement will be a ready to use membrane of HY 400 (400 grams/M2) Polythelene Polyproplyne Polymer compound with a bonding of special building glue like Rheomix-141, a MBT product.

Water proofing protection treatment in the basement foundation shall be carried out just before the laying of steel reinforcement for raft concrete. The flexible membrane barrier of HY 400 grade-PPPCWM to control the infiltration of water shall be laid on the entire RCC surface with the normal overlapping of 100mm on edge to each other layer.

10.2.2 Application Procedures

10.2.2.1 Water proofing protection treatment system to basement

The sub-base (P.C.C.) of the ground structure shall be cleaned and all dirts, loose materials should be removed thoroughly. Then after, a 25mm thick cement sand plaster (1:5) should be applied to make the surface smooth and leveled. The plaster should be done with smooth finishing. During the application of product the surface should be kept dry by continuous pumping water.

After laying of membrane smoothly on the green plastered surface it should be pressed smoothly. The overlapping joints are glued by specified glueing system. When the entire basement surface is covered by HY series membrane, the joints of each rolling membranes shall be extra protected by laying of 100%

synthetic brushable rubber coating of RC 2000/2200 on the 75 mm wide along the joints to provide monolithic bond on the overlapping areas.
After completion of laying of HY series apply the extra protective plaster screed with 25 mm (1:5).

10.2.2.2 Water Proofing Protection Treatment System for Shear Wall:

When the construction of RCC works for raft and shear wall is over, the HY protective membrane system applied earlier below the raft concrete section shall be exposed and this is further extended on the vertical surface upto the plinth level. The joints of the applied membranes on the vertical wall also shall be sealed with specified glueing system as well as rubber coating along the joints (75 mm wide). The water proofing membrane is further protected by plastering with cements sand mortar in 1:4 ratio. In addition to this the application of HY 400 grades of protective membrane system on the surface of positive hydrostatic pressure, all construction joints between the raft and shear wall shall be considered for extra protection by pressure grouting (injection) treatment with a expanding plasticizing grout admixture Flowcable-50 inside of basement so as to seal the honey combs and joints between shear wall and raft. Water proofing protection treatment system for shear wall shall be carried out as follows:

- The outer surface of shear wall structure shall be cleaned of all dirt, loose materials thereafter a 25 mm thick plaster (1:4) should be applied to make the surface smooth and leveled. The plaster should be finished smooth.
- Apply the Pheomix – 141 cement bonding coat or any approved building glue on the entire outer plastered surface of shear wall.
- After laying HY series membrane smoothly on the green bonding layer it should be pressed smoothly.
- The overlapping joints are glued by specified glueing system. When the entire surface is covered by HY series membrane, the joints of each rolling membranes shall be extra protected by laying of 100% synthetic rubber coating of RC 2000/2200 on the 75 mm wide along the joints to provide monolithic and on the lapping area. After completion of laying of HY series membrane, the extra protective plaster screed of 12 mm thick in 1:4 shall be applied in the treated surface of shear wall.

11. GLASS WORKS

11.1 SCOPE FOR GLASS

Provide all labor, materials, equipment, transportation and operation necessary for and incidental to the fixing of glass panes in windows, doors, ventilation and partitions as herein specified or shown on the Drawings.

11.2 GLASS

All glass shall be of standard quality free from flaws, bubbles, specks and other imperfection. Clear sheet glass shall be of O.Q. quality and plate glass shall of S.G. quality or "Float" glass.

a) Reflective Type Colored Tinted Float Glass
   - 0 Arctic Blue Eclipse Reflective Glass, coating on #2 Surface, or 1/4" Pilkington Arctic Blue High - Performance Tinted Float Glass

b) Glass Box (Brick)
c) Frosted Glass
d) Float Glass
e) Toughen Glass

11.3 THICKNESS OF GLASS

Generally glass for glazed doors shall be 4mm thick and for windows 4 mm thick for length of glazing less than 1.5 m. For length of glazing greater than 1.5 m the thickness shall be 5mm unless otherwise indicated on the Drawings or herein specified.

11.4 PUTTY FOR FIXING GLASS

Putty for glazing in wood frames shall be prepared by mixing (1) part white lead with three (3) parts finely powdered chalk powder and then adding pure unadulterated boiled linseed oil and mixing into a stiff, knife - consistency paste. Approved glazing compound prepared and applied in accordance with manufacturer's specifications and as herein specified may be used.

11.5 CUTTING THE PANES

Glass panes shall be cut to have square corners and straight edges to sizes to fit slightly loose in the frames with not more than 3mm clearance all round.

11.6 INSTALLATION OF GLASS

All glass shall be installed securely bedded in putty in the following manner.

a) A thin layer of putty is first put in the rebate of the frame and glass is then placed and pressed into the putty to a solid bearing.
b) The glass is then face-puttied after which the wood beads fastened in place and any spaces that may occur between the glass and wood are filled by forcing putty into such voids and surplus putty is removed with the putty-knife.
c) All putty joints shall be continuous and for all exterior glazing shall be absolutely watertight.
d) Putty shall be painted approximately ten days after glass is fixed to prevent the putty from cracking.

11.7 CLEANING OF GLASS

Prior to acceptance of the building clean all glass throughout. Remove labels, grease, paint and other foreign substances, leaving the work in perfect condition.

Methods of cleaning glass panes other than as listed below are to be approved by the Engineer and in no account shall windows be cleaned by scraping with glass or by other harmful means.

a) Cleaning with methylated spirit and soft clean cloths.
b) Painting the glass panes with lime wash and leaving it to dry and then washing with clean water.
c) Rubbing with finely powdered chalk.
d) Rubbing with damp salt for cleaning paint spots.

12. FINISH HARDWARE WORKS

12.1 SCOPE FOR HARDWARE

Furnish all finish hardware necessary to complete the project, in sufficient quantities to meet the project requirements, even though every such item is not specifically mentioned, including the correct number of screws of proper size, materials and finish for each pieces of hardware in perfect operating conditions.

12.2 STORAGE OF HARDWARE

Storage, installation, condition and operation of all hardware shall be provided for under chapter 8 of this specification and as indicated on the Drawings or directed by the Engineer.

12.3 HARDWARE MATERIALS

All hardware shall be of the approved manufacturer's standard for first quality and in accordance with the standards as established by ISI.

a) Door Locks: (A) Bolt/Cavier (B) Suro Vigil/Eureka Forbe (C) Dorma
b) Anodized Aluminium Hardware: (A) Arkey (B) Essel (C) Everite
c) Floor Spring For Aluminium Door: (A) Geze (B) Dorma
d) Door Closer: (A) Geze (B) Dorma
e) Brass/Powder Coated Hardware: (A) Eribehri (B) Parmar (C) Palladium
f) Hinges, Drawer Slides, Trays: (A) Cavalier, (B) Ebco
g) Push & Kick plates: Push plates and kick plates shall be made of brass or as indicated on the Drawings.
h) Handrails: Handrails of all types for Stair Case Handrails wall shall be made up of Stainless Steel with different Diameters as per standard IS - Grade 304 Standards. The handrail pipes of stainless steels are to be selected and samples shall be approved from the Engineer as per aforesaid Standards.

13. PLASTER WORKS

13.1 MATERIALS FOR PLASTER WORK

Lime, cement, sand and water used shall be in accordance with the requirements of chapter 5 and chapter 6 of this Specification. Sand shall be graded to a suitable fineness to produce smooth, even steel troweled finished surface.

Cement: The cement shall conform to the specifications under concrete work grade 43.

Sand: Sand shall conform to the general specifications for sand under concrete work. Sand mix shall consist of approximately 50 percent course sand as specified for concrete mix and 50 percent fine sand as specified by the Engineer. Sand shall be washed and free of all mica, clay, silt, organic and any other foreign matter.

Wire Mesh: Wire mesh over joints of dissimilar material shall be 19mm chicken wire mesh of 20 SWG galvanized wire or any other material approved by Engineer.

13.2 MIX OF PLASTER

Plaster mix shall be in accordance with the requirements of Section 6.02.

13.2.1 Wall Plaster

Wall rendering with 12mm thick cement plaster 1:6 (1 part cement to 6 parts sand) over a spatter dash coat of 1 part cement to 1 part course sand.

13.2.2 Ceiling, Soffits and Exterior Plaster

Ceiling, soffits and exterior rendering with 12mm thick cement plaster 1:4 (1 part cement to 4 parts sand) over a spatter dash coat of 1 part cement to 1 part course sand.

13.3 PREPARATION OF SURFACE TO BE PLASTERED

The surface to be plastered shall be brushed clean mortar joints of brick masonry or hollow concrete walls or any other surface to be plastered shall be raked to a depth of approximately 12mm, and the surface brushed down with a stiff brush and thoroughly wetted. The surface shall be free of all dust, loose materials, grease etc. Ceiling surface should be hacked with close proximity to the satisfaction of the Engineer.

13.4 METHOD OF PLASTERING

Plaster shall be applied in two coats. The thickness of the first cost shall be just sufficient to fill all unevenness of the surface and shall be applied with even, firm pressure to insure good bond, cross scratched and moist cured. After the first coat has properly cured, let dry thoroughly, then dampen and apply the finish coat. The finish coat shall be steel trowel finished to a smooth, even, burnished surface, completely free from defects or trowel marks. The thickness of plaster in total shall not be less than 12 mm. Wall plastering shall be started from top and work down bond to the floor. Ceiling plastering shall be completed before starting the wall plastering. To ensure uniform thickness and vertical plaster face plumb guider strips may be applied as required.

Application:
Surface shall be brushed clean of all foreign matter. Mortar, concrete or any other material projecting from the plane surface of the wall shall be removed. Chicken wire mesh shall be placed over the joints between brick or stone masonry and concrete columns, beams or other concrete structural members and between brick and stone masonry walls to prevent cracking of plaster. The mesh shall lap on each side of the joint by at least 200mm and fixed to the masonry with masonry nails placed no more than 300mm apart in the mortar joints. The mesh shall be attached to concrete surfaces by 19mm grips and screws spaced nor more than 300mm apart. Concrete nails may be used in place of grips and screws only if the nails can be securely fastened in the concrete. All concrete surfaces shall be hacked to produce a rough surface to ensure the plaster will properly adhere to it

The plaster shall be applied in two coats, the first a spatter dash and the final coat. The spatter dash coat shall consist of a slightly liquid mixture of 1 part cement to 1 part course sand and thrown forcefully onto the wall surface. This coat shall be left to set for at least 12 hours before applying the final finish coat of 1:6

plaster. This application of the spatter dash is to produce a rough surface on which the final coat of plaster will adhere.

The final coat shall consist of cement mortar in proportions of 1:6 for Wall (1 part cement to 6 parts sand) and 1:4 for ceilings (1 part cement to 4 parts sand) by volume. The cement and sand shall be accurately measured and dry mixed in a mixing machine. The mix shall be kept dry and hand mixed with water as the work proceeds, mixing only the quantity of plaster that can be consumed within a 30-minute period. Water shall be carefully added to the mix to produce a stiff plastic mixture, care being taken not to add more water than is required. Mortar that has started to set shall not be used.

The finished surface shall be minimum 12mm thick, uniform in texture with adjacent walls truly perpendicular to each other, corners at 90 degrees and the plaster on each wall truly vertical and absolutely plane without waves. The surface shall be finished at once by being rubbed over with trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be and carefully and neatly finished. Rounding of corners and junctions as required and directed shall be without extra charge. The finished plaster shall be cured for 7 days and protected against damage.
Sample of workmanship shall be approved prior to commencement of work.

13.5 ADDITIONAL STRENGTH OF CORNERS

To give additional strength to external angled corners, the corners shall be dusted with neat cement during the steel trowel finishing of the finish coat.

13.6 FINISHED PLASTER SURFACE

Care shall be taken to insure that finished plaster surfaces shall be plumb, square, straight and true to line. All arises and corners shall be straight clean and sharp.

13.7 CURING OF PLASTER WORKS

Moist curing shall be accomplished by keeping the plaster uniformly damp by suitable means. Moist curing shall start during application and continue for not less than 7 days.

13.8 APPROVAL BY THE ENGINEER

All plaster work shall be subject to approval of the Engineer, and work failing to meet the requirements of these specifications to the satisfaction of the Engineer shall be dismantled and replaced at the Contractor's expense.

13.9 SAMPLE OF PLASTER WORK

Before starting plaster work, the contractor shall prepare a sample panel of plastering at least one square metre for the approval of the Engineer. The sample shall be prepared in an area designated by the Engineer. The Contractor shall obtain approval before starting work and preserve the approved sample intact until all plastering is completed.

13.10 MEASUREMENT

Measurements shall be in square meters of the finished plaster surface. Opening shall be deducted in full and jambs and soffits shall be measured in square meters. Openings less than 1 square meter shall not be deducted nor shall payment be made for jambs, soffits or the sides of such openings. The rate shall include all materials (including supply and installation of wire mesh), scaffolding and curing for both spatter dash and final plaster coats; hacking concrete surfaces; rounding of all corners and junctions; making grooves and forming drip courses wherever required. Unless otherwise specified nothing extra shall be allowed for plaster on independent columns and beams, any short width or on curved surfaces and difficult location. No extra payment shall be made for extra lift.

14. TILES AND STONE FINISHING WORKS

14.1 VITRIFIED FLOOR TILE

14.1.1 Material

A} TILES: All the Tiles sizes and shades shall be as per pattern approved by the Engineer. Tiles shall be either manufactured by Johnson or any other approved brand.

B} TILE FIXING: Use Grey polymer modified cementitious adhesive from approved manufacturer for vitrified floor tile fixing.

C} TILE JOINT FILLING: Use Polymer modified cementitious Grout from conjunction with **BAL ADMIX- GT1** for filling tile joints.

D} CEMENT: OPC – 43 Grade, Sand: fine preferably of Zone II or III of IS: 383, potable water. **(EPOXY GROUT** should be used where Chemical resistance & hygiene is Important).

14.1.2 Tools

A} TILE FIXING: Use Metal Trowel for Adhesive beds spreading on substrate. 6mm Round notched trowel for all floor tiles

B} TILE JOINT FILLING: Use a Rubber Pad or Squeeze for filling BAL Grout with ADMIX-GT1in the tile joints.

14.1.3 Preparation:

Surface Back ground substrate should be neatly plastered with 1:3 Cement Sand without scratch coat, in plumb & level, cured with water for at least two weeks.
(Tiles are need not to be soaked in the water but simply cleaned by a cloth)

14.1.4 Application

A} TILE FIXING:

1. Mix adhesive powder with clean & potable water (approx. 2 parts powder & 1 part water by volume) to achieve a smooth & lump free paste.
2. Apply the adhesive paste on prepared substrate for tiling, with suitable trowel. (Check Tools A) holding trowel @ 45 to 50 degrees to floor.
3. Spread adhesive paste 1 sq. m. at a time & check intermittently wetness of paste before placing tile.
4. Slide & push tile into spread paste with a slight twisting action to achieve complete coverage behind tile within 15- 20-min time.
5. Keep suitable joints.
6. Clean the surplus Adhesive paste from joints.

B} TILE JOINT FILLING:

1. Mix ADMIX-GT1 or equivalent with water in proportion 100ml Admix GT1 to 250 ml Water to make homogeneous liquid mixture.
2. Mix GROUT with Liquid mixture (Approx. 1kg Grout to the 350 ml liquid mixture) to achieve a smooth & lump-free paste.
3. Fill up the tile joints with Grout paste without breaks or gaps into tile joints using Squeeze.
4. Use Paste within 20 minutes time period
5. After 30 minutes remove the excess Grout on tile surface with a wet sponge & then with a dry sponge.

(**PRECAUTION:** Joint filling with GROUT should be carried out after complete setting of Adhesive paste).

14.1.5 Joints in Tile Work

Joints in tile work shall be accurately aligned with horizontal joints level and vertical joints plumb. Joints shall be maintained uniformly wide by aligning spacer lugs on tile edges if tiles are so manufactured or by use of wetted strings.

14.1.6 Tile Layout

Layout tile work so that no tile less than half size occurs, where tile must be cut at edges or penetrations, the cut edges shall be carefully fitted and neatly ground. No chipped, cracked or broken tile shall be used and all defective work shall be replaced and repaired to the satisfaction of the Engineer and at the Contractor's expense.

14.1.7 Coverage

A} TILE FIXING: For a good substrate following coverage are possible.
6mm Round notched trowel for all floor tiles - Approx. 40-50 Sq. ft

B} TILE JOINT FILLING: Please refer to BAL ENDURA or any other approved manufacturer's Grout Data Sheet.

14.1.8 Curing

Use Products including Adhesives & Grouts that are self cured products & need NO WATER CURING.

14.1.9 Trafficking

Trafficking can be carried out after 24 HOURS.

14.2 VITRIFIED CLADDING TILE

14.2.1 Material

A} TILES: All the Tiles sizes and shades shall be as per pattern approved by the Engineer. Tiles shall be either manufactured by Johnson or any other approved brand.

B} TILE FIXING: Use Grey polymer modified cementitious adhesive in conjunction with ADMIX-AD1 or equivalent for vitrified tile cladding.

C} TILE JOINT FILLING: Use Polymer modified cementitious Grout available in multi natural shades in conjunction with ADMIX- GT1 or any equivalent for filling tile joints.

D} CEMENT: OPC – 43 Grade, Sand: fine preferably of Zone II or III of IS: 383, potable water.
EPOXY GROUT should be used where Chemical resistance & hygiene is Important.

14.2.2 Tools

A} TILE FIXING: Use Metal Trowel of following sizes for Adhesive beds spreading on substrate.

1. 3mm Trapezoidal notched trowel for wall tiles (Size upto 8"x12")
2. 6mm Round notched trowel for all floor tiles & wall tiles above size 8"x12"

B} TILE JOINT FILLING: Use a Rubber Pad or Squeeze for filling Grout with ADMIX-GT1in the tile joints.

14.2.3 Preparation:

Back ground substrate should be neatly plastered with 1:3 Cement Sand without scratch coat, in plumb & level, cured with water for at least two weeks.
(Tile are need not to be soaked in water but simple cleaned by a cloth).

14.2.4 Application

A} TILE FIXING:

1. Mix ADMIX-AD1 or equivalent to clean potable water in proportion 1.25 Lit. ADMIX-AD1 to 5 Lit water to achieve a homogeneous liquid mixture.
2. Mix adhesive powder with the homogeneous mixture (approx. 20 Kg adhesive powder to 6.25 liquid Mixture) to achieve a smooth & lump-free paste.
3. Apply the adhesive paste on prepared substrate for tiling, with suitable trowel.(Check Tools A}) holding trowel @45 to 50 degrees to wall.
4. Spread adhesive paste 1 sq. m. at a time & check intermittently wetness of paste before placing tile.

5. Slide & push tile into spread paste with a slight twisting action to achieve complete coverage behind tile within 15- 20-min time.
6. Mention suitable joints.
7. Clean the surplus Adhesive paste from joints.

B} TILE JOINT FILLING:

1. Mix ADMIX-GT1 or equivalent with water in proportion 100ml Admix GT1 to 250 ml Water to make homogeneous liquid mixture.
2. Mix GROUT with Liquid mixture (Approx. 1kg Grout to the 350 ml liquid mixture) to achieve a smooth & lump-free paste.
3. Fill up the tile joints with Grout paste without breaks or gaps into tile joints using Squeeze.
4. Use Paste within 20 minutes time
5. After 30 minutes remove the excess Grout on tile surface with a wet sponge & then with a dry sponge.

(**PRECAUTION**: Joint filling with GROUT should be carried out after complete setting of Adhesive paste).

14.2.5 Coverage

A} TILE FIXING: For a good substrate following coverage are possible.

1. 3mm Trapezoidal notched trowel for wall tiles (Size upto 8"x12")- Approx. 50-60 Sq. ft
2. 6mm Round notched trowel for all floor tiles & wall tiles above size 8"x12"- Approx. 40-50 Sq. ft.

B} TILE JOINT FILLING: Please refer to BAL ENDURA or any equivalent approved manufacturer's Grout Data Sheet.

14.2.6 Curing

Use Products including Adhesives & Grouts that are self cured products & need NO WATER CURING.

14.2.7 Trafficking

Trafficking can be carried out after 24 HOURS.

14.3 GRANITE CLADDING (INTERNAL)

14.3.1 Material

A} GRANITE SLAB: All the Granite Slabs should be from Karnataka (INDIA) and 18-20 mm thick pre-polished on all visible side and machines cut in shapes and sizes to design shown on drawings.

B} GRANITE FIXING: Use Grey polymer modified cementitious adhesive for Internal Granite cladding.
(Note: Use of ADMIX- AD1 or equivalent is essential for large format Granite slabs.)

C} GRANITE JOINT FILLING: Use Polymer modified cementitious Grout available in multi natural shades for filling granite joints.
(EPOXY GROUT should be used where Chemical resistance & hygiene is Important).

D} CEMENT: OPC - 43 Grade, Sand: Fine preferably of Zone 2 or 3 of IS: 383, potable water.

TOOLS

A} GRANITE FIXING: Use Metal Trowel for Adhesive beds spreading on substrate.
6mm Round notched trowel for all floor granite & wall granite above size 8"x12".
B} GRANITE JOINT FILLING: Use a Rubber Pad or Squeeze for filling Grout in granite joints.

PREPARATION: Surface back ground substrate should be neatly plastered with 1:3 Cement Sand without scratch coat, in plumb & level, cured with water for at least two weeks.

APPLICATION

A} GRANITE FIXING:

1. Mix adhesive powder with clean & potable water (approx. 2 parts powder & 1 part water by volume) to achieve a smooth & lump-free paste.(Note: Use of ADMIX- AD1 or equivalent is necessary for large Granite slabs, Ref: "External Cladding With Granite" to know application of Admixture).
2. Apply the adhesive paste on prepared substrate for tiling, with suitable trowel. (Check Tools A}) holding trowel @45 to 50 degrees to wall.
3. Spread adhesive paste 1 sq. m. at a time & check intermittently wetness of paste before placing granite.
4. Slide & push Granite into spread paste with a slight twisting action to achieve complete coverage behind tile within 15- 20-min time.
5. Clean the surplus Adhesive paste from joints.

B} GRANITE JOINT FILLING:

1. Mix GROUT with water (Approx. 3 parts Grout To 1 part water by Weight) to achieve a smooth & lump-free paste.
2. Fill up the tile joints with Grout paste without breaks or gaps into tile joints using Squeeze.
3. Use Paste within 20 minutes time
4. After 30 minutes remove the excess Grout on Granite surface with a wet sponge & then with a dry sponge.

(**PRECAUTION:** Joint filling with GROUT should be carried out after complete setting of Adhesive paste).

COVERAGE

A} GRANITE LAB FIXING: For a good substrate following coverage are possible. 6mm Round notched trowel for all floor granite & wall granite above size 8"x12"- Approx. 40-50 Sq. ft.

B} TILE JOINT FILLING: Please refer to BAL ENDURA or any other approved manufacture's Grout Data Sheet.

CURING

Use Products including Adhesives & Grouts that are self cured products & need **NO WATER CURING**.

TRAFFICKING: Trafficking can be carried out after 24 HOURS.

GRANITE CLADDING (EXTERNAL)

MATERIAL

A} GRANITE SLAB: All the Granite Slabs should be from Karnataka (INDIA) and 18-20 mm thick pre-polished on all visible side and machines cut in shapes and sizes to design shown on drawings.

B} GRANITE FIXING: Use Grey polymer modified cementitious adhesive in conjunction with ADMIX- AD1 or equivalent for External Granite cladding.

C} GRANITE JOINT FILLING: Use Polymer modified cementitious Grout available multi natural shades in conjunction with ADMIX- GT1 or equivalent for filling tile joints.
(EPOXY GROUT should be used where Chemical resistance & hygiene is Important).

D} Cement: OPC – 43 grade, Sand: Fine preferably of Zone 2 or Zone 3 of IS: 383, potable water.

TOOLS

A} GRANITE FIXING: Use Metal Trowel for Adhesive beds spreading on substrate.

1. 3mm Trapezoidal notched trowel for wall Granite (Size upto 8"x12").
2. 6mm Round notched trowel for all floor Granite & wall Granite above size 8"x12".

B} GRANITE JOINT FILLING: Use a Rubber Pad or Squeeze for filling Grout with ADMIX-GT1in the tile joints.

PREPARATION: Back ground substrate should be neatly plastered with 1:3 Cement Sand without scratch coat, in plumb & level, cured with water for at least two weeks.

Cement: OPC – 43 grade, Sand: Fine preferably of Zone 2 or Zone 3 of IS: 383, potable water.

APPLICATION

A} TILE FIXING:

1. Mix ADMIX-AD1 or equivalent to clean potable water in proportion 1.25 Lit. ADMIX-AD1 to 5 Lit water to achieve a homogeneous liquid mixture.
2. Mix adhesive powder with the homogeneous mixture (approx. 20 Kg Adhesive powder to 6.25 liquid Mixture) to achieve a smooth & lump-free paste.
3. Apply the adhesive paste on prepared substrate for tiling, with suitable trowel. (Check Tools A}) holding trowel @45 to 50 degrees to wall.
4. Spread adhesive paste 1 sq. m. at a time & check intermittently wetness of paste before placing.
5. Slide & push Granite into spread paste with a slight twisting action to achieve complete coverage behind tile within 15- 20-min time.
6. Clean the surplus Adhesive paste from joints.

B} GRANITE JOINT FILLING:

1. Mix ADMIX-GT1 or equivalent with water in proportion 100ml Admix GT1 to 250 ml Water to make homogeneous liquid mixture.
2. Mix GROUT with Liquid mixture (Approx. 1kg Grout to the 350 ml liquid mixture) to achieve a smooth & lump-free paste.
3. Fill up the granite joints with Grout paste without breaks or gaps into granite joints using Squeeze.
4. Use Paste within 20 minutes time.
5. After 30 minutes remove the excess Grout on Granite surface with a wet sponge & then with a dry sponge.

(**PRECAUTION**: Joint filling with GROUT should be carried out after complete setting of Adhesive paste).

COVERAGE

A} GRANITE FIXING: For a good substrate following coverage are possible.
6mm Round notched trowel for all floor tiles & wall tiles above size 8"x12"- Approx. 40-50 Sq. ft.

B} GRANITE JOINT FILLING: Please refer to BAL ENDURA or any other approved Brand's Grout Data Sheet.

CURING:

Use Products including Adhesives & Grouts are self cured products & need NO WATER CURING.

TRAFFICKING:

Trafficking can be carried out after 24 HOURS.

15. CAST IN SITU FLOORS, SCREEDS AND SKIRTING WORKS

15.1 SUB-FLOORING - R.C.C

Providing and laying 75 mm thick reinforced cement concrete 1:2:4 (1 part cement, 2 parts sand and 4 parts stone aggregate 20mm and down) sub-floor with 8mm reinforcing bars damp-proof membrane and brush finish.

Material

Concrete: The concrete mix shall be in the proportion of 1:2:4 with 20mm aggregate and shall conform to the specifications for structural concrete as stipulated in clause 2 of these Specifications. If 20mm round river aggregate of good quality is available at the same or less cost, the Contractor shall use this aggregate in place of the crushed aggregate.

Water Proofing Membrane: The plastic sheet for the waterproof membrane shall be 500-gauge clear polythene sheet of approved quality or HY series 400 grade Material.

Reinforcing Bars: The reinforcing bars shall be 8mm diameter CDT or TMT conforming to the specifications for reinforcing steel as stipulated in clause 2.11 of these Specifications.

Welded Wire Mesh: The welded wire mesh shall be 25mm square pattern with 14 SWG wire conforming to IS 4948:1974.

Installation

The surface of the sub-grade whether sand/gravel fill, stone soling or brick soling shall be cleaned of all foreign matter and made free of all sharp objects that could puncture the water-proof membrane.

The polythene sheet or HY series shall be laid over the sub-grade and plinth beams with a minimum 200mm overlap on all edges. The sheet shall be carefully laid around the floor dowels by slitting the ends of the sheet ensuring the sits align with the position of the bars. For sheets laid continuous over the interior plinth beams, holes may be punched in the sheet at the corresponding position of the reinforcing dowels and the sheet carefully slid over the dowels ensuring they do not tear the sheet. Care must be taken that no punctures are made or created on the sheeting. The punctured portions shall be properly sealed. Traffic should be avoided over the sheeting once it is laid. The sheet must be held in position until the concrete floor is cast.

The plinth beam dowels shall be bent to their correct horizontal position as shown in the design drawings and the 8mm reinforcing bars shall be laid and tied in place at the spacing indicated in the design drawings. Care must be taken to ensure the polythene sheet is not torn or displaced during installation of the reinforcing bars. The bars shall be supported by cover blocks staggered in rows 500mm apart in both directions. The blocks shall be 35mm high to support the bars at the approximate center of the 75mm thickness of the concrete floor. The bars shall be cleaned of all oil, grease, earth and other foreign matter before laying the concrete. To prevent cracks in the floor over plinth beams, welded wire mesh shall be placed over the portion of plinth beams on which no superstructure wall is to be erected. The mesh shall be placed such that the edges extend beyond the edges of the plinth beam by 300mm. The mesh shall be laid on top of the reinforcing bars and securely fastened to the bars with binding wire. The ends of the mesh shall be lapped a minimum of 200 mm.

The concrete shall be of the specified mix with just sufficient water to facilitate hand compaction with only mild tamping. The concrete shall be carefully placed so as not to displace or puncture the plastic sheet, leveled and mildly tamped to consolidate the concrete and to bring the slurry to the surface. After the initial set the surface shall be brushed with a stiff brush (Khareto) to produce deep scratches in the surface for bonding with the finish floor. Any smooth cement film visible on the surface of the concrete must be removed by brushing and washing with water. The work should be completed in one operation or at the direction of the Engineer. The sub-floor shall be cured for at least seven days.

Measurement

The measurements shall be in cubic meters calculated from the length, width and thickness of the concrete sub-floor. Nothing shall be admissible for slope, small areas, corners and work in any shape. Deductions will be made for columns and any other area exceeding 0.05 square meters not concreted. Rate The rate shall include the cost of all material, labor for installation, delivery and storage, all complete, except the supply and installation of reinforcing bars and welded wire mesh that will be separate items measured in kilograms and running meters, respectively.

15.2 CAST IN SITU MOSAIC FLOOR (NOT APPLICABLE)

15.3 IPS FINISH FLOOR

Providing and laying 40 mm thick plain cement concrete 1:2:4 (1 part cement, 2 parts sand and 4 parts stone chips 10mm) finished floor with a smooth punning finish.

15.3.1 Material

Concrete: The concrete mix shall be in the proportion of 1:2:4 with 10mm stone chips and shall conform to the specifications for concrete as stipulated in clause 2 of these Specifications. If 10mm round river gravel of good quality is available at the same or less cost, the Contractor shall use this gravel in place of the stone chips.

15.3.2 Installation

The surface of the sub-floor must be absolutely clean of all foreign matter. Any plaster or other cement material must be chipped from the surface so as to reveal the original brush finish. After thoroughly cleaning the surface, a cement slurry shall be brushed over the sub-floor on which finished floor is to be immediately installed. The slurry must not set before the top finish layer is poured and should be applied just prior to laying the concrete of the finish floor.

The concrete shall be of the specified mix with just sufficient water to facilitate hand compaction with only gentle tamping. The concrete shall be laid to the specified levels and slope (if required) in thickness not less than 40mm. The surface shall be worked to bring the cement slurry to the surface and fill all voids. A 1mm layer of 1:1 cement/sand punning mixture shall be uniformly spread over the surface of the floor and troweled smooth. At the initial set the surface shall be finished with a steel trowel producing a smooth, uniform surface. The surface shall be without float mark or air holes.

After the final finish and before the surface fully sets, lines shall be imprinted on the surface with a heavy cord approved by the Engineer and in the pattern indicated in the design drawings or as approved by the Engineer. The finish surface shall be cured for 7 days. A sample of the finished floor shall approved by the Engineer before starting the actual work.

15.3.3 Measurement

The measurements shall be in square meters calculated from the length and width of the finished floor. Nothing shall be admissible for slope, small areas, corners and work in any shape. No deduction shall be made for protruding or independent columns occurring in the floor, doorframes embedded in the floor or any other item when the area does not exceed 0.1 square meters. The rate shall include the cost of all material and labor for installation and finishing, all complete.

15.4 CEMENT PLASTER SKIRTING

Providing and laying 18mm thick cement plaster skirting of any height in cement mortar 1:3 (1 part cement and 3 parts sand) finished with a floating coat of neat cement and hardening liquid.

15.4.1 Material

The mortar mix shall be in the proportion of 1:3 cement/sand and shall conform to the specifications for these materials as stipulated in clause 2 of these Specifications.

15.4.2 Installation

The thickness of the skirting shall be governed by the thickness of internal plaster. It shall project by 6 mm. from the finished surface of the plaster. The receiving surface shall be prepared as per the plastering on walls.

Mortar shall be well mixed and applied as per cement plaster. When the surface becomes even it shall be uniformly covered with a 1mm coat of neat cement finish mixed integrally with a hardening liquid 2 liters to 50 kg of cement and troweled to a smooth finish. The corners, angles, junctions shall be truly vertical and or horizontal. Rounding of corners and junctions as required shall be done without any extra charge. The finished surface shall be cured for 7 days.
The Engineer shall approve samples of workmanship prior to execution of work.

15.4.3 Measurement

The measurements shall be in square meters of the work done and rate shall include material and labor, all complete.

15.5 CEMENT SKIRTING AND DADO

The cement skirting shall consist of 20 mm thickness of 1:3 cement and mortar as specified in the drawings. The cement skirting shall be applied to the wall surface to the line, levels and dimensions, and finished with a floating coat of neat cement.

The cement skirting and dado shall comply with the general requirements of this chapter and chapters 5,6.
The measurements shall be in running meters of the work done and rate shall include material and labor, all complete.

15.6 MOSAIC SKIRTING

Providing all materials and laying 20mm thick mosaic (terrazzo) skirting of any height with a 8mm thick white cement and marble chips finish over a base of plain cement mortar in 1:3 (1 part cement and 3 parts sand). Thickness of base course (screed/ plaster) - backing shall be of 22 - 25 mm thick.
The measurements shall be in running meters of the work done and rate shall include material and labor, all complete.

15.6.1 Materials

Mosaic: Materials are the same as in item 8.4 with the exception of glass strips that are not required.
Cement Plaster: Materials are the same as in item 9.1.

15.6.2 Installation

The thickness of the skirting shall be governed by the thickness of internal plaster. It shall project by 6 mm. from the finished surface of the plaster. The receiving surface shall be prepared as per the plastering on walls.

The base plaster shall be of 1:2, one part cement and three parts sand, and applied as per the specifications for wall plaster ensuring that the thickness will allow for the finished mosaic surface to extend exactly 6mm out from the surface of the adjacent wall plaster. The finished surface shall be roughened to ensure good bond with the mosaic finish.

Marble chips constitute at least 70% of mosaic surface and shall be mixed in equal proportions with the white cement and marble dust, i.e. one part marble chips, one part white cement and one part marble dust. The thickness of the mosaic finish shall be minimum 8mm. The required quantity of marble chips, marble dust and white cement for the complete work shall be thoroughly mixed and carefully stored to be used as the work progresses. Only the amount of mix that can be laid in one hour shall be mixed with water. Water shall be added in quantities to produce a stiff plastic mix such that the cement can be easily worked into all voids.

The mosaic finish shall be applied no later than 24 hours after the application of the base plaster. The mosaic mix shall be troweled onto the surface of the bedding plaster and worked until the surface is smooth true to line. The corners, angles, junctions shall be truly vertical and or horizontal. Rounding of corners and junctions as required shall be done without any extra charge. The finished surface shall be cured for 7 days. The mosaic shall be hand ground with roughing stone of no. 60 grit followed by a finishing stone of no. 80 grit. Neat cement grout shall be applied to the cleaned surface to fill the surface voids. Not less than 72 hours later all surplus grout should be removed by regrinding using no. 100 grit stone. The surface shall be ground evenly with finest grade. After final grinding with uniform line and level, oxalic acid shall be dusted over the surface, sprinkled with water and rubbed hard with pad and woolen rags. The finished surface shall be completely dried and a sealing compound of 1kg wax to 5 liters turpentine applied as the finished coat.

The Engineer shall approve samples of workmanship prior to execution of work.

15.7 CURING AND PROTECTION OF CAST IN SITU FLOOR

Curing, protection of cast in situ floor shall be in accordance with the requirements of chapters 5, 6.

16. PUNNING AND POINTING WORKS

16.1 MATERIALS

The materials required for punning and pointing works as cement, sand and water shall be in accordance with the requirements of chapters 5 and 6.

16.2 MORTAR MIX

The mortar mix for the works shall be in accordance with the requirements of Chapter 6. Cement used per unit area to be given.

16.3 PREPARATION OF THE BASE SURFACE

Before applying the punning and pointing, the base surface shall be cleaned, any dust or loose particles removed. The average thickness of the punning and pointing work shall not be less than 3 mm. The pattern shall be as per instruction of the Engineer or as shown in the drawings.

The coat shall be finished by rubbing with a steel trowel and any depression shall be filled in and rubbed to shining surface.

16.4 SAMPLE WORK

The contractor shall prepare samples of 1 square meter of the punning and pointing works until the quality, texture and finish required is obtained and approved by the Engineer. The approved sample shall be preserved until the punning and pointing works are executed to the conformity with the approved sample.

16.5 CURING

The works shall be kept wet at least for 7 days.

17. PAINTING AND COLOUR WASHING WORKS

17.1 MATERIALS AND WORKMANSHIP

The materials and workmanship for painting and colour washing of internal and external surfaces shall confirm to the respective Indian standards or equivalent.

17.2 PRIMER COAT

Supply and application of priming paint for wood, concrete and metal surfaces including surface preparation.

17.2.1 Material

The primers shall be in seal tins of Asian Paints P. Ltd, Berger, Jenson & Nicholson P. Ltd., Nerolac Paints P. Ltd. or as approved by the Engineer.

17.2.2 Surface Preparation

All surfaces shall be sanded and cleaned. The surface for cement plaster shall be patched with the thick paste of the same primer and smoothed with fine carborundum stone after drying.

In case of timber having knots and nails holes, they should be filled with stopping and knotting materials. The knotting material shall consist of pure shellac dissolved in methylated spirit. For stopping, Russian talc or putty shall be used. The stopping shall consist of two parts of whiting (powdered chalk), one part of white lead mixed together in double boiled linseed oil and well kneaded. The surface thus treated shall be allowed to dry up and then sanded, or a readymade approved putty may be used.

In case of metal, all rust shall be removed with a rotary steel brush grinding machine, sanded and properly cleaned.

17.2.3 Application

After preparing the surface, the priming coat shall be applied with natural bristle brushes and as per manufacturer's printed instructions.

17.2.4 Measurement

Measurements shall in square meters for surface widths greater than 150mm and in running meters for surface widths less than 150mm according to the following convention. The rate shall be included in the finish painting work unless otherwise specified.

17.3 PLASTIC EMULSION PAINT

The surface shall be prepared as specified for oil paints. First a priming coat of primer as specified by the manufacturer shall be applied and scrapped off.

The second and third coats of plastic emulsion paint of approved shade and manufacture shall be applied to achieve an even surface. If the finish is not to the satisfaction of the Engineer then more coats shall be applied to achieve smooth and even surface.

17.4 READYMADE ENAMEL PAINT

Surface to be painted shall be dry, free from dust and dirt and rubbed smooth by means of sandpaper or pumic stone to the satisfaction of the Engineer.

The paint shall be ready mixed synthetic enamel or oil paint of approved make and manufacture. The primary coat shall be ready mixed of approved make and manufacture and shall be applied even with brushed. After the primary coat is applied and perfectly dried all holes, cracks etc. Shall be filled with putty and the surfaces sand papered. Then a second coat of paint of approved shade and manufacture shall be evenly applied and allowed to dry. The third coat shall be carefully applied as and when required, to achieve smooth and even surface.

17.5 FRENCH POLISH

The work shall be first cleaned and scrapped thoroughly with sandpaper. It then will be painted with a "Filler" composed of chalk and whiting Methylated spirit and sand papered.

A thin coat of French polish shall then be applied and sand papered. Subsequent coats of French polish not less than 5 coats shall be applied till the proper finishing is achieved to the satisfaction of the Engineer.

18. FALSE CEILING WORKS

18.1 PLASTER OF PARIS

These shall be made out of best plaster of Paris powder of approved quality. The boards shall be of 60 x 60 cm. size of 12 mm. thickness, plain or perforated or any other decorative pattern, as specified in the drawings.

The boards shall be fixed on 60 x 60 cm. salwood batten framework of suitable sizes as shown on drawings by brass screws. The screw face shall be sunk 3 mm deep in the board face and the head of screw shall be covered by spotting with plaster of paris paste trowelled flush. The joint in the boards shall be flush and will be filled with plaster of paris paste or as specified.

The battens on which the boards are fixed on salwood runners of designed section as shown on drawings by iron screws. The runners will be 120 cm. centre to centre cross wise and will be supported from the ceiling by WI clamps of suitable length having threads and suitable nuts to hold the runners with necessary washers.

18.2 ACCOUSTIC BOARDS

The boards shall be 60 x 60 cms. size 20 mm thickness as specified in the schedule of quantities. Other specifications shall be the same as for Plaster of Paris.

The acoustic boards may be made of
(a) 12 mm thermocaustic board
(b) 3 mm commercial ply board and shall confirm to IS.

18.3 GYPSUM BOARDS

The Fibrous Gypsum Boards shall be 60 x 60 cm. thickness as specified in the schedule of quantity. Other specification shall be same as plaster of paris.

The Gypsum boards shall be made of fibre gypsum reinforced with hessianment and shall confirm to IS.

19. PARTITION WORKS

19.1 ALUMINIUM PARTITIONS

These shall be from proven, simple and elegant material made from a reputed and approved manufacturing unit. The boards shall be made from partly laminated and partly glazed with glass of thickness 4mm. Variation in other decorative texture/pattern finish designs should also be a possibility.

Partitions will be made from aluminium confirming to IS standards and to BS. The partition shall be either square edge or tapered edge finished. The frames of aluminium partition should be best quality of powered coated.

The partition is to be out of various manufactured sizes of boarding/lining material adequately and rigidly strengthened by metal studs and noggings. The partition material should be carefully handled and stored and never dragged while moving.

20. JOINTS SEALERS, WATER STOPERS

20.1 JOINTS IN CONCRETE

The requirement of joints and joint sealers in concrete works shall in general fulfill the requirements of chapter 5.

20.2 WATER STOPS

The Contractor shall supply and fix waterstops in all contraction and expansion joints in members which are to be water-retaining and where shown on the Drawings.

Waterstops built into joints shall be made of rubber or similar approved material and shall have a hollow centre bulb. They shall be obtained from manufacturers approved by the Engineer and shall be stored, fixed and jointed in accordance with the manufacturer's instructions. They shall be fabricated into the longest practicable units complete with angles and junctions at the manufacturer's works and shall be made continuous throughout the structure below highest water level and where shown on the drawings. The number of joints in the waterstop made on Site shall be kept to a minimum.

Where water stop joints are vulcanized site jointing shall be performed strictly in accordance with the supplier's recommendations. The tensile strength of the spliced waterstop at a factory-made splice shall be at least 90% of the waterstop's tensile strength, when tested according to BS 703 with the spliced joint in the middle portion of the dumb-bell test speciment and the tensile force applied normally in the direction of the splice. The tensile strength of a waterstop spliced at the site shall be 80% if the original strength of the waterstop.

The edge bulb section shall be circular. The webs shall be plain without serration. The waterstop shall be carefully maintained in the position shown on the Drawings and properly protected from damage and the harmful effects of light and heat during all stages of construction. The stop-boards on each side of the waterstop shall be accurately wrought to match the profile of the waterstop. The concrete shall be carefully compacted under and around the waterstop so as to leave no cavities.

The Contractor shall supply the manufacturer's test certificates for each consignment of waterstop delivered to site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

The rubber for rubber waterstop shall satisfy the following requirements when tested as moulded sheet in accordance with BS 903:

Minimum tensile strength	20 N/mm² (204 kg/cm²)
Minimum elongation at break 500%	
BS Hardness (BS 903/Part A7/1957)	60 to 65 degrees
Maximum compression set by constant deflection method	20% of original deflection

Maximum water absorption
after 2 days at 20°C 5%

After accelerated ageing
(48 hours at 70°C in oxygen
at 20 N/mm² (0.22 kg/mm²)
(i) Minimum tensile strength 80% of intitial value
(ii) Minimum elongation at 80% of initial value
break

20.3 JOINT FILLERS

The Contractor shall supply and fix pre-moulded joint fillers in all expansion joints and where shown on the Drawings. Unless otherwise specified, the joint filler shall be of resin or bituminous bonded cork. The filler shall be obtained from a manufacturer approved by the Engineer and shall be stored and fixed in accordance with the manufacturer's instructions. The joint filler of the thickness specified shall be cut to shape and fixed to fill the whole space between the concrete faces of the joint which is not otherwise filled by waterstop and joint sealer. Abutting pieces shall be placed in close contact and the joints covered on each side to prevent the passage of cement grout.

The Contractor shall supply the manufacturer's certificate for each consignment of joint filler delivered to Site and shall, in addition, supply to the Engineer sufficient of each consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

The filler shall comply with United States Federal Specification HH-F-34 le Type II Class B for the resin bonded cork and HH-F-34le Type I Class B for the Bituminous bonded cork.

The filler shall also comply with the American Society for Testing of Materials Specification as follows: -
(a) For resin bounded cork - specification ASTM D1752 - 67 Type II
(b) For bituminous bonded cork - specification ASTM D1751-73

20.4 JOINT SEALERS - GENERAL

The Contractor shall construct recesses at expansion and contraction joints on both faces of the concrete work except on the underside of continuously supported work and on faces backfilled with earth. The recesses shall be accurately formed to the lines and dimensions shown on the Drawings.

The Contractor shall prepare the surfaces of the recess and shall supply a joint sealer and fill or caulk the recess completely with it.

Unless otherwise shown on the Drawings or ordered by the Engineer the joint sealer shall be a hot poured rubber/bitumen compound for horizontal joints, and a bituminous putty for sloping, vertical and soffit joints.

Where shown on the Drawings, or ordered by the Engineer, an elastomeric two-part polysulphide sealer shall be used. Such joint sealers and the requisite priming materials shall be obtained from manufacturers approved by the Engineer and shall be used in accordance with the manufacturer's instructions. The application of joint sealer shall not be commenced without the contractor having first obtained the approval of the Engineer.

The Contractor shall supply the manufacturer's test certificate for each consignment of each type of joint sealer delivered to Site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure, if ordered.

21. MISCELLANEOUS WORKS

21.1. DISMANTLING WORKS

The contractor shall dismantle the existing structure of all kind and take away from the site on contractor’s own cost and possible amount shall be paid by the contractor for the scrapped materials received from the dismantling works. The resulting material shall be the property of the Employer and all suitable materials shall be stockpiled for reuse purposes within a lead of 30 m as directed by the Engineer.

21.2 GRAVEL PILING

The contractor shall supply crushed aggregate and apply gravel packing for gravel piling works of diameter 800mm as per drawings and instruction of Engineer. A proper compaction shall be done by the contractor using appropriate tools and equipment to make the surface good for the construction of foundation as per design. This work shall be done as per guidance of Engineer as well as Geotechnical Engineer.

21.3. SHEET PILE

The contractor shall supply and use sheet piling sheets with necessary supports for safe excavation of foundation soil with proper guidance of Engineer as well as Geotechnical Engineer. A design of sheet pile shall be provided by the contractor and checked by the Geotechnical Engineer before execution of the earthwork excavation works at the site. All kind of necessary safety precautions shall be taken by the contractor for this work. Any losses of property and lives shall be the contractor's responsibility.

22. SANITARY, PLUMBING AND WATER SUPPLY WORKS

22.1 SCOPE

This Specification covers the construction of internal and external water supply, soil, waste, vent and rain water system, installation of toilet fixtures.

22.2 REFERENCE DOCUMENT

The work specified in this section shall be in accordance with the following standards, or approved equal, except as they are modified and supplemented herein:

Code	Subject
IS:778 - 1964	Specification for gunmetal gate, globe and check valves for water, steam and oil only.
IS:780E - 1966	Specification for sluice valves for various purposes.
IS: 781E - 1959	Specification for sand cast brass screw down bib taps and stop taps for water services.
IS:1171 - 1963	Basic requirement of water supply, drainage and sanitation.
IS:1239 - 1968	Specification for M. S. or G. I. Pipes and fittings.
IS:1703 - 1962	Specification for cast iron manhole covers and frames intended for use in drainage work.
IS:1742 - 1960	Code of practice for building drainage.
IS:2065 - 1963	Code of practice for water supply in building.
IS:771	- 1958 Specification for vitreous china sanitary ware.
IS:4985	Specification for UPVC pipe
IS:5382	Specification for rubber seal ring.
ASTM : D 2846	Specification for CPVC pipes

22.3 RELATED WORK

The Contractor shall become familiar with other Divisions of the specifications affecting work of this trade.

22.4 GENERAL REQUIREMENT

The scope of work covered by this Chapter shall be deemed to comprise the furnishing and installation of all cold and hot water supply pipe work, soil, waste, rain and vent pipe work, vitreous china

sanitaryware, CP fixtures etc as shown on plans and as specified. It shall also include the supply of the appertaining materials and parts, scaffolding, off loading on site and all operations in connection with civil works, unless otherwise specified in the Bills of Quantities.

Materials and parts, which the Contractor shall supply and install, shall be new and unused. They shall comply with the regulations regarding quality and dimensions. Materials and parts that are not standardised shall be used only with the approval of the Engineer.

The materials shall be protected from rain and inclement weather all to the satisfaction of the Engineer. The cost of covering materials shall be deemed to be included in the unit prices for the brickwork and masonry.

22.5 SAMPLES/SUBMITTALS

Representative samples to be used shall be submitted to the Engineer and his approval taken before bulk purchase. The samples shall be kept with the Engineer for future reference and comparison. All materials supplied shall conform to these approved samples in all respects.

22.6 BASIC MATERIALS AND METHOD

All materials provided for the contract will be in strict accordance with the latest version of the applicable Indian Standards. All manufacturer's data, specifications and relative information together with samples will be submitted to the Engineer or Site In-charge for approval prior to being purchased, otherwise at the contractor's own risk.

22.7 MATERIALS TRADE NAMES VARIATIONS

Tenders shall be based upon complete installations. Products required which are not shown or mentioned, or not specified herein as to manufacturer; quality, etc. shall be furnished of the highest quality. Materials shall be new and free from all defects. All materials, apparatus or equipment called for on the plans or in the specifications by trade names, or the name of a particular manufacturer, or by catalogue reference are the materials, apparatus, or equipment which should be allowed for in the Tender, or qualification submitted at the time of Tender submission.

22.8 REGULATIONS

The work shall be carried out in accordance with all rules, regulations, by-laws and requirements of all authorities having jurisdiction. All changes and alterations required by an authorized inspector of any authority having jurisdiction should be carried out at no cost to the Owner.

22.9 DRAWINGS AND SPECIFICATIONS

These specifications shall be considered as an integral part of the drawings, which accompany them. Neither the plans nor the specifications shall be used alone. Any item or subject omitted from one, but which is mentioned or reasonably implied in the other shall be considered as properly and sufficiently specified and therefore must be supplied by the contractor. Misinterpretation of any requirements of either the drawings or specifications shall not relieve the contractor of his responsibility for properly completing his work. The contractor shall apply to the Engineer or Site In-charge for any explanation, which he may require in regard to the meaning and intent of any clause in the specification and contract. He shall be held responsible for any errors or losses consequent upon failure to obtain such explanation. The contractor shall consult with the Engineer or Site In-charge to obtain detail drawings or instructions for exact location of equipment as work progresses, before installing fitting or equipment and will be responsible for coordination with all other work trades including finishes. Drawings show general location and routes to be followed by pipes, ducts, etc. where not shown, or shown diagrammatically, the contractor shall install them in accordance with best trade practices.

22.10 SHOP DRAWINGS

The contractor shall submit to the Engineer or Site In-charge all shop and setting out drawings or diagrams necessary in order to make clear the work intended or to show its relation to adjacent work of other trades. The contractor shall make any changes in such drawings or diagrams, which the Engineer or Site In-charge may require, consistent with the contract. Details of shop drawings submitted for approval shall show clearly the relations of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such

measurements shall be made by the contractor and noted on the drawings before being submitted for approval.

22.11 AS BUILT DRAWINGS

Three months prior to the end of the Defects Liability Period, the Contractor shall submit As Built Drawings based on AUTOCAD printout and corresponding digital files as per Division 1 – General Requirements.

22.12 MAINTENANCE MANUAL

The Contractor shall submit a draft outline of the proposed format and contents within 30 days after the issuance of the virtual completion certificate by the Engineer. The submitted manual will conform to the approved outline.

The Manual shall be contained in a black three ring loose-leaf binder and be subdivided into sections according to the various divisions of this specification. Material shall be fully indexed, with a typed contents page located at the front of the Manual. Tabbed sheets shall be used to subdivide the contents as required. All material shall be neatly and legibly presented. Photocopies will be used only if original documents are not available.

All materials shall be clearly labeled according to manufacturer, manufacturer's reference, source, location of use, and quantity.

Include in the Maintenance Manual a list of all materials submitted indicating quantities, source, manufacturer, manufacturer's reference(s), and location of use. Also include printed manufacturer or supplier's instructions on use, application, and maintenance of all products and materials.

22.13 CUTTING AND PATCHING

Openings not indicated on the Engineering or Structural drawings, which are required for bringing equipment into the building or for other temporary or permanent service, shall be approved by the Engineer or Site In-charge. The contractor will provide maintain and restore these openings and shall pay for their provision and restoration. Ample notice shall be given of size and location of such openings. The contractor shall ensure that he does not undertake any cutting that may impair the strength of the building. No holes, except expansion bolts and small screws may be drilled into the structure without obtaining prior approval. Persons, skilled in the trades, shall do all cutting and patching work in a neat and workman like manner.

22.14 PAINTING

All equipment supplied under this specification shall be delivered to the site with a factory applied prime coat of paint unless noted otherwise. All supports and hangers shall receive a prime coat of paint. Painting where required for pipe, duct services, equipment identification, including stenciling shall be carried out by a paint tradesman under this division in accordance with the workmanship and material specification. All factory prime-coated or finish coated equipment shall be touched up or repainted if equipment is marred during shipment or installation.

22.15 EXPANSION AND CONTRACTION

Unless shown otherwise, the contractor shall be responsible for measures to control the thermal movement of piping and apparatus. Piping shall be erected in such manners that strain and weight does not come directly upon connections, joints or apparatus. Where possible, the effect shall be obtained by providing changes in direction and loops in pipe runs, supplemented by the necessary guides, anchors and limit stops.

22.16 PIPE SLEEVES

An adequate number of sleeves (pipe inserts) of mild steel shall be provided where pipes pass through concrete, masonry and similar work. The pipe inserts shall have a flange welded in the center around its circumference, in order to provide water tight and secure fixing into the structure. The sizes of the pipe sleeves (pipe inserts) shall be as per the drawings supplied and / or as given below.

22.16.1 SLEEVES THROUGH EXTERIOR WALLS BELOW GRADE

i. Sleeves in exterior foundation walls below grade shall project 25 mm beyond the outside surface of the wall and be flush with the inside surface.
ii. The annular space between the sleeve and the pipe shall be caulked with un-tarred oakum and sealed with approved caulking compound. The sealing shall be 25 mm deep from each side. The pipe and sleeve surfaces shall be cleaned to enable good bonding. Allow 24 hours for setting of the compound. The contractor shall adhere strictly to the manufacturer's recommendation.

22.16.2 SLEEVES THROUGH INTERIOR WALL, FLOOR AND CEILINGS

i. Sleeves through interior masonry walls and partitions shall be set flush with finished wall surfaces.
ii. Sleeves through floors in finished areas shall terminate 25 mm above the finished floor.
iii. Sleeves through floors in service area (e.g., mechanical rooms) shall terminate 50 mm above the finished floor.
iv. The annular space between sleeves and pipes shall be packed with Silicon Rubber. In Machine Room, the packing shall be finished at both ends of the sleeve with 6 mm deep caulking compound. In other areas the finishing may be on the room side only.
v. Pipe insulation shall be carried full thickness through pipe sleeves.

Unless otherwise specified elsewhere, the sleeves size shall be as follows:

Out Side (OD) Diameter of Pipe (If Insulated, OD of Insulation)	Sleeve Size (Nominal Bore of the Pipe for Sleeve)
OD 20 mm to OD 32 mm	NB 2" (50 mm)
OD 33 mm to OD 75 mm	NB 4" (100 mm)
OD 76 mm to OD 125 mm	NB 6" (150 mm)

22.17 CLEAN UP

The contractor shall clean all exposed metal surfaces from grease, dirt or other foreign materials. Chrome plated and polished work shall be left bright and clean. All openings in pipes and fixtures shall be properly capped and plugged during construction. Fixtures and equipment shall be properly protected from damage during the construction period and shall be cleaned in accordance with the manufacturer's instructions.

22.18 SANITARY FIXTURES, RUNS, PIPES

The recommended positions of the sanitary fixtures, runs of all piping etc. as shown in the layout drawing will be adhered to as far as possible or as far as practicable.

Should there be any discrepancy or incomplete description, ambiguity or omission in the drawings and other documents, whether original or supplementary forming the Agreement, completion or maintenance of the installation, the Contractor shall immediately on discovering the same, draw the attention of the Engineer to this.

Prior to the installation of all fittings, pumps, traps, etc. The finial position shall be ascertained from the Engineer.

22.19 PROPRIETARY OF MATERIALS

Where proprietary of materials are specified hereafter, the Contractor may propose the use of similar materials of other manufacture but of equal quality for approval by the Engineer. Should the price of alternate materials proposed be lower in price, the Contractor shall a revise schedule of price for the particular item along with his proposal for the use of alternate material in lieu of the one specified.

All materials and goods, where specified to be obtained from a particular manufacturer or supplier, are to be used or fixed strictly in accordance with their instructions.

22.20 PACKAGING

The Contractor is to provide special packaging according to standard practices to project materials or parts of materials from damage, and his rates will be deemed to include for all such protection.

22.21 SPECIFIED MATERIALS

The source of materials stated in the Specifications are those from which materials are generally available. However, materials not conforming Specifications shall be rejected even if they come from the stated sources. The Contractor should satisfy himself that sufficient quantity of material of acceptable Specification is available from the stated or other sources.

22.22 STANDARDS

All materials, Workmanship and components shall where applicable and unless otherwise stated in the Agreement or comply with Indian standard or code of practice in use. The Indian Standards referred to here are:

Indian Standards (I.S.), Published by Bureau of Indian Standard, India.

Should there be any discrepancy or incomplete description, ambiguity or omission in the drawings and other documents; whether original or supplementary forming the Agreement, completion or maintenance of the installation, the Contractor shall immediately on discovering the same draw the attention of the Engineer to this. The Works shall be carried out according to this Specification whether specifically mentioned elsewhere or not. No extra in any form will be paid unless it is definitely stated as it is in the Bill of Quantities. Whenever the Specifications are not given or when the Specification is ambiguous, the relevant Indian standards or British Standards and further amendments will be considered as final and binding.

22.23 QUANTITIES

The Works shall be related to the drawings which the Agreement is presumed to have studied. Nothing extra will be paid for any items because of its shape, locations or other difficult circumstances, even if the schedule makes no distinction, as long as the item is shown in the drawings. The quantities given in this schedule are provisional. The Contractor will be paid for the actual quantity of Works executed as measured at Site and priced at the rates in the schedule. The Engineer reserves the right to increase or decrease any of the quantities or to totally omit any item or Works. Any claim by the Contractor on these accounts will not be entertained.

22.24 EXCAVATION FOR PIPE LINES

In excavating trenches for pipe lines, slight rails shall be erected, before excavation is commenced, at every 100 meters and at all change of direction or gradient. The sight rail shall consist of a board, not less than 10 centimeters deep, with the top edge planed true and straight. This shall be supported by a stout wooden post at each end, and its top edge accurately fixed to a definite and, as far as practicable, uniform height above the level of the pipe to be laid. The centre line of the pipe shall be denoted on each rail thereon, and the rail on one side of the centre line painted rail, and on the other side white. The depth of the excavation and the level of the pipe invert shall be checked by means of boning rods of appropriate length. The boning rods used are to be accurately made to the various lengths required, the lower and being provided with a shoe of sufficient projection to rest on the centre of the invert of the last pipe laid.

The excavation shall be carried out to the lines and levels shown on the plans or as ordered by the Engineer, and shall be deep enough to permit a minimum cover as specified hereunder.

Pipe	Minimum Cover in mm
	Normal Ground
Galvanized Iron	600
CPVC / Multilayer	600
PVC/ DWV	600
RCC Hume	900

The Contractor shall be responsible for and shall at his own cost, make up all subsidence or slips whether arising from its nature of the materials in embankments, from the nature of the ground or from

any cause whatsoever. The Contractor shall, his own expense keep the whole of the Working Site dry and from water and construct such temporary water courses and drain as may be surface of the Works. The Contractor shall include in his rates the cost of providing all tools, machinery and all temporary Works such as staging, struts, shoring, planks and poling boards and their removal on the completion of the Works and the cost of pumping and trenches. Whenever pumping is necessary, the whole Works shall be executed as quickly as possible, due care being taken to avoid excessive pumping, which may cause settlement of surrounding land and property.

Any trench or excavation which may have been taken to a great depth than necessary shall be filled into the required level with suitable material approved by the Engineer and rammed solid with watering at the Contractor's expense.

Special care shall be taken provide a solid even bed for the barrel of the pipe, and the floor of the trench shall be properly shaped to received the socket it and the barrels of the pipes. Where lock is met within the trenches, the excavation shall be taken to a depth of 15 cm of selected filling (approved by the Project Engineer) placed on the rock and consolidated to form a firm even bed for the pipe where required, socket holes shall be cut in the rock. In narrow trenches, socket holes shall be cut in the rock. In narrow trenches, the width of the excavation shall be increased. The sides of trenches shall be allowed a slope not exceeding 1 to 12, the width at the bottom being at least 30 cm wider than the socket of the pipe, so as to allow room for ramming the refilled materials under and at the sides of the pipe.

22.25 RE-FILLING

No refilling shall be carried out until the construction Works has been tested and approved. The re-filling on the top and around the sewers shall be done with great care and in such a manner as will obtain the greatest amount of compactness and solidity possible. For that purpose, the earth shall be laid and rammed in regular layers not more than 230mm (9") thick up to the surface and also watered and rammed at each layer. The top soil shall be carefully replaced to match the existing.

22.26 DISPOSAL OF SURPLUS SOIL

The contractor shall, at his own costs and charges, provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

22.27 TESTING OF PIPES LINES

CPVC Water Supply Pipes

After each section of the pipeline has been laid and jointed and anchorage's built in for the bends, the pipeline shall be tested in lengths of 2 kilometers or less as directed by the Project Engineer, by and at the expense of the Contractor. Before testing, the trench shall be partially backfield except at the joints. The accessories nodded viz. Test pump, pressure gauge, end pieces including connecting valves and piping etc., for carrying cut the hydraulic tests shall be provided by the Contractor's. The Contractor shall provide the supply of necessary labour and water for testing at his expense, the cost of this shall be included in the unit rate for lying and jointing of pipes. The pipes and joints found to be defective during the test shall be replaced and or reduce by the Contractor and the related labour cost be met by the Contractor.

The two tests that shall be carried out are –

(i) Pressure test: a pressure of at least double the maximum Working pressure, pipes and joints shall be absolutely watertight under the test.

(ii) Leakage test (to be conducted after the satisfactory completion of the pressure test) at a pressure to be specified by the Engineer for a duration of two hours. Unless otherwise specified the leakage test pressure shall be the lower or ½ times the maximum static pressure that will be experienced by the pressure after installation.

Where any section of the main is provided with concrete thrust blocks or anchorages, the pressure test shall not be made until at least five days have elapsed after the concrete was caste.

The procedure to be followed are as follows:

Pressure Test:

- Each valved section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrants and blow-offs. If these are not available are not available at high places, necessary tapping may be made at points or highest elevation before the test is made and plugs inserted after the tests have been completed.

- If the trench has been partially back-filled the specified pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the poi in a manner satisfactory to the Engineer. The duration of the test shall not be less than 24 cm.

- All exposed pipes, fittings, valves and joints should be carefully examined. Any cracked or defective pipe, fitting and value discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall to repeat. All joints showing visible leaks shall also be recalled or redone until tight.

(ii) Leakage Test:
- Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure.

The pipe installation will not be accepted until the leakage is less than the number of cm3/h as determined by the formula-

$$q1 = \frac{N\ D\ P}{3.3}$$

Where,

q1 = the allowable leakage in cm^3/h.
N = number of joints in the length of the pipeline.
D = diameter in mm, and
P = the average test pressure during the leakage

22.28 SANITARY AND SEWER PIPES

22.28.1 Gully Traps

Gully traps shall be as per the drawing supplied.

Gully traps shall be fixed in cement concrete 1:5:10 and a brick masonry chamber 300 mm x 300 mm inside in cement mortar 1:5 with 150 mm x 150 mm grating inside and 300 mm x 300 mm CI sealed cover and frame weighing not less than 7.3 kg to be constructed as per standard drawings.

22.28.2 Sewer Drainage and Site Drainage

The work covered under this section comprises of the supply and installation of the following:

a. Night Soil and Waste Water drainage system complete
b. Strom Water drainage system complete

Pipes for these works shall be as follows:
a. Pipes up to OD 110 mm size should be of PVC / DWV Pipe having working pressure of 4.0 and 6.0 kgf per sq cm and carried out as described herein.
b. Pipes over OD 110 mm and up to OD 250 mm should be of PVC / DWV and carried out as described herein.

22.28.3 Manholes and Grease Trap Collection Chambers

Manholes and Chambers shall be constructed as shown in Detail Drawings, and where shown on Site Services layout. Materials shall be of not less than 225 mm Brickwork, cast-in-place concrete, or pre cast concrete. Concrete shall be M: 20 strength. All brickwork shall be plastered in cement, sand (1:2). Gratings, lids and castings in general shall be in Cast Iron in accordance with IS 5961 and built in or fixed as detailed.

All manholes designated to be constructed shall be as specified in the Schedule of Quantities.

All manholes shall be supported on a base of cement concrete of such thickness and mix as given in the Schedule of Quantities or shown on the drawings.

Where not specified, manholes shall be constructed as follows:

Maximum Depth in mm	Internal Dimensions of Manhole Chamber
Up to 450 mm	450 mm x 450 mm
Over 450 mm and Up to 600 mm	600 mm x 600 mm
Over 600 mm and Up to 1200 mm	Dia 900 mm or 900 mm x 900 mm
Over 1200 mm and Up to 3000 mm	Dia 1200 mm or 900 x 1200 mm

All manholes shall be provided with cement concrete benching in 1:2:4 mix. The benching shall have a slope of 100 mm towards the channel. The depth of the channel shall be the full diameter of the pipe. Benching shall be finished with a floating coat of neat cement.

The manhole chamber covers and frames shall comply with the following ratings:

Manhole Cover	Out Side Size of Frame	Inside Size of Frame	Weight in Kg
Light	27" x 27"	24 " x 24" or Ø 500 mm	78.5 kg
Heavy	27" x 27"	24 " x 24" or Ø 600 mm	216 kg

All manholes shall be plastered with 12 mm thick cement mortar 1:3 (1 cement & 3 coarse sand) and finished inside with a floating coat of neat cement. Manholes shall be plastered outside as above cut with rough plaster.

All manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab weight of cover and frame thickness of slab shall be as specified in the Bill of Quantities or given above.

22.28.4 Making Connections

Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connections; contractor shall remove all sewage and water if encountered in making the connection without additional cost.

22.29 SOIL, WASTE, VENT AND RAIN WATER PIPING

22.29.1 Soil, Waste and Vent Pipes

22.29.1.1 Polyvinyl Chloride (PVC) Pipes and Fittings:

All soil, waste, vent and rain water pipes shall be Un-Plasticized Rigid Polyvinyl Chloride (uPVC) pipes unless specified otherwise. All pipes shall be straight and smooth and inside free from irregular bore and other manufacturing defects.

All fittings shall conform to Standard DIN: 19531 or BS: 4514. Fittings shall be of the required degree with or without access door. All access doors shall be made up with rubber gasket, while screw cover to make the fitting air and water tight.

The recommended joints of uPVC pipes shall be solvent cement joints or with rubber ring socket joints. The rubber rings shall confirm to Indian Standard IS: 5382.

22.29.2.2 Storage and Handling

uPVC Pipes: The pipes should be given adequate support at all time. Pipes should be stored in a reasonably flat surface free from stones and sharp projections so that the pipe is supported throughout its length. In storage, pipes racks should provide continuous support and sharp corners of metal racks should be avoided. Socket and spigot pipes should be stacked in layers with socket end placed at

alternate ends of the stacks to avoid top sided stacks. It is recommended not to store pipe inside another pipe.

On no account pipes shall be stored in a stressed or bent condition or near the source of the heat. Pipes should not be stacked more than 1.5 meters high and pipes of different sizes and classes should be stacked separately.

The ends of pipes should be protected from abrasion and particularly those specially prepared for jointing either by spigot or socket solvent cement joints.
If due to unsatisfactory storage of handling a pipe becomes 'kinked' the damaged portion should be cut out completely. 'Kinking' is likely to occur in very thin walled pipes.

22.29.1.3 Jointing of uPVC Pipes

Methods of Jointing:

i) Solvent Cement Joints

The technique is used with spigot and socket type joint, in which the socket is made specially to form a close fit on the pipe end and with injection molded fittings.

Solvent Cement of the pipe manufacturer make shall be used as per the recommendations of the manufactures.

The dust, oil, water grease etc. should be wiped out with dry cloth from the surface to be coated with solvent cement. The coating of solvent cement shall be applied evenly on the inside of the fittings for full length of insertion and then on the outside of the pipe end up to the marked line and the pipe twisted to a quarter of a turn to spread the cement evenly at the same time ensuring the pipe, pushed home fully into the socket. The pipe should be pushed into the rifting socket and held for one to two minutes as otherwise the pipes comes out of the fitting due to slippery quality of cement and the tapering inside bore of the fitting. The surplus cement on the pipe surfaces shall be wiped out. In most of the cases the pipe inserted should be up to the marked line and in no case shall be less than 2/5 of the diameter of the pipe and up to marked line.

When the joint is made, the remaining cement on the pipe surfaces shall be wiped off immediately without fail as the continued action of solvent cement will weaken the wall on the pipe and cause failure under pressure. For warm place in summer month joints shall be made preferably early in the morning or in the evening, when it is cooler and for cold place in winter joints shall be made preferably during the day (sunny) when it is warm.

Since solvent cements are inflammable they should not be used near the naked flames. In certain cases fumes given off from solvent cement may be a source of danger if not carried in a ventilated area.

When not in use, containers of solvent cement should be kept closed tightly to avoid loss of solvent or entry of dirt. Cement, which has gelled or hardened, should be discarded.

ii) Rubber Ring Joints or 'O' Ring Shrink Joints (Shaft Piping)

uPVC pipe and uPVC pipe fittings may be jointed with approved rubber ring to provide the watertight seal. The ring may be housed in groove formed in the socket housing. The rubber is compressed and makes a seal between the pipe and the housing. It is advisable to use uPVC Lubricant for proper sliding of the pipe end to the rubber socket piece.

22.29.1.4 Fixing to Supports

The pipes and specials (fittings) before being laid of fixed shall be examined to see that there are no cracks or defects. The pipes and fittings shall be thoroughly cleaned of all dust and dirt. After laying or fixing the pipes in position they shall be arranged in such a way that centre line of pipes coincide with the centre line of the alignment. Fittings, cleanout and floor drains shall also be laid in their position as stated above uPVC Pipes shall be fixed vertically in shaft by means of uPVC clips anchored to walls using uPVC washers, Galvanized Screws and Plastic dowels. In case of pipes laid horizontally, pipe shall be supported on M.S. Brackets / Hangers of approved design clamped with uPVC Clips.

All pipes laid shall have its open ends securely closed with appropriate plugs during progress of work. Pipes and fittings shall be fixed by using proper approved holder bat clams and special hangers. The pipes shall be fixed perfectly vertical or in a line as directed or as shown in the drawings. The pipes, lay vertically or horizontally shall have the supporting clamps, hangers, Brackets, etc., as per the specification or as directed by the Engineer. uPVC bat clamps holders shall be used to fix all vertical uPVC pipes in truly vertical position. Branch pipes shall be connected to the stack at the same angle as that of the fittings. Each stack shall be terminated at top for vent. Horizontal pipes running below the ceiling shall be fixed on structural with adjustable clamps. Horizontal pipes shall be laid to uniform slope as mentioned in the drawings and the clamps adjusted to the proper levels so that the pipes fully rest on them. As per the site condition, if required or directed by the Engineer, pre-fabricated semi circular (half the diameter of the said pipe) made out of Plain GI Sheet of proper thickness shall be provided below the horizontal running pips along with above-mentioned adjustable clamps.

22.29.1.5 Testing

All uPVC Soil, Waste, Vent, Rain Water (SWR) pipes and uPVC pipe fittings shall be tested by smoke test and left in working order after completion. The smoke test shall be carried out as stated below:

Smoke shall be pumped into the SWR pipes at the lowest level from a smoke machine, which consists of a blower and a burner.

The materials usually brunt are greasy cotton waste which form clear pungent smoke which is easily detectable by sight as well as by smell if leaking at any point of the drain. During testing if any joint is found leaking the same shall be rectified by the Contractor at no extra cost & to the satisfaction of the Engineer-in-charge.

22.29.2 Nahani or Floor Traps

Nahani or floor traps shall be uPVC, deep seal with an effective seal of 50 mm. As per drawing, Waste pipes may be discharged over the trap. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate) and extended 35 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 300 mm x 300 mm and of the required depth.

22.29.3 Cutting and Making Good

Pipes shall be fixed and tested as building work proceeds. Contractor shall provide all necessary sleeves, holes and chases in structural members as building work proceeds. Wherever holes are cut or left originally they shall be made good with cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate) and the surface restored as in original condition. No additional payment shall be made for cutting and making good of holes.

22.30 WASTE PIPES FROM APPLIANCES

22.30.1 Waste Pipes from Appliances

Waste pipe from appliances e.g. wash-basins, shower, bath tub, sinks, drinking fountain, urinals, water closets, etc. shall be of uPVC as given in the Schedule of Quantities or drawings. "Galvanized or Black Wrought Iron Pipes or Pipe Fittings should not be used for Soil Pipes, Waste Pipes, Rain Water Pipes, Anti-Siphon Pipes, Vent Pipes or Drain Pipes from any appliances."
All pipes shall be fixed in gradient towards the out fall drain. Pipes inside a toilet room shall be chased unless otherwise shown on the drawings. Where required pipes may be run at ceiling level in suitable gradient as mentioned in the drawing or directed by the Engineer and supported on structural clamps.

22.30.2 Clean Outs

Clean-outs shall be full pipe size up to 110 mm and a minimum of 110 mm on larger pipe. A clean out shall be installed at, or as close as possible to, the base of every vertical waste, soil and drain stack. A clean out shall be installed at the up-slope of each pipe at which a building drain or branch changes direction by more than 45°.

Clean-outs in horizontal drainage piping shall be at intervals not greater than:

- 15 m where the piping is of dia 100 mm and smaller.
- 30 m where the piping is of large than dia 100 mm.
- 6 m where waste pipes are horizontally connected to sinks.

Nickel Bronze or Stainless Steel Floor Plates with Frames shall be installed on finished floors for access to clean-outs. Clean-outs on horizontal lines in finished areas shall be as per IS specifications.

22.31 WATER SUPPLY

22.31.1 Pipe Line

All Water Supply Pipe Line shall be as mentioned in the drawings and Bill of quantities. The Pipes will be:

22.31.2 Chlorinated Polyvinyl Chloride (CPVC) Pipe & Fittings

Chlorinated Polyvinyl Chloride (CPVC) Tubes / Pipes of Class 11 in Copper Tube Size (CTS) dimensions conforming to ASTM: D 2846 of approved brand. Pipe Fittings shall be of Chlorinated Polyvinyl Chloride (CPVC) of Class 11 in Copper Tube Size (CTS) dimensions conforming to ASTM: D 2846 of approved brand. The Pipe Fittings are Couplings, Elbows, Bends, Tees, Transition Coupling, Transition Bushings, etc. Manufacturer's Trademark should be stamped on the CPVC Pipe Fittings.

CPVC Pipe and CPVC Pipe Fittings shall have cold weld joints by CPVC Solvent cement confirming to ASTM: 493. After cutting the pipe, care shall be taken to remove burr from the end of the pipe with appropriate tools. Only with TEFLON tape, threaded Fixtures shall be fitted with CPVC Threaded Adopters.

22.31.3 Laying

All Pipes and fittings shall be of class specified in BILL OF QUANTITIES manufactured under respective Standards.

All main supply pipes and other pipes to be laid under the ground shall be laid over a minimum of 600 mm sand bedding or selected granular material compacted as described herein this specification.

The water main shall be laid and maintained to the required lines and grades with fittings, valves, and connections at the required locations and all valves and stems plumb.

Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient performance for the work.

All pipes, valves and fittings shall be carefully lowered into the trench piece by piece by hand ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings.

Under no circumstances shall water main materials be dropped or dumped into the trench.

Valves, valve covers, meters, tapping sleeves and other accessories shall be installed as per the manufacturer's recommendations and in conjunctions and compliance with the requirements of the Local Government or Public Service Authority specifications.

It will be the responsibility of the Contractor to furnish and install all proper size pipe bends for both horizontal and vertical deflections that are required to construct the water main to the line and grade as shown and specified.

22.31.4 Jointing

The jointing shall be made in accordance with the instructions of the pipe and fitting manufactures. The pressure pipe shall be tested to a minimum of 10 kg / sq. cm. pressure. The setting and arrangement of pipes shall be as per the working drawings. Pipes are cut to size and ends are squared.

The pipes and fittings shall be inspected at the site before use. Where the pipes have to be cut, the end shall be carefully plugged so that no obstruction to bore is effected.

The pipe shall be cleaned and cleared of all foreign matters before being laid. For joining, the out side of pipe and the inside of the socket shall be cleaned. Care should be taken that all pipes and fittings are properly joined so as to make the joints completely watertight.

After lying, the open ends of the pipe shall be temporarily plugged to prevent access of water, soil or any other foreign materials. Jointing of pipes shall be made according to the different kind of pipes by thread screwing, cold welding, flanges, or flexible joints etc. Joints between dissimilar materials, e.g. copper shall be by means of copper-alloy unions or union ferrules, etc.

Care shall be taken to ensure that all piping and fittings are clean internally and free from particles of sand, soil, metal, plastic, filings and chips, etc.

22.31.5 Clamps

All pipes laid shall have its open ends securely closed with appropriate plugs during progress of work. Pipes and pipe fittings shall be fixed by using proper approved holder bat clams and special hangers. The pipes shall be fixed perfectly vertical or in a line as directed or as shown in the drawings. The pipes laid vertically shall have supporting, the clamps at 1.5 meters centre to centre and the pipes laid horizontally, the clamps at every 1.2 meters centre to centre as shown in the Drawing or as directed by the Engineer. MS bat clamps holders shall be used to fix all vertical pipes in truly vertical position. Horizontal pipes running below the ceiling shall be fixed on structural with adjustable clamps. Horizontal pipes shall be laid to uniform slope as mentioned in the drawings and the clamps adjusted to the proper levels so that the pipes fully rest on them. As per the site condition, if required or directed by the Engineer, pre-fabricated semi circular (half the diameter of the said pipe) made out of Plain GI Sheet of proper thickness shall be provided below the horizontal running pips along with above-mentioned adjustable clamps. No Iron hooks shall anchor pipes in wall chases.

22.31.6 Testing Water Service Lines

The water service lines shall be hydrostatically tested. Test pressure shall be 10 kg / sq. cm. and the pipes shall be tested for the specified pressure for 24 hours. Defective pipes, pipe fittings and pipe joints shall be replaced or repaired immediately and retested.

22.31.7 Unions

Adequate number of unions shall be provided on all pipelines to enable to dismantle later. Unions shall be provided near each valve, stopcock, and check valve.

22.31.8 Shut-Off Valve

Gate Valves or Ball Valves shall be heavy gunmetal full way type conforming to IS: 778 (Class: II). Valves shall be tested at manufacturer's works to 21 kg / sq. meter and shall have manufacturer's name stamped on it.

22.31.9 Check (Non Return) Valves

Check Valves / Non Return Valves shall be heavy gunmetal Swing Type conforming to IS: 778 (Class: II). Valves shall be tested at manufacturer's works to 21 kg / sq. meter and shall have manufacturer's name stamped on it.

The Engineer or Site In-charge shall approve all valves before installation work. up to 65 mm and small shall be gunmetal

22.31.10 Isolating Valves

Isolating valves shall be provided on all branch lines to enable isolation of groups of fixtures and sections of building and as shown on drawings.

22.31.11 Drain Points

Drain valves shall be installed in all liquid carrying systems at the low points to facilitate complete drainage of the system.

22.31.12 Hose Bibs

Hose bibs in the building shall be cast brasses with a leather disc, screwed pipe end, 20 mm pipe hose tread. Hose bibs in finished areas shall be chromium plated.

22.31.13 Insulation

All internal and external Hot and Cold water supply pipes shall be insulated using closed cell elastometric nitrile rubber foam. Working temperature of the tube shall be -50°C up to +105°C and the thickness shall be 19mm.

22.32 EXTERNAL WATER SUPPLY

22.32.1 Pipes

All pipes lay outside of the building and generally underground shall be considered as External Water Supply. The types of Pipe and Pipe Fittings shall be as per drawings and / or as mentioned in the Bill of Quantities. The installation of pipe line shall be properly carried out and should be completely watertight. All fixtures and fittings shall be properly installed and checked against leaks at designated pressure. Necessary Pipe Sleeves in the wall, floor, etc should be provided as per the specification.

22.32.2 Excavation

Generally, external water mains pipe shall be laid a minimum of 600 mm below ground level. Excavation for trenches shall be done as specified elsewhere, but the depth of the trenches shall be as follow

Size of Pipe	Width of Trench	Depth of Trench
For dia 15 mm to 50 mm	300 mm	750 mm
For 65 mm to 100 mm	450 mm	1000 mm

22.32.3 Backfilling

Backfilling of trenches shall not commence until the pipes therein have been tested and approved by the Engineer. Under non-paved areas selected excavated materials free from large stones refuse, or organic material as approved by the Engineer or Site In-charge shall do the backfill.

22.33 INTERNAL WATER SUPPLY

22.33.1 Pipes

All pipes inside the building from Over Head Tank to the Toilets and where specified, shall be considered as Internal Water Supply Pipe Line. The types of Pipe and Pipe Fittings shall be as per drawings and / or as mentioned in the Bill of Quantities. The installation of pipe line shall be properly carried out and should be completely watertight. All fixtures and fittings shall be properly installed and checked against leaks at designated pressure. Expansion of hot water pipes shall be compensated for by flexible piping layouts and / or by utilizing bends in pipe line. Necessary Pipe Sleeves in the wall, floor, etc as well as pipe supports, clamps, brackets, etc should be provided as per the specification and instruction of the Engineer.

22.33.2 Pipe Supports and Hangers

The pipes and pipefitting before being laid to fixed shall be examined to see that there are no cracks or defects. The pipes and fittings shall be thoroughly cleaned of all dust and dirt. After laying or fixing the pipes in position they shall be arranged in such a way that centre line of pipes coincide with the centre line of the alignment. Fittings, Valves, etc., shall also be laid in their position as stated above. CPVC Pipes shall be fixed by push fit before any solvent cement is applied and when cleared by the Engineer then only permanent joints to be made. All the horizontal and vertical run pipes should be supported to walls with the help of GI/MS Pipe Clamps that should be anchored by Galvanized Screws and Plastic dowels. In case of pipes laid horizontally under ceiling, pipe shall be supported on M.S. Brackets / Hangers of approved design.

SPACING FOR SUPPORTS & HANGERS OF FIXING FOR INTERNAL PIPING

Kind of Pipe	Size of Pipe Line	Interval for Pipe Supports for Horizontal Run Pipe Line	Interval for Pipe Supports for Vertical Run Pipe Line
CPVC / PVC Pipe Line for Water Supply	15 mm/ ½ "	1.25 m	1.25 m
	20 mm / ¾"	1.50 m	1.50 m
	25 mm / 1"	1.50 m	1.50 m
	32 mm / 1¼"	1.75 m	1.75 m
	40 mm / 1½"	1.75 m	1.75 m
	50 mm / 2"	2.00 m	2.00 m
uPVC Pipe Line for Soil, Waste & Rain Water	OD 50 mm	1.50 m	2.00 m
	OD 75 mm	2.00 m	2.50 m
	OD 110 mm	2.00 m	3.00 m
	OD 160 mm	2.50 m	3.00 m

22.33.3 Method of Measurement

GI, CPVC, MS Pipe Line above ground or under ground shall be measured per running meter or running feet and the rate shall be inclusive of all fittings including unions, Hangers, Brackets, Clamps, Pipe Sleeves, cutting chases etc on wall, ceiling, floor and making good the same and testing of pipes and fittings, making good.

Pipes below ground shall be measured per running meter or running feet and the rate shall be inclusive of all fittings and testing of pipes and fittings except the excavation for trenches, refilling and disposal of surplus earth.

Other Fixtures such as Gunmetal valves, non return valves, ball cocks, foot valves, stop cocks, bib cocks, etc., shall be measured by number.

22.33.4 Bathroom Fixtures and Fittings

22.33.4.1 Bathroom Fixtures

All bathroom fixtures, Ceramic and CP fittings shall be supplied free of cost by the Owners at site Store, Contractor shall make his own arrangement at his cost to check, take delivery, store, install in position including transportation to site of work. No allowances shall be made for theft, breakage and defective materials after taking delivery of the materials.

22.33.4.2 Installation of Fixtures

The fixtures and fittings shall be provided with all such accessories as are required to complete the item in satisfactory working conditions, whether specifically mentioned or not in the Schedule of Quantities, Specifications and Drawings.

The Bathroom fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Engineer in-charge/Engineer or Site In-charge/Owners, and shall fully meet with the esthetic and symmetrical requirements as demanded by the Engineer In-charge / Engineer or Site In-charge / Owner.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Engineer-in-charger's requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Skilled workman shall install fixtures with appropriate tools according to the best trade practice. Manufacturer's instructions shall be followed for the installation of fixtures. Fixtures in all toilets shall be standard height, mounting as called for on the drawings. Fixtures shall be mounted rigid, plumb and true to alignment.

22.33.4.3 Mock Up and Trail Assembly

The installation of the bathroom fixtures and fittings shall be as per the shop drawings approved by the Engineer-in charge.

The contractor shall assemble on trial basis at least one set of each type of bathroom fixture and fittings in order to determine precisely the required supply and disposal connection. Relevant instructions from

manufacturers shall be followed as applicable. This trial assembly shall be developed to facilitate determining the location of punctures, holes, holding devices etc. that will be required for final installation in position of all bathroom fixtures and fittings. The above assembly shall be subject to final approval by the Engineer-in charge / Engineer or Site In-charge / Owner.

The fixtures in the trial assembly can be reused for final installation without any additional payments for fixing or dismantling of the fixtures.

22.33.4.4 Supporting and Fixing Devices

The contractor at his own cost shall where required, provide all fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly look in the final assembly. These shall be installed complete with appropriate washers and gaskets, jointing Materials and Screws etc. as per manufacture manuals.

22.33.4.5 Final Installation

The contractor at his own cost shall install all bathroom fixtures and fittings in their final position in accordance with approved trail assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between built-in piping system and the bathroom fixtures shall be through proper couplings, unions and flanges to facilitate removal / replacement of bathroom fixtures without disturbing the built in piping system. All couplings, unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and true to alignment. The outlets of water closet bowls and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be arranged as to give visible warning and discharge. A check shall be made to ensure that necessary anchoring devices have been provided for supporting Water Closets, Wash Basins, Sinks and other appliances.

22.33.4.6 Protection against Damage and Theft

The contractor shall take every precaution to protect all bathroom fixtures and fittings issued to them against damage, misuse, crazing, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion and handing over of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all fixtures and fittings. Any fixtures and fittings found damaged, cracked, chipped, stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

22.33.4.7 Testing

All fixtures and fittings shall be tested for their proper performance by the Contractor thoroughly to satisfy himself that they are in order, before applying for virtual completion.

22.34 MISCELLANEOUS WORK

Disinfecting the Piping System

Before commissioning the water supply system the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure through mixing. Sufficient chemical shall be used to give the water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 gms of powder to 1'000 litres of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used the proportions shall be as specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes opened successively working progressively away from storage tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and

pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purposes.

Safety Code

- First aid appliance shall be maintained in a readily accessible place including adequate supply of sterilized dressings and cotton wool.
- An injured person shall be taken on a public hospital without loss of time, in cases where the injury necessitates hospitalization.
- Suitable and strong scaffolds should be provided for all works that cannot safely be done from ground.
- No portable single ladder shall be over 8 meters in length. The width between the side rails shall not be less than 30 cm (clear) and the distance between two adjacent runs shall not be more than 30 cms. When a ladder is used an extra labor shall be engaged for holding the ladder.
- The excavated materials shall not be placed within 1.5 meters of the edge of the trench or half of the depth of trenches whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.
- Every opening in the floor of a building or in working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one meter.
- No floor, roof or other part of the structure shall be over loaded with debris or materials as to render it unsafe.
- Workers employed on mixing and handling materials such asphalt, cement mortar or concrete and lime mortar shall be provided with protective foot wear and rubber hand gloves.
- Those engaged in welding works shall be provided with welder's protective eye-shields and gloves.
- No paint containing lead or lead products shall be used.
- Suitable facemasks should be provided to the workers when the paint is applied in the form of spray or surface having lead paint dry rubbed and scraped.
- The Contractor to the painter shall supply overalls and adequate facilities shall be provided to enable the working painters to wash during the periods of cessation of work.
- Hoisting machines and tackle used in the works, including their attachments, anchorage and supports shall be in perfect condition.
- The ropes use in hoisting or lowering material or as means of suspension shall be of durable quality and adequate strength and free from defects.

22.35 SANITARY FIXTURES AND ACCESSORIES

All sanitary wares and fittings shall be first class quality white glazed vitreous china ceramic and approved by the Engineer.

22.35.1 Water Closet (W.C.)

(a) European pattern W.C. commode and flushing cistern.

These shall be of white glazed vitreous china first class quality, double or single trap syphonic water closet suite as specified in the Bill of Quantities, P or S Trap, with attached ceramic flushing cistern as specified conforming to ISO or Indian standard Specification. The commode and flushing cistern shall be free from cracks, blisters and shall have smooth surface.

Fixing :- W.C. commode shall be fixed to floor with CP brass screws or by means of 75mm long 6.5mm dia counter sunk bolts and nuts imbedded in concrete or as per the instruction of the Project Engineer. The base of pedestal of the commode shall be filled with white cement mixed with pigment to match the shade of floor or as directed by the Engineer. Following measure shall be adopted for fixing the W.C. commode

1. The central axis of the commode shall be perpendicular to the finished face of wall.
2. The outlet of the commode shall be centrally placed in the rubber gasket of the PVC pipe as per drawing or as directed by the Engineer and shall have not leakage.
3. The distance between centre line of outlet of W.C. commode and finished wall face shall be so adjusted as to rest squarely against the finished wall face.
4. Seat and lid shall be of ISI marked solid of heavy duty quality and fitted exactly on the rim of the W.C. Commode with C.P. brass hinges, rubber buffers and C.P. brass nuts.

Method of Measurement
Measurement for the European Water Closet will be made per unit set of complete installation.

22.35.2 Wash Basins

These shall be white glazed vitreous china of first class quality with single tap hole as specified in the Bill of Quantities. These shall be free from cracks, crazes, blister and shall have smooth surface.

Fixing: The basin shall be supported on brackets as per manufacturer's instructions. The basin shall be under-counter or wall hung type. There shall not be any gap between top edge of the basin and finished face of wall.

22.35.3 C.P. Pillar Cock:

This shall be 15 mm size of C.P. brass central hole cock with fancy knob head.

Method of Measurement
Measurement for the Hand Wash basin will be made per unit set of complete installation.

22.35.4 Urinals

These shall be white glazed vitreous china of first class quality flat back type. The urinals shall be free from cracks, blisters and shall have smooth surface.

Fixing : Urinals shall be fixed on the wall with the help of C.P. brass screws as per the manufacturer's instructions and/or directed by the Engineer. There shall not be any gap between the back edge of the urinal and finished face of the wall. Urinal shall be battery operated sensor type.

Method of Measurement
Measurement for the Urinal will be made per unit set of complete installation.

22.35.5 Water Tanks

Water tank shall be of HDPE extra heavy type as shown on the drawing and specified in the Bill of Quantities. Tank shall be supplied with manhole covers and locking arrangement as per drawing or as directed by the Engineer.

Water tank shall provide inlets, outlets, scour and overflow pipes, sockets for float level switches and inter connections if required. Overflow pipes shall be provided with a mosquito proof brass grating. Scour pipe of size as specified by the Engineer shall be provided with a bend and pipe piece and plug terminating outside the tank wall.

Ball cocks used for tanks shall be high pressure ball cocks with brass lever rods and polythene ball floats. The ball floats shall conform to Indian standard which shall be hammer tested.

Water tank shall be fixed in position as shown on drawing or as directed by the Engineer.
Method of Measurement
Measurement for the Water tank will be made per unit set of complete installation.

22.35.6 Toilet paper holder

Toilet paper holder shall be of CP as per BILL OF QUANTITIES. It shall be fixed in wall in a neat Workmanlike manner. Recess in walls, where required, shall be provided. It shall be fix with C.P. brass screws, where required.

Method of Measurement
Measurement for the Toilet Paper Holder will be made per unit set of complete installation.

22.35.7 Soap tray or soap dish

Soap tray or soap dish shall be CP as per BILL OF QUANTITIES. Soap tray shall be fixed in wall in a neat Workmanlike manner. Recess in walls, where required, shall be provided. It shall be fixed with C.P. brass screws, where required.

Method of Measurement
Measurement for the Soap Dish will be made per unit set of complete installation.

22.35.8 Towel Rod

Towel rod shall be heavy type of C.P. brass with two brackets. The size of the rod shall be as specified on the drawing or Bill of Quantities. The brackets shall be firmly fastened by means of C.P. brass screws firmly embedded in the wall.

Method of Measurement
Measurement for the Towel Rod will be made per unit set of complete installation.

22.35.9 Mirror

Mirrors shall be of approved make 5mm thick. All edged shall be rounded off. Mirrors shall be fixed to wall with brass chromium plated screws and washers. Mirrors shall be of beveled edge of sizes as specified in the Bill of Quantities.

Method of Measurement
Measurement for the Mirror will be made per unit set of complete installation as per size.

22.35.10 C.P. Grating

Floor and urinal traps shall be provided with chromium plated grating, with rim of approved design and shape. Minimum thickness shall be 3mm.

Method of Measurement
Measurement for the CP Grating will be made per unit set of complete installation.

22.35.11 C.P. Fittings

All C.P. fittings, additional bib cocks, cockroach trap etc. shall be of the best quality heavy pattern of approved make. All C.P. fittings shall be fixed in a Works man like manner and shall not carry tool marks and scratches.

Method of Measurement
No Measurement will be made for CP fittings except for the additional items in Bill of Quantities. All CP fittings are presumed to be installed with sanitaryware requirement. Measurement will be made for Additional CP fittings as per Bill of Quantities item per unit of installation.

MAKE OF EQUIPMENT AND APPROVED MANUFACTURES

.1	G. I. / M. S. Pipes	a.	Indian Tube Co. (TATA)
		b.	Jindal (Hissar)
2.	G. I. Fittings	a.	UNIK or R or C Brand
3.	Gate / Globe / Butterfly	a.	Leader
		b.	Zolotto
4.	Sanitaryware	a.	Duravit
		b.	Kohler
		c.	Cotto
5.	C. P. Fitting and accesories	a.	Grohe
		b.	Hansgrohe
		c.	Viking
		d.	Schell
6.	Mirror	a.	Modi Float
		b.	Asahi Float
7.	CPVC Pipes and Fittings	a.	Marvel
		b.	Mangalam
		c.	Hilltake

8. Water Pumps	a.	Grundfos
	b.	Wilo
	c.	KSB
9. uPVC Pipes and Fittings	a.	Hilltake
	b.	Mangalam
	d.	Marvel
	e.	Nepatop or Equivalent
10. Plastic Roof Tank	a.	Mangalam
	b.	Nepatop
	c.	Hilltake or equivalent

23. FIRE FIGHTING SYSTEM

23.1 GENERAL

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser fire hydrant system as required by the drawings and specified hereinafter or given in this Bill of Quantities.

Without restricting to the generality of the foregoing, the fire hydrant system shall include the following:

IS 1239 Mild Steel Pipe (Heavy Grade) including valves, hydrants and appurtenances as given in BOQ.

Landing valves of 63 mm diameter, canvas hose pipes, hose reels, hose cabinets for external Hydrant, 63 mm diameter fire brigade connections for draw out and inlet, connections to pumps, appliances and pressure reducing devices, 20mm diameter gunmetal nozzle for hose reel.

23.2 REFERENCE DOCUMENT

The work specified in this section shall be in accordance with the following standards, or approved equal, except as they are modified and supplemented herein:

- NFPA -14 Standard for the installation of Stand Pipe and Hose system
- NFPA -20 Installation of Centrifugal Fire Pump
- NBC 208:2003 Nepal National Building Code
  - 4 Fire fighting Provision
  - Hydrant System

23.3 RELATED WORK

The Contractor shall become familiar with other Divisions of the specifications affecting work of this trade.

23.4 SAMPLES/SUBMITTALS

Representative samples of MS Pipe and fittings, Valves, Fire Hose Cabinet, Hydrant Pipe, Hose Reel, Nozzle, Fire Extinguisher etc to be submitted for approval. All pumps and its accessories to be used shall be submitted to the Engineer and his approval taken before bulk purchase. The samples shall be kept with the Engineer for future reference and comparison. All fire items supplied shall conform to these approved samples in all respects.

All fire protection items shall have to be approved by the Engineer. Any fire items not up to the specification must be removed from the site immediately at Contractor's own cost

23.5 SHOP DRAWINGS

The contractor shall submit to the Engineer all shop drawings or diagrams necessary in order to make clear the work intended or to show its relation to adjacent work of other trades.

The contractor shall make any changes in such drawings or diagrams, which the Engineer may require, consistent with the contract.
Details of shop drawings submitted for approval shall show clearly the relations of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements; such measurements shall be made by the contractor and noted on the drawings before being submitted for approval.

23.6 AS BUILT DRAWINGS

Three months prior to the end of the Defects Liability Period, the Contractor shall submit As Built Drawings based on AUTOCAD printout and corresponding digital files as per Division 1 – General Requirements.

23.7 MAINTENANCE MANUAL

The Contractor shall submit a draft outline of the proposed format and contents within 30 days after the issuance of the virtual completion certificate by the Engineer. The submitted manual will conform to the approved outline.

The Manual shall be contained in a black three ring loose-leaf binder and be subdivided into sections according to the various divisions of this specification. Material shall be fully indexed, with a typed contents page located at the front of the Manual. Tabbed sheets shall be used to subdivide the contents as required. All material shall be neatly and legibly presented. Photocopies will be used only if original documents are not available.

All materials shall be clearly labeled according to manufacturer, manufacturer's reference, source, location of use, and quantity.

Include in the Maintenance Manual a list of all materials submitted indicating quantities, source, manufacturer, manufacturer's reference(s), and location of use. Also include printed manufacturer or supplier's instructions on use, application, and maintenance of all products and materials.

23.8 MATERIALS

23.8.1 General Requirements

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Engineers.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.

Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

23.9 INTERNAL & EXTERNAL FIRE HYDRANT SYSTEM

23.9.1 SCOPE

Work under Fire Hydrant System shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser and fire hydrant system as required by the drawings and specified hereinafter or given in the Bill of Quantities.

All fire mains and branches should be exposed everywhere with necessary pipe truss, supports, hangers, clamps etc.

23.9.2 PIPES AND FITTINGS

All pipes within the building in exposed locations and shafts including connections shall be welded joints as specified by the Engineer.

Pipes shall be given one primary coat of red oxide paint and two or more coats of synthetic enamel paint to give an even look (fire red, shade No. 536 as per IS: 5).

All fittings such as bends, tees, etc. shall be fabricated using the same MS pipe material and as per the site conditions and requirement.

Pipes shall be provided with electrical resistance welding. Jointing shall be butt welded between pipe and pipe and fittings.

Joints between Steel and M.S. pipes shall be made by provided a suitable flanged tail or sockets piece and Steel flanges on the M.S. pipe shall have appropriate number of holes and shall be fastened with nuts, bolts and 1.5mm thick compressed asbestos gaskets.

All equipment and valve connections shall be through flanges (Welded or screwed for Steel).

All welded piping is subjected to the approval of the Engineers and sufficient number of flanges and unions shall be provided.

23.9.2.1 PIPING INSTALLATION

Tender drawings indicate schematically the size and location of pipes. The Contractor on the award of the work, shall prepare detailed working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain valves and all pipe support, structural supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass. Drawings to be got approved from Local Fire Authorities.

Contractor shall submit the Hydraulic calculation for the system in accordance with Fire Authority by-laws.

Piping shall be properly supported on or suspended from stand clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers, and be responsible for their structural sufficiency.

Pipe supports shall be of Mild steel, adjustable for height and primer coated with rust preventive paint and finish coated back. Where pipe and clamps are of dissimilar materials a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe Size	Spacing between Supports
25 mm	3.65 meters (12'-0")
32 to 150 mm	4.57 meters (15'-0")

Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the roof floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the lowest point and air vent at the highest point. The Contractor shall coordinate with structural.

Pipe sleeves, 50 mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and angular space filled with fire proof materials like putty, fire seal etc.

Piping work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation and coordination with other agencies work so that particular area work shall be carried out in one stretch.

Piping layout shall take due care for expansion and contraction in pipes.

23.9.3 WELDED JOINTS

In general, the pipe work for Fire Fighting System shall have welded joints. However, other jointing methods may be adopted at places where required so far for certain specific considerations.

The welding of pipes in the field should comply with IS:816, 1969. Electrodes used for welding should comply with IS:814, 1991.

Joints between pipes and fittings shall be made with pipes and fittings having "V' groove and welded with electrical resistance welding in an approved manner. Butt welded joints shall not be acceptable. Care shall be taken to remove any burr from the end of the pipe after cutting.

All welders must be fully qualified and proof of an operator's qualification shall be either the Contractor's record of suitable tests passed within the previous six months or tests made before the commencement of the work.

The Contractor must submit to the Engineer the names of the welders who will be employed on the work, together with documentary evidence of their competency.

Any welder considered by the Engineer as not having the skill necessary for the work will at once be barred from further welding on the site or in the Contractor's workshop.

The Engineer may instruct the Contractor to cut out typical welded joints for inspection and the Contractor shall include for the removal of such pieces and re-making joints to the satisfaction of the Owner. The Contractor shall include in his Tender for the cost of removing all such pieces for inspection and re-making joints.

Care must be exercised by the Contractor to ensure that the welding flux does not project into the bore of the tube. All welds shall be good, clean metal, free from slag inclusions and porosity, of even thickness and regular contour, well fused with the parent metal and finished smooth.

Where site welding is carried out in proximity to inflammable materials, the Contractor must take special precautions to protect the materials from risks of fire.

23.9.3.1 TESTING OF WELDED JOINTS

The welded joints shall be tested in accordance with procedure laid down in IS: 3600 (Part I). One test specimen taken from at least one field joint out of any 10 shall be subjected to test.

If the results of the tensile test do not conform to the requirements specified, retests of two additional specimens from the same section shall be made, each of which shall conform to the required specifications. In case of failure of one or two, extensive gouging (scooping out) and repairing shall be carried out as directed by the authority.

If internal pressures exceed 1.5 Mpa (15kgf/cm2), special attention should be given to the assembly of the pipe and the first run of weld. Non-destructive testing of the completed weld may be carried out on pipelines by radiographic (see IS: 4853) or ultrasonic method (see IS: 4260) as agreed upon between the Owner and the Contractor.

23.9.4 FLANGED JOINT

Flanges shall be as per the relevant Indian Standard and shall be faced. Rubber or asbestos gasket shall be inserted between the joints.

Flange shall be provided on:

a. Straight runs not exceeding 12-15 m on pipelines 80 mm dia and above or as indicated in the drawing.
b. Both ends of any fabricated fittings e.g. bends, tees etc. of 65 mm or larger diameter.
c. For jointing all type of valve, appurtenances, pumps, connection with other type of pipes, to water tanks and other places necessary and required as per good for engineering practice.

23.9.5 VALVES:

23.9.5.1 Gate Valves:

Gate valves shall be provided as required or as shown in the applicable shop drawings conforming to the following specifications:

Gate valves shall conform to I.S:778-1971, Class - I, Flanges to BS 4504-PN6, PN10, PN16 or as required. Valves shall have non-rising spindles unless otherwise specified and shall be suitable for 21 Kg/Sq.cm test pressure.

23.9.5.2 Check valves:

Check valves shall be provided as required or as shown on the drawings and conform to BS EN 558-1. The valves shall comply with following specifications:

Test Pressure	:	21 Kg/ cm^2
Body	:	Ductile Iron, GG40
Disc	:	AISI 316/Ductile Iron with Nickel Plate
Resilient Seat	:	EPDM
Hinge pin	:	AISI 316
Spring	:	AISI 304
Retainer Screw	:	Carbon steel
Disc Bearing	:	Teflon
Operating Pressure	:	232 PSI
Flanges standard	:	DIN PN10/16

23.9.5.3 Butterfly Valves:

All the isolation valve 50cm and above on the equipment and water lines, where specified or shown on drawings shall be BL-A LUG type butterfly valves. They shall be designed for installation between flanges drilled in accordance with American Standard and with the hand lever operation. The Valve's liner and Disc are replaceable and available in various materials for media compatibles. The valves shall comply with BS: 5155 or IS:13095.

Test Pressure	:	21kg/sq cm
Body	:	Ductile Iron, GG40
Disc	:	AISI 316/Ductile Iron with Nickel Plate
Liner	:	EPDM
Hand Lever	:	American Standard
Temperature	:	266 Degree F (max.)
Operating Pressure	:	232 PSI
Flanges standard	:	ANSI 150 LBS

Installation:
Valve shall be installed in a manner that allows future removal and service of the valve. Packing and gasket shall not contain asbestos. The valve shall be of the same size as the pipe to which they are

installing. Valve above 150mm diameter shall be self locking warm gear type water proof and proctor lubricated.

23.9.5.4 PRESSURE GAUGES

Pressure gauge shall be not less than 100 mm dia dial and of appropriate range and be complete with shut off gauge valve etc. duly calibrated before installation.

Pressure gauge shall be provided at the following locations and as indicated on the drawings and Bill of Quantities. Care shall be taken to protect pressure gauges during pressure testing.

23.9.5.5 LANDING VALVE

Contractor shall provide on each locations as shown on the drawings one double headed gunmetal landing valve with 63 mm dia outlets and 80mm inlet (BS 5041 Part -1) with individual shut off valves and cast iron wheels. Landing valves shall have flanged inlet and instantaneous type outlet as shown on the drawings.

Instantaneous outlets for fire hydrants shall be standard pattern approved and suitable for fire brigade hoses.

Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia, 15 meter long rubberized fabric lined hose pipes with gunmetal male and female instantaneous type coupling machine wound with GI wire (Hose to BS 5041 Part -1) Multipurpose Nozzle with instantaneous branch pipe with fire hose reel, gunmetal branch pipe with nozzle.

Each hose box shall be conspicuously painted with the letters “FIRE HOSE”.

23.10 FIRE HOSE REELS

Contractor shall provide standard fire hose reels with 20mm dia, high pressure rubber hose of 36 meters length with gunmetal nozzle with 5mm bore, and control valve, connected wall mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall conform to BS 5274. The hose reel shall be connected directly to the pipe riser through an independent connection.

23.10.1 ORIFICE FLANGES

Provide orifice flanges fabricated from 6mm thick stainless steel plate to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 Kg/m^2. The design of the orifice flanges shall be given by the Contractor as per the location and pressure conditions of each hydrants/hose reel and get approved from Engineer before installation.

23.10.2 FIRE HOSE CABINETS

Provide hose cabinets for all hydrants fabricated from 1.5 mm CRCA MS sheet with single or double glass front door and locking arrangement with breakable glass key access arrangement, duly painted fire red with Powered Coated paint fixed to wall or self supported on floor as per site conditions. The cabinet shall also have a separate chamber to keep the key with breakable glass as per approved design. Hose cabinets shall be Powder Coated fire red paint with “FIRE HOSE” written on it prominently. Samples of hose cabinet for internal and external works be got approved from Engineer before installation at site.

Indoor type Fire hose cabinet suitable to accommodate 1 No. landing valve, 2 Nos. 15 meters long hoses, 1 No. first aid reel, 2 Nos. branch pipe and 1 Nos. fire extinguishers or as given in BOQ.

Outdoor type Fire hose cabinet suitable to accommodate 2 Nos. 15 meters long hoses and 1 Nos. branch or as given in BOQ.

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23.10.3 AIR RELEASE VALVES

Provide 25mm dia, screwed inlet spring type single acting brass air valve on all high points in the system or as shown on drawings on top of air cushion tanks. Air release shall conform to BS Standard.

23.10.4 SLUICE VALVES

Sluice valves shall be cast iron double flanged solid wedge, outside screw, non rising stem, yoke type bonnet and two piece gland construction. The valves shall have renewable screwed body seat rings. Flanges shall have raised faces and serrated face finish and shall conform to IS: 909.

Installation:
Valve shall be installed in a manner that allows future removal and service of the valve.

Packing and gasket shall not contain asbestos. The valve shall be of the same size as the pipe to which they are installing. Valve above 150mm diameter shall be self locking warm gear type water proof and proctor lubricated. Provide chain operators w/chain cleats on all valves more than 2.4 meters above floor.

23.11 FIRE BRIGADE CONNECTIONS

The Contractor shall provide gun-metal 4 way Fire Brigade collecting head with 63 mm dia instantaneous type inlets with built in check valves and 150 mm dia flanged outlet connection.

23.11.1 TESTING

All piping shall be tested to hydrostatic test pressure of 15 Kg/Sq.cm or twice the design pressure whichever is higher for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Client's Representative.

Piping required subsequent to the above pressure test shall be re-tested in the same manner.

System may be tested in sections and such sections shall be securely capped.

The Engineer shall be notified well in advance by the Contractor of his intention to test a section of piping and all testing shall be witnessed by the Engineer's Representative.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the system concerned. If proper circulation is not achieved due to air bound connections, the Contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification including the tarring-up and re-finishing of floors, walls etc. as required.

The Contractor shall provide all materials, tools, equipment, instruments, services and labour required to perform the test, and shall ensure that the plant room and other areas are cleaned up and spill over water is removed.

The Contractor shall give the pressure test of head for external yard hydrant at ground level

23.11.2 PAINTING

All pipes in exposed locations shall be painted with one coat of approved red oxide primer and two or more coats of approved synthetic enamel paint of approved shade after the Hydrostatic test pressure of the external and internal hydrant piping network.

23.11.3 MEASUREMENT

Mild steel pipes shall be measured per linear meter of the finished length and shall include all fittings, welding, jointing and testing.

Butterfly valves with orifice flanges, check valves and full way valves shall be measured by numbers and shall include all items necessary and required for fixing and as given in the Specifications/Bill of Quantities.

Landing valves, hose cabinets, rubberized fabric linen fire hose pipes, First-aid fire hose reels (with gunmetal port way valves) and gunmetal branch pipes shall be measured by numbers and shall include all items necessary and required for fixing as given in the Specifications/Bill of Quantities.

Suction and delivery headers shall be measured per linear meter of finished length and shall include all items as given in the Bill of Quantities

No additional payment shall be admissible for cutting holes or chases in walls or floors or ceiling, making connections to pumps, equipment and appliances.

23.11.4 RATES AND BASIS OF PAYMENT

The rate shall include the cost of labour and materials involved in all the operations described above.

The completed Works shall be paid at their respective contract unit rate which shall be the full and the final compensation to the Contractor to complete the work as per these Specifications.

23.12 CENTRIFUGAL PUMPS

23.12.1 SCOPE

Contractor shall furnish all labour, materials, equipment for supply, installation testing and commissioning of complete fire hydrant system. In general, the item of works shall include but not limited to the following:

Electrically operated common for hydrant and Jockey pumps, diesel engine driven common standby pump.

Mild Steel heavy pipes for fire protection system including fittings, valves, accessories etc. as given in BOQ.

Internal and external fire hydrants including valve chambers, fire brigade inlet connections, air cushion tanks with air release valves, M.S. hose box for Internal and External fire hydrants as given in BOQ.

23.13 ELECTRIC PUMPS

23.13.1 Main Electrical Pump and Jockey Pump

Contractor shall provide and install electrically operated fire pumps and Jockey pump of capacity and head indicated in the Drawings/Bill of Quantities

Pumping sets shall be single/multi stage horizontal centrifugal or end suction single or multi outlet with cast iron body and bronze dynamically balanced impellers. Connecting shaft shall be stainless steel with bronze sleeve and grease lubricated bearings mounted on common M.S. base frame mounted on a suitable nos. of cushy foot mounting on foundation.

The coupling joints for the prime mover with the pump shall be provided with a sheet metal guard.

Pumps shall be provided with approved type of mechanical seals.

23.13.2 Motors for Electric Driven Pumps

Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. The motor shall have class `H' insulation.

Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.

Motors for fire pumps shall meet all requirements and specifications of the tariff advisory committee.

23.13.3 Construction for Main Electric Pump:

Pumps shall be as per IS: 1520-1660, IS: 9079, IS: 325 and shall be of following construction:

Pump and driver shall be mounted on a single bed-plate and directly driven through flexible coupling in case of horizontal split casing pumps.

The pumps shall be of the type approved by statutory authority and capable of delivering not less than 150% of rated capacity at a head of not less than 65% of the rated head. The shut off head of pump

shall not exceed 120% of the rated head. The drive motor shall be continuous rating type and its rating shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge.

S.No.	PUMP DESCRIPTION	HORIZONTAL SPLIT CASING
1	Flow(lit/min)	As per BoQ
2	Head(meter)	As per BoQ
3	Pump Type	End Suction
4	Pump Eff(%)	73.5
5	RPM	As per BoQ
6	Motor(Kw)	As per BoQ
7	Electrical Supply	3x400 Volts,50Hz
8	Suction & delivery	100x65
9	Control Panel	Included
10	MOC Casing	Cast Iron
11	MOC Impeller	Cast Iron
12	Pressure Tank	Included
13	MOC Shaft	EN 8
14	Bearings	Heavy Duty Ball/Roller Bearings
15	Base Plate	Fabricated M.S./Cast Iron
16	Flanges	Conforming to IS:1536/1960
17	Packing	Gland Packing
16	Starter	Auto start

23.14 DIESEL ENGINE

23.14.1 Engine Rating:

The Diesel Engine shall be of approved make and type having bare engine horse power rating (after correction for altitude and ambient temperature) equivalent to the higher of the following two values:

20% in excess of the maximum brake horse power required to drive the pump at its duty point.

The brake horse power required to drive the pump at 150% of its rated discharge.

The engine shall be complete with cooling mechanism, air-filtration, exhaust system (insulated exhaust pipe will be paid separately), shut down mechanism, fuel tank, starting mechanism, batteries, battery chargers, ancillary equipment, tools kit, spare parts and all other accessories to complete the work.

23.14.2 Engine Cooling:

The following systems are acceptable:
Cooling by water from the discharge of fire pump (taken off prior to the pump discharge valve) direct into the engine cylinder jackets via a pressure reducing device to limit the applied pressure to a safe value as specified by the engine manufacturer. The outlet connection from this system shall terminate at least 150mm above the engine water outlet pipe and be directed into an open tundish so that the discharge water is visible.

A heat exchanger, the cooling water being supplied from the pump discharge (taken prior to the pump discharge valve) via a pressure reducing device, if necessary to limit the applied pressure to a safe valve as specified by the engine manufacturer. The water outlet connection from this system shall be so designed that the discharged water can be readily observed.

23.14.3 Fuel Tank:

The fuel tank shall be of welded steel constructed to relevant Indian Standard for M.S. drums. The tank shall be mounted above the engine fuel pump to provide gravity feed. The tank shall be fitted with an indicator showing the level of the fuel in the tank. The capacity of tank shall be sufficient to allow the engine to run on full load for 6 hours.

23.14.4 Diesel Engine Exhaust System:

The Diesel Engine exhaust system shall be provided with 150mm dia insulated pipe.

23.14.5 Air Vessel for Fire Pumps

Provide an air vessel fabricated from 10 mm M.S. sheet with dished ends and suitable supporting legs, air vessel shall be provided with a 100mm dia flanged connection from pump, one 25mm dia drain with valve, one gunmetal water level gauge and 25mm sockets for pressure switches. The vessel shall be 450mmx2000mm dia high and tested to 10.0Kg/Sq.cm pressure.

The fire pumps shall operate on drop of 1 Kg/Sq.cm pressure in the mains. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

23.14.6 Construction for Diesel Pump

Pumps shall be as per IS: 1520-1660, IS: 9079, IS: 325 and shall be of following construction:

Pump and driver shall be mounted on a single bed-plate and directly driven through flexible coupling in case of horizontal split casing pumps.

The pumps shall be of the type approved by statutory authority and capable of delivering not less than 150% of rated capacity at a head of not less than 65% of the rated head. The shut off head of pump shall not exceed 120% of the rated head. The drive motor shall be continuous rating type and its rating shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge.

S.NO.	PUMP DESCRIPTION	HORIZONTAL SPLIT CASING
1	Flow (lit/min)	As per BoQ
2	Head (meter)	As per BoQ
3	Pump Type	End Suction
4	Pump Eff (%)	53
5	RPM	1450
6	Motor (Kw)	As per BoQ
7	Electrical Supply	12 Volts
8	Suction & delivery	125x100
9	Control Panel	Included
10	MOC Casing	Cast Iron
11	MOC Impeller	Cast Iron
12	Pressure Tank	Included
13	MOC Shaft	EN 8
14	Bearings	Heavy Duty Ball/Roller Bearings
15	Base Plate	Fabricated M.S./Cast Iron
16	Flanges	Conforming to IS:1536/1960
17	Packing	Gland Packing
16	Starter	Auto start

23.15 ACCESSORIES AND FITTINGS

The following accessories shall be provided with each pump among other standard accessories required:

Coupling guard for end suction /horizontal split casing pumps.

Lubrication fittings and seal piping.

Test and /or air vent cocks.

Following fittings shall be provided with each pump among other standard fittings required:

Suction and discharge shut off valves (butterfly type), 'Y' strainer on suction and discharge check valves as specified under section "piping".

Pressure gauge at discharge of size not less than 100 mm dia and of the appropriate rating with gauge valves etc.

25mm GI gland drain.

23.16 CONTROL PANEL

23.16.1 Cubical Panel:

The main switch board cubicle panel shall be of floor mounted type, totally enclosed, dust and vermin proof made from 14 SWG M.S. sheet of suitable size duly painted with one coat of anti-corrosive paint and two coats of synthetic enamel paint of approved make and shade with stove enameled finish. The cubical shall comprise of the followings:

Incoming main M.C.C.B unit of required capacity.
Outgoing M.C.C.Bs one for each motor.
Aluminium busbar of suitable capacity.
Fully Automatic "D.O.L." starter suitable for the motor H.P. with Push Buttons and ON/OFF indicating light one for each motor.
Single phasing preventors one for each motor.
96 mm^2 panel type Ampere meters - one for each motor complete with CTs.

150 mm^2 voltmeter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase.

Three neon phase indicating lamps.

Rotary switch for manual/auto operation.

All colour coded internal and inter-connecting wiring from incoming main to busbar, switch board panel and power/control cables from switch board cubicle to motors, engine and batteries etc. complete in all respect.

All switchgears and accessories shall be approved make to relevant IS codes and to the satisfaction of Project Manager/Consultant and rating of all equipment must match the KW of motors included. All electrical work to be carried out as per CPWD rules/specifications.

23.16.2 Earthing:

There shall be two independent earthing stations at least 3 meters away from the pump room. Each earth electrode shall consist of G.I. earth plate 600mmx600mmx6mm thick including accessories and masonry enclosure with cover plate having locking arrangement. All electrical apparatus, cable boxes and sheath/armour clamps shall be connected to the main bar by means of branch earth connection of 25mmx5mm G.I. strip. All joints in the main bar and between main bar and branch bars shall have the lapping surface properly tinned to prevent oxidation. The joints shall be riveted and sheathed. The main earthing strip shall be 25x5mm G.I. in 40mm dia G.I. pipe from earth electrode as required.

Earth plates shall be buried in a pit 1.2 x 1.2m at minimum depth of 3 meters below ground. The connections between main bars shall be made by means of these 10 mm studs and fixed at 100mm centers. The pit shall be filled with coke breeze, rock salt and loose soil. A G. I pipe of 20mm dia with perforations on the periphery shall be placed vertically over the plates to reach ground level for watering.

Brick masonry manhole 30x30x30cms size shall be provided to surround the pipe for inspection. A bolted removable link connecting main bar outside the pit portion leading to the plates shall be accommodated in this manhole for testing.

Earthing shall be done complete as per CPWD specifications.

23.16.3 Cabling:

All cables from switch board panel to the motors shall be PVC insulated and PVC sheathed armored aluminum conductor power cables of 650/1100 V grade conforming to IS: 1553. The cables of required size shall be suitable for laying on surface of wall or in flooring with suitable clamps. Necessary cable trays shall deemed to be included in this item as per site requirements.

The termination shall be with brass compression glands suitable for PVC sheathed armored aluminum conductor cable of 1.1 KV `A' grade of the required size

23.17 INSTALLATION

23.17.1 Pump installation

Pump shall be installed as per manufacturer's recommendations. Pump sets shall be mounted on machinery isolation cork or any other equivalent vibration isolation fitting. Concrete floating foundation shall be provided by the Engineer as per approved shop drawings and specifications. The isolation pads, foundation bolts etc. shall be supplied by the Contractor. Contractor shall however ensure that the foundation bolts are correctly embedded.

Pump sets shall preferably be factory aligned, whenever necessary, site alignment shall be done by competent persons. Before the foundation bolts are grouted and the couplings are bolted, the bed plate levels and alignment results shall be submitted to the Engineer.

23.18 TESTING AND COMMISSIONING

Work shall consist of pre-commissioning, commissioning, testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the Contractor under this contract. Testing and commissioning Work shall be executed without any additional cost. Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract. Contractor shall get the thread test between the Fire Department Hose and service connections.

23.19 PRE-COMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, electrical wiring, motor control panels and water level controlling devices the Contractor shall proceed as follows:

23.20 TESTING OF M.C.C.

1. Tests to be carried out for motor control centers shall be:

2. Insulation resistance test with 500 volt megger, before and after high voltage test, on all power and control wiring.

3. High voltage test at 3000 Volts A. C. for one minute on all power and control wiring.

4. Low voltage continuity test (6 volts) on power wiring of each feeder, between bus bars and outgoing terminals with switches and contactors in closed position Low voltage continuity test (6 volts) on all control wiring.

5. Operation test for all feeders with only control supply made "ON" to ensure correctness of control wiring, operation of the various equipment used, such as push buttons, protective devices, indicating lamps and relays, etc. All contactors shall be checked for the earth bus provided in the M.C.C.

6. Operation of all instruments and meters provided on the M.C.C.

23.21 MEASUREMENT

Pumping sets, and switch board cubicle shall be measured by number and shall include all item necessary and required and given in the specifications.

Earthing and power/control cabling shall not be measured separately but included in switchgear cubicle and shall include all items necessary and required to complete the work as per specification and relevant IS to the satisfaction of Engineer.

Pressure switches and pressure gauges shall not be measured separately, but included in respective pumping sets and shall include all items necessary and required to complete the work to the satisfaction of Engineer.

23.22 RATES AND BASIS OF PAYMENT

The rate shall include the cost of labour and materials involved in all the operations described above. The completed Works shall be paid at their respective contract unit rate which shall be the full and the final compensation to the Contractor to complete the work as per these Specifications.

23.23 REFERENCE DOCUMENT

The work specified in this section shall be in accordance with the following standards, or approved equal, except as they are modified and supplemented herein:

S.No.	Reference	Subject
1.	BS	Code of practice for British Standard
2.	IS	Code of practice for Indian Standard

23.24 RELATED WORK

The Contractor shall become familiar with other Divisions of the specifications affecting work of this trade.

23.25 SAMPLES/SUBMITTALS

Representative samples of all types of Fire Extinguisher shall be submitted to the Engineer and his approval taken before bulk purchase. The samples shall be kept with the Engineer for future reference and comparison. All Fire Extinguisher items supplied shall conform to these approved samples in all respects.

All fire protection items shall have to be approved by the Engineer. Any fire Extinguisher items not up to the specification must be removed from the site immediately at Contractor's own cost.

23.26 MATERIALS

23.26.1 General Requirements

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Engineers.

Dry Powder Fire Extinguisher shall be fixed truly vertical as required in a neat workmanlike manner and shall be placed as shown in Drawing.

Dry Powder Fire Extinguisher shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in passages etc.

Dry Powder Fire Extinguisher shall be securely fixed to walls by suitable clamps or inside MS cabinet. Only approved type of anchor fasteners shall be used for RCC walls.

23.27 DRY POWDER FIRE EXITINGUISHER SYSTEM

23.27.1 Test Demonstration

At least 1 extinguisher per each type shall be demonstrated at site in simulated fire conditions. Fire extinguishers shall be installed as per BS Code of practice for selection, installation and maintenance of portable first aid appliances. Hand appliances shall be installed in readily accessible locations with the Appliance brackets fixed to wall by suitable anchor fasteners. Each appliance shall be provided with an inspection, testing, change of charge and other relevant data. All appliances shall be fixed in a true workman like manner truly vertical and at current locations.

23.27.2 Dry Powder Fire Extinguisher

Dry Powder Fire Extinguisher conforming to BS 5423:1987 or as given in BOQ. The Dry Powder agents shall be mono-ammonium phosphate and ammonium sulphate base.

Dry Powder Fire Extinguisher shall be as follows:
CO_2 -4.5kg:

Model	CO_2 -4.5 2
Media	CO_2
Capacity	4.5kgs
Discharge time	10sec. to 18sec.
Gas storage pressure	85 kgf/cm^2
Cylinder diameter	140mm
Overall height	710mm approx.
Operation method	Upright
Temp. range	0 27 ± 5°C
Charged weight	17 kgs approx.
Test pressure	250kgf/cm^2

Dry Chemical Powder DCP -6 kg:

Model	DP6
Types	Sq. Grip Nozzle
Media	Dry Powder (IS:4308)
Capacity	6 Kg.
Effective discharge	85% min
Jet length	6m min.
Discharge time	23sec. to 30sec.
Test pressure	30kgf/cm^2
Expansion space pressure	15kgf/cm^2 max.
Gas cartridge	180 gms CO_2
Anti-corrosion inhibitor	Epoxy polyester powder coating
Overall width	280mm approx.
Overall height	560mm approx.
Shell diameter	180mm
Charged weight	19kg approx.
Temp. range	0 27 ± 5° C
Operation method	Upright

23.27.3 MEASUREMENT

Fire extinguishers shall be measured by numbers and include installation and all items necessary and required and given in the Bill of Quantities.

23.27.3 RATES AND BASIS OF PAYMENT

The rate shall include the cost of labour and materials involved in all the operations described above.

The completed Works shall be paid at their respective contract unit rate which shall be the full and the final compensation to the Contractor to complete the work as per these Specifications.

LIST OF APPROVED MATERIAL IN ORDER OF PREFERENCE

Description	**Approved Makes/ Brands**
Electric drive centrifugal Main Fire pump set	Kirloskar/ Mather & Platt
Electric drive centrifugal Fire pump set	Grundfos/ Kirloskar/ Mather & Platt
Electric Motor for Fire pump	Siemens/ ABB/ Kirloskar/ NGF/ Bharat Bijli/ Crompton Greaves
CI Butterfly Valves	Audco/ KSB/ Alfa Laval
CI Sluice Valves	Kirloskar/ Upadhyay/ H. Sarkar
CI Non-Return Valves	Kirloskar/ KSB/ Advance
GM Brass Valve	Zoloto/ Leader
CI Y-Strainer	Kirloskar/ KSB/ Advance
CI Flexible Coupling	Kirloskar/ KSB/ Advance/ IVC
Air Release Valve	Zoloto/ Leader
Ball Valve	Zoloto/ Leader
Pressure Switch	System Sensor/ Dunfoss/ Switzer
Flow Switch	System Sensor/ Dunfoss/ Spray Safe/ Pottar

Description	Approved Makes/ Brands
Landing Valve	Newage/ Minimax/ Shah Bhogilal / SAFE GUARD
RRL Hose Pipe	Newage/ CRC/ Nirmal Rubber Industries / SAFE GUARD
First Aid Hose Reel	Padmini/ Newage/ Minimax/ Cosco/ SAFE GUARD
Branches, Nozzles, Couplings	Newage/ Minimax/ Safex/ SAFE GUARD
Fire brigade inlet connection	Newage/ Minimax/ Shah Bhogilal/ SAFE GUARD
Flexible Hose	Flexihead/ Viking
MS Pipes	Tata Steel/ Jindal Hissar
Forged Fittings	VS Engineering/ JK Forging/ BM/ Industrial Valves Company
GI Fittings	Unik/ R/ HB
Portable Fire Extinguishers	Newage/ Minimax/ Safex/ Alert/ Zenith/ SAFE GUARD
Fire extinguisher refills	IFP/ KV Fire Chemicals / SAFE GUARD
Welding Rod	Advani
Anticorrosive Tape (Pypkote)	IWL India Limited

24. AIR-CONDITIONING & VENTILAION SYSTEM (HVAC)

24.1 GENERAL

Supply, site delivery, installation, testing and commissioning of proposed system including skilled manpower/labors, testing instruments, tools, installation materials, service equipment, consumables and making the entire system ready for continuous operation of the air-conditioning system as per design and drawing, specifications, instruction and site conditions:

- Heat pump type VRF multi split air-conditioning systems with 4 way ceiling cassette type indoor units and remote controllers
- Heat pump type DC Inverter single split air-conditioning systems 4 way ceiling cassette type indoor units and remote controllers
- Floor standing precision type cooling only air-conditioning systems
- Sound insulated rectangular centrifugal exhaust air supply fans
- Inline tubular fresh air supply fans
- Refrigerant quality copper pipe and factory made branch kits covered with closed cell insulation
- cPVC drainpipes covered with closed cell insulation
- Power coated aluminium fresh/exhaust air grilles
- Related electrical work
- Related civil work
- Comprehensive 2 year Guarantee with defective part replacement
- Maintenance plan during 2 year guarantee period
- Proposal for AMC contract for 3 year after expiry of guarantee period with Annual Maintenance plan
- Additional works, applicable during installation period.

24.2 BASIS OF DESIGN

Outdoor Conditions

	DBT [^{0}C]	RH [%]
i) Summer	33	70
i) Winter	0	65

Indoor Conditions

	DBT [^{0}C]	RH [%]
i) Summer	24	55 %
ii) Winter	20	55 %

Fresh air Supply : 15 CMH per person

Lighting Load : 10 W/Sq.m.

Occupant Load : 73 W/person (Latent Heat)
: 58 W/person (Sensible Heat)
Toilet Exhaust : 15 ACH

24.2.1 Operating Tests

After all mechanical work has been completed, tested, adjusted and approved, the system shall be tested for six continuous days, or longer when so directed, to demonstrate that they fulfil all requirements and that they operate satisfactorily in full load in presence of representative of RBB and consultant.
The bidder shall furnish three copies of test data, computations and results in reports in report form to the consultant.

24.2.2 Instruments:

All instruments required for testing and commissioning shall be provided by the contractor at his cost. Cost for those items shall be included in item rate of equipment.

24.2.3 Two Years Comprehensive Guarantee with parts replacement

Testing, trial usage or use of equipment for temporary provision of services shall not shorten or modify the terms of this guarantee. Manufacturers shall provide their standard guarantees for work under this division. However, such guarantees shall be in addition to and not in lieu of all other liabilities, which the manufacturer and bidder may have by law or by other provisions of the contract documents.

All materials, items of equipment and workmanship furnished under this division shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship which may develop shall be made good, forthwith, by and at the expense of the bidder, including all other damage done to areas, materials and other systems resulting from this failure.

The bidder shall guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated for 2 years with part replacement of defective parts.

The bidder shall guarantee that all components used in installed air-conditioning system are in stock at all the time with them and assures to replace within stipulated time.

Upon receipt of notice from the RBB of failure of any part of the systems or equipment during the guarantee period, the bidder at his own expense shall replace the affected part or parts within 24 hours of written notification.

All mechanical equipment, pipe works, control system and installed accessories shall have a guarantee for a period of one year. Any part that fails or proves defective during this guarantee period except force majuere shall be replaced or repaired without any extra cost. If the defects are not rectified within stipulated time frame the *RBB* may arrange to do so at the contractor's risk and cost, without prejudice to any other rights. The contractor failing to fulfil their duty will be black listed and will be automatically disqualified to participated in any future projects of the *RBB.*

24.2.4 Operation and Maintenance Instructions:

During operating tests, the contractor shall arrange and pay for the services of qualified and authorized representatives of manufacturers of air-conditioning equipment to instruct the *RBB*'s operating personnel in operating and maintaining the systems and equipment. The period of this instruction shall be one week.

During operating tests, the bidder shall arrange to keep one experienced mechanical engineer on the job for a continuous period of 5 days.

24.2.5 Workmanship:

The entire work provided in this specification shall be constructed and finished in every respect and substantial manner. It is not intended that the drawings shall show every pipe, fitting and appliance, but the bidder shall furnish and install all such parts as may be necessary to complete the systems in accordance with the best trade practice and to the satisfaction of the consultant.

The successful bidder shall obtain detailed information from the manufacturers of apparatus as to the proper method of installing and interconnections.

All pipes shall be thoroughly cleaned and blown out by dry nitrogen to prevent any debris from accumulation of debris in the indoor unit's coil when systems are placed in operation. All temporary connections required for blowing out the network of piping and any other equipment or labour for cleaning shall be provided by the contractor.

24.3 EQUIPMENT

24.3.1 Heat pump type VRF multi split air-conditioning units

24.3.2 Four way ceiling cassette type indoor units

a) Cabinet Section: Cabinet of 4 way ceiling cassette type indoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity. Supply and return air grill shall be made of high quality plastic. Return air grill shall be located at center, while four way supply air grill with automatic louver shall swing in order to maintain proper air distribution. The flap shall be designed to prevent soiling on false ceiling near supply grills. The flap shall be easily removed if require. Access panel should be constructed as to easy removable. The indoor unit shall be equipped with powerful inbuilt drain pump to avoid the collection of water in drain pans and over flow inside the room. The unit shall equipped with drain pan inspection port for cleaning of drain pan and drain pump easily. The mounting height should be able to adjust through the panel corner cover.

   Supply/return grill size of way ceiling cassette type indoor unit shall be 850 mm x 850 mm x 260 mm.

b) Fan: Fan shall be energy efficient turbo axial type for noiseless operation suitable for the electric characteristic of 220 *volts 1ph. 50 hz.* Thermal & electrical protectors shall protect fan. Fan shaft shall be of stainless steel and supported in self aligning precision for balancing.

c) Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to aluminium fins assembled within heavy gauge aluminium framework.

d) Filter Section: Filter shall be easily accessible and designed for easy withdrawal of filter cells. Filter. Filters shall be of dry (cleanable) type having efficiency rating of 90 %. Filters must possess a high flow rate, high dust retention with low differential pressure.

e) Refrigerant: Refrigerant used in the equipment shall be environmental friendly with a zero Ozone Depleting Potential rating R-410A. R-410A has better heat transfer properties than other common refrigerant and higher density which allows reducing pipe sizes in heat exchangers and interring connecting pipes. Thus reduces amount of refrigerant to be charged.

f) Capacity: Nominal cooling and heating capacity of each 4 way ceiling cassette type indoor unit shall be not be less than data given in B.O.Q.

g) Power consumptions: Nominal power consumption of each 4 way ceiling cassette type indoor unit shall be not be more than data given in B.O.Q.

24.3.3 VRF type Outdoor unit

a. Cabinet Section: Cabinet of outdoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity.

b. Compressor shall be scroll type DC inverter hermetic with suction and discharge valves, gas cooled motor, vertical crank shaft balanced and mounted on vibration isolators to provide free floating operation. It should have the over load protection. Whereas, condenser fan shall be propeller type made of glass reinforced acryl styrene resin and direct driven with DC motor for improved energy efficiency.

c. The outdoor shall be suitable for 3 phase, 380 V, 50 Hz. Condenser fan and compressor shall be protected by separate thermal & electrical protectors. Further more HPC/LPC switch shall be installed to protect the compressor.

d. Power cables and control cables shall be installed as per equipment manufacturer's requirement.

e. Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to Aluminium blue fins assembled within heavy gauge aluminium framework. Headers shall be in copper coil and header shall be electro-tinned after manufacturers.

f. Refrigerant flow control: The outdoor unit shall have electronic expansion valves to meet exact cooling/heating demand.

g. Accumulator: The outdoor unit shall have over sized accumulator to store unused refrigerant during low demand and optimises the flow of gaseous refrigerant and oil to the compressor.

h. Noise level: The outdoor unit shall have low noise level. While operating at highest speed the noise level of each out door unit shall not exceed data given in B.O.Q.

i. Capacity: Nominal cooling and heating capacity of each VRF type outdoor unit shall be not be less than data given in B.O.Q.

j. Power consumption: Nominal power consumption of each VRF type outdoor unit shall be not be more than data given in B.O.Q.

24.3.4 Heat pump type DC Inverter Single Split Air-conditioning Units with 4 way ceiling cassette type indoor units

All outdoor units shall be equipped with DC inverter type compressor capable of adjusting the speed as per cooling/heating load in the occupied zone and temperature setting to achieve the desired comfort. Indoor units shall be 4 way ceiling cassette type. Cooling, heating capacities, power consumptions, noise level, refrigerant etc. shall be as mentioned in BOQ.

24.3.5 Four way ceiling cassette type indoor units

a. Cabinet Section: Cabinet of 4 way ceiling cassette type indoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity. Supply and return air grill shall be made of high quality plastic. Return air grill shall be located at center, while four way supply air grill with automatic louver shall swing in order to maintain proper air distribution. The flap shall be designed to prevent soiling on false ceiling near supply grills. The flap shall be easily removed if require. Access panel should be constructed as to easy removable. The indoor unit shall be equipped with powerful inbuilt drain pump to avoid the collection of water in drain pans and over flow inside the room. The unit shall equipped with drain pan inspection port for cleaning of drain pan and drain pump easily. The mounting height should be able to adjust through the panel corner cover.

   Supply/return grill size of way ceiling cassette type indoor unit shall be 850 mm x 850 mm x 260 mm.

b. Fan: Fan shall be energy efficient turbo axial type for noiseless operation suitable for the electric characteristic of 220 *volts 1ph. 50 hz.* Thermal & electrical protectors shall protect fan. Fan shaft shall be of stainless steel and supported in self-aligning precision for balancing.

c. Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to aluminium fins assembled within heavy gauge aluminium framework.

d. Filter Section: Filter shall be easily accessible and designed for easy withdrawal of filter cells. Filter. Filters shall be of dry (cleanable) type having efficiency rating of 90 %. Filters must possess a high flow rate, high dust retention with low differential pressure.

e. Refrigerant: Refrigerant used in the equipment shall be environmental friendly with a zero Ozone Depleting Potential rating R-410A. R-410A has better heat transfer properties than other common refrigerant and higher density which allows reducing pipe sizes in heat exchangers and interring connecting pipes. Thus reduces amount of refrigerant to be charged.

f. Capacity: Nominal cooling and heating capacity of each 4 way ceiling cassette type indoor unit shall be not be less than data given in B.O.Q.

g. Power consumptions: Nominal power consumption of each 4 way ceiling cassette type indoor unit shall be not be more than data given in B.O.Q.

24.3.6 Inverter type Outdoor unit

a. Cabinet Section: Cabinet of outdoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity.

b. Compressor shall be scroll type DC inverter hermetic with suction and discharge valves, gas cooled motor, vertical crank shaft balanced and mounted on vibration isolators to provide free floating operation. It should have the over load protection. Whereas, condenser fan shall be propeller type made of glass reinforced acryl styrene resin and direct driven with DC motor for improved energy efficiency.

c. The outdoor shall be suitable for 1 phase, 220 V, 50 Hz. Condenser fan and compressor shall be protected by separate thermal & electrical protectors. Further more HPC/LPC switch shall be installed to protect the compressor.

d. Power cables and control cables shall be installed as per equipment manufacturer's requirement.

e. Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to Aluminium blue fins assembled within heavy gauge aluminium framework. Headers shall be in copper coil and header shall be electro-tinned after manufacturers.

f. Refrigerant flow control: The outdoor unit shall have electronic expansion valves to meet exact cooling/heating demand.

g. Accumulator: The outdoor unit shall have over sized accumulator to store unused refrigerant during low demand and optimises the flow of gaseous refrigerant and oil to the compressor.

h. Noise level: The outdoor unit shall have low noise level. While operating at highest speed the noise level of each out door unit shall not exceed data given in B.O.Q.

i. Capacity: Nominal cooling and heating capacity of each inverter type outdoor unit shall be not be less than data given in B.O.Q.

j. Power consumption: Nominal power consumption of each VRF type outdoor unit shall be not be more than data given in B.O.Q.

24.4 FLOOR STANDING PRECISION TYPE COOLING ONLY AIR-CONDITIONING UNITS

24.4.1 Floor Standing Indoor Unit:

a. Cabinet Section: Cabinet of Floor standing indoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity with power coated panels. Supply air out let shall be located at bottom of the indoor unit while return air inlet shall be located at the top of the indoor unit to maintain proper air distribution. Cabinet shall also be cladded with thermal and sound insulation material. It shall also be compact in design for saving space and maintenance friendly with access from front.

b. Fan: Fan shall be turbo axial type with electronically commuted (EC) motor for low energy consumption and noiseless operation suitable for the electric characteristic of 220 *volts 1ph. 50 hz.* Thermal & electrical protectors shall protect fan. Fan shaft shall be of stainless steel and supported in self aligning precision for balancing.

c. Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to aluminium fins assembled within heavy gauge aluminium framework. Cooling coil shall be designed with high sensible heat factor (SHF) with up to 1 for maintaining high efficiency and suitable for data centre.

d. Filter Section: Filter shall be easily accessible and designed for easy withdrawal of filter cells. Filter. Filters shall be of dry (cleanable) type having efficiency rating of 95 %. Filters must possess a high flow rate, high dust retention with low differential pressure.

e. Refrigerant: Refrigerant used in the equipment shall be environmental friendly with a zero Ozone Depleting Potential rating R-410A. R-410A has better heat transfer properties than other common refrigerant and higher density which allows reducing pipe sizes in heat exchangers and interring connecting pipes. Thus reduces amount of refrigerant to be charged.

f. Compressor: Compressor shall be scroll type DC inverter hermetic with suction and discharge valves, gas cooled motor, vertical crank shaft balanced and mounted on vibration isolators to provide free floating operation. It should have the over load protection. Furthermore, HPC/LPC switch shall be installed to protect the compressor. The outdoor shall be suitable for 3 phase, 380 V, 50 Hz.

g. Accumulator: The outdoor unit shall have over sized accumulator to store unused refrigerant during low demand and optimises the flow of gaseous refrigerant and oil to the compressor.

h. Control system: Control system shall be equipped with high resolution digital display. It shall also have provision of self-diagnosis system, on/off, programmable temperature and fan modes operation setting.

i. Capacities: Nominal cooling capacity of each Floor standing indoor unit shall be not be less than data given in B.O.Q.

j. Power consumption: Nominal power consumption of each 4 way ceiling cassette type indoor unit shall be not be more than data given in B.O.Q.

24.4.2 Remote Condensing Unit:

a. Cabinet Section: Cabinet of outdoor units shall be fabricated of heavy gauge electro-galvanized mild steel with structural rigidity.

. b. Whereas, condenser fan shall be propeller type made of glass reinforced acryl styrene resin and direct driven with DC motor for improved energy efficiency.

c. The outdoor shall be suitable for 1 phase, 220 V, 50 Hz. Condenser fan shall be protected by separate thermal & electrical protectors.

d. Power cables and control cables shall be installed as per equipment manufacturer's requirement.

e. Coil Section: Refrigerant coil shall be of copper tube mechanically bonded to Aluminium blue fins assembled within heavy gauge aluminium framework. Headers shall be in copper coil and header shall be electro-tinned after manufacturers.

f. Refrigerant flow control: The outdoor unit shall have electronic expansion valves to meet exact cooling/heating demand.

g. Noise level: The outdoor unit shall have low noise level. While operating at highest speed the noise level of each out door unit shall not exceed data given in B.O.Q.

h. Capacity: Nominal cooling and heating capacity of each VRF type outdoor unit shall be not be less than data given in B.O.Q.

i. Power consumption: Nominal power consumption of each VRF type outdoor unit shall be not be more than data given in B.O.Q.

24.5 ACCESSORIES:

24.5.1 Refrigerant Pipe, Drain Pipe and Fresh Air Duct/Pipe:

Refrigerant pipe:
Refrigerant pipe interconnecting indoor units and outdoor units shall be of refrigeration quality copper pipe; soft drawn seamless high grade copper pipe. Refrigerant line shall be covered properly to avoid any mechanical injuries. All pipe joints shall be properly braced with oxy-acetylene (if required). For the refrigerant pipes larger than 19mm diameter hard copper pipe should be used with elbows wherever required. For the smaller pipes pipe bender should be used for bending the pipe.

Indoor units shall be connected to main refrigerant pipe with factory made branch kit having facility to joint various sizes of pipes as required in each branch kit. Model number of branch kit shall be mentioned in the bid document. Pipe sizing shall be carried out as per manufacturer's instructions.

All insulated refrigerant pipes exposed to outdoor shall be covered with 24 gauge G.I. ducting and properly secured on walls/floors. The bidder shall include the cost for this purpose in rate of refrigerant pipes and not entitled to claim separately.

The bidder must submit the detail refrigerant piping layout with respective pipe sizes, location of branch kit along the bid document.

Drain pipe:
Drain pipe shall be made of cPVC. The bidder shall maintain adequate slope to avoid the collection and leakage of condensate drain.

Fresh air duct shall be made of 0.6 mm thick GI sheet and branches to each 4 way ceiling cassette indoor unit shall be made of uPVC pipe. It is bidder's responsibility that the refrigerant and drain pipe sizes are as per the manufacturer's recommendation and are of correct sizes to ensure the optimum operation of entire installed HVAC system.

24.5.2 Testing of Refrigerant Pipe, Drain Pipe & Fresh Air Duct/Pipe:

The contractor shall test the refrigerant piping with nitrogen at a pressure 2 times greater than nominal operating discharge pressure and keep the pressure record every 2 hours during day and every 12 hours during night for 24 hours. All inactive refrigerant piping shall keep pressurized all the time till connection of indoor units and outdoor unit are ready. It is the Contractor's responsibility to ensure that the installed pipes are free of debris and moisture to ensure smooth and trouble free operation of the entire HVAC system.

Testing of drain pipe shall be carried out by filling the drain pan of indoor units by water and allowing to flow the water to drain and make sure that there is no leakage and accumulation of water inside the pipe.

Testing of fresh air duct/pipe shall be carried out with smoke testing to make sure that there is no leakage and proper distribution of fresh air supply to each indoor unit by adjusting balancing dampers.

24.6 REFRIGERANT:

Refrigerant used in the equipment shall be R-410A. Additional R-410A shall be charged into the system if required. The additional amount of refrigerant required shall be calculated based on the length and size of installed liquid refrigerant pipe and manufacturer's data book. The bidder is not entitled to claim for extra refrigerant required. Cost of extra quantity of refrigerant, if required shall be included in unit cost of equipment.

24.7 REMOTE CONTROLLER

Each indoor unit shall have individual wired remote controller with LED display having provision of weekly operation schedule to be registered. It shall also have provision of self-diagnosis system, temperature settings and cooling, heating and fan modes operation setting. It shall have three speed fan controller. It shall have provision of setting upper and lower room temperature to precisely control the room temperature and energy conservation. It shall also have run hours meter to registered cumulative operation hours of the unit since commissioning.

24.8 PIPE INSULATION

All refrigerant pipes shall be insulated with closed cell insulation tubes of respective sizes with at least 19 mm thickness for pipes exposed to outdoor and 13 mm thickness for pipes installed indoor. All piping to be insulated shall be cleaned thoroughly before applying insulation. Care shall be taken to ensure that there are no damages to piping insulation. All joints shall be sealed with adhesive compounds.

Insulation material should be of expanded closed cell electrometric nitrile rubber material having a thermal conductivity of not more than 0.034 w/mK at 24 °C. The density of the material shall not be more than 0.75 g/cu.cm.. Material shall be self-extinguishing and CFC free so as not to emit toxic gases in case of fire.

24.9 SUPPORTS/HANGERS FOR PIPING

Vertical piping: Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents.

Horizontal piping: Horizontal piping shall be secured at sufficiently close intervals to keep the pipe in alignment and prevent sagging. Pipe support shall be adjustable for height.

All pipe support shall be painted with two coats of red oxide and two coats of enamel paints of approved colour. Spacing of pipe support shall not be more than 3 m. Extra support shall be provided at the bends and tees, if required. Insulated piping shall be supported in such a way so as not to damage the insulation. None of the pipe hanger shall be secured to the support made for false ceiling. The hangers shall be secured with help of at least 6 mm diameter anchor bolt.

Where pipes pass through floors and walls provide PVC pipe sleeves 30 mm larger than outside diameter of the pipe inclusive of insulation. The centre of the pipes shall be at the centre of the sleeves and sleeves shall be flushed with the finished surface. The bidder is not entitled to claim for extra cost for supports/hangers for pipes, cost for these items shall be included in unit cost of pipe.

24.10 SUPPORT FOR INDOOR UNITS AND OUTDOOR UNITS

4 way ceiling cassette type indoor unit shall be hanged on ceiling by 4 numbers of 8 mm diameter threaded rod with expansion bolt having provision of adjustment of height. The units shall be properly levelled so as not to spill the condensate drain.

Supports for each outdoor shall be strong enough to hold the weight of the unit and locally fabricated using MS angles. Such support shall be secured with 4 numbers of 10 mm diameter expansion bolt on floor. The support shall be painted with two layers of red oxide and two layers of enamel paint of specified colour. The outdoor unit shall be installed on vibration isolator as recommended by the manufacturer.

The bidder is not entitled to claim for extra cost for supports/hangers for indoor and outdoor equipment, cost for these items shall be included in unit cost of equipment.

24.11 TESTING OF CONTROL SYSTEM AND PERFORMANCE TESTING OF HEAT PUMP TYPE VRF MULTI SPLIT AC UNITS, DC INVERTER SINGLE SPLIT AC AND FLOOR SATNDING PRECISION TYPE AC UNITS

After installation of the entire heat pump type VRF multi split and DC inverter type single split air-conditioning systems and precision type air-conditioning systems,a testing and commissioning must be conducted to check the performance of the AC systems, control system and drain piping system. The test report shall include but not limited to designation of AC units, location, voltage, current, indoor and out door temperature, humidity, air flow rate, suction and discharge pressures etc. The contractor shall get prior approval of the format of test report and conduct the test in presence of consultant and RBB. Then the contractor shall submit test report to the consultant for approval. The bidder is not entitled to claim for extra cost for supports/hangers for indoor and outdoor equipment, cost for these items shall be included in unit cost of equipment.

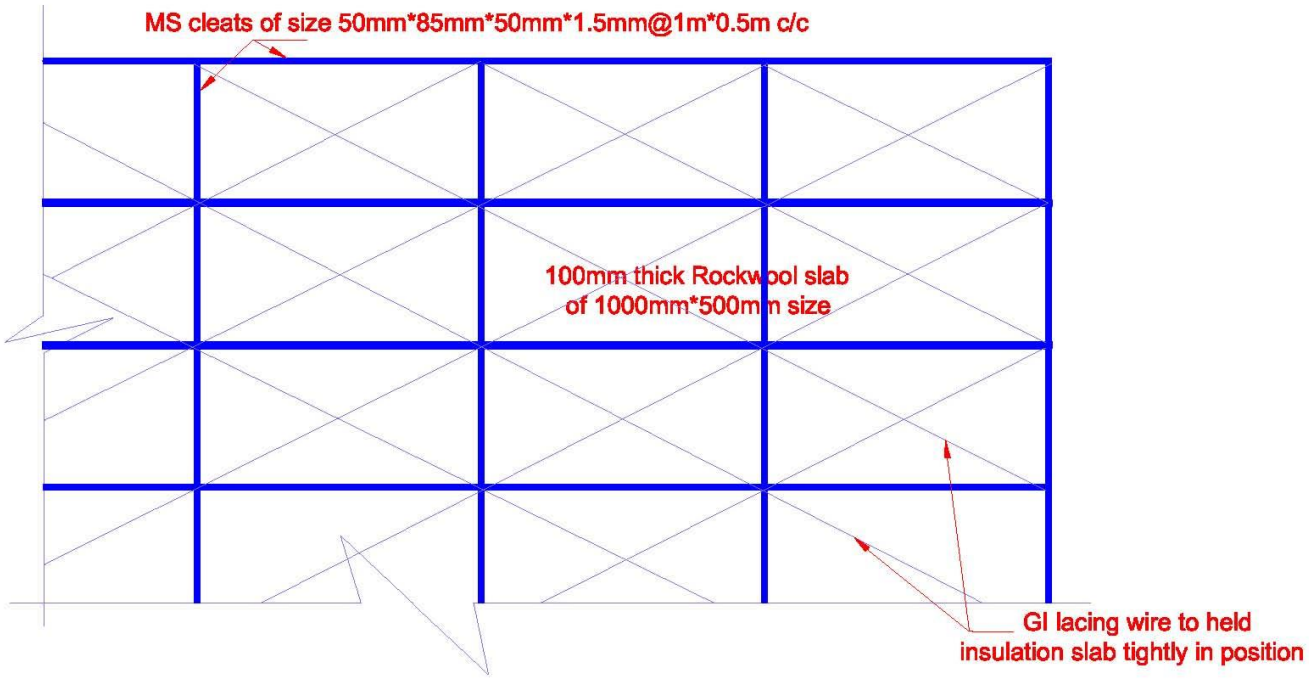
24.12 RELATED ELECTRICAL WORKS:

Electrical power supply for all indoor units and VRF type inverter outdoor units, DC inverter Outdoor unit and outdoor units of precision type AC unit shall be provided by Electrical contractor. The Electrical contractor shall provide control panel with MCB, MCCB, contractors, high/low voltage protector, phase

protectors, earth leakage circuit breaker (ELCB) and indicator lamps. However, it is the HVAC contractor's responsibility to provide the control (data) cable required between indoor units and outdoor units and control (data) cable for each remote controller shall be also be provided by the HVAC contractor themselves. The control (data) cable shall be shield twisted pair (STP) type. The bidder is not entitled to claim for extra cost for control/data cable, cost for these items shall be included in unit cost of equipment.

24.13 RELATED CIVIL WORKS:

The air-conditioning contractor shall submit the shop drawing showing the locations of the cut out / hole to be made on existing wall/floor/ceiling and get written approval from the consultant prior to make holes / cut the groves. The holes / cut outs shall be made by using drilling machine / cutters, not by chisel and hammer. Utmost care must be taken not to make existing wall/floor/ceiling dirty/damage. All holes made shall be filled with cement plaster / plaster of Paris of same quality as existing by Civil Contractor. Installation of the indoor units shall be carried out in close coordination with false ceiling contractor. The VRF type out door units shall be installed on structurally rigid MS frame and secured by at least 4 numbers of diameter 12 anchor bolts with vibration isolators. Repairing of walls, RCC slab, plastering and painting are not scope on the HVAC contractor.



UNDERDECK INSULATION
(By 100mm thick Rockwool slab)

CONTENTS

PART I: GENERAL TECHNICAL SPECIFICATIONS

1. ITEMS OF GENERAL APPLICATION

1.1 GENERAL

1.1.1 Scope

These General Technical Specifications cover principles, responsibilities and requirements for items which are of general nature and which will be applicable to all civil engineering and building works pertinent to the project.

They shall be read in conjunction with the Part II: Particular Technical Specifications the Conditions of Contract, the Bill of Quantities (BOQ) and the Drawings.

1.1.2 Definitions

a) General
Acceptable/Approved (Approval) - Acceptable to/approved (approval) by the Engineer.

Agreed - Agreed in writing.

As detailed - As detailed on the drawings.

Authorized/ordered/rejected - Authorized/ordered/rejected by the Engineer.

Designated - Shown on the drawings or otherwise specified by the Engineer or, in relation to an item scheduled in the bid documents, descriptive of an item to be priced by a bidder.

Engineer - The person or institution designated to act as the (Residential Engineer / Supervision Engineer/ Consultant's Engineer) in conditions of contract. It is also referred to as the Project Engineer (Residential Engineer / Supervision Engineer/ Consultant's Engineer)

Indicated - Indicated in or reasonably to be inferred from the contract, or indicated in writing by the Engineer.

Instructed/directed/permitted -Instructed/directed/ permitted by the Engineer.

Satisfactory - Capable of fulfilling or having fulfilled the intended function.

Service - Any pipeline, cable, duct etc. for conveying or transmitting any fluid or other matter.

Submitted - Submitted with the tender or submitted to the Engineer, as appropriate.

b) Tolerances
Deviation - The difference between the actual (i.e., measured) size or position and the specified size or position.

Permissible deviation - The specified limit(s) of deviation.

Tolerance - The range between the limits within which a size or position must lie.

c) Measurement and Payment
Bill/schedule - The bill/schedule of quantities.

Billed/scheduled rate - The unit rate or price entered in the bill/schedule at which the Contractor undertakes to execute the particular work or to provide the required material, article or service, or to do any or all of these things, as set out in the item concerned.

Billed/scheduled - Listed in the bill/schedule of quantities.

Fixed charge - A charge for work that is executed without reference to time.

Method-related charge - The sum for an item inserted in the bill by the Contractor when tendering, to cover items of work relating to his intended method of executing the Works.

Time-related charge - A charge for work the cost of which, to the Employer, is varied in proportion to the length of time taken to execute the particular item scheduled.

Value-related charge - A charge that is directly proportional to the value of the contract.

1.2 FACILITIES FOR THE ENGINEER

1.2.1 Engineer's Site Office

The Contractor shall provide, maintain, furnish, and equip for the Engineer 3 room site office required of the principal works and for the period of whole project period. The contractor should provide required no of furnitures for Engineer's Site office with Tables, executive chairs, almariha, carpets, file cabinets, curtains, meeting table with chairs.

1.2.2 Services and equipment to the Engineer

The Contractor shall be responsible for the proper maintenance of the above listed offices and equipment, which shall be available at all the site offices during the mentioned period. He shall keep the offices and toilets clean and shall provide adequate cleaning staff for this purpose throughout the contract period.

Similarly, the contractor shall provide 2 no of Laptop with lazer A3 size printer, photocopy machine with regular supply of tonner, printer papers with suitable size and maintenance of the equipments provided for the Engineers.
The contractor shall supply and provide stationary items to the Engineers for entire project period including papers and minor stationary tools and equipments.

The Contractor should assure the payment of the monthly rental fees (if any) including furniture, water supply, electrical supply telephone, internet, TV cable and other services for the above mentioned site offices.

The Contractor shall regularly, and when required, clean, repair, and maintain the Engineers' offices and vehicles, shall carry out emptying of the septic tanks and supply water to the water tanks. All electricity, water and telephone charges, relating to the Engineers' offices, including connection and disconnection fees and rental charges shall be paid by the Contractor.

1.2.3 Vehicles

The Contractor shall make available for the use of the Engineer and Engineer's staff the required two no of vehicles – 4 wheel at least Scorpio / double cab type throughout the contract period and shall cover all cost of fully comprehensive insurance, driver, fuel, oil, lubricants etc and maintenance at regular intervals for the vehicles. The vehicles except if it is rented, shall became the property of the contractor at the end of the contract.

1.2.4 Survey Assistance and Equipment

The Contractor shall make available to the Engineer suitably educated and trained survey assistants and labourers for use on and about the Site in sufficient numbers and at all reasonable times.

Necessary survey equipment shall be provided for the use of the Engineer's staff, and maintained in good condition throughout the Contract period:

1.2.5 Safety Equipment

The Contractor shall provide the Engineers with necessary safety equipment which shall become the property of the Contractor upon completion of the Contract.

1.2.6 Support Staff

The Contractor shall provide, for the sole use of the Engineer for the duration of the Contract, the services of necessary personnel.

1.2.7 Engineer's Laboratory

The Contractor shall provide and maintain a testing laboratory with furniture and equipment, required to carry out all tests specified. The Contractor shall employ full-time for the Contract period a qualified laboratory technician capable of carrying out the tests specified or implied for testing of materials. The laboratory technician shall assist and work under the direction of the Engineer's Representative. The Contractor shall supply all labour for assisting the technician.

The supplied laboratory equipment shall be maintained, repaired and replaced in the event of loss or damage for the duration of the Contract. The equipments shall become the property of the Contractor at the end of the Contract.

1.2.8 Measurement and Payment

No separate measurement and payment will be made for any of the above listed items under this Section 1.4, Site Installation. All associated costs are deemed to be included in the unit rates of the BOQ.

1.3 ACCESS TO AND POSSESSION OF SITE

1.3.1 The Site

The Site includes any designated areas and any temporary working areas described herein.
Final Possession of the Site, or Parts thereof, for the purpose of carrying out the execution of the Works to be given by the Employer pursuant to Clause 42.1 of the Conditions of Contract shall be subject to any restrictions mentioned in the Contract. As such land acquisition is a slow process the Contractor shall himself obtain whatever temporary wayleaves are required by him.

1.3.2 Temporary Wayleaves, Access Costs

In accordance with Sub-Clause 42.3 of the Conditions of Contract the Contractor shall be responsible for obtaining temporary wayleaves.

The cost of obtaining wayleaves for temporary working areas and for any additional areas outside the Site required by the Contractor in connection with the Works as well as for the access to all of these shall be borne by the Contractor himself.

The Contractor shall at all times provide proper facilities for access and inspection of the Works by the Engineer, his assistants, inspectors, agents and representatives of Client/ public agencies having jurisdiction.

The Contractor shall reinstate any temporary working areas to the condition prevailing prior to his initial entry as soon as possible after the work in those areas has been completed so as to keep the period of occupation to a minimum. The Contractor shall in any event restore the areas to a tidy and workmanlike condition. Boundary walls, fences and other structures that have been damaged, removed or otherwise interfered with by the Contractor shall be restored to a condition at least equivalent to their original condition.

Prior to commencing work in the vicinity of overhead power lines the Contractor shall acquaint himself with all the regulations of the Nepal Electricity Authority governing such work.

The Contractor shall be responsible for ensuring that all persons working in such areas are aware of the relatively large distance that high voltage electricity can "short" to earth when cranes or other large masses of steel are in the vicinity of power lines.

1.3.3 Access to Adjoining Property

Convenient access to driveways, houses and buildings adjoining the work shall be maintained and temporary approaches to intersecting streets and alleys shall be provided and kept in good condition by the Contractor.

As soon as a section of surfacing, pavement, or a structure has been completed, it shall be opened for use by traffic at the request of the Engineer.

The Contractor shall not prevent the free access to public water valves, water hydrants, or utility valves.

In order that unnecessary delay to the travelling public may be avoided, the Contractor, when so ordered by the Engineer, shall provide competent flag men whose sole duty shall consist of directing traffic either through or around the work. Reference is made also to Sub-Section 1.5.2.

1.3.4 Permanent Right-of-Way

The Employer will make all statutory arrangements necessary for obtaining the final possession of the Site and the permanent right-of-way in the shortest possible time.

1.3.5 Measurement and Payment

Reference is made to Sub-Section 1.2.8.

1.4 SITE INSTALLATIONS

1.4.1 Camp for Contractor's Staff

In accordance with all stipulations of the Conditions of Contract the Contractor shall provide adequate housing with all necessary amenities and facilities for his staff and labour. The type of housing, such as accommodation containers, pre-fabricated or in-situ buildings or even rental is entirely up to him. Also the choice of one central camp or of various sub-camps is up to him as this depends greatly on the approved work programme.

During the whole period of existence, from setting up through operation to final removal upon completion of the Works, the Contractor shall be fully responsible for constantly carrying out all measures necessary for safeguarding the natural environment affected by his camp or camps.

He shall cause the least possible interference with existing amenities, whether man-made or natural. No trees shall be felled except as authorized by the Engineer (re clause 2.1 of this specification).

Latrine and ablution facilities and first-aid services shall be provided in sufficient type and numbers to the satisfaction of the Engineer and shall be maintained in a clean and sanitary condition at all times.

On completion of the Works or as soon as the facilities provided by the Contractor are no longer required, the Contractor shall remove such facilities and clear away all surface indications of their presence.

1.4.2 Contractor's Offices, Stores and Services

The Contractor shall provide, erect, construct, maintain and subsequently remove proper offices, stores, workshops, laboratories, storage and parking areas for his own use. Such facilities shall be sufficiently sized and equipped to enable him to manage his operations and those of his Subcontractors in a professional manner and to enable him to carry out all his obligations under the Contract.

Sheds for storage of materials that may deteriorate or corrode if exposed to the weather shall be weatherproof, adequately ventilated and provided with raised floors.

Within his offices a meeting room shall be available for site meetings with the Engineer and the Employer.

These Contractor's facilities shall be subject to the same stipulations regarding siting, interference with amenities and environmental protection as the Contractor's camp.

1.4.3 Contractor's Plant

When working in built-up areas, the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant that would otherwise cause a noise level exceeding 85 dB (A) during excavation and other work. Alternatively, he shall, by means of barriers, effectively isolate the source of any such noise in order to comply with above requirement.

1.4.4 Water Supply

The Contractor shall make his own arrangements for the supply of all water for his camp, office and other temporary buildings as well as for the execution of the Works.

Temporary water connection may be arranged with NWSC at established rates. Water for testing of pipe sections, however, shall not be taken from the mains as stipulated in the relevant Section of the Technical Specifications.

When using other sources of water, such as stone spouts, etc. the Contractor shall have due regard to and coordinate with other users.

Water for drinking purposes shall be of drinking water quality.

1.4.5 Sanitation

The Contractor shall maintain the Site and all working areas in a hygienic conditions. In all matters of health and sanitation he shall comply with the requirements of the local Medical Officer of Health or other competent authority.

1.4.6 Sewage and Waste Disposal

The Contractor shall make provision for the discharge or disposal from his camp, offices and the Works of all water as well as of all liquid and solid waste products however arising. The methods of disposal shall be to the satisfaction of the Engineer and of any authority or person having an interest in any land or watercourse over or in which water and waste products may be so discharged.

1.4.7 Pollution

The Contractor shall take all reasonable measures to minimize any dust nuisance, pollution of streams and inconvenience to or interference with the public (or others) as a result of the execution of the Works.

1.4.8 Energy Supply

The Contractor shall install, operate, maintain and subsequently remove temporary supplies of electricity for power, heating, cooling, lighting and ventilation of all camps, offices, stores, laboratories and other temporary buildings used by the Contractor in addition to all electricity requirements in connection with the construction, testing and maintenance of the Works.

The Contractor shall ensure that all proposed electrical installations comply with the requirements of the Nepal Electricity Authority and shall be responsible for and shall bear all costs associated with obtaining the written approval of that authority for such installations and their operations.

Prior to placing orders for transformers, conductors, cables and associated equipment, the Contractor shall ensure by enquiry with the Nepal Electricity Authority that his proposed equipment is suitable for use with the existing or proposed medium/high tension electricity supply lines.

1.4.9 Supply of Fuel, Lubricants, etc.

The Contractor shall be responsible for arranging and ensuring that adequate supplies of petrol, diesel oil, motor oil, kerosene, lubricants and other petroleum products are available at all times to meet his requirements for the purpose of or in connection with the Contract; the Contractor's particular attention is drawn to this requirements as from time to time shortages and interruptions in the supply of fuel oils, etc., may occur.

He shall make his own arrangements for the supply of all other types of fuel required for the purposes of the Contract.

Firewood may be obtained on the open market. Under no circumstances shall the Contractor cut down trees for firewood.

With regard to the transportation, storage and handling of all his fuel requirements, including all electrical connections, he must strictly comply with all relevant safety codes and regulations.

1.4.10 Temporary TV, Telephone and Internet Connections

Telephone

The Contractor shall arrange at his own cost for temporary telephone connections to his offices and other installations.

He shall be responsible for all installations, connection and disconnection charges of all telephones for his and his Representative's offices.

Similarly, 2 Sets of new Mobile (Smart) Phone shall be provided to Engineers with post paid SIM card and necessary monthly cost and maintenance shall be borne by the contract till the end of Defect's Loability Period.

Internet / WIFI

A reliable unlimited Internet facility with necessary equipment and accessories shall be provided to the Engineers' mobile sets and wifi system at the Engineer's site office and at site residence including monthly bills shall be borne by the contractor till the end of Defect's Liability period of the Proejct.

Television Sets

The contractor shall provide a 32" LED Smart TV to the consultant's Site residence with cable connections with monthly bills payments till the end of the project.

No separate payment shall be made against the facilities of Telephone, Internet and TV facilities provided to Engineers at the site.

1.4.11 First Aid

The Contractor shall make his own arrangements for treatment of casualties on the Site in such first-aid units as may be thought necessary. The Contractor shall be responsible for the construction of such first-aid units and their management and operation and the removal by ambulance of injured or sick employees to nearby hospitals. The first-aid service shall cover the Contractor's own personnel as well as that of the Employer, the Engineer and all Subcontractors.

1.4.12 Fire Protection

No naked fire shall be used by the Contractor on or about the Site otherwise than in the open air without the permission in writing of the Engineer. If in the Engineer's opinion the use of naked fire may cause a fire hazard, the Contractor shall at no extra cost to the Employer take such additional precautions and provide such additional fire fighting equipment as the Engineer considers necessary.

The term "naked fire" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.

Compliance with the requirements of the Engineer shall not relieve the Contractor of any of his obligations under the Contract.

1.4.13 Contractor's Canteen

The Contractor shall provide adequate facilities to comply with Sub-Clause 9.4 of the Conditions of Contract.

1.4.14 Site Safety

Reference is made to the relevant stipulations of Sub-Clause 9.4 of the Conditions of Contract.

The Contractor shall at all times in the conduct of his work and that of his Subcontractors adhere to the established rules and regulations concerning all safety matters at Site such as the recommendations contained in the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc., or other internationally recognized recommendations to the extent that such provisions do not conflict with the applicable laws. This is specially important wherever it is necessary to enable the free passage of the public through the Site.

The Contractor's Safety Officer shall have the qualification and the authority to issue instructions to the Contractor's personnel regarding protection measures to prevent accidents.

During construction the Contractor shall erect, maintain and subsequently remove sufficient barricades, guards, lighting, sheeting, shoring, temporary sidewalks and bridges, danger signals as well as temporary covering of potential accident areas.

If and where required the Contractor shall erect and maintain suitable and approved temporary fencing to enclose such areas of the works and areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under Clauses 13 of the Conditions of Contract. Where temporary fencing has to be erected alongside a public road, foot-path, etc., it shall be of the type required by and shall be erected to the satisfaction of the authority concerned.

All open excavations along pipe lines shall be protected sufficiently to keep out livestock, and ensure the safety of workmen and members of the public and be in accordance with the directives of the police and the other local regulations.

Where work is to be carried out in the proximity of buildings, bridges, tanks or other structures, the Contractor shall take all necessary precautions, including shoring and strutting, where necessary, to ensure the safety of the structures that are at risk.

The Contractor shall be responsible for all damages or injury which may be caused on any property by trespass by the Contractor's or his Subcontractor's employees in the course of their employment, whether the said trespass was committed with or without the consent or knowledge of the Contractor.

1.4.15 Protection of Overhead and Underground Services

The Contractor will be held responsible for any damage to known services (ie services that are within the Site and are shown on the drawings) and he shall take all necessary measures to protect them. All work or protective measures shall be subject to approval. In the event of a service being damaged, the Contractor shall not repair any such service unless instructed to do so.

Where no underground services are shown on the drawings or scheduled but the possibility of their presence can reasonably be inferred, the Contractor shall, in collaboration with the Engineer, ascertain whether any such services exist within the relevant section of the Site. The Contractor shall complete such an investigation well in advance of the start of construction work in the said section and he shall submit a report in good time to enable the Engineer to make whatever arrangements are necessary for the protection, removal or diversion of the services before any construction works commences.

As soon as any underground service not shown on the drawings is discovered, it shall be deemed to be a known service and the Contractor will be held responsible for any subsequent damage to it. If such service is damaged during the course of its discovery, the cost of making good such damage will be met by the Employer unless he establishes that the Contractor did not exercise reasonable diligence and that the damage was avoidable.

Where the authority concerned elects to carry out on its own account any alterations or protective measures, the Contractor shall co-operate with and allow such authority reasonable access and sufficient space and time to carry out the required work.

Permanent alterations to or permanent diversion of services necessitated by the execution of the Works and authorized will be paid for in terms of the conditions of contract, but no such work will be paid for if it has not been previously inspected and if proper written instructions have not been given.

1.4.16 Signboards

Signboards shall be placed at specified locations giving, in English and Nepali, information about the project and Employer, and the names of the Engineer and Contractor in a form and size to be agreed upon by the Employer and the Engineer. They shall be of durable construction capable of withstanding the effects of the climate until the end of the Defects Liability Period.

Besides these signboards the Contractor shall not, except with the written authority of the Engineer, exhibit or permit to be exhibited on the site any other form of advertisement.

1.4.17 Site Roads

The Contractor shall provide and maintain such access to the various sections of the Works as he requires for the proper execution of the work. Access roads shall be so arranged as to minimize inconvenience to adjoining landowners or occupants and to the general public. The site roads shall be of gravel or equivalent material providing a hard surface for vehicles. Temporary roads shall be removed when they are no longer required.

1.4.18 Testing Facilities, Laboratory

The Contractor shall provide a site laboratory equipped and furnished with all testing facilities required to perform all mandatory tests stipulated in the various specific clauses of these Technical Specifications (see Clause 1.2.7 above).

Other tests which may be required upon instruction of the Engineer and which cannot be performed in the site laboratory shall be carried out on behalf of the Contractor at other laboratories acceptable to the Engineer.

1.4.19 Cleaning-up of Site

Reference is made to Clause 55 and 56 of the Conditions of Contract.

Before application is made for the Employer to accept any substantially completed Section of the Works, all items shall be complete, ready to operate and in a clean condition. All trash, debris, unused building materials and temporary facilities shall have been removed from the Site. Tools, equipment and construction machinery not needed during the subsequent Defects Liability Period for repair and adjustment shall not remain on the Site. The temporary walkways, parking areas and roadways shall be completely swept and broomed.

1.4.20 Site Drainage

The Contractor shall keep each Section of the Works well drained until the Engineer certifies that it is substantially complete and shall ensure that, so far as is practicable, all work is carried out in the dry. Excavated areas shall be kept well drained and free from standing water except where this is impracticable having regard to methods of Temporary Works properly adopted by the Contractor.

The Contractor shall provide, operate and maintain in sufficient quantity such pumping equipment, well points, pipes and other equipment as may be necessary to minimize damage, inconvenience and interference and shall construct, operate and maintain all temporary coffer-dams, sumps, ditches, drains and other temporary works as may be necessary to remove water from the Works while construction is in progress. Such Temporary Works and plant shall not be removed without the approval of the Engineer.

Notwithstanding any approval by the Engineer of the Contractor's arrangements for the removal of water, the Contractor shall be responsible for the sufficiency thereof and for keeping the Works safe at all times and for making good at his own expense any damage to the Works.

The Contractor shall be responsible to keep the Works clear of water at whatever pump rate found necessary.

1.4.21 Measurement and Payment

No separate measurement and payment will be made for any of the above listed items under this Section 1.4, Site Installation. All associated costs are deemed to be included in the unit rates of the BOQ.

1.5 TEMPORARY FACILITIES

1.5.1 Temporary Diversions of Utilities

If in the opinion of the Engineer it is necessary to make temporary diversions of services in connection with the Works, the Contractor shall arrange with the relevant authority for the construction of diversions. The cost of these diversion shall be covered under the appropriate item in the Bill of Quantities.

The Contractor may at his own cost and subject to the approval of the Engineer and the authority concerned, make such temporary diversions as may facilitate the carrying out of the Works. These temporary diversions shall be reinstated to the full satisfaction of the Engineer and the relevant authority on completion of the Works.

1.5.2 Detours and Traffic Control

The Contractor shall program his work in such a way that, wherever the temporary closure of street sections to public thoroughfare cannot be avoided, the duration of traffic diversion can be kept as short as possible. No streets shall be closed and no detours shall be introduced and no traffic diverted until the Contractor's proposals have been approved by the Engineer and the appropriate Government authorities, such as the Roads Department.

Where work is to be carried out in public roads, the Contractor shall give notice to the Engineer sufficiently in advance of the date on which he wishes to commence such work.

The Contractor shall be responsible for obtaining the permission of the Employer, Road Department and the Police for works he intends to carry out in public roads. Two copies of the Contractor's proposals to the relevant authorities shall be submitted to the Engineer. One copy of all obtained approval shall be submitted to the Engineer.

The Contractor's attention is drawn to the fact that processing of the documentation required by the local authorities prior to the cutting of existing public roads takes approx. 30 days. During the Monsoon period (June to August) no road cuttings are normally allowed.

Detours shall be selected in such a way that the inconvenience to the affected traffic as well as to the inhabitants of the affected areas is kept to a minimum.

The Contractor shall furnish, install and maintain at all times during the execution of the Works all necessary traffic signs, barricades, lights, signals and other traffic control devices, including flagging and other means of guiding traffic through the work zone. Traffic control shall be managed in accordance with prevailing rules and regulations, and with the approval and to the satisfaction of the Engineer.

All devices mentioned above shall be in conformity with the requirements of the Roads Department. All traffic signs and control devices to be furnished and installed by the Contractor shall be approved by the Engineer for their location, position, visibility, adequacy and manner of use under specific job conditions.

All traffic control devices necessary for the initial stage of construction shall be properly placed and operational before any construction is allowed to start. When work of a progressive nature is involved, the necessary signs shall be moved concurrently where they are needed.

If the Engineer determines that proper provisions for safe traffic control are not being provided or maintained, he may restrict construction operations affected by such defective signs or devices until such provisions are established or maintained, or may altogether order suspension of the Work until a proper traffic control is achieved. In case of serious or willful disregard by the Contractor of the safety of the public or his employees, the Engineer may take necessary steps to rectify the situation and deduct the cost thereof from monies due or becoming due to the Contractor. The Contractor shall be responsible for all resulting delays.

The Contractor shall designate or otherwise employ personnel to furnish continuous surveillance of the traffic control operations. The designated personnel shall be available day and night to respond to calls involving damage due to vandalism or traffic accidents.

At sections where traffic is in operation and when ordered by the Engineer, the movements of the Contractor's equipment from one place of work to another shall be subject to traffic control. During rush hours movement of larger vehicles, such as trucks, cranes, dumpers, etc. through main thoroughfare are not permitted by the police. Spillage resulting from hauling operations along or across the road way shall be removed immediately at the Contractor's expense.

1.5.3 Provision of Temporary Services

When the rehabilitation or replacement of existing public utilities requires their temporary disconnection, the Contractor shall provide the affected users with temporary services in at least the same standard as the original services.

For water supply he may install temporary lines or arrange for regular supply by tankers.

When forced to disconnect existing sewers the Contractor shall install temporary pipes of adequate size to carry off sewage from any private sewer facilities cut off by construction work. Connections to temporary pipes shall be made immediately by the Contractor upon cutting off the existing facility. No sewage shall be allowed to flow from any severed facility upon the ground surface or into the trench excavation. Pipes used in temporary sewers may be plastic or approved flexible material.

Upon completion of work the Contractor shall replace all severed connections and restore to operating order the existing sanitary facilities.

No valve or other controls in public service facilities shall be operated by the Contractor without approval of the Engineer. All users affected by such operation shall be notified by the Contractor at least one hour before the operation and advised of the probable time when service will be restored.

1.5.4 Protection of Adjoining Property

The Contractor shall control the movement of his crews and equipment on right-of-way including access routes approved by the Engineer so as to minimize damage to crops and property and shall endeavor to avoid marring the lands. Ruts and scars shall be obliterated and damage to land shall be corrected and the land shall be restored as closely as possible to its original conditions before final taking-over of the Works.

The Contractor shall be responsible directly to the Employer for any excessive or avoidable damage to crops or lands resulting from his operations whether on lands adjacent to right-of-way or on approved access road and deductions will be made from payment due to the Contractor to cover the amount of such excessive or avoidable damage as determined by the Engineer.

1.5.5 Reinstatement Upon Completion

Temporary facilities shall be provided by the Contractor, only for as long as required after which he shall dismantle and remove the same from their place of use as speedily as possible. Re-usable components shall be safely stored by the Contractor in his yard.

The place of use shall be cleared and reinstated immediately to at least the condition existing before the temporary facilities were provided to the satisfaction of the Engineer.

1.5.6 Measurement and Payment

Ordered temporary diversions of utilities under Sub-Section 1.5.1 and provision of temporary services under Sub-Section 1.5.3 shall be covered by a provisional sum in the BOQ. Measurement will be at actual quantities. Valuation will be in accordance with Clause 40 of the Conditions of Contract.

1.6 COORDINATION WITH OTHER AUTHORITIES

1.6.1 Statutory Services

As far as possible the Contractor shall acquaint himself with the actual location of all existing public utilities such as sewers, water mains, drains, cables for electricity, telephone lines, lighting poles, masts, etc., before commencing any works likely to affect the existing utilities. The Contractor shall with the assistance of the Employer obtain such information directly from the responsible authorities as early as possible.

1.6.2 Notices, Permits

Well in advance of the programmed start of any work which may affect traffic or any existing utilities the Contractor shall give advance notice to the respective authority indicating the type, the exact location, the programmed starting time and the expected duration of the works and shall provide whatever particulars may be required by the authorities to issue any required permits and make all necessary arrangements. The Employer will provide whatever assistance possible to the Contractor to facilitate the permit procedure which, however, will remain the sole responsibility of the Contractor.

1.6.3 Witnessing and Post-Construction Clearances

It is expected that the issue of these permits will be tied to the requirement that the work may only be carried out in the presence of authorized inspectors from the authorities concerned. Their job will be to witness and assess any damage or interference with their respective utility. Should such disturbances occur it will be at their discretion to authorize either the Contractor to correct them or to arrange for specialized repairs through their own personnel.

Notwithstanding the provisions of Clause 11 of the Conditions of Contract, the Contractor shall be fully responsible for all costs whatever resulting from avoidable damages of or interferences with other utilities.

As proof that the works in question have been completed to the satisfaction of the authorities concerned the Contractor shall submit to the Engineer upon request official post-construction clearances issued by the respective authorities.

1.7 SUBMISSIONS BY THE CONTRACTOR

1.7.1 Pre-Construction Surveys and Setting Out

Upon commencement of the Works the contractor shall carry out all additional survey work necessary for setting out the Works. He shall establish all setting out necessary for the performance of the Work to the approval of the Engineer including levels of the original ground surface at the Site and final surveys of the completed Works for the final measurement. Levels shall close within 25 mm times the square root of the length of the circuit in km.

Ground levels shall be taken jointly by the Contractor and the Engineer both prior to commencing and after completion of earthworks. The result of the survey shall be recorded in the manner agreed between the Engineer and the Contractor and be signed by both.

Where cross sections are ordered these shall be at 25 m intervals or at such other spacing as may be ordered by the Engineer. The location of the first cross section shall be approved by the Engineer and each cross section shall extend a minimum distance of 10 m beyond the limits of the Works.

From the center line and grades established, the Contractor shall furnish and place all additional stakes, templates and bench marks necessary for marking and maintaining points, lines and sections for layout of the Works. The Contractor shall give 2 working days notice in writing whenever he will require the assistance of the Engineer for laying out any portion of the Work.

The Contractor's methods of recording survey data shall be subject to approval and field books and tabulated data shall be well maintained and made available for inspection and checking by the Engineer when ordered.

Instruments and equipment for surveys shall be subject to rigorous inspection by both the Contractor and the Engineer and any item found to be defective, in the opinion of the Engineer, shall be promptly replaced, repaired or adjusted as directed. All surveying shall be done under the direct supervision of a qualified surveyor or engineer who, as an employee of the Contractor, shall be subject to the approval of the Engineer at all times during the progress of the work in accordance with Clause 9 of the Conditions of Contract.

1.7.2 Detailed Design of Temporary Works

In accordance with Clause 18 of the Conditions of Contract the Contractor shall submit for approval full particulars, including drawings of any of the site installations and Temporary Works. If required the Contractor shall also submit calculations of the stresses, strains and deflections which will arise in falsework or other Temporary Works and these calculations shall be accompanied by detailed Working Drawings to show the Contractor's proposals. Approval by the Engineer of the Contractor's proposals, calculations or drawings shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

1.7.3 Working Drawings

Working Drawings shall be submitted by the Contractor to the Engineer as called for by the Contract. Working Drawings shall include, but not be restricted to, reinforcement detail drawings and bending

schedules, shop drawings for structural steel and miscellaneous metal work, working drawings for mechanical equipment, architectural items and electrical work and drawings for other work for which the Engineer's approval is required.

It shall be the Contractor's own responsibility to prepare such Working Drawings as he may require for the proper setting out and construction of all structures and facilities. Work shall not commence on an individual structure or facilities until the relevant Working Drawings have been approved by the Engineer.

Within 28 days of the date of the letter of Acceptance, the Contractor shall submit to the Engineer a Drawings Submittal Schedule for the Working Drawings listing the anticipated dates upon which they will be submitted for approval by the Engineer. The submission dates shall be spaced at reasonable intervals to allow at least 14 days for the Engineer to duly check and to either approve them or to request changes or modifications, as the case may be.

All dimensions shall be in metric units and each drawing shall be properly identified by a drawing head and a numbering code in the form prescribed by the Engineer upon commencement of the Works. ISO or DIN standard size sheets shall be used.

Drawings shall not be smaller than 210 x 297 mm (DIN A4) or larger than 841 x 1189 mm (DIN A0).

Prior to submittal, the Contractor shall also check the drawings prepared by his Subcontractors for accuracy and completeness, especially that the relation to adjoining work is accurately shown.

The Contractor shall submit 3 (three) copies of all drawings for approval.

Any changes or modifications to the Working Drawings that the Engineer considers necessary shall be made by the Contractor promptly and the drawings resubmitted for approval.

Approval of Working Drawings will be given by the Engineer in the form of a stamp "RELEASED FOR CONSTRUCTION" together with the date and the authorized signature. Only those Working Drawings carrying the signed and dated stamp shall be used for execution.

Copies of all such approved Working Drawings together with one unreduced transparency shall be supplied to the Engineer by the Contractor immediately after approval. The cost of preparing and providing all Working Drawings shall be included in the Contract Rates.

Should it be found at any time after approval has been given by the Engineer to a Working Drawing submitted by the Contractor that the said Working Drawing does not comply with the terms and conditions of the Contract or that the details do not agree with the Working Drawings previously approved, such alterations and additions as may be deemed necessary by the Engineer shall be made therein by the Contractor and the work carried out accordingly without entitling the Contractor to extra payment on account thereof, except where such alternations and additions are to be made in direct consequence of written order by the Engineer to vary the Works in accordance with Clause 39 of the Conditions of Contract.

No examination by the Engineer of any document submitted by the Contractor or of the Contractor's Working Drawings, nor the approval expressed by the Engineer in regard thereto, either with or without modification, shall absolve the Contractor from any liability imposed upon him by any provision of the Contract. Notwithstanding the Engineer's approval of the Working Drawings the Contractor shall be responsible for any dimensional or other errors.

1.7.4 As-Built Drawings

Such approved Working Drawings as have been selected by the Engineer shall be correctly modified for inclusion in the As-Built Drawings incorporating such variations to the Works as have been ordered and executed. Such drawings shall show the actual arrangement of all structures and items of equipment installed under the Contract. The Contractor shall submit 1 (one) reproducible copy and 3 (three) prints of all As-Built Drawings clearly named as such to the Engineer for approval before applying for the Taking-Over Certificate for the respective Section of the Works.

During the course of the Works, the Contractor shall maintain a fully detailed record of all changes from the approval to facilitate easy and accurate preparation of the As-Built Drawing in accordance with Clause 58 of the COC.

Irrespective of the other contractual prerequisites stipulated in Clause 56 of the Conditions of Contract, no Section of the Works will be considered substantially completed until the respective As-Built Drawings have been approved by the Engineer.

1.7.5 Progress Reports

The Contractor shall furnish the Engineer, at no extra cost to the Employer, at regular monthly intervals, no. of copies and formats determined by the Engineer, with Progress Reports containing the following information:

(a) physical progress for the report month and estimated progress for the next month;
(b) completion schedules (target and actual) based on the approved construction programme as provided in Clause 27 of the Conditions of Contract;
(c) updated S-curves for physical progress at different sections of the Works any report which may be specifically requested by the Employer and/or the Engineer.quality management activities weather / daily report

These monthly reports shall be submitted not later than 7 days after the end of the report month.

1.7.6 Record / Progress Photographs

Out of these Record Photographs the Contractor shall select 10 characteristic ones as Progress Photographs attached to the Progress Reports.

Notwithstanding the obligations of the Contractor to provide cameras for the Engineer's site office, the Contractor shall arrange required number of photographs to be taken by a professional photographer monthly, or as ordered by the Engineer as Record Photographs and shall provide the negatives and 2 colour prints each on glossy paper unmounted and of a size not less than 210 mm x 297 mm (A4) in transparent plastic pockets contained in hard cover album. Each print shall contain upon its back the date and description of the view taken. The Contractor shall ensure that no use is made of any negative or print without permission from the Employer.

1.7.7 Measurement and Payment

No separate measurement and payment will be made for all Sub-Sections of Section 1.7, the cost of which shall be deemed to be included in other unit rates of the BOQ.

1.8 QUALITY CONTROL

1.8.1 Quality Control Plan and Procedures

The Contractor shall be responsible for establishing and maintaining procedures for quality control which will ensure that all aspects of the Works comply with the requirements of the Contract.

As soon as reasonably practicable prior to the commencement of Works the Contractor shall submit for approval a Quality Control Plan giving detailed proposals for control of quality of all aspects of work on the Site and at suppliers' workshops.

The Quality Control Plan shall include the following:

a list of the Contractor's staff engaged in quality control
a list of any outside testing agencies employed by the Contractor for work in connection with quality control
where a testing laboratory is to be established on Site under the Contract, a list of major items of equipment and a layout of the laboratory, together with details of the tests which will be carried out there
a list of manufactured items and materials, obtained by the Contractor for the Works, which require inspection at the suppliers' premises, and the proposed procedures for ensuring quality control
a list of materials and operations to be inspected by the Contractor at the various stages of construction work on Site, together with inspection procedures, test types and frequencies
sample of proposed quality control records, testing forms and reporting forms.
Standards of Testing to be followed i.e. testing procedures.

Unless the Engineer permits otherwise, the approved Quality Control Plan shall be followed throughout the construction of the Works. Any approval by the Engineer of the Contractor's plan and procedures shall not relieve the Contractor of his obligation to ensure that the Works comply with the requirements of the Contract.

The Contractor shall appoint a suitably qualified member of his staff to be responsible for all aspects of quality control and to maintain effective liaison with the Engineer.

1.8.2 Sampling and Testing

Reference is made to Clause 33 and 34 of the Conditions of Contract.
The Contractor shall provide for the approval of the Engineer, samples of all construction materials and manufactured items required for the Permanent Works. All samples rejected by the Engineer shall be removed from Site. All approved samples shall be stored on Site by the Contractor for the duration of the Contract, and any materials or manufactured items subsequently delivered to Site for incorporation in the Permanent Works shall be of a quality at least equal to the approved sample.

Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer. Samples for testing will generally be selected by the Engineer from materials to be utilized in the project and all tests will be under the supervision of, and as directed by, and at such points as may be convenient to the Engineer.

Material requiring testing shall be furnished in sufficient time before intended use so as to allow for testing. No materials represented by tests may be used prior to receipt of written approval of said materials.

The Contractor shall give the Engineer at least 14 days notice in writing of the date on which any of the materials will be ready for testing or inspection at the suppliers' premises or at a laboratory approved by the Engineer and unless the Engineer shall attend at the appointed place and time the test may proceed in his absence. The Contractor shall in any case submit to the Engineer within 7 (seven) days after every test such number of certified copies of the test readings as the Engineer may require.

The provisions of this Clause shall also apply to materials supplied under any nominated subcontract.

After all construction at each Section is completed and before applying for taking-over, the Contractor shall perform field tests as called for in the Specifications. The Contractor shall demonstrate to the Engineer the proper operation of the facilities and the satisfactory performance of the individual components. Any improper operation of the system or any improper, or faulty construction shall be repaired or corrected to the satisfaction of the Engineer. The Contractor shall make such changes, adjustments or replacement of equipment as may be required to make the same comply with the Specifications, or replace any defective parts or materials.

In addition to any special provision made herein as to sampling and testing materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the Works may be called for at any time by the Engineer and these shall be furnished without delay by the Contractor at his own cost. Approved samples will be retained by the Engineer who will be at liberty to reject all materials and workmanship that are not equal or better in quality and character than such approved samples.

All costs incurred by the Contractor, in connection with sampling and testing of all materials and items required for the Works shall be deemed to be included and covered by the tendered Contract Rates.

Notwithstanding the provisions for payment in respect of testing given in Clause 34 of the Conditions of Contract, all costs in connection with conducting tests and delivery of samples to an approved laboratory shall be deemed to be included and covered by the Contract Rates for the following categories of tests:

a) tests conducted at the premises of the Contractor, Subcontractor, manufacturer or supplier which are normally or customarily carried out at such premises for the items or materials being supplied for the Works.
b) tests which are normally or customarily conducted on the items or materials being supplied for the Works by the Contractor, Subcontractor, supplier or manufacturer but which have to be conducted at an approved laboratory because the necessary testing facilities are not available on the premises of the Contractor, Sub-Contractor, supplier and manufacturer.

c) tests on locally obtained materials or items either on the Site or at an approved laboratory for the purpose of obtaining the approval of the Engineer to the classification, use and compliance with the Specifications of such items or materials.
d) routine quality control tests conducted by the Contractor to ensure compliance with the Specifications.
e) regular testing of concrete and other materials as specified in the relevant Chapters of the Technical Specifications.
f) standard shop and Site acceptance tests, including trial assemblies, of mechanical equipment.

1.8.3 Preservation of Approved Samples

Where samples, including samples of materials and workmanship constructed on the Site, are submitted as a reference for materials and workmanship to be provided as part of the Permanent Works, they shall, after approval by the Engineer, be carefully preserved for this purpose on site by the Contractor to the satisfaction of the Engineer until permission is given by the Engineer for their disposal.

1.8.4 Inspection and Acceptance

The Engineer may appoint Inspecting Engineers to inspect and test materials and articles on his behalf prior to their despatch to the Site. The Inspecting Engineer will examine, test and if necessary analyze all materials and articles to be used in the Works including all items of fabricated or finished work unless the Engineer shall direct otherwise. The Inspecting Engineer shall be granted free access at all reasonable times to the premises of the Contractor and/or any Subcontractor and shall be afforded every facility for making inspections, making tests, which it is normal or customary to undertake at the premises of the Contractor or Sub-Contractor and for taking samples for testing and analysis.

The Contractor and/or Subcontractor shall give adequate notice to the Engineer or the Inspecting Engineer as to when any materials, articles or fabricated work will be ready for inspection and shall take into account the possibility of delays in postal communication when giving such notice. Belated requests by telephone or telex for an immediate inspection of particular items scheduled for shipment which cannot be met will not be sufficient reason for waiving inspection thereof and the Contractor shall be held solely responsible for all consequences arising out of any delay resulting from his failure to give adequate notice.

The Engineer and the Inspecting Engineer shall be kept properly informed of the progress of any work being carried out on materials and articles being prepared or supplied by the Contractor or any Subcontractor for use in the Works to enable them to make such arrangements for inspection, testing and analysis as they may consider appropriate.

The inspection of all items of fabricated or finished work will be carried out only against Working Drawings that have been approved by the Engineer and that bear his endorsement of approval.

Neither the Engineer nor the inspecting Engineer will undertake the inspection of any item of fabricated or finished work until such time as the Contractor shall have forwarded to the Engineer the approved Working Drawings covering the items to be inspected, together with four copies of the respective orders.

The Engineer may require to inspect work being prepared and to witness tests at supplier's premises. The Contractor shall give the Engineer adequate notice of the programmes of work and testing at suppliers' premises to enable the Engineer to arrange such inspections.

Manufactured items and materials delivered to the Site shall be inspected by the Contractor on arrival. Any defects shall be notified to the Engineer. Minor defects to surface finishes and the like in manufactured items shall be made good in an approved manner to the satisfaction of the Engineer. Items with more serious defects shall be returned to the suppliers for correction or replacement as appropriate.

Inspections or tests carried out by or on behalf of the Engineer shall not relieve the Contractor of his responsibilities in connection with quality control.

1.8.5 Materials/Equipment Certificates

Where certificates are required by the Specifications or relevant Reference Standard, the original and one copy of each such certificate shall be provided by the Contractor.

Certificates shall be clearly identified by serial or reference number and shall include information required by the relevant Reference Standard or Specification clause.

The timing for submittal of certificates shall be as follows:

(a) manufacturer's and supplier's test certificates shall be submitted as soon as the tests have been completed and in any case not less than 7 calendar days prior to the time that the materials represented by such certificates are needed for incorporation into the Permanent Works
(b) certificates of tests carried out during the construction or on completion of parts of the Permanent Works shall be submitted within 7 days of the completion of the test.

No materials, articles or items of fabricated or finished work to be supplied by the Contractor or Subcontractors which have been inspected and tested by the Engineer or the inspecting Engineer shall be despatched unless a Passing Certificate has been reqested by the Contractor from the Engineer and subsequently been issued by the Engineer to the effect that the same are approved. Neither the Contractor nor Sub-Contractors shall make use of any materials or articles ordered by them for the purpose of fabrication until a Passing Certificate covering the said materials and articles shall have been issued by the Engineer or inspecting Engineer.

1.8.6 Site Records

Daily records of on-site testing and inspection shall be kept on forms of approved format. Test results shall be certified by the responsible member of the Contractor's staff. All test certificates and inspection records (including any from suppliers or other outside testing agencies) shall be clearly identified with the appropriate part of the Works to which they refer, and they shall be submitted to the Engineer together with the respective Passing Certificate.

Once each month, or at such longer intervals as the Engineer may allow, the Contractor shall submit in an approved form a summary of all quality control inspections and tests performed at Site and elsewhere in the intervening period.

Test results shall be summarized in tabular form or graphically or both in a way which best illustrates the trends, specific results and specification requirements. Where the tests show that the specified requirements were not achieved, the report shall describe the action which was taken.

Each report shall also contain a forecast of quality control work likely to be carried out during the period to be covered by the succeeding report.

The Contractor shall keep detailed and up-to-date inventories in an approved form of goods and materials already approved by the Engineer for which Passing Certificates have been issued as well as of all other goods and materials subject to quality control which are on order, delivered, found faulty, lost during the work or to be surplus to requirements. The Engineer shall have access to these records at all times.

1.8.7 Daily Log Book

The Contractor shall keep a Daily Log Book at each site. This Daily Log Book shall be in a form approved by the Engineer and shall contain, but not be limited to, the following major items of information:

a) name of Contractor and Package No.
b) date
c) weather conditions (max./min., temperature, hours and intensity of rainfall)
d) work carried out during the day per Section (description, quantities)
e) major equipment used per section (on contractual work, on extra work ordered, approximate operating time on either)
f) strength of labour force per Section (on contractual work, on extra work ordered, hours worked on either)
g) delays (cause, effects such as idle time etc.)
h) unusual events (earthquakes, floods, fires, storms, accidents, etc.)
i) visitors at Site.

Each daily log shall be signed by the responsible Site Manager of the Contractor and "noted" by the Engineer.

1.8.8 Measurement and Payment

No separate measurement and payment will be made for Section 1.8, the cost of which shall be deemed to be included in other unit rates of the BOQ. In fulfilling the obligation of Sub Clouse 1.8.4, the Contractor shall also take into account the cost associated with inspection visits by Engineer's Instructors to manufacturer's premises that are located outside Nepal in foreign countries.

1.9 STANDARDS, CODES AND ABBREVIATIONS

1.9.1 Reference Standards and Codes

The Works shall be carried out in accordance with the relevant quality standards, test procedures or codes of practice, collectively referred to as Reference Standards, listed in the relevant parts of the Specifications. The Contractor shall familiarize himself fully with the requirements of such standards. If no standard is indicated then the relevant ISO Standard or, in the absence of such standard, the relevant German, British, American or Indian Standards shall apply, or others, if so approved.

The Contractor may propose, at no extra cost to the Employer, the use of any alternative relevant authoritative internationally recognized Reference Standard which shall be no less exacting, in the opinion of the Engineer, than the corresponding standard quoted in the Specification. The Contractor shall demonstrate to the Engineer that the alternative standard is suitable and equivalent to the specified standard, as well as provide proof of previous successful use. The Engineer shall decide whether or not the use of such alternative will be allowed as a Reference Standard.

The Contractor shall obtain and keep on Site at least one copy of each approved Reference Standard and each Reference Standard referred to in the Specifications, and will make these accessible to the Engineer at any time upon request.

The Contractor shall obtain the Reference Standards from the addresses given below:

ISO	International Organization for STANDARDIZATION, Rue de Varembe, Geneva, Switzerland
DIN	Deutsche Industrie Norm (German Industry Standard) from Deutsche Normenausschuss, Beuth-Vertrieb, P.O.Box 1045, W-1000, Berlin 30, Federal Republic of Germany
BSI	British Standards Institution, 101 Pantonville Road, London N1 9ND, England
AASHTO	American Association of State Highway and Transportation Officials, Suite 341 National Press Building, Washington, D.C. 2004, U.S.A.
ACI	American Concrete Institute, P.O. Box 4754, Redford Station, Detroit, MI 48219, U.S.A.
AISC	American Institute of Steel Construction, 101 Park Avenue, New York, NY 10017, U.S.A.
ASTM	American Society for Testing and Materials, 2501 Race St., Philadelphia, PA 19103, U.S.A.
AWS	American Welding Society, Inc., 2501 N.W. 7th St., Miami, FL 33125, U.S.A.
AWWA	American Water Works Association, 6666 West Quincy Ave. Denver, Colorado 80235, U.S.A.
IS	Indian Standards, Manak Bhawan - 9, Bahadur Shah Jafar Marg, New Delhi, 11002
SIS	Swedish Standards

1.9.2 Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations so not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.9.3 Metric Units

S.I. units of measurement shall be used throughout the Contract. All information and data originating in another system shall be transferred by the Contractor into the S.I. system.

1.9.4 Abbreviations

A	=	AmpŠre
ACI	=	American Concrete Institute
AC	=	asbestos cement, alternating current
API	=	American Petroleum Industry
ANSI	=	American National Standard Institute
AASHTO	=	American Association of State Highway and Transportation Officials
ASTM	=	American Society for Testing and Materials
BB	=	Bansbari
BH	=	Bhaktapur
BOQ	=	Bill of Quantities, Schedule of Quantities
BS	=	British Standard
CBR	=	California Bearing Ratio
Cl-	=	chloride ion
cm	=	centimetre
cm2/g	=	square centimetre per gram
CO2	=	carbon dioxide
d	=	day(s)
Cu	=	copper
DC	=	direct current
dia	=	diameter
DIN	=	Deutsche Industrie Norm (German Standard)
DN	=	diameter nominal (=ND)
DK	=	Dhobi Khola
EC	=	electro-conductivity
g/cm3	=	gram per cubic centimeter
g/m2	=	gram per square meter
GK	=	Gokarna
h	=	hour
HDPE	=	high density polyethelene
HMG	=	His Majesty's Government of Nepal
HP	=	horse power
IDA	=	International Development Association
IEC	=	International Electro-Technical Commission
IS	=	Indian Standard
ISO	=	International Standard Organization
kg	=	kilogram
kg/cm3	=	kilogram per cubic centimetre
kg/cm2	=	kilogram per square centimetre
km	=	kilometre
kN	=	kilo newton
KVA	=	kilo volt amp,re
l	=	litre
m	=	meter
m2	=	square meter
MCB	=	miniature circuit breaker
MCCB	=	moulded case circuit breaker
m3	=	cubic metre
mg/l	=	milligram per litre
MH	=	Manohara
min	=	minute
mm	=	millimetre
m/min	=	metre per minute
m3/d	=	cubic metre per day
m3/min	=	cubic metre per minute
m/s	=	metre per second
MPa	=	Mega Pascal
mm/s	=	millimetre per second
MVA	=	mega volt ampŠre

N	=	Newton
ND	=	nominal diameter (=DN)
NEA	=	Nepal Electricity Authority
NH2	=	ammonia
nm	=	nanometer
N/mm2	=	Newton per square milimetre
NPSH	=	net positive suction head
NTU	=	nephelometric turbidity unit
NWSC	=	Nepal Water Supply Corporation
OMC	=	Optimum moisture content
PC	=	personal computer
pH	=	hydrogene concentration (acidity)
PI	=	Process and Instrumentation
PN	=	nominal pressure (maximum permissible working pressure)
ppm	=	parts per million
RC	=	reinforced concrete
r/min	=	revolution per minute
s	=	second
SI	=	SystŠme International d'Unit,s
Si	=	silicon
T	=	temperature
t	=	metric ton
uPVC	=	unplasticised polyvinyl chloride
V	=	Volt
VDE	=	Vereinigung Deutscher Electro-Ingenieure (German Electrical Standard)
VDU	=	visual display unit
W	=	Watt
ºC	=	centigrade
º	=	degree
"	=	inch
%	=	percent
4WD	=	four wheel drive
<	=	smaller/less than
>	=	larger/more than
OPC	=	Ordinary Portland Cement
RHPC	=	Rapid Hardening Portland Cement
PBFC	=	Pozzolanic Blast Furnace Cement

2. CIVIL ENGINEERING WORK

2.1 SITE CLEARANCE

2.1.1 Scope

This specification covers the removal of vegetation, boulders of size up to 0.2 cum, surface obstructions, and the demolition and removal of structures including their basements (if any) not directly associated with or incidental to any excavation.

2.1.2 Interpretations

2.1.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and be read in conjunction with this specification:

a) General
b) Earthworks, as applicable.

2.1.2.2 Application

This specification contains stipulations that are generally and particularly applicable to site clearance.

2.1.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Cleared surface - The natural surface of the ground after clearing of surface vegetation has been completed.

Designated site/area - A site or an area the position of which in relation to the work to be carried out is shown on the drawing or is described in the specification and is therefore known to the Contractor at the time of tendering.

Finished level - The level of the finished earthworks as shown on the drawings or stated in the project specification.

Grubbing - The operation of digging out the roots of vegetation.

Original ground level - The level of the surface of an area before the commencement of clearing.

2.1.3 Material

Material obtained from clearing and grubbing and from the demolition of structures shall be disposed of in borrow pits or other suitable places indicated by the Engineer and shall be covered with soil or gravel. Where no such place is indicated by the Engineer, the Contractor shall make his own arrangements for the provision of a suitable place.

For the disposal or burning of combustible material reference shall be made to clause 1.4.12 of this specification.

The Contractor shall not clear the Site of or damage any living tree having a girth more than 0.5 m (measured 1 m above the ground level) situated on the parts of the Site not subsequently to be occupied by the works without the written permission of the Engineer. All trunks and branches of such trees shall be stripped of secondary branches, sawn into transportable lengths and stacked at designated sites. Such timber shall not be used by the contractor for any purpose, and shall remain the property of the Employer.

Fencing wire shall be neatly wound into rolls or coils and all such wire, together with all fence posts and other re-usable material from structures, etc., shall be stacked at designated sites.

2.1.4 Plant and Equipment

The Contractor shall provide saws for cutting of trees and branches as ordered, and plant that is suitable for grubbing roots and for digging out and removing other obstructions on the Site.

2.1.5 Construction and Workmanship

2.1.5.1 Areas to be Cleared and Grubbed

The Contractor shall clear the parts of the Site subsequently to be occupied by the Works and shall maintain them clear of vegetation. Areas such cleared shall include but not be limited to borrow areas, portions of the Site where excavations are to be carried out and embankments and structures constructed, however, the Contractor shall not commence clearing and grubbing until the Engineer has designated, in writing and in detail, the exact areas to be cleared or grubbed and the time at which the work is to be started.

The Contractor shall ensure that the general shape, profile, and levels of the area are not materially altered during clearing and grubbing operations.

2.1.5.2 Cutting of Trees

The Contractor shall take the necessary precautions to prevent injury to persons and animals and damage to structures and other private and public property. Where necessary, trees shall be cut in sections from the top downwards.

No tree shall be cut down until the Engineer has given written authorization for such work to commence.

If possible, trees shall be felled in such a manner as to allow removal of the root together with the trunk.

Individual trees indicated and marked by the Engineer as trees to be preserved shall be left standing and uninjured. An amount of **NRs 100,000/-** shall be deducted from monies due to the Contractor as a penalty in respect of every such tree that is damaged or removed unnecessarily or without the authorization of the Engineer.

2.1.5.3 Clearing

Clearing shall consist of:

a) the removal of all trees and bushes (complete with roots), other vegetation, rubbish, fences, and all other material that may interfere with the construction of the works.
b) the disposal of all material resulting from the clearing
c) the removal and disposal of structures that encroach upon or may otherwise obstruct other work on the Site and that can be cleared by means of a bulldozer of approximately 130 kW (structures that cannot be so cleared shall be broken down)
d) the removal off all rocks and boulders of size up to 0.2 m3 that are lying on the surface to be cleared or exposed during the clearing operation.
e) where fences have to taken down, the sorting, coiling, and stacking of the material, and
f) the removal and stacking of other re-usable materials as scheduled.

The moving of a certain amount of soil or gravel may be inherent in or unavoidable during the process of clearing. No extra payment will be made for the removal of such soil or gravel.

2.1.5.4 Grubbing

All stumps and roots larger than 75 mm in diameter shall be removed to a depth of at least 600 mm below the finished level and at least 100 mm below original ground level. Where a road bed or other area has to be compacted, all stumps and roots included matted roots shall be removed to a depth of at least 200 mm below the cleared surface.

Except in borrow areas, cavities resulting from grubbing shall be backfilled with approved material and compacted to a density at least equal to that of the surrounding ground.

2.1.5.5 Re-clearing of Vegetation

If during the contract period vegetation should again grow on any portion of the Site, borrow area, or other areas that have been cleared in accordance with this specification, the Engineer may, if he considers it necessary, order that such area(s) be re-cleared.

Such re-clearing shall include the removal and disposal of grass, shrubs, and other vegetation, as in the first clearing operation.

2.1.5.6 Conservation of Topsoil

The removal of stumps and roots as specified under clause 2.1.5.4 above shall be done in such a manner that the topsoil is at least disturbed.

2.1.5.7 Demolition of Structures

Before moving plant onto the Site and commencing operations the Contractor shall establish to the Engineer's satisfaction that the method of demolition proposed by the Contractor is such that he can keep any nuisance arising from dust, noise, and vibration to an acceptable level and ensure the safety of structures adjacent to those to be demolished.

The materials obtained from demolition shall be reserved for further use when considered suitable by the Engineer, all rubbish and material unsuitable for further use shall at the cost of the Contractor be destroyed or removed from the Site.

Prior to the start of any work, the Contractor should lay-out the right-of-way, work areas, clearing, and pavement cuts to insure a proper recognition and protection of the adjacent properties.

All lay-out work must be approved by the Engineer before any demolition, rehabilitation or construction begins.

Demolition of reinforced concrete structures shall be carried out using approved methods and in accordance with any safety regulations enforced by the local municipality or Kathmandu Valley Town Development Committee or relevant thereto. The Contractor should note that a Building Permit is required for demolition work.

Except as noted below, debris arising from demolition shall be removed from the site promptly and disposed of in a place and in a manner acceptable to the local municipality.

The area shall be spread with approved fill material and graded to original levels, or such other levels as the Engineer may direct.

Demolition of walls, tanks, plates inside building to be rehabilitated will be performed with the required care, without damaging the stability of the structure.

Where required or directed by the Engineer, the existing structure will be temporary reinforced to assure the stability. The Contractor will submit to the Engineer's approval the methods applied for demolishing and the proposed temporary safety measures. The Engineer's approval shall not relieve the Contractor of any of his responsibilities under the Contract.

2.1.6 Measurement and Payment

2.1.6.1 Basic Principles

The items scheduled for clearance and demolition will be classified according to the nature of the materials involved and the methods of their disposal.

Only those areas designated to be cleared in terms of 2.1.5.1 will be measured for payment. The area of surfaced roads, structures, and paved areas falling within such designated areas will be deducted from such measurements.

Where conservation of topsoil without prior clearing is ordered, the removal of topsoil from the specified area will be measured as excavation and no payment will be made for clearing and grubbing but the contract has to pay to the client for the reusable materials collected from the demolision works. The total cost of the reusable material and cost of the desmantaling works should be calculated and necessary claim or payble amount should be quote in the Bid.

2.2 EARTHWORKS

2.2.1 Scope

This specification covers earthworks carried out with light or heavy plant or by hand, for general excavations, terracing, landscaping etc. It covers the requirements for siteworks, excavations for foundations for buildings, bridges and general structures and reinstatement of surfaces.

2.2.2 Interpretations

2.2.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.1 Site Clearance
c) 3.1 Pipe Trenches, as applicable.

2.2.2.2 Application

This specification contains clauses that are generally applicable to earthworks. Interpretations, additions, and variations of this specification (if any) are set out in the Particular Technical Specification.

2.2.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Average haul - The average distance that material is transported along the designated or shortest route.

Backfill - Approved material placed in an excavation after specified operations have been performed.

Borrow - Material obtained from various sources such as borrow pits.

Borrow pit - An excavation made for the purpose of procurement of material.

Catchwater drain - An open drain or mound intended to intercept water and to lead it to suitable discharge points.

Freehaul - Haul of which the cost is included in the scheduled rate for the material excavated or backfilled.

Overbreak - Excavation carried out in excess of the designated profile.

Overhaul - Haul in excess of freehaul and measured separately.

Pass - In regard to compaction, a movement of an approved compacting machine from one end of the layer being compacted to the other end.

Restricted excavation - An excavation so restricted in area or width as to preclude removal of material by a bulldozer.

Specified density - The ratio of field density to laboratory-determined modified AASHTO maximum density.

Spoil - Unsuitable or excess material removed to waste.

Stockpile - A pile of material that has been selected, loaded, transported and unloaded in a heap outside the confines of a borrow pit or of an excavation that forms part of the works.

2.2.3 Materials

2.2.3.1 Classification for Excavation Purposes

The Engineer will decide on the classification of the materials, which will be based on inspections and criteria given below.

The excavation of material will be classified as follows:

a) Soft excavation. Material that can be efficiently (ie in a manner that can reasonably be expected of an experienced contractor, having regard to the production achieved) removed or loaded, without prior ripping.
b) Intermediate excavation. Material that can be efficiently ripped by a bulldozer of up to about 220 kW flywheel power.
c) Hard rock excavation. Material that cannot, before removal, be efficiently ripped by a bulldozer specified above, but can be removed only after blasting.
d) Boulder excavation. Material containing more than 40 % by volume of boulders in the range 0.05 to 20 m3, in a matrix of soft material or smaller boulders.

2.2.3.2 Classification for Placing Purposes

a) Material for embankments, terraces, etc. Such materials shall, generally, have a CBR of at least 3 % (compacted at OMC), a PI not exceeding 18, and a maximum dimension of 300 mm, unless otherwise specified in the Technical Specifications.
b) Material for replacement of overbreak. Where replacement of overbreak with backfill is authorized, the material shall be an approved graded material having a PI not exceeding 10, a CBR of at least 10 %, and a maximum dimension of 150 mm or two-thirds of the thickness of the layer being compacted.

c) Material for backfill or fill against structures. Material placed as backfill or as fill within 500 mm of structures shall comply with requirements specified under a) above except that it shall not contain more than 10 % rock or hard fragments retained on a sieve of nominal aperture size 50 mm.

2.2.3.3 Selection

Topsoil, if required for later use on the Site, as well as any other material excavated that is suitable for backfilling or for filling against the finished structures, shall be selected and stockpiled in the vicinity of the structures.

All other material from excavation, being excess material or unsuitable for re-use shall be disposed of on the Site or within the freehaul distance.

Any material that is below the finished level of an excavation and that the Engineer considers to be unsuitable, shall be excavated and disposed of as directed. The resultant space shall be refilled with backfill and compacted as specified.

2.2.4 Plant and Equipment

Plant shall be suitable for obtaining the end result required under the conditions applicable to the Site.

Compaction plant used for applying the dynamic load, controlling the moisture content, and grading or mixing, shall be capable of achieving the compaction specified with the material available.

Any vehicle or item of plant provided by the Contractor for the transport of materials shall conform to the requirements of the applicable road traffic ordinance if the vehicle or plant is required to operate on any public road, street, or area that has been surfaced.

Where any of the Contractor's operations or the movement of any of the Contractor's vehicle or plant has caused damage to the surface of any area normally open to the public, the Contractor shall repair such surface as a matter of urgency, and at his own expense.

The Contractor shall provide and use, where applicable, equipment that is suitable for the detection and location of underground service pipes and cables.

2.2.5 Construction and Workmanship

2.2.5.1 Precautions

Safety and safeguarding

Every excavation that is accessible to the public shall be adequately protected by barriers or fences, provided with lighting at night and watched to ensure that barricades and lights are effective at all times. Reference shall be made to clause 1.4.14 of this specification.

The Contractor shall suitably safeguard excavations if the depth of an excavation or the nature of the material excavated render the sides of the excavation liable to movement that might endanger the Works or the workmen engaged on the excavation.

This safeguarding may consist of supports by timber or sheeting adequately strutted and braced, or, if approved by the Engineer, by a reduction of the slope of the excavated face or faces so that any danger to the Works or the said workmen is removed.

The Contractor shall make good any fall of earth or rock due to insufficient safeguarding at his own expense, as directed and by approved means.

Without relieving the Contractor in any way of his responsibility, the Engineer may order additional lateral support for, or the sloping or reduction of the slope of, the sides of any excavation. During the progress of each excavation, the Contractor shall report to the Engineer the presence of bedding planes inclined towards the excavation, seepage water and any other feature that may affect the stability of the excavation, as soon as the presence of such feature or features is known. All timbering and sheeting shall be removed from the excavation at the completion of the work, unless the written permission of the Engineer allowing any portion to remain is obtained.

Should blasting be necessary, the Contractor shall obtain the permission from the Engineer and the local authority well in advance and in writing and shall take every precaution to protect the Works and persons, animals and property in the vicinity of the Site. The Contractor will be held responsible for any injury or damage caused by any blasting operations and shall, at his own expense, make good such damage. A copy of the blasting permit(s) issued to the Contractor to cover the purchase, storage, and handling of explosives, shall be handed over to the Engineer.

When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound and stable as the nature of the material permits. The Contractor shall make good at his own expense any additional excavation necessitated by the shattering of rock in excess of the overbreak allowance specified.

Existing services

The tender drawings as well as the Contractor's working drawings show positions of existing services based on the best information available.

The Contractor shall, before commencing work in any particular area, verify the position of all services and all other obstacles and existing works on the Site.

The Contractor shall have the equipment referred to in clause 2.2.4 above available on the Site for as long as is necessary to detect and locate such services and, if so ordered, he shall excavate by hand to expose such services in areas and in a manner and at a time agreed upon with the Engineer.

The Contractor shall advise the Engineer at least 5 days in advance of the actual date on which he proposes to excavate near any cable. He shall not use mechanical equipment to excavate within 3 m of the assumed position of any cable and shall, if necessary, expose the cable by means of hand excavation carried out under proper supervision. When so ordered, the Contractor shall backfill such observation trenches with approved material to the compaction density ordered.

Where a service is damaged because of the Contractor's negligence, he shall make good such damage or bear the cost of the repairs, as applicable.

Stormwater and groundwater

The Contractor's responsibility in terms of clause 1.4.20 will be held to include the provisions of adequate protection against flooding by stormwater, flow from springs, and seepage, and to include provision for repair, at his expense, of any damage to the works that may arise as a result of the inadequacy of the protection provided by him. Except where the use of tremies has been approved, foundation excavations for structures shall be kept free of water at all times until they have been expected and approved and concrete footings or foundations have been cast.

Nuisance

Wherever dust from the works, haul roads, borrow pits or road deviations becomes a nuisance to the public the Contractor shall, when so ordered by the Engineer , apply sufficient water or take other measures to lay the dust.

All excavated material shall be so deposited as not to interfere with or endanger the works, other property or traffic. The Engineer may order the Contractor to remove, at his expense, any material that the Engineer considers liable to endanger or to interfere with the Works, private property, traffic or pedestrians, and to place such material at some other approved location.

Roads

The Contractor shall reinstate and maintain the surfaces of all roadways through which trenches or other excavations have been made. Should any subsidence occur at the site of such trench or excavation, the Contractor shall immediately restore the road surface to its correct level. Where immediate restoration is impracticable, the Contractor shall provide protection as specified under clause 2.2.5.1.1 above. The Contractor shall follow the requirements of the Department of Roads.

Traffic control

Where work affects the operation or safety of public road traffic, the Contractor shall, in addition to complying with the requirements of clause 2.2.5.1.1, provide, erect and maintain traffic signs, warning lights etc. in positions agreed to or ordered by the Engineer

2.2.5.2 Methods and Procedures

Site preparation

Before carrying out any work on any site, the site shall be inspected where necessary together with the Engineer.

The Contractor shall request in writing such site inspections where in his opinion the situation shown in the Drawings has changed and/or is incorrect.

Before the commencement of any earthwork, the site shall be surveyed in conjunction with the Engineer's representative to establish existing ground levels, and these agreed ground levels shall form the basis for the calculation of quantities of any subsequent excavation and filling.

Should work commence in the absence of this joint survey, the Engineer's statement shall be final.

Prior to the start of excavation proper, if and as scheduled, all areas in which excavation is to take place or that are to be covered by banks, structures etc., shall be cleared as specified under clause 2.1 above.

Where so ordered, the Contractor shall remove and conserve the topsoil for later use in a manner approved by the Engineer. The Contractor will not be required to remove topsoil from any area in which the average depth of topsoil is less than 150 mm.

Excavation

Excavation shall be carried out to the depth indicated or to such greater depths as may be required by the Engineer to ensure a satisfactory foundation.

Except where otherwise specified, shown on the drawings, ordered or dictated by the requirements for safeguarding, excavation shall be so carried out and so trimmed to the outline of the concrete work shown on the drawings that the excavated surfaces will act as forms for the concrete works. Such surfaces as well as the bottom of excavations shall be cleaned by hand, air or other effective means to remove all loose, soft or otherwise unsuitable material and as required by the Engineer.

Should the Contractor excavate to dimensions in excess of those stipulated or permitted, he shall fill in the excess at his own expense in the manner specified or approved by the Engineer. Excavated surfaces that will remain permanently exposed shall be finished off in a neat and workmanlike manner and shall be graded to provide adequate drainage.

When the Contractor is required by the Engineer to open up borrow pits, he shall maintain them so that they do not become a danger to persons and livestock. On completion of borrowing, the sides of the pits, if not filled with unused material, shall be graded 1:2, or as the Engineer may direct. The Contractor shall not spoil, stockpile or waste any material without approval. He shall dispose of surplus and unsuitable material in areas designated. Spoil heaps shall be flattened to present a neat level or graded surface.

The Contractor shall not sell any materials arising from excavations, demolitions and the like carried out on the Site unless permission is obtained from the Engineer.

Placing and compaction

Where approved material from excavations is insufficient to form designated embankments, terraces etc., the Contractor shall, unless otherwise ordered, obtain the additional material, as directed, from borrow pits at sites approved by the Engineer. Where it is necessary to use clay or clayey material in embankments, such material shall be placed not less than 1 m and not more than 5 m below the finished surface. Rock having a maximum dimension exceeding 600 mm shall not be placed in embankment fills. The material of each embankment shall be deposited in layers of thickness, before compaction, not exceeding 300 mm. The material shall be spread to form a layer that is of approximately uniform thickness, and graded over the whole area of the embankment. Each layer shall be compacted at OMC to a density of at least 90 % of modified AASHTO maximum density in the case of cohesive soil or 98 % in the case of non-cohesive soil. Should the material be too wet, owing to rain or any other cause, it shall be harrowed and allow to dry out to the correct moisture content before compaction is undertaken. The Contractor shall ensure that stormwater will at all times be discharged uniformly over the full area of each embankment or through specially prepared and protected drainage ditches to prevent scouring of the slopes.

Where backfilling or filling around or against structures has been authorized by the Engineer, such filling shall be placed, and shall be compacted approximately simultaneously on both sides of the structure to minimize unequal loading. All excavations shall be carefully refilled with approved material in layers of thickness not exceeding 250 mm before compaction, and to a density equal or better than that of the adjoining undisturbed material. Each layer shall be completed before the next is added. Except with the consent of the Engineer, filling shall not be deposited in water.

Finishing

On completion of earthworks to the finished level, the whole surface shall be graded, shaped and compacted to final grades and levels. The surface shall be lightly watered as the Engineer may direct.

If ordered by the Engineer, topsoil shall be placed on level and slightly graded areas and shall be lightly compacted by tamping, and trimmed neatly to required lines, grades and levels. the final thickness of topsoil after compaction shall be at least 100 mm.

If ordered by the Engineer, grass or other vegetation shall be planted after topsoiling has been completed. Such planted areas shall be neatly trimmed and well watered, and the Contractor shall ensure that planted areas are not permitted to dry out. Any grass or vegetation planted that fails to grow shall be replaced by the Contractor, at his expense.

Transport for earthworks

All haul of material imported from borrow pits or from commercial sources selected by the Contractor shall be regarded as freehaul. The freehaul distance within which the Contractor will be required to move material without separate compensation shall be 10 km.

Transportation of earth material beyond the freehaul distance will be regarded as overhaul. Each overhaul distance is 10 km and is the distance beyond the end of the freehaul by the shortest practicable route.

The Contractor shall not incur overhaul expenses without prior approval of the Engineer.

2.2.6 Tolerances

2.2.6.1 Positions, dimensions, levels, etc.

The work shall be finished to and within the limits (permissible deviation = PD) given below:

a) Excavations
- (i) position on plan, ie PD in plan of any point measured from nearest grid line: +35 mm
- (ii) dimensions on plan, ie PD from the designed dimensions: +50 mm
- (iii) foundation level, ie PD in level of surface of excavation trimmed to receive concrete: +50 mm
- (iv) level (other than foundation level), ie PD from designed levels with reference to nearest transferred bench-mark: +15 mm

b) Embankments, terraces etc.
- (i) position of top edge, ie PD from designated position of any point, measured from nearest grid line: +300 mm
- (ii) alignment of top edge, ie PD from a line joining any two points 30 m apart on top edge of embankment: +100 mm
- (iii) finished levels, ie PD from designated levels with reference to nearest transferred bench-mark: +50 mm
- (iv) slopes of top surfaces, ie PD from rate of fall: + 5 %

2.2.6.2 Moisture content and density

The permissible deviations (PD) shall be as given below:

a) OMC in field during compaction: +1% and -2%
b) specified density: +(no top limit) and -0

2.2.7 Testing and Acceptance

To determine founding conditions or for other purposes, the Engineer may require the Contractor to drill, auger or excavate holes in advance of the start of construction. When so requested by the Engineer, the Contractor shall provide labour, tools, machinery and equipment for sinking such exploratory holes and for refilling them. Such operations will be paid as daywork.

The Contractor shall carry out sufficient tests to satisfy himself about the consistency of material placed in embankments and as backfill.

The Engineer may carry out check tests as he deems necessary, at any depth or at any layer. Where these tests reveal that the material used does not comply with the applicable requirements of the specification, or that the compaction specified has not been attained, the Contractor shall rectify the work to the satisfaction of the Engineer.

2.2.8 Measurement and Payment

2.2.8.1 Basic principles

Rates tendered for excavation shall cover the cost of excavating and re-use of the excavated material in backfilling, forming embankments, terraces, etc., and the cost of disposal of any surplus and unsuitable material within the freehaul distance.

Excavations which are required to be backfilled will be measured as if taken out with vertical sides regardless of whether they have been taken out with sloping sides. They will be measured from the net plan of the finished concrete footing, foundation, building or concrete structure except that, in the case of conical-bottomed tanks or other such structures, the volume will be measured from the finished outline of the concrete as shown on the drawings.

2.3 CONCRETE

2.3.1 Scope

This specification covers the requirements for plain and reinforced concrete, either cast-in-situ or precast, for civil engineering and building construction applicable to this project.

2.3.2 Interpretations

2.3.2.1 Supporting specifications

The following specifications shall, inter alia, form part of and be read in conjunction with this specification:

a) 1 General
b) 2.2 Earthworks, as applicable.

2.3.2.2 Application

This specification contains clauses that are generally applicable to concrete and structural precast concrete work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification.

2.3.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

a) General

Adverse weather. Cold weather, or weather in which the ambient temperature is above 25º C, or the relative humidity is low, or the wind velocity is high, or weather in which any combination of the latter three conditions occurs, and which tends to impair the quality of fresh or hardened concrete or otherwise causes concrete to have abnormal properties.

Approved laboratory - A laboratory suitably equipped and staffed for purposes of concrete testing and as such approved by the Engineer.

Cold weather - Weather conditions in which the ambient temperature is 5º C or less.

Concrete cover - The thickness of concrete between the face of the concrete and the outside of reinforcing steel nearest this face as cast.

Cool weather - Weather conditions in which the ambient temperature is higher than 5º C but not higher than 15º C.

Fixture - An item such as a bolt, anchorage, bearing, or the like that is cast or grouted into concrete.
Formwork - Temporary works that is required to support and shape the concrete for a structure.

Hot weather - Weather conditions in which the ambient temperature is higher than 32º C.
Normal weather - Weather conditions in which the ambient temperature is higher than 15º C and less than 32º C.

b) Quality
Class of concrete - See grade of concrete.

Consistency - The extent, as measured by the slump test, to which fresh concrete resists flow or deformation.

Grade of concrete - An identification number for the concrete, the number being numerically equal to the specified strength at 28 days expressed in MPa.

Prescribed mix - Concrete for which the Engineer has prescribed the mix proportions.

Ready-mixed concrete - Concrete complying with the relevant requirements of the specification and delivered to the Site in a plastic state.

Sample (of concrete) - The minimum volume of uncompacted freshly mixed concrete required for a designated test (eg 16 dm3 for the compressive strength test for 3 cubes of nominal side 150 mm).

Strength concrete - Concrete designed primarily for strength.

Target slump - The average value for the slump of concrete aimed at to ensure compliance with the slump required in terms of the specification.

Workability - The property of fresh concrete that determines the ease with which it can be placed and compacted without segregation of the constituent materials.

c) Strength
Characteristic strength - See specified strength.

Specified strength - The required concrete strength (or the strength corresponding to the required concrete grade) stated on the drawings or in the Technical Specification, and which in all cases represents the strength below which not more than 5 % of valid 28 d test results obtained on cubes of concrete of the same grade can be expected to fall.

Strength concrete - A strength concrete is designated by its specified strength followed by the size of stone used in its manufacture, eg 30 MPa/19 mm refers to a Grade 30 mix made with 19 mm stone.

Target strength - An average value of the strength of concrete that is higher than the specified strength and is aimed at to ensure that the specified strength is attained. (Note: If the standard deviation can be determined, the value of the target strength is at least equal to the specified strength plus 1.64 times the standard deviation of valid 28 d test results.)

Valid test result - The average result obtained from the testing of three test cubes of concrete.

d) Exposure conditions
Mild conditions - Conditions under which the concrete is protected from the weather and is exposed only to air.

Moderate conditions - Conditions under which the concrete is sheltered from severe rain and is not subject to freezing when wet, or buried in non-aggressive soil, or continuously under fresh water.

Severe conditions - Conditions under which the concrete is exposed or subject to any of the following: driving rain, alternate wetting and drying out, freezing when wet, fresh water at the water line, splashing or spraying with fresh water, corrosive fumes or heavy condensation of water, aggressive soil, salt-laden air.

Very severe conditions - Conditions under which the concrete is exposed to any of the following: water containing sulfates or chlorides, highly corrosive fumes.

e) Joints

The location of joints is controlled by design requirements and construction limitations. All joints are "construction joints" within the general meaning of the term. Joints shown on the drawings or otherwise specified are "designated joints". The Engineer may, in collaboration with the Contractor , approve further joints before the casting of concrete, which joints will then become "designated joints". The terms "construction joints", "movement joints", "contraction joints", and "expansion joints" are used to identify various types of designated joints. The term "unforeseen joint" is used to identify a joint formed during concreting when plant failure, inclement weather, or some other unforeseen event has enforced a halt in the placing of concrete and has thus created a situation in which a construction joint has to be made in a location that was neither designated nor approved before the commencement of concreting.

2.3.2.4 Abbreviations

For the purpose of this specification, the abbreviation for reinforced concrete shall be RCC and the abbreviation for plain concrete shall be PCC.

2.3.3 Materials

2.3.3.1 Approval of materials

The Contractor shall supply in good time to the Engineer for his approval, samples of the aggregates and, if so ordered, of the water, that he proposes to use for the concrete and shall furnish evidence that the water and aggregates comply with the requirements of clause 2.3.3.3 and 2.3.3.4 below. Evidence shall be in the form of a statement from an approved laboratory of the results of tests, or an authoritative report or record of previous experience.

2.3.3.2 Cement

Cement and blends of Portland cement and milled granulated blastfurnace slag shall comply with the relevant ISO, DIN (eg DIN 1164), BS (eg BS 12, BS 1370, BS 4027), or ACI standards and shall be either Ordinary Portland Cement (OPC), Low Heat Portland Cement, Rapid-hardening Portland Cement (RHPC), Sulphate-resisting Portland Cement (HS), or Portland Blastfurnace Cement (PBFC). Any type of cement or any other standard than those referred to above shall be used only when specifically authorized, in writing, by the Engineer.

Within eight weeks of the award of the Contract a report on proposed cement sources shall be submitted to the Engineer. The report shall propose primary and secondary sources of supply and shall give each manufacturer's full analysis of chemical composition and physical properties determined in accordance with DIN 1164 or similar.

The report on cement sources shall be submitted at least four weeks in advance of the commencement of work on trial concrete mixes.

Separate storage facilities shall be provided on the Site for each type of cement used. Cement shall be fresh when delivered to Site and the consignments shall be used in the order of their delivery. The Contractor shall mark the date of delivery on each consignment and each consignment shall be stored separately in such manner as to be easily accessible and identifiable. No cement in bags or other container shall be used unless these and the manufacturer's seals are intact at the time of mixing. If the cement is delivered in bags it shall be stored under cover and on elevated floors that provide proper protection against moisture and other factors that may promote deterioration. Bulk cement may be used providing it is stored in approved weather-proof silos or similar containers provided that the cement drawn for use is measured by mass and not by volume.

The Contractor shall not use cement which has hardened into lumps, but subject to removal of the lumps by screening, the Engineer may allow such cement to be used in non-structural concrete mixes.

2.3.3.3 Water

Water shall be clean and free from injurious amounts of acids, alkalis, organic matter, and other substances that may impair strength, durability, or appearance of the concrete.

The Contractor shall take samples of the water from the proposed source and shall carry out such tests as required. The results of the test shall be submitted to the Engineer in the form of a report on the proposed source of water. Use of water with physical or chemical characteristics which lie outside the limits given below will not be permitted. In addition to the tests listed below, tests shall be carried out if directed by the Engineer to compare initial setting times and compressive strengths of cement pastes prepared with water from the proposed source, and with distilled water.

a)	Sulfate content (as SO3)	max. 500 mg/l
b)	Chloride content (as CI)	max. 500 mg/l
c)	Bicarbonate content (as HCO3)	max. 1000 mg/l
d)	Total dissolved solids	max. 1500 mg/l

2.3.3.4 Aggregates

Both the coarse aggregate (stone) and the fine aggregate (sand) shall comply with the relevant applicable and approved standards (eg DIN 4226 or similar).

Aggregates of different nominal sizes shall be delivered to the Site and stored separately and in such a way that segregation is minimized and intermixing of different materials and contamination by foreign matter is prevented.

Fine aggregate shall be natural sand, manufactured crushed rock sand, (excluding crushed rock fines which are by products/rejects of coarse aggregate production) or a combination of both.

A combination of different materials will only be permitted where the two materials are separately batched and where each material separately complies with the requirements of this specification. In addition the evidence of full scale comparative site trials shall clearly demonstrate that a combined fine aggregate provides improved concrete relative to the use of either material as a sole fine aggregate. Except where otherwise approved on the basis of evidence of acceptable performance in concrete the grading of a fine aggregate, or of combined fine aggregate, shall comply with the grading limits for groups of 0/1, 0/2 and 0/4 in accordance with DIN 4188.

Fine aggregates shall be free of clay lumps and friable particles. The amount of hollow shells likely to form voids or remain partially unfilled and present in material retained on a DIN 2.0 mm sieve, determined by direct visual separation, shall not exceed 3% by weight of the entire sample.

Fine aggregate shall not contain considerable amounts of flaky and or elongated particles. The water absorption of fine aggregate, determined in accordance with DIN 4226 Part 3, shall not exceed 2.0% by weight.

The total acid soluble Sulfate content of fine aggregate, expressed as sulphur trioxide (SO3), shall not exceed 0.40% by weight. The total acid soluble chloride ion (Cl) content of fine aggregate, expressed as calculated equivalent (Cl x 1.6 = NaCl) sodium chloride (NaCl), shall not exceed 0.05% by weight.

Coarse aggregate shall be natural gravel, or crushed gravel, or crushed rock, complying with the requirement of DIN 4226 or similar approved.

Where an aggregate comprises a mixture of natural and crushed material the proportion of natural (uncrushed) particles shall not vary by more than + 5 % form the proportion contained in the aggregates used in the full scale trial mixes which had been approved. The proportion of decomposed or weathered particles in the aggregates shall not exceed 0.5% by weight as determined in accordance with DIN 4226 Part 3.

All coarse aggregates shall be produced, stockpiled and batched as single-sized materials complying with the grading limits in groups 2/8, 4/32, 8/32 of DIN 4226 Part 1, or as may be otherwise approved by the Engineer on the basis of evidence of acceptable performance in concrete.

The amount of materials passing a 0.063 mm nominal sieve in each size of single-sized aggregates shall not exceed the percentages by weight given in DIN 4226 Part 1 as determined by the Test Method given in DIN 4226 Part 3.

The proportion of flaky particles shall not exceed 20 % by weight, nor elongated particles exceed 35 % by weight in each of the fractions of single-sized aggregates as determined in accordance with DIN 4226 Part 3.

The water absorption of each size of coarse aggregate, determined in accordance with DIN 4226 Part 3, shall not exceed 2.0% by weight.

The total acid soluble Sulfate contents of coarse aggregates expressed as sulphur trioxide (SO3), shall not exceed 0.4% by weight.

The total acid soluble chloride ion (Cl) contents of coarse aggregates, expressed as calculated equivalent (Cl x 1.6 = NaCl) sodium chloride (NaCl), shall not exceed 0.02% by weight as determined in accordance with DIN 4226 Part 3. In the case of mass concrete this percentage may be increased at the Engineer's discretion.

Sources of aggregate for concrete, extraction procedures and production methods shall be to the approval of the Engineer.

Aggregate deposits or existing aggregate production at the proposed sources shall be sampled and tested to assess their potential suitability for use in the works. The results of the sampling and testing shall be reported to the Engineer.

The method of sampling shall be by agreement with the Engineer, and shall be carried out in the presence of the Engineer's Representative.

2.3.3.5 Admixtures

Admixtures shall not be used in any concrete without the approval of the Engineer, who may require tests to be made before they are used. To facilitate approval, the Contractor shall provide the following information:

a) the trade name of the admixture, its source, and the manufacturer's recommended method of use
b) typical dosage rates and possible detrimental effects of under-dosage and over-dosage
c) whether compounds (such as those containing chloride in any form as an active ingredient) likely to cause corrosion of the reinforcing steel or deterioration of the concrete are present, and, if so, the chloride content (expressed as chloride ions or as equivalent anhydrous chloride) by mass of admixture
d) the average expected air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the manufacturer's recommended rate of dosage.

If the use of air-entraining agent is permitted by the Engineer, test measurements shall be carried out on Site by the Contractor, as and when required by the Engineer, to determine

a) the percentage of air entrained in the concrete, and
b) the density of concrete.

The Contractor shall provide equipment to permit measurement of entrained air at such frequencies as are required by the Engineer.

2.3.3.6 Reinforcement

Reinforcing bars and welded steel fabric shall comply with the relevant applicable and approved standards (e.g. DIN 488).

All reinforcement shall be hot rolled, high tensile steel with a minimum yield strength of 420 MPa. Where shown on the drawings or provided for in the bending schedule, or approved by the Engineer, mild steel reinforcement may also be used, but only in exceptional cases.

Reinforcing steel shall be so stacked on Site as to make identification (with regard type and sizes) easy and off the ground as to prevent distortion, and shall be protected from aggressive environments and contamination.

2.3.3.7 Storage capacity

The storage capacity provided and the amount of material stored (whether cement, aggregates, steel, or water) shall be sufficient to ensure that no interruption to the progress of the work is occasioned by lack of materials.

2.3.3.8 Deteriorated material

Material that has deteriorated, or that has been contaminated or otherwise damaged, shall not be used in the concrete. Such material shall be removed from the site without delay.

2.3.3.9 Waterstops

The Contractor shall supply and fix waterstops in all joints in members which are to be water-retaining and where shown on the drawings.

Waterstops built into joints shall be made of PVC, rubber or similar approved material and shall have a hollow centre bulb. They shall be obtained from manufactures approved by the Engineer and shall be stored, fixed and jointed in accordance with the manufacture's instruction. They shall be fabricated into the longest practicable units complete with angles and junctions at the manufacture's works and shall be made continuous throughout the structure below highest water level and where shown on the drawings. The number of joints in the waterstop made on Site shall be kept to a minimum.

Where waterstop joints are vulcanized site jointing shall be performed strictly in accordance with the supplier's instructions and recommendations. The tensile strength of the spliced waterstop at a factory-made splice shall be at least 90% of the waterstop's tensile strength, when tested according to BS 703 with the spliced joint in the middle portion of the dumb-bell test specimen and the tensile force applied normally in the direction of the splice. The tensile strength of a waterstop spliced at the site shall be 80% of the original strength of the waterstop.

The edge bulb section shall be circular. The webs shall be plain without separations.

The Contractor shall supply the manufacturer's test certificates for each consignment of waterstops delivered to Site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

The rubber for waterstop shall satisfy the following requirements in accordance with BS 903:

a)	Minimum tensile strength	20 N/mm2
b)	Minimum elongation at break	500%
c)	BS Hardness (BS 903/Part A7/1957)	60 to 65º
d)	Maximum compression set	20%
e)	Max. water absorption after 2 d at 20ºC	5%

2.3.3.10 Joint filler

Unless otherwise specified, joint filler shall be of expanded polystyrene, resin or bituminous bonded cork, or similar (eg ("Flexcel"). The filler shall be obtained from a manufacturer approved by the Engineer and shall be stored and fixed in accordance with the manufacturer's instructions. The Contractor shall supply the manufacturer's certificate for each consignment of joint filler delivered to Site and shall, in addition, supply to the Engineer sufficient of each consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

2.3.3.11 Joint sealant

Unless otherwise shown on the drawings or ordered by the Engineer, an elastomeric two part polysulphide sealer shall be used. Only such joint sealers and the requisite priming materials shall be obtained from manufacturers which have been approved by the Engineer. They shall be used in

accordance with the manufacturer's instructions and recommendations. The application of joint sealer shall not be commenced without the contractor having first obtained the approval of the Engineer.

The Contractor shall supply the manufacturer's test certificate for each consignment of each type of joint sealer delivered to Site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure, if ordered.

Where the drawings show a layer of bituminous paint between concrete faces, the Contractor shall clean and dry the face to which the bitumen is to be applied and shall then paint the bitumen on in two separate applications. The bitumen shall be a straight run bitumen, grade 40/50 penetration, or other approved by the Engineer.

2.3.4 Plant and Equipment

2.3.4.1 General

All plant and equipment shall be maintained in good working order at all times during concrete work.

2.3.4.2 Batching plant

The Contractor shall ensure, by regular examination, calibration, and tests, that the batching system functions efficiently and accurately and that hoppers and cement containers are kept dry and clean. The batching plant shall be such that cement may be batched to an accuracy of within 2 % of the mass required, that water be measured to an accuracy of within 2 % of the quantity required, and that aggregate be batched to the accuracy of 3% of the mass required.

In the case of an automatic plant, the weighing scales shall be so interlocked that a new batch of materials cannot be delivered until the weighing hoppers have been completely emptied of the previous batch and the scales are in balance. Where discharge of materials from the hoppers is manually controlled, a method of signalling shall be employed to ensure that ingredients are not omitted, or are not added more than once, when a batch of concrete is being made up.

Admixtures shall be used in liquid or powder form and shall be measured by volume or weight in the case of liquids and by weight only if in powder form and shall be dispensed through equipment capable of measurement within the tolerance specified. Tanks or drums containing liquid admixtures shall be clearly labelled for identification purposes and stored in such a way as to avoid damage from contamination. Agitation shall be provided for liquid admixtures which are not in stable solutions.

2.3.4.3 Mixing plant

The type and capacity of mixing machines shall be such that the rate of output of concrete is suitable for the rate of concreting. Each machine shall be capable of producing a uniform distribution of the ingredients throughout the batch and shall comply with the specification to which the manufacturer claims it has been manufactured. Worn or bend blades and paddles shall be replaced. The inner surfaces of the mixer shall be clean and free from hardened concrete. The mixers used shall be specially suited to the production of low slump concrete.

2.3.4.4 Vibrators

Vibrators shall be capable of fully compacting each layer of concrete. At least one standby vibrator shall be available at all times during concreting for every three vibrators necessary to maintain the rate of placing.

Vibrating equipment used for the production of PCC elements, whether in the form of a vibrating table, an external vibrator attached to the mould, or an immersion vibrator, shall have the frequency that is suitable for the compaction of low slump concrete.

2.3.4.5 Formwork

Formwork shall be so designed and constructed that the concrete can be properly placed and compacted and that, subject to the tolerances specified, the required shapes, finishes, positions, levels, and dimensions shown on the drawings are maintained. The formwork and joints shall be capable of resisting the dead load, including the pressure exerted by the wet concrete, wind forces, and all other

superimposed loads and forces. If not otherwise directed, forms shall be made of steel where practicable.

The types of ties used and their position shall be such that the required finish is achieved and will not be marred by subsequent corrosion of the ties.

Unless otherwise shown or directed, formwork shall be such that exterior corners of finished concrete are provided with 20 mm chamfers and re-entrant corners without fillets.

2.3.4.6 Casting beds and moulds

All casting beds for PCC shall be properly aligned and levelled. Adequate weather protection shall be provided should this be necessary to achieve the standards specified below.

2.3.4.7 Plant and equipment for handling, lifting, and stacking

The Contractor shall provide adequate equipment for so handling, lifting, and stacking precast units that they do not become discolored and are protected from permanent damage due to stresses induced during handling or stacking or due to the use of slings, chains, and hooks.

2.3.5 Construction and Workmanship

2.3.5.1 Reinforcement

Reinforcing bars shall be bent to the shapes and dimensions shown on the drawings and bending schedules. All bars shall be bent cold and bending shall be done slowly, a steady, even pressure being used without jerk or impact.

Steel shall, at the time of the placing of the concrete, be free from loose or powdery rust, scale, oil, or other coatings that may reduce the bond between steel and surrounding concrete, affect the durability of the concrete, or initiate corrosion of the reinforcement. If any substance other than water is used for lubricating the formwork, every precaution shall be taken to avoid contamination of the reinforcing steel by such substance.

Reinforcing steel shall be positioned as shown on the drawings or as directed and maintained in those positions within the tolerances specified. It shall be secured against displacement by tying at intersections with annealed wire of nominal diameter 1.25 or 1.6 mm, or by the use of acceptable clips or, if permitted by the Engineer, by welding. Reinforcing bars shall be supported and aligned in their correct position by means of hangers, chairs, spacers or saddles of approved design.

Unless otherwise shown on the drawing or directed by the Engineer, the minimum cover of concrete over reinforcing bars, measured from the outside of the most outer bar or stirrup, shall be 25 mm for mild exposure conditions, 35 mm for moderate exposure conditions, and 50 mm for severe exposure conditions or the diameter of the bar to which the cover is measured, whichever is greater.

The Contractor shall ensure that reinforcement including stirrups, links, and tying wire does not encroach into the specified cover. Splices or joints in reinforcing bars shall be made only as and where shown on the drawings or as otherwise approved.

If left exposed for future bonding of extensions to the Works, reinforcing steel shall be protected from corrosion as directed. For PCC units, reinforcement shall, where practicable, be preformed into rigid cages. For this purpose spot welding of bars shall be carried out only by skilled and experienced welders.

2.3.5.2 Formwork

Formwork will be classified in accordance with the surface conditions required on the finished concrete, as shown on the drawings or as directed. Such finishes will be as follows:

a) Rough. No treatment of the surface of the concrete will be required after the striking of the formwork. The finish of the concrete need not be more accurate than Degree of Accuracy III as defined in terms of Clause 2.3.6.

b) Smooth. Imperfections such as small fins, bulges, irregularities, surface honeycombing, and slight surface discolorations shall be made good and repaired by approved methods. The finish of the concrete shall be accurate to Degree of Accuracy II.

c) Special. Special finishes shall be as specified in the Technical Specification.

Forms shall be erected with joints tight enough to prevent leakage of cement mortar.

Surfaces of forms (regardless of the material of which they are made) that are to be in contact with fresh (wet) concrete shall be treated with a coat of non-staining mineral oil or other approved material, or, in the case of timber forms, by thorough wetting of the surfaces with water, so as to ensure easy release and prevent adhesion of the formwork during stripping.

Before re-use, all formwork shall be reconditioned, and all form surfaces that are to be in contact with the concrete shall be thoroughly cleaned.

Where necessary for the proper placing of the concrete, temporary openings for cleaning, inspection, or placing and compaction purposes shall be provided and, subsequently, so closed as to provide the finish specified and to conform to the applicable tolerances specified.

Formwork shall not be removed before the concrete has attained sufficient strength to support its own weight and any loads that may be imposed on it. For this purpose, the formwork shall remain in place, after placing of the concrete, as follows:

a)	Concrete cast with OPC, in hot or normal weather		
	(i)	Beam sides, walls, and unloaded columns	1 d
	(ii)	Slabs with props left underneath	4 d
	(iii)	Beam soffits with props left under	7 d
	(iv)	Slab props, including cantilevers	10 d
	(v)	Beam props, including cantilevers	14 d
b)	Concrete cast with RHPC, in hot or normal weather		
	(i)	Beam sides, walls, and unloaded columns	1 d
	(ii)	Slabs with props left underneath	2 d
	(iii)	Beam soffits with props left under	3 d
	(iv)	Slab props, including cantilevers	5 d
	(v)	Beam props, including cantilevers	7 d
c)	Concrete cast with PBFC, in hot or normal weather		
	(i)	Beam sides, walls, and unloaded columns	2 d
	(ii)	Slabs with props left underneath	6 d
	(iii)	Beam soffits with props left under	10 d
	(iv)	Slab props, including cantilevers	10 d
	(v)	Beam props, including cantilevers	14 d
d)	Concrete cast with OPC, in cold weather		
	(i)	Beam sides, walls, and unloaded columns	1.5 d
	(ii)	Slabs with props left underneath	7 d
	(iii)	Beam soffits with props left under	12 d
	(iv)	Slab props, including cantilevers	17 d
	(v)	Beam props, including cantilevers	21 d
e)	Concrete cast with RHPC, in cold weather		
	(i)	Beam sides, walls, and unloaded columns	1 d
	(ii)	Slabs with props left underneath	4 d
	(iii)	Beam soffits with props left under	5 d
	(iv)	Slab props, including cantilevers	9 d
	(v)	Beam props, including cantilevers	12 d
f)	Concrete cast with PBFC, in cold weather		
	(i)	Beam sides, walls, and unloaded columns	4 d
	(ii)	Slabs with props left underneath	10 d
	(iii)	Beam soffits with props left under	17 d
	(iv)	Slab props, including cantilevers	17 d
	(v)	Beam props, including cantilevers	21 d

In cool weather, stripping times shall be determined by interpolation between the periods specified for normal and cold weather.

If the Contractor can prove to the satisfaction of the Engineer that a period shorter than the appropriate minimum given above is sufficient to enable the concrete to comply with its requirements, the formwork may be removed after such shorter period.

Formwork shall be removed carefully so that shock and damage to the concrete are avoided.

Notwithstanding the provisions above, the Contractor shall be responsible for making good any damage to the concrete arising from the removal of formwork and its supports.

2.3.5.3 Holes, chases, and fixing blocks

No holes or chases, other than those shown on the drawings or approved by the Engineer, shall be cut or otherwise formed in the concrete. The manner of attaching fixtures to be embedded in the concrete shall be subject to approval by the Engineer.

2.3.5.4 Pipes and conduits

2.3.5.5 Concrete

Quality

Concrete shall comply with the requirements for strength concrete or for prescribed mix concrete of DIN 1045.

For precast concrete, the mix shall be of Grade B25 unless another grade is shown on the drawings or specified in the Technical Specification.

The types of aggregates and cement shall not be altered during the period of the contract. The slump, in mm and for vibrated concrete, shall be within the limits given below, or within such other limits as are laid down in the Particular Specification, by the Engineer in respect of prescribed mix concrete, or by the Engineer after receipt of the Contractor's design for strength concrete, if any Slump, mm

a)	Paving and precast units	max 50 min 30
b)	Heavy mass construction	max 50 min 20
c)	Walls, footings, slabs, beams, columns	max 80 min 30
d)	Plain concrete in substructures	max 60 min 20
e)	Heavy duty industrial floors	max 80 min 50

The concrete shall be of such workability that it can be readily compacted into the corners of the formwork and around reinforcement without segregation of the materials or excessive bleeding of free water from the surface.

Mainly for reasons of durability, the following maximum water/cement ratios shall apply, for different conditions of exposure:

a)	mild and moderate exp. cond.	max. w/c-ratio: 0.55
b)	severe exposure conditions	max. w/c-ratio: 0.50
c)	very severe exposure conditions	max. w/c-ratio: 0.45

The cement content for any structural concrete shall not be less than 280 kg/m3. The requirements for different classes of concrete are given in the table below.

The Contractor will be responsible for the design of prescribed mix concrete and for proportioning of the constituent materials. The Contractor shall provide, on the Site, concrete of the specified materials and in the proportions approved by the Engineer.

The Contractor shall specify the sources of supply of the materials for such concrete and will make available, when required, samples of each aggregate together with information on their origin. He will also specify the following in respect of prescribed mix concrete for each section of the work:

a) the maximum nominal size of coarse aggregate, in millimeters, and its proportions in the mix
b) the proportion of fine aggregate in the mix
c) the type and proportion of cement in the mix
d) the slump, in millimeters, or the w/c-ratio.

The Contractor shall be responsible for the design of strength concrete, and the submission of test cubes to an approved laboratory, and for the measurement of the constituent materials to produce concrete that complies with the requirements specified by the Engineer.

The Engineer will specify the following in respect of strength concrete for each section of the work:
a) the grade of concrete and position on the Works
b) the maximum nominal size of coarse aggregate, in millimeters.

Batching

The mass of cement supplied in a standard sack shall not be less than 50 kg. All cement taken from bulk storage containers and from partly used sacks shall be batched by mass with additional 2 % of mass required.

Mixing water for each batch shall be measured. The amount of water measured shall be adjusted to allow for the moisture content of the aggregates.

If batching is by mass, the mass of the aggregate of each size shall be determined and a correction made for the moisture content of the aggregates.

If batching is by volume, the fine and the coarse aggregates shall be measured separately in suitable measuring boxes of known volume and of such capacity that the quantities of aggregates for each batch are suitable for direct transfer into the mixer. Bulking tests on the fine aggregate shall be conducted regularly and the results used for adjustment of the batch volume of the fine aggregate to give the true volume required.

The Engineer shall be permitted to require additional tests for bulking to be done after rain has fallen or if, in his opinion, any other cause of variation in the moisture content of the aggregate has arisen.

Mixing

The following requirements shall apply to the mixing of concrete at the construction site:
a) Mixing of materials for concrete shall be conducted by an experienced operator.
b) The sequence of charging the mixing plant shall have been approved before mixing commences and, unless otherwise directed, the approved sequence shall be maintained.
c) The total volume of material per batch shall not exceed the rated capacity of the mixer.
d) Before any concrete is mixed, the inner surfaces of the mixer shall be cleaned and all hardened concrete shall be removed. A slurry of cement, sand, and water containing cement and sand in a ratio of 1:2 and in sufficient quantity to cover the entire inside surface of the mixer shall be produced in the clean mixer and discharged immediately before the charging of the mixer with materials at the commencement of each concrete production run.
e) The period of mixing shall be measured from the time when all the materials are in the drum or pan to the commencement of discharge. Subject to the provisions of (f) below, the mixing period for each batch of 1.5 m3 or less shall be at least 1.5 min and 1 min for drum-type and pan-type mixers respectively, and shall be increased by 20 sec and 15 sec respectively for each additional cubic metre or part thereof. During this period, the drum or pan shall be rotated at the speed recommended by the manufacturer of the mixer. The maximum continuous mixing times at the recommended mixing speed shall not exceed 10 min and 6 min per batch for drum-type and pan-type mixers respectively.
f) In the event of delay in the concreting operations, concrete may be retained in the mixer for a maximum period of 2 h provided that the slump is checked frequently and that only enough water to maintain the target slump is added to the mixer. During this period the mixer shall be restarted and run for about 2 min every 15 min. The Engineer may order that the period of 2 h be reduced if, in his opinion, the ambient temperature, or any other factor, will tend to produce early setting.
g) Discharge shall be so carried out that there is no segregation of the materials in the mix. The mixer shall be emptied completely before it is recharged. If the mixer has been out of use for longer than 30 min, it shall be thoroughly cleaned out, particular attention being paid to the removal of any built-up of materials in the drum, in the loader, and around the blades or paddles.

The Engineer will advise whether the production of concrete at a central concrete production facility other than on the construction site is permitted and whether the test results obtained by such a production facility as part of its quality control system are acceptable.

Transportation

Mixed concrete shall be discharged from the mixer and transported to its final position in such a manner that segregation, loss of ingredients, and adulteration are prevented and that the mix is of the required workability at the point and time of placing.

Placing

The Contractor shall give the Engineer 24 h notice of his intention to place concrete. The concrete shall be placed within 1 h (DIN Standard for Cement Initial Set) of the time of its discharge from the mixer. Concrete shall not be retampered by the addition of water or any other material. The forms to be filled shall be clean internally. All excavations and other surfaces of an absorbent nature that are to come into contact with the concrete shall be dampened with water. There shall be no free water on the surfaces against which concrete is to be placed.

Wherever possible, the concrete shall be deposited vertically into its final position to avoid segregation and displacement of reinforcement and other items that are to be embedded.

Deposited concrete shall not be so worked (whether by means of vibrators or otherwise) as to cause it to flow laterally in such a way that segregation occurs. Where possible, the concrete shall be brought up in horizontal layers of compacted thickness not exceeding 450 mm and heaping should be avoided.

Where a chute is used to convey the concrete, its slope shall be such as will not cause segregation, and a suitable spout or baffles shall be provided for the discharge of the concrete.

Concrete shall not be allowed to fall freely through a height of more than 3 m, unless otherwise approved.

Placing of concrete under water will be permitted only under exceptional circumstances when it is, in the opinion of the Engineer, not practicable to dewater before placing. No concrete shall be placed in flowing water. When the placing of concrete is permitted, it shall be placed by means of a tremie. During placing, the lower end of the tremie shall be continuously immersed in the concrete being deposited. To maintain the desired properties of the concrete the quantity of cement in the concrete mix shall be increased by 20 %. Full details of the method proposed and of the adjusted concrete mix proportions shall be submitted to the Engineer for his approval before placing commences. During and after concreting under water, pumping or dewatering operations in the immediate vicinity shall be suspended.

Waterstops shall be carefully maintained in the position shown on the drawings and properly protected from damage and the harmful effects of light and heat during all stages of construction. The stop-boards on each side of the waterstop shall be accurately wrought to match the profile of the waterstop. The concrete shall be carefully compacted under and around the waterstop so as to leave no cavities.

Joint filler material of the thickness specified shall be cut to shape and fixed to fill the whole space between the concrete faces of the joint which is not otherwise filled by waterstop and joint sealer. Abutting pieces shall be placed in close contact and the joints covered on each side to prevent the passage of cement grout.

Recesses at movement joints on both faces of the concrete work except on the underside of continuously supported work and on faces backfilled with earth shall be accurately formed to the lines and dimensions shown on the drawings. The Contractor shall prepare the surfaces of the recesses and shall supply a joint sealer and fill or caulk the recess completely with it, all in accordance with the manufacturer's instructions.

The placing of concrete by pumping in any section of the Works shall be subject to the written approval of the Engineer. The Contractor shall furnish the Engineer with full details regarding the mix proportions of concrete that he intends to place by pumping.

Compaction

The concrete shall be fully compacted by approved means during and immediately after placing. It shall be thoroughly worked against the formwork and around reinforcing steel and other embedded items without displacing them. The concrete shall be compacted in a way to avoid honeycombing and planes of weakness of the hardened concrete. Successive layers of the same lift shall be thoroughly worked together. To achieve this, the compaction tool shall penetrate through the new layer to the lower layer which shall still be sufficiently plastic to permit interknitting.

Compaction shall be carried out by mechanical vibration or (if approved) by spading, rodding, or forking.

Over-vibration resulting in segregation, surface laitance, or leakage, or any combination of these, shall not be permitted. The rate of concrete placing shall be commensurate with the available compaction equipment and only skilled operators shall be permitted to undertake compaction by vibration.

Concrete for precast elements shall be so placed in moulds and vibrated that concrete surfaces are smooth and even and all arrises are true and clean.

Where precast units having architectural finishes are required, the Contractor shall ensure that duplicate samples are submitted to and approved by the Engineer with regard to both colour and quality before full scale production is commenced. One sample will be retained by the Engineer and the other shall be retained by the Contractor at the place of manufacture. The Contractor shall not commence manufacture until acceptable samples have been lodged.

Construction joints

Concreting shall be carried out continuously up to the locations where construction joints are shown on the Contractor's working drawings or up to approved or directed locations. The method adapted for forming such joints and unforeseen joints shall be one of the following:

a) Construction joints when concrete is more than 24 h old. The surface of the concrete shall be brushed with a steel wire brush before new mortar and concrete are placed as specified in (b) below.
b) Construction joints when concrete is more than 24 h but not more than 3 d old. The surface of the concrete shall be sand-blasted or chipped with a light hammer, swept clean, and thoroughly wetted and covered with a 10 mm thick layer of mortar composed of cement and sand mixed in the same ratio as in the concrete. This mortar shall be freshly mixed and placed immediately before the new concrete is placed.
c) Construction joints when concrete is more than 3 d old. The procedure specified in (b) above shall be followed, except that the old surface shall be prepared and kept continuously wet for at least 24 h before the mortar and the new concrete are placed.
d) Construction joints at top of columns. The procedure for brushing and cleaning as specified in (a) or (b) above, as applicable, shall be followed before the steel reinforcement of the slab or floor to be cast on the columns is placed in position.

Curing and protection

After formwork has been removed and as soon as it is practicable in the opinion of the Engineer, all concrete shall be protected from contamination and loss of moisture by one or more of the following methods:

a) Ponding the exposed surfaces with water
b) covering the concrete with sand, or mats made of a moisture-retaining material, and keeping the covering continuously wet
c) continuously spraying the exposed surface with water
d) covering the concrete with waterproof sheeting firmly anchored at the edges
e) the use of an approved curing compound applied in accordance with the manufacturer's instructions.

When the ambient temperature is 5º C and higher, the curing period shall be at least 6 d for concrete made with Portland cement, at least 3 d for concrete made with rapid-hardening Portland cement, and at least 8 d for concrete made with Portland blastfurnace cement. When the ambient temperatures is below 5º C, the curing periods shall be extended by 72 h, 36 h, and 72 h, respectively.

For precast units, the curing period shall be at least 8 d for concrete made with OPC (instead of 6 d) and at least 10 d for concrete made with PBFC or OPC/slag (instead of 8 d), and curing shall start not earlier than 6 h after the concrete has been placed.

Provided that the curing temperature does not exceed 60º C and that the rate of increase does not exceed 20º C/h, precast concrete may be steam cured at atmospheric pressure or curing may be accelerated by casting the concrete in heated moulds.

When the ambient temperature is above 32º C, the temperature of the concrete when deposited shall not be allowed to exceed 32º C. Under adverse hot weather conditions, the Contractor shall take all reasonable steps to reduce to a minimum the placing temperature of the concrete. Stockpiles of

aggregates and all metal surfaces in contact with aggregates and concrete shall be shielded from the direct sun and/or cooled by being sprayed with water, and windbreaks shall be erected, if necessary, to prevent the initial rapid drying-out of the concrete which would otherwise occur before normal curing procedures can be undertaken.

Concrete shall not be placed during periods of heavy or prolonged rainfall.

Concrete surfaces

Exposed surfaces of concrete not finished against forms (such as horizontal or slightly sloping surfaces) shall be brought up to a plane, uniform surface with suitable screed boards.

Where a wood-, steel-, or power-floated finish is required in terms of the Technical Specification, the concrete shall be finished to the tolerances specified for Degree of Accuracy II in terms of 2.3.6.

Finished concrete shall have a neat, smooth, even, and uniform finish free from any honeycombing. If the finish of any formed or floated concrete surface is, to the opinion of the Engineer, unsatisfactory and does not conform to that specified, the Contractor will be required, at his own expense, to rub down such surface while it is still green, or, alternatively, to grind it down with Carborundum or other suitable material when it has hardened or to take other approved measures to give the specified finish.

For precast elements, moulds shall be removed without any shock or vibration that might damage the concrete or have any other detrimental effect on the units and on their surfaces.

Watertight concrete

Each section of the Works that is required, in terms of the Technical Specification, to hold or exclude water shall be watertight, and special care, particularly at construction joints, shall be taken by the Contractor to ensure watertightness. Should any such section of the Works fail to pass the tests for watertightness as required in terms of the Technical Specification or as ordered, or show any sign of water leakage or penetration after being taken into use, it shall be deemed defective and the provisions of 2.3.5.5.14 shall apply.

Concrete in wet ground

Wherever concrete is to be placed in wet ground, shallow drains shall be excavated below the ground formation, filled with broken stone, and connected to suitably placed sumps.

A concrete carpet, the top of which will form the foundation level for the structural concrete, shall then be laid.

The layout and dimensions of the dry-stone drainage channel and the thickness of the carpet will be determined by the Engineer in every case, whether or not these details are given on the drawings, and their construction will be dealt with as daywork.

Grouting

Where the Contractor is required to grout holding-down bolts, or to place grout under column bases or bedplates for equipment, he shall first prepare the relevant concrete surfaces by scrubbing and cleaning them. The mortar grout shall consist of an approved mixture of cement, sand, water, and admixture, and shall be so rammed into each HD-bolt pocket or under each base or bedplate (as applicable) that all voids and pockets are completely filled around the bolt or between the top of the concrete and the underside of the metalwork, and, in the case of a base or a bedplate, that the grout projects beyond the base or bedplate. After the void has been completely filled, the edges of the mortar grout shall be trimmed at an angle of 45º outward from the bottom edges of each base or bedplate and the trimmed edge wood-floated to a neat finish.

Concrete pumping

Where approved by the Engineer, the Contractor may use a suitable concrete pump for transporting the concrete from the batching plant or transport vehicle to the point where it is to be deposited, in which case the specified mix proportions shall be adjusted and agreed with the Engineer at the time of submission of the relevant method statement. The concrete shall be fed directly from the batching plant or transport vehicle into the hopper of the pump. Once concreting has commenced the rate of the flow and mixing must be such as to ensure continuous movement of the concrete in the pipework, which shall have as few bends as possible. Frequent slump tests (eg in accordance with BS 1881) shall be carried out at the delivery end to ensure the consistency and workability at the point of placing. All equipment must be thoroughly cleaned at the end of each operation.

Defects

The concrete shall be homogeneous and free from honeybombing, interstices, and planes of weakness. If, after removal of the forms, the concrete shows any defect, the Contractor shall immediately report such defect to the Engineer, and he shall not carry out any patching or remedial work until authorized to do so by the Engineer.

After thorough inspection and investigation of the quality and strength of the defective work and after due consideration of the possible consequences of such defect, the Engineer will either specify the extent and method of repair or order the demolition and reconstruction of the whole of the defective work to the extent that he considers necessary.

The cost of all such investigation, repair, and remedial work and of any demolition and reconstruction of defective work shall be borne by the Contractor and all repair, remedial, and reconstruction work shall be executed to the satisfaction of the Engineer.

Handling and erection of precast units

The Contractor shall ensure that lugs, slots, holes, etc., provided for handling units and moving them from the point of manufacture to the place where they are erected, are adequate and are so arranged that excessive stresses do not occur in any unit during handling, movement, or erection. Without the Contractor's responsibility being limited in any respect, the position of lifting and supporting points, the method of lifting, and the type of equipment and transport used shall be subject to approval by the Engineer.

The Contractor shall place indelible identity, location, and orientation marks on each unit, as and where necessary.

Packing pieces shall be such that they do not discolour or otherwise permanently damage the units.

Precast units shall be so stacked that the accumulation of trapped water and dirt is prevented, that, in the case of small units, deformation is minimized during the curing process, and that large units such as bridge beams have complete freedom of movement during the curing process.

The method of assembly and erection agreed to with the Engineer shall be adhered to on the Site. Immediately after the unit is in position and before the lifting equipment is removed temporary supports or temporary connections between units shall be provided as necessary. The final structural connections shall be completed as soon as is practicable.

No-fines concrete

No-fines concrete, eg for use in subsoil drainage, shall consist of a 1:8 cement/aggregate mix by volume. Aggregate shall be 18 mm to 10 mm graded. Only sufficient water shall be added to ensure complete coating of the aggregate. One half of this water shall be placed into the mixer first, after which the aggregate and cement shall be admitted. After partial mixing the balance of the water shall be added until a suitable consistency of mix is achieved.

Concrete for benching

Concrete for benching in manholes and similar structures shall consist of Grade 15 concrete unless otherwise specified. It shall be placed with low workability to the approximate shape required, and, while still green, shall be finished with not less than an average of 20 mm of cement screed to a steel trowelled finish and to the contours indicated on the drawings.

Air-entrained concrete

Concrete, where specified, shall include an approved air-entraining agent capable of producing a 5% air-entrainment with a tolerance of 0.5%.

The mix shall be properly designed, having regard to the nature and grading of the aggregate and air-entraining agent being used.

The Engineer reserves the right, at any time, to sample and test the air-entraining agent used in the Works.

Preference shall be given to the use of air-entraining agents which can be administered in fixed calibrated amounts through a dependable mechanical dispenser or cachet, and which are added to the mixing water.

No air-entraining agent shall be used in the Works without the written approval of the Engineer.

Records

The Contractor shall maintain written records that provide the following information:

a) The date on which each section was concreted
b) the position of the section within the Works
c) the time taken to place the concrete
d) the daily weather conditions
e) the nature of samples taken and the dates they were taken
f) the curing history
g) the date of removal of formwork
h) the type (mix) and grade of concrete

2.3.6 Tolerances

2.3.6.1 General

Permissible deviations (PD) appropriate to the degree of accuracy will be applied to linear dimensions, position, plumb (verticality), level, squareness, and bow.

Where precast units are to fit on or between cast-in-situ concrete units, the tolerances applicable to the cast-in-situ concrete shall be compatible with the tolerances applicable to the precast units.

The Degree of Accuracy may be one of the following:

a) Degree of Accuracy III for use where a high degree of accuracy is unnecessary, eg mass foundations
b) Degree of Accuracy II for what is normally considered "good work"
c) Degree of Accuracy I where the use of special, as opposed to normal, methods or materials (or both) is warranted, eg prefabricated units or where such are to fit in.

Deviations will be measured as set out below:

a) Any deviation from flatness of a plane surface will be measured as the maximum deviation of the surface from any straight line of length 3 m joining two points on the surface, determined by means of a straight-edge the ends of which are supported on identical blocks of suitable thickness placed over each of the points.
b) Any abrupt change in a continuous surface, including a local depression or peak in a floor or wall and any abrupt change caused by a joint in formwork will be measured as specified in (a) above.
c) Out-of-squareness of a corner or an opening or an element such as a column will be measured by taking the longer of two adjacent sides as the base line, and determining any departure from the perpendicular of the side at either end of the base line.

2.3.6.2 Permissible Deviations

If no Degree of Accuracy is specified in the Technical Specification, Degree of Accuracy II shall apply.
The Permissible Deviations are:

a) for the Degree of Accuracy III:

(i) reinforcement

spacing between two adjacent bars	+ 25 mm
location of ends of bars	+ 40 mm
cover to reinforcement	- 0,+ 20 mm

(ii) foundations

position in plan from grid or centre line	+ 50 mm
linear dimension in plan cast against excav.	+ 60 mm
linear dimension in plan cast against formw.	+ 30 mm
level of underside of concrete	- 40,+ 20 mm
surface level	- 30, +15 mm

(iii) elements above foundation

position in plan from grid or centre line	+ 25 mm
linear dimensions	+ 30 mm
cross-section dimension	- 10,+ 20 mm

level of any element or component	- 20,+ 10 mm
plumb, per metre of height	5 mm
plumb, maximum of any point, at any height	70 mm
out-of-squareness, for short sides <0.5 m	+ 10 mm
out-of-squareness, for short sides < 2.0 m	+ 20 mm
out-of-squareness, for short sides < 4.0 m	+ 25 mm
flatness of or abrupt changes in exp. surface	10 mm
flatness of surface to be plastered	15 mm
abrupt changes in surfaces to be plastered	10 mm
cover to reinforcement	0 mm
location in plan or elev. of HD-bolts	+ 5 mm
constituents in the concrete mix	+ 5 %

b) for the Degree of Accuracy II:

(i) reinforcement

spacing between two adjacent bars	+ 20 mm
location of ends of bars	+ 30 mm
cover to reinforcement	- 0,+ 15 mm

(ii) foundations

position in plan from grid or centre line	+ 35 mm
linear dimension in plan cast against excav.	+ 40 mm
linear dimension in plan cast against formw.	+ 20 mm
level of underside of concrete	- 30,+ 15 mm
surface level	- 20,+ 10 mm

(iii) elements above foundation

position in plan from grid or centre line	+ 15 mm
linear dimensions	+ 20 mm
cross-section dimension	- 5, + 10 mm
level of any element or component	- 15, + 5 mm
plumb, per metre of height	4 mm
plumb, maximum of any point, at any height	50 mm
out-of-squareness, for short sides <0.5 m	+ 5 mm
out-of-squareness, for short sides <2.0 m	+ 15 mm
out-of-squareness, for short sides <4.0 m	+ 20 mm
flatness of or abrupt changes in exp. surface	5 mm
flatness of surface to be plastered	10 mm
abrupt changes in surfaces to be plastered	5 mm
cover to reinforcement	0 mm
location in plan or elev. of HD-bolts	+ 3 mm
constituents in the concrete mix	+ 5 %

c) for the Degree of Accuracy I:

(i) reinforcement

spacing between two adjacent bars	+ 15 mm
location of ends of bars	+ 20 mm
cover to reinforcement	- 0,+ 10 mm

(ii) foundations

position in plan from grid or centre line	+ 20 mm
linear dimension in plan cast against excav.	+ 20 mm
linear dimension in plan cast against formw.	+ 10 mm
level of underside of concrete	- 20,+ 10 mm
surface level	- 10, + 5 mm

(iii) elements above foundation

position in plan from grid or centre line	+ 5 mm
linear dimensions	+ 10 mm
cross-section dimension	+ 5 mm
level of any element or component	- 10,+ 0 mm
plumb, per metre of height	2 mm

plumb, maximum of any point, at any height	30	mm
out-of-squareness, for short sides <0.5 m	+ 3	mm
out-of-squareness, for short sides <2.0 m	+ 10	mm
out-of-squareness, for short sides <4.0 m	+ 15	mm
flatness of or abrupt changes in exp. surface	30	mm
flatness of surface to be plastered	5	mm
abrupt changes in surfaces to be plastered	3	mm
cover to reinforcement	0	mm
location in plan or elev. of HD-bolts	+ 1.5	mm
constituents in the concrete mix	+ 5 %	

d) for precast beams
the deviation from the intended line measured on a part of or on the overall length of the beam shall not exceed 3 mm for the length of up to 3 m, and for each additional metre in length a deviation of 1 mm will be allowed up to a maximum of 10 mm. In addition, the rate of deviation from the intended line shall not exceed 1:300.

2.3.7 Tests and Acceptance

2.3.7.1 Facilities and frequencies of sampling

For the purposes of taking samples and carrying out tests, the Engineer shall have free access to the Works, and the Contractor shall provide all equipment required for the sampling (eg cones, moulds) as specified and render any assistance necessary. If so required, the Contractor shall provide storage and protection for such samples on the Site.

While concrete of a particular grade is being placed under the same conditions, sets of samples (each sample being sufficient for 3 cubes, cylinders, beams, or prisms, as applicable) shall be taken.

The sets of samples shall be taken as close as is practicable to the start of placing and at appropriate intervals thereafter, or from one particular batch and then from subsequent batches chosen at appropriate intervals.

At least one set of samples shall be taken from each day's casting and from at least every 90 m3 of concrete of each grade placed.

Only one sample shall be drawn from any one batch of concrete, and, except where otherwise ordered, no sample shall be taken of any grade until at least 3 batches of such grade have been mixed and discharged.

2.3.7.2 Testing

All testing shall be carried out in accordance with the relevant applicable standards or as directed by the Engineer.

The Contractor shall ensure that Site testing is carried out by a competent technician or by a person deemed by the Engineer to be sufficiently experienced.

The Contractor shall ensure that laboratory testing is carried out by a recognized testing institution or an approved laboratory or a firm approved by the Engineer.

Where early-strength testing is desired by the Contractor (eg for determination of the 7 d strength), plans for such testing and interpretation of results shall be as agreed between the Contractor and the Engineer.

2.3.7.3 Acceptance criteria for strength concrete

Should any test result obtained on concrete of a specific grade show that the strength is more than 3 MPa below the specified strength, the concrete will be deemed not to satisfy the requirements of the specification. Should an examination carried out as described below satisfy the Engineer that the structural adequacy and durability of the part of the structure in which the concrete has been used is not impaired, the concrete shall be accepted and the mix design and other factors influencing the quality shall be reviewed in order to ensure that further concrete cast will be of the quality as specified.

The following are the criteria to be applied with regard test results:

a) The average of any three consecutive test results obtained on concrete of a specific grade shall exceed the specified strength by at least 2 MPa.

b) If the criterion given in (a) above is not met but the said average is at least equal to the specified strength, the concrete cast shall be accepted but the mix design and standard of control shall be reviewed and adjusted as necessary.

Should the said average result be less than the specified strength, the Engineer will investigate, as described below, the part of the structure in which concrete represented by such result has been used.

If, after evaluation of the test results an examination of the concrete in the structure is indicated, one or more of the procedures in the sequence given below may be adopted at the discretion of the Engineer to determine the acceptability or otherwise of concrete in particular sections of the structure:

a) An assessment of the stress level in the structure concerned in relation to the test result obtained

b) non-destructive testing, subject to similar concrete of proved acceptable quality being available in comparable members in the same construction as a reference (impact hammers and ultrasonic testing are two examples of such test techniques that may be used, provided the apparatus has been previously calibrated)

c) the testing of drilled cores in accordance with relevant applicable standards under terms and conditions agreed upon between the Engineer and the Contractor.

Where load tests are, in the opinion of the Engineer, unsuitable or impractical, and if an examination described above does not show the concrete strength to be acceptable, or if a portion of the structure fails to pass the test, the Contractor shall, on the instructions and directions of the Engineer, either replace or strengthen by approved means each that failed or contains concrete that failed, as relevant; and any section, irrespective of strength, the functional purpose of which is affected by the section or concrete referred to in (a) above.

The Contractor shall bear the cost of any replacement or strengthening referred to above as well as any other remedial measures that may be ordered to restore the durability of the concrete to that achievable by concrete of the strength required in terms of the specification.

2.3.7.4 Individual load tests on precast units

If so directed by the Engineer, the unit to be tested shall be supported at its designed points of support and loaded for 5 min with a load equal to the sum of the characteristic dead load plus 1.25 times the characteristic imposed load, and the deflection shall then be recorded. The maximum deflection measured after application of the load shall be checked for compliance with the applicable requirements of the relevant applicable standards.

The recovery shall be measured 5 min after the removal of the applied load and the load shall then be re-imposed. The percentage recovery after the second loading shall be at least equal to that determined after the first loading and at least 90 % of the deflection recorded during the second loading. At no time during the test shall there be, in the opinion of the Engineer and in the light of a reasonable interpretation of the relevant data, any sign of weakness or faulty construction in the unit under test.

If destructive tests for beam units are ordered, the unit to be tested shall be supported at its design points of support, and loaded to its ultimate design load. The unit shall not fail within 15 min after the application of the test load. A deflection exceeding 1/40 of the span shall be regarded as failure of the unit.

For units not amenable to the tests described above, details of the testing arrangements shall be agreed between the Engineer and the Contractor before such units are cast.

2.3.8 Measurement and Payment if not otherwise specified in the B.O.Q.

2.3.8.1 Principles

Formwork

Formwork will be measured as the net area of the face of the concrete. No deduction will be made for fillets and splays of size up to 100 x 100 mm or for openings of diameter up to 0.7 m or of area up to 0.5 m2.

Formwork in continuous lengths of narrow width of up to 300 mm will be measured by length, the width or range of width being stated in the schedule.

Boxing-out, the forming of holes, and other such operations will be measured by number, basic dimensions, perimeters, or drawing references, as stated in the schedule.

Separate items will be scheduled

a) for each class of finish required
b) for the different angles of inclination of formwork as given below:
   (i) horizontal: $>85^0$ up to 95^0
   (ii) sloping: $>10^0$ up to 85^0
   (iii) battered: up to 10^0
   (iv) vertical: 0^0
c) for each type of structural element, such as walls, beams, slab, etc.
d) for formwork to curved surfaces
e) for voids or openings classified as follows:
   (i) large: >0.1 up to 0.5 m^2
   (ii) small: up to 0.1 m^2

Reinforcement

Steel for reinforcement will be measured net by mass of all bars, including supporting steel detailed on the bending schedules. No allowance will be made for cutting, waste, spacer devices, or binding wire.

Welded mesh will be measured by area to be reinforced by means of mesh, no allowance being made for cutting, waste, laps, or deductions for end cover.

Steel offcuts resulting from the cutting and bending of reinforcing steel in accordance with the bending schedule shall be deemed to be the property of the Contractor.

Concrete

The volume or area of concrete, in which unit the payment is intended, will be computed from the measurements net to the dimensions shown on the drawings or to the dimensions cast, whichever is the smaller. Structural elements that are undersized will be measured for payment only if they are accepted by the Engineer.

No allowance will be made for concrete required to make up overbreak in soft excavation, but payment will be made for additional concrete or formwork, ordered in writing by the Engineer to replace unsuitable material or overbreak in hard rock or in intermediate excavation.

Subfoundation carpets and blinding layers will be measured to the plan size of the concrete structure resting on it, and measured on the mean thickness as cast, provided that the Engineer is satisfied that the excavation has not at any point been taken deeper or wider than necessary.

Separate items will be scheduled, as applicable, for each type and each grade of concrete, for each unit or element in the structure (where these would materially influence the pricing), such as

a) slabs that are horizontal, sloping, conical or off different thickness
b) concrete deposited under water
c) small quantities each less than 0.5 m3 of formed surfaces, and
d) different surface finishes, other than just striking-off and levelling.

3 PIPELINES AND RELATED WORKS

3.1 PIPE TRENCHES

3.1.1 Scope

This specification covers earthworks for trenches for all types and sizes of pipes. It covers excavation, the preparation of a trench bottom, backfilling and the reinstatement of surfaces.

3.1.2 Interpretations

3.1.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.1 Site Clearance
c) 2.2 Earthworks

3.1.2.2 Application

This specification contains clauses that are generally applicable to earthworks for pipe trenches. Interpretations, additions, and variations of this specification (if any) are set out in the Particular Technical Specification.

3.1.2.3 Definitions

For the purpose of this specification the following definitions shall apply (re also drawing 3.2):

Backfill (Main fill) - The approved filling material placed in a pipe trench after the pipe has been laid, bedded and surrounded by the blanket that has been compacted at the sides and over the top of the pipe.

Bedding - The material, and the operation of placing it, of the bedding cradle and blanket, up to the underside of the backfill.

Blanket - The bedding zone in which material is placed and compacted on or from the top of the cradle up the sides and over the top of the pipe in such a manner that the barrel of the pipe is supported continuously and firmly on the sides and protected over the top by a dense cushion of material.

Cradle - The bedding zone in which material is placed firmly and without voids under and up the sides of a pipe in such a manner that for all practical purposes the pipe cannot move or deflect.

3.1.3 Materials

Except that material will not be classified as boulder excavation, the excavation of material will, for purpose of measurement and payment, be classified as specified in clause 2.2.3.1 above.

For selected fill material, the requirements given in 3.2 Pipe Bedding shall apply.

Backfill material shall be material excavated from trenches, provided only that it contains no organic material, that it excludes stones of average dimension exceeding 150 mm, and that it can be so compacted as to avoid significant settlement, and shall have a PI not exceeding 12, a minimum CBR of 15 % at specified density if placed in the upper 200 mm of the subgrade, and a minimum CBR of 7 % if the backfill is to be placed lower in the subgrade. Material containing more than 10 % of rock or hard fragments that are retained at a sieve of nominal aperture size 50 mm, and material containing large clay lumps that do not break up under the action of the compaction equipment being used, will be regarded as unsuitable for use in backfilling.

Where trenches cross or run along surfaced roads and paved areas of which the surfaces are ordered by the Engineer to be reinstated, the Contractor shall obtain prior approval for subbase and base materials that may be required to supplement such materials lost during excavation. Materials for

bituminous or asphalt construction shall comply with the applicable standards of the Roads Department of the Ministry of Transport.

The Contractor is not required to use selective methods of excavation but may, if he so wishes, screen, wash or otherwise treat excavated material in order to produce material suitable for the bedding. He shall take positive steps to avoid burying or contaminating materials which otherwise would be suitable for use as different types of fill, topsoil, or road material, as applicable.

3.1.4 Plant and Equipment

The Contractor shall use trenching plant that will excavate to a width such that the side allowance does not exceed the appropriate values specified in 3.1.5.2 below by more than 50%.

The Contractor shall use appropriate techniques or provide plant such as pumps, well points and sheeting or close timbering for keeping the trenches sufficiently free from water to enable him to lay pipes true to line and level and to bed them soundly.

The Contractor may use mechanical compaction equipment but he shall select such equipment and operate it in such a manner that the pipeline is not stressed or damaged. Machine compaction shall not be used directly above the pipe until sufficient backfill has been placed to ensure that machine compaction loads transmitted to the top of the pipe are not greater than would be imposed by normal road traffic over a pipeline with cover of depth 600 mm.

3.1.5 Construction and Workmanship

3.1.5.1 Precautions

With regard dealing with water, the requirements of clause 1.4.6 and 1.4.20 shall apply in addition to the stipulations below.

In the case of a trench on sloping ground, the Contractor shall take approved measures (such as the construction of cross-embankments) to minimize erosion in the trench and adjacent ground.

With regard accommodation of traffic and access to properties, the Contractor shall, in addition to the requirements of clause 1.5.2, construct or put in order such bypass(es) as may be required to deviate traffic from portions of the road that are to be affected by the construction; or where half-width construction is ordered or approved, so arrange his work that the traffic will at all times have free one-lane access to at least half the width of the roadway; or ensure, wherever possible, that the whole road is open at night and left in a trafficable condition, complete with traffic signs and protection facilities as specified.

He shall also ensure, wherever possible, that the usable width of the road is at least 3.5 m and he shall provide and allow reasonable access to persons occupying properties that fall within or adjoin the area over which he is working. If, for any reason, such access has to be closed during the construction period, the persons affected shall be given reasonable notice for each such period of closing.

With regard existing services that intersect or adjoin trenches, the requirements of clause 1.5.1 shall apply.

3.1.5.2 Minimum base width

Unless otherwise shown on the drawings, specified in the Particular Technical Specifications, or as directed, the base width of a trench shall be not less than the external diameter of the pipe barrels plus twice the side allowance as shown below:

ND		up to 125 mm	side allowance 300 mm
ND	over 125 mm	up to 700 mm	side allowance 300 mm
ND	over 700 mm	up to 1000 mm	side allowance 400 mm
ND	over 1000 mm	up to 2000 mm	side allowance 500 mm
ND	over 2000 mm	up to - mm	side allowance 600 mm

The minimum base width for pipes not exceeding 125 mm and laid at a depth not exceeding 1.5 m may be less than 600 mm for flexible continuous piping that, in terms of the specification or schedule, require no bedding or jointing in the trench. Where two or more pipes are to be placed in one trench, the base

width of the trench shall be no less than the sum of the external diameters of the pipes barrels plus the side allowance for each outer pipe plus, between each pair of adjacent pipes, the average of the side allowance for each pipe.

3.1.5.3 Site clearance

The Contractor shall clear, in accordance with clause 2.1, an area of sufficient width along the route of the pipeline to ensure that his selection operations are not hampered.

3.1.5.4 Excavation

Pipe trenches shall be excavated in lengths approved by the Engineer, to widths that provide at least the appropriate side allowance (within trench supports, if any) as specified in clause 3.1.5.2 above, and such that half of the base width is on either side of the designated centre-line of the pipe.

The sides of each trench from the bottom up shall be as nearly vertical as possible for at least the height of the bedding.

When cutting through bituminous surfaces, the edges of the existing bitumen base and/or wearing courses shall be cut back vertically to straight lines.

In densely built-up areas with restricted and confined space, such as in the old town areas, the stockpiling of excavated material adjacent to the trench for use as backfill material may not always be possible. In such cases the Contractor shall make allowance in his rates for transporting such material to and stockpiling it at a distance away from the point of excavation, at locations suitable and approved by the Engineer.

3.1.5.5 Trench bottom

Material that the Engineer considers to be unsuitable at the bottom of the trench shall be excavated to the depths and disposed of in the manner described. The resulting space shall be refilled, as ordered, with approved material and compacted as directed.

The depth of the trench shall be such that the depth of the cradle can be placed under the pipeline, and the trimming and grading of the bottom of the trench shall be such that the barrel of each length of pipe can be uniformly supported over its full length, free at the joints, and at the correct grades and levels.

Where the trench excavation is in rock or in material containing hard objects or boulders that may adversely affect the uniformity of the pipe foundation, such rock or material shall be removed to a depth of 100 mm below the specified trench bottom.

Where the bottom of the trench has been loosened during excavation, it shall be compacted at OMC to 90 % of modified AASHTO maximum density prior to bedding and pipelaying.

The bottom of pipe trenches shall be sufficiently straight to enable the pipe to be laid without reduction of the side allowances given in 3.1.5.2 above and in conformity with the applicable tolerances specified.

3.1.5.6 Backfilling

Backfilling of pipe trenches shall commence as soon as possible after the pipe has been laid and firmly bedded in the specified cradle and the blanket has been placed and adequately compacted at OMC around, under the overhang and over the top of the pipe to the height of blanket cover specified.

Backfilling shall be carried out as described below and over the full extent of the actual trench excavation and to original ground level, except where otherwise directed.

Unless the Contractor is authorized by the Engineer to use other material, the material for backfilling above the bedding (cradle and blanket) shall be obtained from trench excavations.

Unless prior approval has been obtained, no filling shall be placed in water.

Hard and rock material shall be incorporated in the backfill above the bedding only to the extent approved. Depending on the quality of the material, the Engineer may direct that it be suitably mixed with other backfill material.

In areas subject to road traffic loads and where the available backfill material has a PI higher than 12, the Contractor shall obtain specific instructions from the Engineer before proceeding with the placing of the backfill.
Excavation material from the trench, which is unsuitable or has become surplus because of bulking, displacement by the pipe and importation, shall be disposed of along the trench servitude within the freehaul distance from the source of such excavation material, unless otherwise ordered by the Engineer.

Any deficiency of backfill material from trench excavations because of removal of organic or other unsuitable material shall be made up from suitable surplus material from other excavations on the Site within the freehaul distance. If, in the opinion of the Engineer, insufficient or no suitable material is available for this purpose from such excavations, and the shortage of such material has not been caused by the methods used by the Contractor, the Engineer shall authorize the Contractor to import sufficient suitable material. The Contractor shall so arrange his work that the importation of backfill material is kept to a minimum in respect of both quantity and overhaul.

The Contractor shall complete backfilling of trenches expeditiously and in reasonable lengths.

Where trenches are in roads or paved areas, the Contractor shall clean the road surface or paved area adjacent to the trench.
With regard transport for earthworks for trenches, the requirements of clause 2.2.5.2.5 shall apply.

3.1.5.7 Compaction

In areas subject to traffic loads, trenches shall be backfilled in layers of thickness (after compaction) not exceeding 150 mm and the material shall be compacted to 93 % of modified AASHTO maximum density in the case of cohesive soil or 98 % in the case of non-cohesive soil, up to the top of the subgrade level as shown in the Drawings.

3.1.5.8 Reinstatement of surfaces

In all cases, the Contractor shall, if ordered, reinstate surfaces over the full extent of the top of the actual excavation.

On private properties or other unsurfaced areas, the top 300 mm layer of each trench that will not be subject to road traffic loads shall be of such topsoil as is available in addition to soft material from excavations. The finished surface of backfilling that is left proud of the surrounding ground to allow for initial settlement shall be not more than 150 mm above the surrounding ground. Any settlement below original ground level that occurs during the execution of the contract or the period of maintenance shall, as soon as is practicable, be made good by the Contractor with material of the same quality as that adjacent to the trench.

In the case of gravel roads or similar surfaced areas, the Contractor shall, immediately after completion of the backfilling to the top of the subgrade level, reinstate the road surface by filling the reminder of the trench with a well-graded and approved hard-wearing gravel surface of thickness at least 150 mm, and of quality equal to that of the existing road surface compacted to at least 95% modified AASHTO. The gravel layer shall be finished with a slight camber in order to allow for initial settlement but shall not be left so far proud of the adjacent road surface or shall not be shaped such as to cause excessive jolting of any vehicle proceeding with normal speed.

The Contractor shall maintain the gravel surface to a standard suitable for normal traffic until the bitumen surfacing has been reinstated.

If the surface of a road with a stabilized base has been disturbed, the base shall be replaced with crusher run base compacted with sufficient moisture to give a density of at least 98 % modified AASHTO maximum density.

Except where immediate reinstatement of the bitumen surface is ordered, the Contractor shall reinstate the bitumen surface after sufficient time has elapsed to show up inadequately compacted areas and after such areas have been made good.

Except if otherwise ordered by the Engineer, the surface of a bitumen road shall be reinstated with asphalt of at least the thickness used in the original state. The base material shall be graded to a level sufficiently below the final road surface to allow the bitumen surfacing to be accommodated, and the

edges of the existing bitumen wearing course shall be cut back vertically to a straight line. Before the bituminous construction is commenced, all loose materials and dust shall have been removed and the surface shall have been approved and prime coated at 1.0 l/m2 of MC30 cutback bitumen. The bituminous surface will have a tolerance of -0+6 mm after compaction.
The Contractor shall maintain the reinstated surfaces and shall make good, at his expense, any damage due to any subsidence, pothole or other unevenness immediately after it occurs during the period of the contract or during the maintenance period.

Where, during the execution of the works, any road or paved surface adjacent to a trench has been damaged in any way whatsoever by the Contractor's equipment, he shall, at his own expense and as soon as is practicable, repair and restore such surface to a condition at least equivalent to that previously existing, and to the satisfaction of the Engineer.

3.1.6 Tolerances

3.1.6.1 Alignment and grade

The deviation from the specified level of the invert and the specified dimensions of a trench and (for a height equal to at least the diameter of the pipe) of the lower part of the sides of the trench shall be such that the pipe may be laid and bedded in the trench within the tolerances specified for the pipeline.

3.1.6.2 Moisture content and density

The requirements for moisture content and density given in clause 2.2.6.2 shall apply.

3.1.7 Testing and Acceptance

The Contractor shall prove the CBR, Marshall and their specified properties of reinstatement materials before use at a rate of one test per 200 m3 of material. In-situ density test/maximum dry density of non-bitumenous materials, and Marshall compaction / in-situ caring of bitumenous materials will be carried out for every 200 linear meter of trench or part thereof by the Contractor in the presence of the Engineer, or by an independent laboratory approveed by the Engineer. The cost of all testing will be included in the Contractor's rates. In the event of failure results, the Engineer will order any necessary re-testing and remedial works at the Contractor's expense.

3.1.8 Measurement and Payment

3.1.8.1 Basic principles

Rates tendered for excavation shall cover the cost of excavating and re-use of the excavated material in backfilling and the cost of disposal of any surplus and unsuitable material along the route of the pipeline within the freehaul distance of the source.

Excavations for trenches will be measured as if taken out with vertical sides regardless of whether they have been taken out with sloping sides. The length used for computation will be the total through-length of the pipeline from end to end or from structure to structure, and no deduction will be made for valves, manholes, catchpits and the like. The volume will be computed from the depth determined in accordance with clause 3.1.5.5 and the width in accordance with clause 3.1.5.2.

3.2 PIPE BEDDING

3.2.1 Scope

This specification covers the bedding, consisting of the bedding cradle and the selected fill blanket, for buried pipes for carrying fluids under pressure or gravity.

3.2.2 Interpretations

3.2.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General

b) 2.1 Site Clearance
c) 2.2 Earthworks, as applicable.
d) 3.1 Pipe Trenches

3.2.2.2 Application

This specification contains clauses that are generally applicable to the bedding of pipes. Interpretations, additions, and variations of this specification (if any) are set out in the Particular Technical Specification.

3.2.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Bedding - The material in the bedding cradle and fill blanket up to the underside of the main fill, and the operation of placing and compacting bedding in the manner specified.

Bedding cradle - The zone in which bedding is placed firmly and without voids under and up the sides of a pipe in such a manner that for all practical purposes the pipe cannot move or deflect.
Evenly graded - Descriptive of a particulate material that is such that the sizes of approximately 90 % by mass of the grains are evenly distributed between stated limits.

Expansion joint - A joint in concrete bedding in which two concrete surfaces are separated by resilient filler of thickness at least 15 mm.

Flexible pipe - A pipe of which the diameter is reduced by more than 1 % under external radial force before the appearance of cracks.

Joint hole - A depression formed in the bedding cradle to accommodate a joint in a pipeline.

Main fill - The approved filling material placed in a pipe trench after the pipe has been laid, bedded, and surrounded by selected fill blanket up to 150 mm cover above the top of the pipe.

Rigid pipe - A pipe of which the diameter is reduced by not more than 1% under an external radial force before the appearance of cracks.

Selected fill blanket - Material placed and compacted to form a blanket on or from the top of the bedding cradle up the sides and over the top of the pipe in such a manner that he barrel of the pipe is supported continuously and firmly on the sides and is protected over the top by a dense cushion of material.

Selected fill material - Material that complies with the requirements of clause 3.2.3.2 below.

Selected granular material - Material that complies with the requirements of clause 3.2.3.1 below.
Singularly graded - Descriptive of a particulate material in which over 90 % by mass of the grains is retained on a single sieve of any specified size aperture between stated limits.

3.2.3 Materials

3.2.3.1 Selected granular material

Selected granular material shall be material of a granular, non-cohesive nature that is singularly graded between 0.6 and 19 mm and is free draining.

3.2.3.2 Selected fill material

Selected fill material shall be material that has a PI not exceeding 6 and that is free from vegetation and from lumps and stones of diameter exceeding 30 mm.

3.2.3.3 Bedding

Bedding for rigid pipes shall be of Class A, B, or C and bedding for flexible pipes shall be selected granular material and selected fill material. The bedding cradle for Class A bedding shall be concrete. Bedding cradles for Class B and C bedding shall be of selected granular material. The material for the selected fill blanket shall in all cases comply with the requirements of clause 3.2.3.2.

3.2.3.4 Selection

The Contractor may screen, wash, or otherwise treat excavated material from pipe trenches or other excavations in order to produce material suitable for bedding or covering the pipeline. The Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline.

When material suitable for use as selected fill material or selected granular material is not readily available from trench or other excavation within a distance not exceeding 1 km, the Contractor shall, subject to the Engineer's approval for each material, obtain suitable material to replace the shortfall by opening up borrow pits at approved areas located at intervals along the route of the pipeline or by importing from commercial or other sources.

3.2.4 Plant and Equipment

Adequate equipment shall be provided by the Contractor for the placing and compacting of bedding as specified in clause 3.2.5.1.3 and 3.2.5.1.4 below.

The Contractor shall also provide the necessary test equipment for performing on Site the tests referred to in clause 3.2.7.1 and 3.2.7.2 below.

3.2.5 Construction and Workmanship

3.2.5.1 General

No bedding shall be laid until the Engineer has approved the trench, measured the depth if necessary, and authorized pipelaying to proceed.

Except in the case of Class A bedding, the joint holes shall be refilled with fine granular material and lightly compacted to prevent the migration of adjacent pipe bedding material into the holes and to obviate the forming of hard spots under joints.

In the placing of bedding, all voids under the overhang of the pipes shall be filled and the compaction shall be carried out uniformly on each site of the pipes so as not to cause any lateral or vertical displacement of the pipe.

Bedding shall be carried out as pipelaying proceeds, and shall be completed before the acceptance test is carried out.

The degree of compaction attained for bedding (other than concrete and the material over the top of the pipeline) shall be 90 % modified AASHTO maximum density.

3.2.5.2 Placing and compacting of rigid pipes

In addition to complying with the requirements listed above, the Contractor shall construct the bedding for rigid pipes in accordance with the following requirements:

a) **Class A.** The pipes shall be supported on a continuous cradle of concrete having a 28 d compressive strength of at least 20 MPa. During pipelaying and before the placing of the concrete bedding, the pipes shall be suitably supported. Care shall be taken during the placing of the concrete to prevent movement or flotation of the pipes. In the case of pipes with flexible joints, concrete shall not be allowed to enter the joints during casting of the bedding and a positive vertical expansion joint in the bedding cradle shall be formed at each pipe joint. The selected fill blanket shall not be placed in any section until a period of 24 h has elapsed after placement of the bedding cradle in that section. The main fill shall not be placed in any section until the bedding cradle in that section has achieved a compressive strength of at least 15 MPa.

b) **Class B.** The pipes shall be bedded on a continuous bed of selected granular material, the material being placed in accordance with the details, as relevant, and the bedding constructed in the manner shown, as relevant. To ensure that each pipe will be fully supported throughout the length of its barrel on the bedding cradle, joint holes shall be formed in the bedding cradle for pipe sockets and couplings.

c) **Class C**. The pipes shall be placed directly on the trench bottom after this has been hand-trimmed to ensure that each pipe will be fully supported throughout the length of its barrel. Joint holes shall be formed in the trench bottom for pipe sockets and couplings.

Any material that is used to support a pipeline temporarily during construction or does not comply with the requirements for bedding cradle shall be removed before the selected fill blanket for Class B or C is placed.

3.2.5.3 Placing and compacting of flexible pipes

In addition to complying with the requirements of clause 3.2.5.1 above, the Contractor shall construct the bedding for flexible pipes in accordance with the following requirements:

Flexible pipes shall be supported on a continuous bed of selected granular material of compacted depth of at least 100 mm and covering the full width of the trench. The granular material shall be compacted to the density specified in clause 3.2.5.1.4. Additional selected granular material shall than be placed carefully and evenly between the sides of the trench and the pipeline, in layers of uncompacted thickness approximately 100 mm and in accordance with the construction details. Each layer shall be compacted individually to the density specified in clause 3.2.5.1.4. Particular care shall be exercised to prevent damage, deflection, or displacement of the pipeline.

After completion of the bedding cradle, selected fill blanket shall be placed carefully in layers of 100 mm uncompacted thickness over the full width of the trench and shall be compacted to the density specified in clause 3.2.5.1.4 up to a height of at least 300 mm above the crown of the pipeline.

3.2.5.4 Concrete casing

In special cases, and where ordered by the Engineer, pipes shall be encased in concrete of the specified grade, generally of at least 15 MPa. The lower part of the encasement shall be constructed in the manner specified for Class A bedding. Once the pipeline has been tested and approved, the pipes shall be covered with concrete to the specified depth and expansion joints shall be cut or constructed in the upper part to coincide with those in the lower part. No earthfilling over the concrete shall be commenced until at least 5 d after the concrete has been placed or until the concrete has attained a strength of at least 10 MPa.

3.2.6 Tolerances

The permissible deviations shall be as follows:

(i)	OMC in field during compaction	-2, +1 %
(ii)	Density when bedding rigid pipes	-0, +5 %
(iii)	Density when bedding flexible pipes	-0, +3 %

3.2.7 Testing and Acceptance

The Engineer may order density tests to be carried out to determine the density and grading of the bedding.

The tests may be carried out by the sand replacement method or, where the grading of the bedding is such that the particle size is not less than 0.075 and not more than 2 mm, by use of a dynamic cone penetrometer.

If the results of such density tests show that the material has been compacted to a density equal to or in excess of the applicable specified value (see clause 3.2.5.1), the compaction will be accepted and the Employer shall bear the cost of the tests. If the density is found to be below the specified value, the Engineer may order removal and recompaction at the Contractor's expense, and the cost of the testing shall be borne by the Contractor.

3.2.8 Measurement and Payment

3.2.8.1 Basic principles

The operation of bedding (see clause 3.2.2.3) will not be measured separately, but the provision alongside the trench of bedding materials will be measured separately. The rate for laying a pipeline

shall cover the cost of handling, placing, and compacting the bedding materials up to the underside of the main fill, in addition to any other cost associated with laying the pipeline.

The volume of bedding materials will be computed from the dimensions of the pipe and the side allowance and the depth of each bedding section, as applicable.

No allowance will be made for bulking of material.

Separate items are scheduled for material for the bedding cradle and for the selected fill blanket to provide for the probability the excavated material from the trench is more likely to comply with the requirements for the latter than for the former.

Material displaced by the pipeline and by importation of material from sources other than trench excavation, shall be disposed of along the pipeline within a distance of 1 km from source unless otherwise ordered by the Engineer.

Freehaul as well as overhaul, if the latter is ordered, of such disposed material shall be covered as specified in clause 2.2.5.2.5.

3.3 PRESSURE PIPELINES

3.3.1 Scope

This specification covers the supply and installation of pipelines of diameter not exceeding 1000 mm, complete with ancillary works, for transporting water or sewage under working pressures not exceeding 2.5 MPa.

It also covers the construction of connections from a water reticulation main to the boundaries of (or other specified points on) individual plots or properties, and covers the pipework, meters, and the making of the connections.

3.3.2 Interpretations

3.3.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.1 Site Clearance
c) 2.2 Earthworks
d) 3.1 Pipe Trenches
e) 3.2 Pipe Bedding
f) 2.3 Concrete
g) 4.1 Brickwork

3.3.2.2 Application

This specification contains clauses that are generally applicable to the construction of medium pressure-pipelines and plot connections. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification.

3.3.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Ferrule - A short metal tube that is screwed or plugged into the wall of a pipe or into a saddle to form a connection.

Fitting - A special or a valve, or a process of jointing (except welding) straight pipes to one another and to specials and valves.

Leading connection - A short pipeline used for conveying water from a reticulation main to a domestic meter.

Saddle - A metal ring split into two semi-circular halves that are clamped round a pipe and used together with or has a built-in ferrule to form a connection.

Special - Any pipe other than straight pipe, such as bends, tees, reducers, etc.
Stop tap - A shut-off device (stop valve) installed in a pipeline to control the flow of water.
Straight pipe - A straight pipe of uniform bore and of standard or non-standard length.

3.3.2.4 Abbreviations

For the purpose of this specification the following abbreviations shall apply:

AC	Asbestos cement
CI	Cast iron
CID, DN	Constant internal diameter
COD	Constant outside diameter
GI	Galvanized iron (steel)
DCI, DI	Ductile cast iron
HDPE	High density polyethylene
IRHD	International rubber hardness degree
PTFE	Polytetrafluor ethylene
PVC	Polyvinyl chloride
uPVC	Unplasticized polyvinyl chloride

3.3.3 Materials

Pipes and fittings shall be of the types specified in the Particular Technical Specification and, unless otherwise required in terms of the Technical Specification, they and their couplings shall be capable of withstanding the applicable test pressure specified in clause 3.3.7.3.1 below. All pipes and fittings shall be supplied complete with couplings and jointing material.

Satisfactory temporary end covers shall be provided for the protection of threads, flanges, and prepared ends of plain-ended pipes and fittings, and to prevent damage to internal lining during transportation and during handling on Site.

Pipeline materials shall be so transported, stored, and handled that pipes are not overstressed at any time and fittings are not damaged in any way. Pipes damaged or cracked in any way shall be removed from the Site.

Materials for manholes and surface boxes shall be as specified in the relevant Particular Technical Specifications. Ferrules shall be manufactured from leaded gunmetal and shall be of a standard pattern screw-in or plug-in type, as directed. The outlets of the ferrules shall be such that they are compatible with the pipes used for the connections. Saddles shall be of malleable or ductile iron with an ultimate strength of 310 MPa, PE or PVC, or as directed. Stop taps shall, unless otherwise directed by the Engineer, be of screw-down pattern, clockwise closing, and shall be fitted with a crutch for hand operation.

Non-domestic water meters shall be of the type, size, and manufacture specified in the Technical Specification. Domestic water meters will be provided by the Employer.

Should the Contractor proposes to use pipes and fittings of material other than those specified, he shall submit for approval detailed specifications including details of the types of couplings he proposes to use with such pipes and fittings. The Contractor shall not use pipes or fittings of such other material unless and until he has obtained written approval for their use from the Engineer.

Bedding shall be a light sandy material.

Bricks and mortar for valve and meter chambers shall be in accordance with the requirements of specification 4.1.

Surface boxes and covers may be of CI or other material approved by the Engineer. All CI surface boxes shall have been hot dipped in an acceptable bituminous or similar compound before despatch from the manufacturer's works.

3.3.4 Plant and Equipment

The plant and rigging equipment used by the Contractor for the handling and placing of pipes shall be subject to the approval by the Engineer and shall be such that no pipe is overstressed during any operation covered by the specification.

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline.

The Contractor shall provide all the equipment, materials, tools, and fittings required for the performance of the tests given in clause 3.3.7 below.

3.3.5 Construction and Workmanship

3.3.5.1 Laying

The trench bottom shall be prepared as specified in 3.1.5.5. Trenches shall be kept sufficiently dry to allow proper and safe bedding, laying, and jointing of pipes and kept dry until the pipeline has passed the required tests and construction of the selected fill blanket over the pipes has been completed.

A pipeline shall be laid and bedded to even grades and to levels and alignments shown on the drawings or as directed. It shall be laid centrally in the trench and with the manufacturer's class and quality identification marks visible from the top of the trench, if possible.

Control of laying and bedding shall be by means of boning rods and sight rails or an acceptable laser beam device. Sight rails shall be painted black and white and shall be fixed securely and accurately.

Each pipe and each fitting shall be thoroughly cleaned and carefully examined for damage and defects immediately before laying. Should any damaged or defective pipe or fitting be laid, it shall be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

Every reasonable precaution shall be taken to prevent the entry of foreign matter and water into the pipeline. At the close of each day's work or at any time when work is suspended for a significant period, the last laid pipe shall be plugged, capped, or otherwise tightly closed until laying is recommenced.

During laying and jointing of pipes and until the pipeline(s) has/have passed the required acceptance tests and the trenches have been backfilled, all trenches shall be kept in a state which, in the opinion of the Engineer, is reasonably dry.

Unless otherwise shown on the drawings or specified in the Technical Specification, or ordered, the depth of trenches for pressure pipelines shall not exceed 3 m and shall be such that the cover over the top of the pipeline will be at least 0.9 m.

Where so required, the cover or the alignment of a pipeline may change gradually by deflection at pipe joints, but this deflection shall not be greater (and should generally be less) than the deflections permitted by the manufacturer of the pipe.

The minimum clearance between the outside of a pipeline being laid and the outside of any other pipe that it crosses shall be 150 mm. Where this requirement conflicts with the requirements for cover over the pipeline the Contractor shall ask the Engineer for written instructions and shall carry out the work in accordance with those instructions.

The Contractor shall record all relevant data (eg street name, number of plot, location measurements and distances in relation to boundary peg(s), size of connection, depths at connecting point etc.) for the preparation of "as-built" drawings, and shall make these records available to the Engineer.

3.3.5.2 Jointing

All pipelines shall be jointed in accordance with the manufacturer's instructions and to the approval by the Engineer.

Each end of pipes being jointed with detachable couplings shall be thoroughly cleaned by brushing and wiping immediately before being jointed. All rubber rings and seals shall be carefully inspected after being placed in position and before the joint is closed, to ensure that they have not suffered any cuts, tears, or other damage, and are not in any way defective. Only the lubricants (if any) recommended by the manufacturer of the pipe shall be used for sleeve-type couplings and rubber insertion rings.

Joints of uPVC pipes shall be lubricated with soft soap or similar material approved by the manufacturer. Grease derived from petroleum products shall not be used in uPVC joints.

In the jointing of pipes with flanges, special care shall be taken to align, grade, and level the pipes, specials, and valves to avoid straining of the flanges. All bitumen and paint shall be removed from the mating face of each flange immediately before jointing. Bolts shall be tightened up evenly in opposite pairs to ensure uniform bearing.

Care shall be taken to avoid damage to the internal surface of the pipes during assembly of the pipeline.

Wherever loose flanges are welded onto pipelines, the Contractor shall ensure that the inner lining is restored to the thickness specified and that the new lining is soundly jointed to the existing one.

3.3.5.3 Setting of valves, specials, and fittings

Unless otherwise specified in the Technical Specification, or directed, gate valves shall be set upright and butterfly valves shall be set with the main shafts horizontal. All valves, specials, and fittings, if to be placed in urban, industrial, or similar built-up areas, shall be located in the exact positions shown on the drawings or otherwise directed (and not merely to suit standard pipe lengths) but in all other (open) areas they may be located to suit the pipe lengths. After cutting a pipe to suit the position of a valve, special, or fitting, the Contractor shall, by means of an approved method, prepare the ends to suit the coupling sleeve etc.

3.3.5.4 Concrete casing

Where the Engineer requires pipes to be encased, a concrete of strength 15 MPa/37.5 mm shall be used.

No part of the concrete casing shall be closer than 150 mm to any flexible joint of a concrete encased pipeline.

The pipe trench for a concrete-encased pipeline shall be excavated to the depth below the bottom of the pipe, as ordered or shown on the drawings, and to sufficient width to allow for the concrete to be placed to the full specified width. The bottom of the trench shall be trimmed true to line and grade. A light concrete screed shall be placed on the bottom of the trench, concrete saddles or pads of the requisite thickness spaced suitably, and the pipeline laid on them true to line, grade, and level. After being jointed the pipes shall be tested in accordance with the applicable tests given in clause 3.3.7, care being taken to ensure that the pipes do not move during testing. After the pipeline has been tested, suitable formwork shall be erected and concrete carefully placed and vibrated in position underneath the pipe and up both sides. The concrete level shall be raised equally on both sides of the pipe until encasement is complete and a cover over the surface of the pipe is provided that is nowhere less than that ordered or shown on the drawings. No earth filling over the concrete shall be commenced until at least 5 d after the concrete has been placed or until the concrete has attained a strength of at least 10 MPa.

3.3.5.5 Anchor/thrust blocks and pedestals

At tees, bends, terminal valves, end caps, and where otherwise directed, anchor/thrust blocks shall be constructed to dimensions ordered or shown on the drawings. Unless otherwise specified in the Technical Specification, anchor/thrust blocks and pedestals shall be constructed of strength 15 MPa/37.5 mm concrete. The concrete shall be well punned around the pipe, if in trenches, against the undisturbed faces and bottom of the trench. Backfilling behind or under thrust faces will not be permitted. Excess excavation shall be replaced with the prescribed mix concrete given above at the Contractor's expense.

Care shall be taken to leave all joints accessible. No anchor/thrust block and pedestals shall be concreted until the approval of the Engineer has been obtained.

3.3.5.6 Valve and hydrant chambers

Unless otherwise specified in the Technical Specification, shown on the drawings or directed by the Engineer, all gate and scour valves, hydrants, and air valves in reticulation pipelines of nominal diameter up to and including 275 mm shall be housed in a chamber. Such chambers shall be of standard design and are normally made of brickwork in 1:3 mortar or of concrete.

3.3.5.7 Manholes

Unless otherwise specified in the Technical Specification, shown on the drawings or directed by the Engineer, all gate and scour valves, hydrants, and air valves in reticulation pipelines of nominal diameter 300 mm and greater shall be housed in a manhole made of brickwork, reinforced in-situ concrete, or precast concrete.

3.3.5.8 Brickwork in chambers and manholes

Unless otherwise specified in the Technical Specification, shown on the drawings or directed by the Engineer, the walls of chambers and manholes shall be constructed in an approved bond comprising header and stretcher courses with the fare face on the inside. No false headers shall be built in and only whole bricks shall be used except where closures are required to form bond.

For further requirements, reference is made to specification 4.1-Brickwork.

3.3.5.9 Lifting and relaying of existing pipelines

Existing pipes and fittings that are to be removed shall be lifted and the material recovered as far as is practicable. The pipes and couplings shall be removed from the trench and placed in the Contractor's site store where they shall be cleaned, sorted, and listed. A copy of the list of undamaged material recovered shall be handed to the Engineer.

Where recovered pipes are directed to be relaid, rubber rings, insertion packings, damaged joints, and rusted bolts shall be replaced.

Before recovered pipes are relaid, all pipes shall be tested for compliance with the requirements of the applicable specification and to pressures as directed by the Engineer. For this purpose the Contractor shall provide and install, at a location convenient to him and approved by the Engineer, a suitable test bench and provide and install all the ancillary equipment necessary to perform these tests.

3.3.5.10 Disinfection of potable water pipelines

On completion of the laying and testing, each potable water pipeline shall be disinfected as follows:

(i) During the wet season

a) The pipeline shall be flushed out with clean water until all sediment and other foreign matter have been removed.

b) The pipeline shall than be filled with water containing 0.15 g/l of calcium hypochlorite. The solution shall be allowed to flow slowly into the pipeline until it is filled completely and shall be left there for at least 24 h.

c) The pipeline shall then be thoroughly and repeatedly flushed with clean water until a sample of the washwater drawn from the pipeline complies with the requirements for potable water set out by NWSC.

(ii) During the dry season

a) Flushing as above, except that water shall be reused after it has been allowed to settle out sediments etc.

b) Desinfection as described above.

c) There will be no subsequent flushing, instead, the affected public shall be informed, by the Contractor, that the water will, for a stated and limited period, contain a higher than usual Chlorite content.

d) For a further period, the Contractor shall, as agreed with the Engineer, add Chlorite by approved means (eg injection) to the otherwise normal supply.

3.3.6 Tolerances

3.3.6.1 General

No deviation will be permitted from the minimum cover specified or as shown on the drawings.

3.3.6.2 Control points

For the purpose of this specification valves set on the centre line of the pipeline and designated changes in gradient shall be regarded as control points and shall be located with a permissible deviation of ñ 100 mm on the centre line. The same deviation will be permissible laterally except where the Contractor is required to lay the pipeline at a designated distance from a boundary, kerb line, or fence line, in which case the permissible deviation shall be ñ 30 mm.

Unless otherwise directed and subject to a permissible deviation (measured along the centre line) of ñ 5 m, scour valves shall be located at the lowest points in pipelines and air valves at the highest points.

3.3.6.3 Alignment (plan and level)

Unless otherwise directed, the permissible deviation in alignment between control points from a straight line joining the control points, when measured on the top centre of the pipeline, shall be + 100 mm or + 20 % of the nominal diameter, whichever is the larger, and the permissible deviation per pipe length shall be ñ 30 mm.

The permissible deviation from the designated level at any point on the invert of the pipeline shall be ñ 50 mm or ñ 10 % of the nominal diameter of the pipe, which ever is the larger.

3.3.6.4 Valve chambers, manholes, etc.

Valve chambers, manholes, and the like shall be constructed centrally on the control points and, with the exception of tolerances that affect access to bolts, nuts, etc., with a permissible deviation of ñ 50 mm on all clearance dimensions. The clearance dimension between the outside of each nut and bolt-head and the inside face of the wall of a structure or any other fitting shall generally be 150 mm.

3.3.7 Testing and Acceptance

3.3.7.1 General

As the work proceeds, pipelines shall be tested in convenient lengths by means of test equipment supplied by the Contractor.

Each test shall be carried out in the presence of the Engineer or his representative. The Contractor shall be responsible for carrying out all tests and for all expenses incurred in this connection. When carrying out the hydraulic test, the Contractor shall ensure that all valves, tees, and bends are properly secured and shored to prevent movement of pipes and fittings and, should any such movement occur, the Contractor shall, at his own expense, reposition and, if necessary, repair the pipes and fittings and the securing means.

The section of the pipeline that is to be tested shall be gradually filled with water while avoiding pressure surges due to too rapid filling.

Until each section of the pipeline has been subjected to the hydraulic test and has complied with the requirement for leakage rates specified, the pipeline will not be accepted. The hydraulic test shall be repeated until the Engineer is satisfied that the section under test complies with the said requirement.

3.3.7.2 Standard hydraulic pipe test

Unless otherwise directed, hydraulic testing shall be commenced only after permanent anchor blocks have attained their specified strength, ie after 7 d, or any other time as approved by the Engineer.

After the pipe trench has been partially backfilled and before the trench is filled in at the pipe joints and the fittings, the pipeline shall be tested in sections between isolating valves and/or end caps, blank flanges, or other isolating devices, at the pressure appropriate to the type and, when relevant, class of pipe in the pipeline under test. Where mixed types or classes of pipe occur, and where the pipeline traverses a wide range of altitudes, the Engineer may require that temporary valves or blank flanges be inserted and that the pipeline be tested in reduced lengths and, in addition, at the point of maximum pressure.

Unless otherwise directed or specified in the Technical Specification, the test pressure for field testing shall be 1.25 times the maximum permissible working pressure (nominal pressure) specified or 1.5 times the actual working pressure at the point of testing, whatever is the greater.

The test pressure applied over any section of pipeline under test, taking any differences in elevation along the pipeline into account, shall be such that the pressure at any point along the section is not less than the design pressure or more than 1.5 times the design maximum working pressure at these points.

Where applicable, eg in the case of concrete, AC, or mortar lined pipes, each section shall be filled with water 24 h before the test pressure is applied to ensure saturation of the pipeline.

Care shall be taken to ensure that all air is expelled from the line to be tested after it has been filled and before the test commences.

The specified test pressure shall be maintained for a period of at least 3 h by means of a suitable pump, during which period all pipes, specials, joints, and fittings shall be carefully inspected for leaks. All visible leaks shall be made good and any pipe, special, or fitting found to be defective shall be removed and replaced at the expense of the Contractor and shall, after installation, be tested at the expense of the Contractor again.

In the case of pipes of nominal diameter under 400 mm, and if approved by the Engineer, the test period may be reduced proportionally to the diameter of the pipe, provided that in no case shall the test period be less than 1 h.

The test pressure shall be maintained for a further period of 1 h after the completion of the test period given above, during which time the volume of water required to be pumped into the pipeline for maintaining the pressure shall be measured.

Specific Criteria for allowable leakage during testing are given in part 2: Particular Technical Specifications.

3.3.7.3 Meter testing

Except where a meter is supplied by the Employer, the Contractor shall ensure that each meter has been tested by the manufacturer to twice the working pressure specified in the Technical Specification, and, if so requested by the Engineer, shall submit to him a certificate stating that each meter has successfully withstood the test pressure.

The Engineer may order that some or all meters to be tested on Site after installation to verify that the meter has not been damaged during installation and to determine the accuracy of the readings. Such tests shall be carried out by the Contractor under the direction of the Engineer using approved testing equipment and methods.

3.3.8 Measurement and Payment

The method of measurement of pipelines laying/installation is given in Volume 2 Part 2 : Particular Technical Specification.

3.4 SEWERS AND STORMWATER DRAINAGE

3.4.1 Scope

This specification covers the general construction requirements for sewerage and stormwater drainage systems including connecting sewers, manholes, and the like, but excluding sewer pressure mains, pump stations, treatment works, and ancillary works.

3.4.2 Interpretations

3.4.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General

b) 2.1 Site Clearance
c) 2.2 Earthworks, as applicable.
d) 3.1 Pipe Trenches
e) 3.2 Pipe Bedding
f) 2.3 Concrete
g) 4.1 Brickwork

3.4.2.2 Application

This specification contains clauses that are generally applicable to sewer and stormwater drainage construction. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents).

3.4.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Expansion pipe joint - A pipe joint that allows relative longitudinal movement between adjacent pipes without the occurrence of fracture or leakage.

Flexible pipe joint - A pipe joint that allows relative angular (radial) and longitudinal movements between adjacent pipes without the occurrence of fracture or leakage.

Geofabric blanket - A blanket so woven from synthetic fibres that it is capable of acting as a filter that retains some or all of the solid particles carried by a fluid but, with varying degrees of restriction, allows the passage of the fluid.

Invert slab - The slab, normally of concrete, that forms the bottom of the culvert.

Prefabricated culvert units - Portal or rectangular culvert units that have been prefabricated from reinforced concrete.

Rigid pipe joint - A pipe joint that allows no relative movement between adjacent pipes without the occurrence of fracture or leakage.

3.4.2.4 Abbreviations

For the purpose of this specification the following abbreviations shall apply:

AC	Asbestos cement
CI	Cast iron
CID, DN	Constant inside diameter
COD	Constant outside diameter
PVC	Polyvinyl chloride
uPVC	Unplasticized polyvinyl chloride
CP	Machine made concrete pipe
RCP	Reinforced concrete pipe

3.4.3 Material

3.4.3.1 Pipes, fittings, and pipe joints

Vitrified clay pipes and fittings shall comply with the relevant requirements of the Particular Specification, shall have suitable flexible joints, and shall have a crushing strength of at least 45 kN per metre of bearing surface.

Reinforced concrete pipes and fittings shall comply with the relevant requirements of the Particular Technical Specification, shall have suitable rubber ring or other approved flexible joints, and shall have a cover to reinforcement on the inside face of at least 15 mm.

AC sewer pipes and fittings shall comply with the relevant requirements of the Particular Specification, shall have suitable rubber ring or other approved flexible joints. AC specials and fittings shall have a crushing strength that is equal to or better than that of the pipes to which they are coupled.

Other pipes, such as glass-reinforced polyester pipes, pitch-impregnated fibre pipes, and uPVC pipes, as applicable, also shall comply with the appropriate standards and requirements and shall have suitable approved flexible joints.

3.4.3.2 Alternative materials

Should the Contractor proposes to use pipes and fittings of material other than those referred to above, he shall submit for approval detailed specifications including full details of the type of joints and specials he proposes to use with such pipes and fittings. The Contractor shall not use such pipes or fittings until he has obtained written approval for their use from the Engineer.

3.4.3.3 Bedding

The requirements for bedding of specification 3.2-Pipe Bedding shall apply.

3.4.3.4 Culvert units and pipes

Prefabricated culvert units and pipes shall comply with the requirements as laid down in the Particular Technical Specifications and shall be either precast concrete pipes, AC pipes, or portal and rectangular precast concrete culvert units, as applicable.

3.4.3.5 Concrete

Concrete, cast-in-situ or precast concrete, shall comply with the relevant requirements of specification 2.3.

3.4.3.6 Manholes, catchpits, and accessories

Bricks and mortar shall comply with the relevant requirements of specification 4.1.

Prefabricated manhole sections may be of spun concrete, asbestos cement, glass-reinforced polyester, PVC, or such other material as are approved by the Engineer. Covers and frames for manholes and grid inlets shall be supplied in matching sets, each set bearing a serial number to enable them to be identified.

Step irons shall comply with the applicable requirements of BS 1247 or equal approved and shall be of suitable length for the wall of the manhole into which they are to be built.

3.4.3.7 Geofabric blanket

The synthetic fibres of a geofabric blanket shall consist of at least 85 % by mass of polyester, polyethylene, or polypropylene, or a combination of these polymers, and shall contain such additives as are necessary to render the geofabric blankets resistant to the effects of ultra-violet radiation and heat.

The Engineer's approval of the make and grade of the geofabric shall be obtained by the Contractor before he orders any geofabric or uses it on the Works.

For normal application, and if not otherwise directed by the Engineer or specified in the Particular Specification, geofabric blankets shall be of the non-woven, needle-punched type with a specific weight of approximately 270 g/m2.

3.4.4 Plant and Equipment

The plant and rigging equipment used by the Contractor for the handling and placing of pipes shall be of the type recommended by the pipe manufacturer and subject to the approval by the Engineer and shall be such that no pipe is overstressed during any operation covered by the specification.

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline.

The Contractor shall provide all the equipment, materials, tools, and fittings required for the performance of the tests given in clause 3.4.7 below, and shall provide suitable equipment for the location of faults up to the date of issue of the final certificate.

3.4.5 Construction and Workmanship

3.4.5.1 Trench bottom

The trench bottom shall be prepared as specified in 3.1-Pipe Trenches. Trenches shall be kept sufficiently dry to allow proper and safe bedding, laying, and jointing of pipes and kept dry until the pipeline has passed the required tests and construction of the selected fill blanket over the pipes has been completed.

For the laying of culvert elements, the trench bottom shall be excavated to a depth of 75 mm in soil, or 200 mm in rock, or such other depth as may be shown on the drawings, below the level of the underside of the precast invert slab or to the level of the underside of the cast-in-situ invert slab, as applicable, and this space shall be filled with granular material, compacted, and shaped to enable the culvert units to be bedded properly.
Where, because soft, soggy, spongy, or otherwise unsuitable material is encountered, the bottom of the trench as excavated does not provide a suitable firm foundation for the culvert, the unsuitable material shall be excavated to a depth below the bottom of the culvert indicated by the Engineer and replaced with gravel or other approved granular material compacted to at least 90 % of modified AASHTO maximum density. When so ordered, the Contractor shall construct a layer of concrete blinding, at least 75 mm thick, to provide a suitable working floor.

The width of excavation shall be equal to the total width of the culvert plus a minimum of 1.0 m for both single and multiple openings.

3.4.5.2 Bedding, laying, and backfilling

Each pipe and fitting shall be thoroughly cleaned out and carefully examined for damage immediately before laying. The onus of detecting damaged pipes and fittings before installation shall be on the Contractor. Should any damaged pipe or fitting be found in the sewer after it has been laid, the damaged item shall be removed and replaced at the Contractor's expense.

Pipes shall be laid on the specified bedding cradle true to designated line and level, and the bedding shall be placed and compacted in accordance with the applicable requirements of clause 3.2.5.1. Designated invert levels shall take precedence over design depths shown on drawings.

The completed sewer or stormwater drain shall have no bends or undulations except where directed. Should pipes be allowed to have any deviation from straightness, they shall be so laid that preference is given to level over line.

The method of laying and bedding shall be such that barrels of pipes bear evenly on the bedding for their full length, that no packing is used under the barrels, and that no socket or coupling bears on the bedding.

Where the slope of a pipe is greater than 1 in 10, anchor blocks shall be constructed according to the details provided.

Pipes shall be so cut as to obtain a clean and square end, and, where pipes and fittings of different material shall be jointed, shall be so only with special adaptors recommended by the pipe manufacturer(s).

All pipe openings shall be sealed by the Contractor to ensure that no water, stones, or other foreign matter enters the sewer during or after laying.

The sewer or stormwater drains shall be so jointed to the pipes built into the manholes that there is a flexible joint positioned as close as possible to the manhole.

Unless otherwise directed, construction of culverts shall, as far as is practicable, begin at the lower end.

Precast units shall be lifted and handled only by means of lifting devices approved by the manufacturer.

Lifting eyes shall be caulked with a suitable mortar after the units have been installed.

The Contractor shall exercise due care not to damage, overstress, or displace any culverts by the imposition of any loads such as may be caused by the movement of his own vehicles or compaction

equipment. Where superimposed moving loads in excess of those prescribed in the applicable road traffic ordinance are, during the construction of the Works, likely to pass over completed culverts, the Contractor shall provide sufficient additional cover over the culverts to ensure that the design stresses on the culverts are not exceeded.

Any units that become deformed or cracked, or that are not constructed to the required lines, levels, and grades, or that become displaced in the course of the work, shall be removed and replaced by the Contractor at his own expense.

Joints of butt-ended pipes shall be externally wrapped with either 2 layers of 0.5 mm thick plastics dampcourse or one layer of geofabric blanket. The wrapping shall be at least 200 mm wide and be centrally placed over each joint.

Ogee type pipes need not be wrapped but shall be laid with the spigot ends pointing downstream.

Spigot and socket pipes with rubber ring joints shall, unless another method is directed or approved by the Engineer, be jointed in accordance with the manufacturer's instructions.

Backfilling of pipes and pipe culverts shall comply with the applicable requirements of specification 3.1.

Material for backfilling of portal or rectangular culverts shall comply with clause 3.1.3 and shall be obtained by the Contractor from approved borrow pits, if necessary.

Backfilling alongside the walls and over the top of culverts shall be watered, mixed, placed, and compacted in layers not exceeding 150 mm after compaction, to a density at least equal to that required for the material in the adjoining layers of fill, subgrade, and subbase, as applicable, or to at least 90 % of modified AASHTO maximum density in the case of excavation made in natural ground.

Backfilling shall be carried out simultaneously and equally on both sides of the structure to avoid unequal lateral forces.

3.4.5.3 Manholes, inspection chambers, catchpits etc.

Manholes, inspection chambers, catchpits, inlets, outlet structures etc., shall be constructed of cast-in-situ concrete, precast concrete, brickwork, or AC, as shown on the drawings or as directed, and shall be in accordance with the relevant Particular Technical Specifications.

3.4.5.4 Concrete casing to pipes

In special cases, and where ordered by the Engineer, pipes shall be encased in concrete of the specified grade, generally of at least 15 MPa. The lower part of the encasement shall be constructed in the manner specified for Class A bedding (see 3.2). Once the sewer or stormwater drain has been tested and approved, the pipes shall be surrounded with concrete to the specified depth and expansion joints shall be cut or constructed in the upper part to coincide with those in the lower part. Use shall be made of poker vibrators to ensure proper filling with concrete of all spaces under and around the pipe, and displacement or flotation, or both, shall be prevented. All temporary supports provided for the pipes shall be removed as concreting progresses. No earthfilling over the concrete shall be commenced until at least 5 d after the concrete has been placed or until the concrete has attained a strength of at least 10 MPa.

3.4.5.5 Raising or lowering of existing manholes

Where an existing manhole is required to be raised or lowered, the work shall be so carried out that the finished manhole complies with the applicable requirements of 3.4.5.3 above. Where practicable, the same cover shall be used, which shall, on completion of a manhole be flush with the surface of the finished road, shoulder, or sidewalk, as the case may be.

3.4.5.6 Connecting pipes

Connecting sewers or stormwater drains shall be laid from junctions provided in the main lines to the positions and depths as shown on the drawings or as directed.

The Contractor shall record all relevant data (eg street name, number of plot, location measurements and distances in relation to boundary peg(s), size of connection, depths of invert at connecting point and

end of connection etc.) for the preparation of "as-built" drawings, and shall make these records available to the Engineer.

3.4.5.7 Action to be taken during and after testing

The Contractor shall make good any defects that may be found while the pipeline is under test and after that the tests shall be repeated at his expense until the pipeline is found to comply with the specification.

After the sewer or stormwater drain has passed the tests all access lids shall be properly sealed with bitumen or by any other approved method that will ensure that they are watertight.

3.4.6 Tolerances

3.4.6.1 General

Tolerances will be determined on the basis of permissible deviations from designated location, alignment, grades, and levels. The Contractor shall construct each of the various parts of within the limits set out below.

3.4.6.2 Manhole and catchpit locations

The permissible deviation of the location of manholes and catchpits (other than kerbside catchpits) in plan of the designated position shall be half the pipe length longitudinally and ñ 200 mm laterally, except where locations are dimensioned from fixtures such as fences, kerbs, and the like, in which event the permissible deviation in each direction will be ñ 50 mm.

Such manholes or chambers shall be constructed at the meeting points of intersecting pipelines subject only to such deviations as can be tolerated by the junction channels or specials.

3.4.6.3 Invert levels

The permissible deviation from the designated level of the invert at each manhole shall be ñ 50 mm but, should the fall between any two successive manholes be less than 90 % of that specified, the said permissible deviation shall be reduced to a value such that the fall is at least 90 % of that specified.

The permissible deviation of the level of the invert of a culvert from the designated level shall be ñ 25 mm.

3.4.6.4 Alignment and grade

Subject to the permitted manufacturing tolerances applicable to the pipes being laid, the line of the pipe invert shall at no point between successive manholes deviate from a straight line by more than 5 % of the nominal diameter of the pipe, or be lower than at any other place closer to the lower manhole.

The permissible deviation of the alignment and grade of each culvert shall be ñ 25 mm from the designated line and level, when measured over any 6 m length, and all such deviations shall be gradual.

3.4.6.5 Manholes and chamber structures

The dimensions of walls and roofs of manholes and chambers shall conform to the dimensions specified, subject to the allowable tolerances laid down for concrete structures (see 2.3)

3.4.6.6 Kerbside catchpits, kerb inlets, or grid inlets

The permissible deviations of the longitudinal location shall be half a kerb length or 0.5 m, whichever is the greater and the permissible deviations of the lateral location from the designated distance from the centre line of the road shall be ñ 25 mm, except that any open grid or grid frame shall be truly parallel to and within 5 mm of the face of the kerb.

3.4.7 Testing and Acceptance

3.4.7.1 General

Stormwater drains and culverts will not be tested for leakage of water. Tests described below apply to sewers only.

All acceptance tests shall be carried out in the presence of the Engineer and at such times and in such manner as the Engineer may direct.

No pipe joint or fitting shall be covered until the tests applicable have been completed and the Engineer has authorized such covering.

The sewer or any section of it shall be inspected by the Contractor who, if he deems it ready to be tested, shall advise the Engineer of his intention to subject the sewer or the said section of it to the appropriate tests.

The sewer shall be tested in sections between manholes or chambers, as applicable, the section being tested being isolated from other sections by means of suitable plugs or stoppers that have been braced adequately.

Notwithstanding any authorization by the Engineer as described above, the Engineer may, after backfilling and compaction have been completed, order that the sewer be retested to check that it has not been disturbed or damaged during backfilling.

The Engineer may order one of the following to be carried out on the sewer or any section of it:

a) an air test on pipes, other than concrete pipes, of all sizes; or in the case of pipes, other than concrete pipes, of diameter up to 600 mm, an air test followed by a water test
b) a water test in the case of pipes of diameter up to 750 mm
c) a visual internal inspection in the case of pipes of diameter greater than 750 mm.

The Contractor shall provide all labour and apparatus (including expansible plugs and flexible bag stoppers) that may be required for carrying out the tests.
All test results shall be recorded in the manner directed, whether or not the pipeline or section of pipeline has passed the test.

3.4.7.2 Tests and acceptance/rejection criteria

a) Air test. An approved air testing machine shall be used to raise the gauge pressure in the section of the pipeline under test first to 3.75 kPa. After a 2 min stabilization period the pressure shall be reduced to 2.5 kPa. The machine shall than be switched off and the time taken for the pressure to drop from 2.5 to 1.25 kPa shall be measured. The time taken shall be at least 2 min for ND 100, 3 min for ND 150, 4 min for ND 200, 4.5 min for ND 250, 6 min for ND 300, 8 min for ND 400, 10 min for ND 500, 12 min for ND 600, and 14 min for ND 700.Times applicable for other diameters may beinterpolated.
b) Water test. The section of the pipeline under test and the manhole at the upper end of the said section shall be filled with water to such depth that every portion of the pipeline is subjected to a pressure of not less than 12 kPa and not more than 60 kPa. During the test there shall be no discernible leakage of water. An appropriate period, which shall be at least 12 min, shall be allowed for initial absorption, and the loss of water over the next 30 min shall be noted. The amount lost, in litres, per 100 m of pipeline per hour, shall not exceed the following values: 6 for ND 100, 9 for ND150, 12 for ND 200, 15 for ND 250, 18 for ND 300, 23 for ND 400, 29 for ND 500, 36 for ND 600, and 44 for ND 700. Amounts applicable for other diameters may be interpolated.
c) Tests on existing pipes shall be carried out in accordance with the requirements laid down in the Particular Specification.

Should any section of the pipeline fail to pass the water test, a re-test will be permitted and, in such case, acceptance or rejection of the section will be determined on the result of the re-test.

3.4.7.3 Rejection

In the case of AC, vitrified clay, and fibre pipes, failure under the air test will be deemed to be cause for rejection. After such rejection the Contractor may apply a water test to locate the source of failure, rectify the pipeline, and re-apply the air test. In the case of concrete, failure under the water test will be deemed to be cause for rejection.

3.4.7.4 Testing of connecting sewers

Each connecting sewer shall be tested between its upper end and the junction at the main sewer. The upper end of the connection shall be kept securely closed with expanding plugs during the test. Where practicable the Contractor may test the main and connections simultaneously if he so wishes. On completion of the test, the upper end of the connection shall be permanently sealed by means of a plug stopper suitable for the type of pipe.

3.4.8 Measurement and Payment

3.4.8.1 General

Although measurement and payment for excavation and backfilling are covered in section 3.1 and the provision of bedding material in section 3.2 of this specification, the relevant items for sewers will be scheduled as shown below.

The operation of constructing the bedding cradle and selected fill blanket around and over the top of the pipeline will be regarded as part of the pipe-laying operation.

3.5 PIPE JACKING

3.5.1 Scope

This provisional specification covers the insertion, by jacking, of pipelines under roads and the like without disturbing the surface or interfering with the normal flow of traffic.

3.5.2 Interpretation

3.5.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.2 Earthworks
c) 3.1 Pipe Trenches
d) 3.2 Bedding

3.5.2.2 Application

This specification contains clauses that are generally applicable to pipe jacking. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents)

3.5.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Jacking - The action of pushing a pipeline into position.

Jacking frame - A frame on which the jacks are mounted and through which the jacking forces are transmitted.

Jacking structure - An assembly comprising the jacking frame, and the permanent pipes being jacked.

Lead pipe - A pipe that may be specially prepared at one end and that is intended to be the first pipe to be used in the jacking process.

Reception pit - An excavated pit or shaft that is located at the end of a jacked section of a pipeline.

Thrust pit - An excavated pit or shaft at the commencement point of a jacked section of a pipeline, in which the jacking structure and other equipment are installed and from which the jacking operations are carried out.

Thrust plate - A steel plate that is placed against the end of the pipe against which the jack(s) operates and that is intended to ensure that the jacking forces are spread over the end face of the pipe.

3.5.3 Materials

Unless otherwise directed, pipes for jacking shall be reinforced concrete pipes and shall be capable of withstanding, without damage, the maximum lateral and longitudinal forces to be transmitted during jacking and service.

3.5.4 Plant and Equipment

The Contractor shall provide and use suitable equipment for handling pipes and placing them in position for jacking, for jacking the pipes, for the lubrication of the outer surface of the pipeline, and for excavation within the pipe.

Each set of jacks shall be fitted with a suitably calibrated pressure gauge in good working order and such that he actual jacking force can be read at any time during the jacking operation. To transfer the load from the jacks to the pipes, suitable thrust plates shall be provided for placing against the ends of the pipes.

The Contractor shall provide adequate lighting for the execution of the Works.

3.5.5 Construction and Workmanship

3.5.5.1 General

If required, the Engineer will obtain prior permission from any third party who controls the land or any structure on the land, or both, under the surface of which the pipeline is to be jacked.

Jacking and excavation shall be supervised and undertaken only by persons fully conversant with this work.

The Contractor shall furnish detailed design calculations, specifications, and working drawings to show his methods of installation and method of providing temporary support for the road or other service or structure and any modifications to structures required before pipe jacking commences.

The Contractor shall not commence any work shown on the said drawings or specified in the said specifications until the Engineer has signified in writing that the Contractor may proceed.

Any permission to proceed shall not indicate acceptance by the Employer or the Engineer of any responsibility for safety or adequacy of jacking structures and methods of working and shall not limit the obligations and liabilities of the Contractor in regard to such safety or adequacy.

3.5.5.2 Safety control requirements

The pipeline shall be jacked through under the road or other service or structure, as applicable, without disrupting traffic and without disturbing the alignment or levels of the road surface or other service or structure, as applicable, to an extent that may impair their safety.

Before commencing work in the vicinity of any structure, the Contractor shall make a detailed examination of the structure, record its condition, and submit a copy of such record to the Engineer.

The Contractor shall take measurements before and after the construction period and shall record any change in line or level, or both, of any road or other service or structure being traversed. A copy of such record shall be made available to the Engineer.

3.5.5.3 Sleeve pipes

Pipes intended as sleeve pipes shall be laid with the inside walls smooth and free from projections and sharp edges.

3.5.5.4 Excavation

Generally, the requirements of the specification 2.2 shall apply.

The Contractor shall be responsible for excavation of the thrust and reception pits, which shall be of dimensions at least equal to the minimum deminsions needed for the Contractor's equipment and for safe and efficient working. The approximate dimensions of the pits that the Contractor intends to excavate shall be agreed upon with the Engineer before work commences. The excavated material shall be stockpiled for later backfilling.

The sides of the pits shall be adequately supported by approved means. Where a pit adjoins a heavily used road, the sides of the pits shall be shored during the entire operation to prevent any movement caused by vibration arising from road traffic.

The Contractor shall ensure that, at all times, each pit is provided with barriers and is a safe place within which to work.

During the jacking operation, excavation shall be such that overbreak is kept to a minimum. No material shall be removed in advance of the leading edge where the leading edge is in unstable or loose material. If the material at the leading edge starts to slip or run, excavation shall be stopped immediately and the Contractor shall take such action as is necessary to stabilize the material before excavation is resumed.

If necessary, the Contractor shall make provision for suitable de-watering of the material in the vicinity of the leading edge of the pipe.

Should any cavity occur around the outside of a pipe during the jacking process, such cavity shall be filled immediately by grouting or similar means.

Any subsidence occurring above the jacked pipe and arising from any cause related to jacking operations shall be made good to the satisfaction of the Engineer and at the Contractor's expense.

The Contractor shall ensure that the head of each excavation is drained at all times.
Under no circumstances will jetting be permitted.

3.5.5.5 Jacking procedure

The pipes to be jacked shall be advanced by means of one ore more hydraulic jacks of adequate capacity that bear(s) against a suitable thrust plate so that the thrust of the jack(s) is distributed adequately over the end face of the pipe.

The rear end of each jack shall bear against a suitably designed structure such that the force is transferred to the surrounding material and evenly distributed over an area sufficient to ensure that the bearing capacity of the soil is not exceeded and that no structure in the vicinity of the thrust pit is disturbed.

The Contractor may, with the written permission of the Engineer, inject or otherwise apply a suitable lubricant to the cutting edge of the lead pipe.

Thrust and reception pits should, whenever practicable, coincide with locations of manholes, junction chambers, and the like, as shown on the drawings or as directed, to avoid duplication of work.
When jacking has been completed and jacking equipment dismantled and removed, the thrust and reception pits shall be backfilled to the extent necessary.

The Contractor shall, on completion of the work and before the final payment is made, supply to the Engineer transparencies showing details of the completed structure. Each such transparency shall be certified by the Contractor to be an accurate reflection of the details of the work as constructed.

3.5.6 Tolerances

The position of any point of the finished pipeline shall be within 100 mm horizontally and 50 mm vertically of the designed position. Adjustment to line and level, or both, shall be gradual and the pipe manufacturer's stated maximum permissible draw or angular deflection shall not be exceeded at any point.

Misalignment between pipe units shall not exceed 10 mm.

The Contractor shall check line and level at least once during the installation of each pipe length, and he shall take such corrective action as is necessary. A copy of the results of all checks and a statement of any corrective measures taken shall be available for inspection on the Site, and a copy shall be given to the Engineer as soon as the jacking has been completed.

Should the difference between the actual and the specified position or alignment of the finished pipeline exceed the values permissible to an extent that additional costs are incurred in (re)locating, installing, supporting, or maintaining any pipe or service that has been designed to be laid through the finished pipeline, the Contractor bear such additional costs provided that the details of the work to be done to relocate etc. and the order for the work to be done (by the Contractor or by others) have been given by the Engineer within 30 working days after the completion of the actual jacking operation.

3.5.7 Testing and Acceptance

No tests are required on the completed pipeline jacked.

3.5.8 Measurement and Payment

3.5.8.1 Principles

All items for the pipe jacking are provisional, as jacking is to be regarded as an alternative method to the "cut and cover" method specified elsewhere.

4 BUILDING CONSTRUCTION WORKS

4.1 BRICKWORK

4.1.1 Scope

This specification covers the general construction requirements for brickwork in general building construction.

4.1.2 Interpretations

4.1.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.1 Site Clearance
c) 2.2 Earthworks
d) 2.3 Concrete

4.1.2.2 Application

This specification contains clauses that are generally applicable to brickwork construction, plaster work, and associated work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents)

4.1.3 Materials

4.1.3.1 Bricks

Bricks shall be obtained from an approved manufacturer and shall be either general purpose bricks (for buildings) or special burnt clay bricks or engineering bricks (for manholes etc.) that comply with the relevant applicable standards as approved by the Engineer.

The Contractor shall submit to the Engineer samples of the bricks that he intends using in the construction of the different sections of the Works. The samples of the bricks that are approved will be retained by the Engineer.

Bricks shall be free from defects affecting strength and durability. The amount and extent of manufacture cracks or cracks and chips due to handling shall not be to such a degree as to give an

unsightly appearance to exposed brick surfaces and all face brick to be used on the Work shall match with the samples approved by the Engineer.

All bricks shall be machine made if possible, of good quality brick earth and thoroughly burnt, and shall be of deep cherry red or copper colour. The bricks when dried shall emit a clear ringing sound when struck together and shall not break when thrown on the ground or against other bricks from a height of 1 m. The bricks shall not absorb water more than one sixth of their weight after one hour of soaking by immersion in water. The bricks shall be wholly clean and free from flaws, cracks and underburnt lumps of any kind. They shall be uniform in size and regular in shape and have square, straight and sharp edges and even surfaces.

4.1.3.2 Hollow concrete blocks

The hollow concrete blocks for masonry works shall be machine made and thoroughly compacted in the moulds by external form vibrators or vibrating tables.

The hollow concrete blocks shall be made of 1 part of cement, to 6 parts of well graded fine and coarse aggregates mechanically mixed into a very dense and dry consistency with very low water cement ratio.

The hollow concrete blocks shall comply with relevant applicable standards (eg DIN 18153, IS 2185-1967 IS 2572-1963 or similar) and shall have following physical properties.

a)	Compressive Strength	70 kg/cmý
b)	Drying Shrinkage	0.04%
c)	Moisture Movement	0.03%
d)	Water absorption	240 kg/m3
e)	Moisture content	40%

4.1.3.3 Cement for mortar

Cement for masonry mortar and grout shall be ordinary portland cement in accordance with the requirements of Section 2.3. All cement for mortar for exposed face work shall be of a uniform colour as approved by the Engineer.

4.1.3.4 Lime for Mortar

Lime shall be freshly burnt quicklime or hydrated lime conforming with the relevant applicable standards (eg DIN 1060 or similar).

4.1.3.5 Sand and water for mortar

Sand and water used shall be in accordance with the requirements of section 2.3 and sand for exposed face work shall be of a uniform color as approved by the Engineer.
Sand shall be clean pit sand and shall be free from clay and other impurities and, if so directed, shall be properly screened and washed.

4.1.4 Plant and Equipment

The Contractor is responsible for providing, erecting, dismantling, and removing safe and adequate lifting plant and scaffolding where required.

Mixers used for mixing mortar and grout shall be in accordance with the requirements described under 2.3.4.

4.1.5 Construction and Workmanship

4.1.5.1 Mortar

Unless otherwise directed by the Engineer the mix proportions for mortars for masonry and plaster works by volume shall be as follows:

a) Cement mortars

CM 1:5	Cement: 1 part, Sand: 5 part
CM 1:4	Cement: 1 part, Sand: 4 part

CM 1:3	Cement: 1 part, Sand: 3 part
CM 1:2	Cement: 1 part, Sand: 2 part
CM 1:1	Cement: 1 part, Sand: 1 part

b) Cement-lime-sand mortars

CL 1:1:6	Cement: 1 part, Lime: 1 part, Sand: 6 part
CL 1:2:9	Cement: 1 part, Lime: 2 part, Sand: 9 part
CL 1:1:8	Cement: 1 part, Lime: 1 part, Sand: 8 part

c) Waterproof mortars for DPC and plaster works

WCM 1:4:	Cement 1, Sand 4, Waterproof compound 0.03
WCM 1:2:	Cement 1, Sand 2, Waterproof compound 0.03

d) Coloured plaster

DCM 1:2:	Cement 1, Sand 2, Pigment 0.01
DCM 1:1:	Cement 1, Sand 1, Pigment 0.01
DCM 1:1:4:	Cement 1, Lime 1, Sand 4, Pigment 0.01
DCM 1:1:2:	Cement 1, Lime 1, Sand 2, Pigment 0.01

4.1.5.2 Workability of mortar

The mortar shall be of a readily workable consistency with only enough water to obtain a plastic condition suitable for troweling.

4.1.5.3 Workability of grout

Grout shall be of pourable consistency with a slump of 120 mm when tested in accordance with the standard slump test for mortar and grout.

4.1.5.4 Cement mortar mixing and using period

All cementitious materials and aggregate shall be mixed for a minimum of 2 min in a mechanical batch mixer. Only so much water shall be added as compatible with convenience in using the mortar. If mortar begins to stiffen from evaporation or absorption of a part of the mixing water, the mortar shall be retampered by adding water and remixed. All mortar and grout shall be used within 2.5 h of the initial mixing and no mortar or grout shall be used after it has begun to set.

4.1.5.5 Hand mixing of mortar

Hand mixing shall be carried out on clean, water tight platforms with approved methods.

4.1.5.6 Brick laying

Bricks shall be carefully handled at all stages in delivery, stockpiling, transportation on site and construction to prevent breakage or surface damage. Bricks shall be carefully unloaded by hand and shall not be dumped or thrown. Special care shall be taken with stacking and storage of bricks on the Site.

Bricks shall be thoroughly soaked in water before use and shall be set in a full bed of mortar and grouted in every course. Solid brick masonry shall be in English or other approved bond. The courses shall be laid level and with parallel, neat and regular joints.

Brick masonry shall be carried up evenly and uniformly, no one portion being raised more than 1 m above another at any one time. Vertical joints shall be filled with cement mortar as the bricks are laid. Unfinished brick masonry shall be stepped back in course and thoroughly cleaned before new work is added. Any holes shall be filled with bricks identical with those already incorporated in the work.
The conditions governing the laying of brick masonry in unfavorable weather shall be as specified for concrete in Section 2.3. Exposed faces of brick masonry shall be kept moist for 10 d after laying.

All brickwork shall be placed only after the foundation surfaces have been prepared to the satisfaction of the Engineer.

Bricks shall be well soaked in water for a minimum of 3 h immediately before being laid or as required so that the rate of absorption when laid does not exceed acceptable limits approved by the Engineer. The

method of wetting shall be such that each brick be nearly saturated but the surface appears dry when laid.

Bricks shall be laid in running bond with head joints in each course centered over the bricks in the course below and shall be plumb, level & true to line with full head and bed joints. The ends of brick shall be buttered with sufficient mortar to fill the head joints. The top of the joint mortar may be sloped toward the center of the wall to minimize the amount of mortar forced into the grout core space when the brick are shoved into. Mortar protruding from bed joints into the core space shall be removed before pouring the grout, and no mortar shall be placed or allowed to remain in the core space.

Joints in brickwork shall be uniform and generally 10 mm thick for horizontal and 6 mm wide for vertical joints. Joints shall be tooled to produce a dense V-shaped joint or as otherwise ordered by the Engineer or shown on the drawings. Defect joints shall be cut out and repointed with mortar as directed by the Engineer.

The color and texture of all exposed mortar joints shall be subject to the approval of the Engineer and shall be kept uniform throughout the particular contract by strict adherence to the approved mixes and samples.

Extreme care shall be taken to prevent any concrete, grout, or mortar from staining the face of masonry. If any grout or mortar does contact the face it shall be immediately removed and the surface cleaned with clean water. Masonry work shall be protected against staining, tops of walls shall be covered with waterproof coverings as required, and when work is interrupted.

All walls shall, to the extent possible and as practicable, be built up at the same time. In no case shall any walls be advanced more than 1.5 m above another. If it is necessary to stop off a horizontal run of masonry, the end shall be shaped in pyramid form or as otherwise approved by the Engineer.

Where mortar on joints has partially or totally set, the exposed surface shall be cleaned and thoroughly wetted so as to obtain the best possible bond with the new work. All loose masonry and mortar shall be removed prior to the commencement of the work.

Brickwork shall be taken up truly plumb and each set of four bricklayers shall be provided with a plumb bob and straight edge.

Bricks on the 'fair face' shall be the best available, care being taken that they are not chipped or stained as work proceeds. Bricks shall be laid so as to give a perfectly flat face as tested with a straight edge, and no chipping or rubbing back will be permitted to remedy bad laying.

In the event of fair faced brickwork not being finished with struck joints whilst the mortar is still damp, pointing may be carried out with the approval of the Engineer. In this case all joints shall be raked out to a depth of 20 mm, cleaned free from all loose material and any putlogs filled in. The area to be pointed shall then be thoroughly soaked before pointing takes place, the mortar used being to the satisfaction of the Engineer.

Care shall be taken to keep all brickwork free from mud splashing, mortar, bitumen droppings, etc., and it shall be well cleaned down before being handed over.

If, after the completion of brickwork construction, any of it is found to be out of alignment or level or otherwise not conforming with the permissible deviations specified or otherwise defective, it shall be removed and replaced or repaired by the Contractor, at his own expense, and to the satisfaction of the Engineer.

4.1.5.7 Hollow block laying

Hollow concrete block masonry and any composite masonry shall comply with the requirements of the brick masonry as stated above.

4.1.5.8 Partition walls

Top and ends of full height partition walls shall be securely fastened to beams, slabs, and walls, as applicable, with pre-fixed metal fasteners or holdfasts spaced not greater than 75cm apart unless otherwise indicated. Clearance between top and ends of partition wall and beams, slabs, and walls shall be caulked as indicated or as directed by the Engineer to form a closed continuous joint.

4.1.5.9 Brick manholes

Brick walls for manholes or chambers shall be constructed in an approved bond comprising header and stretcher courses with the fair face on the inside. No false headers shall be built in and only whole bricks shall be used except where closures are required to form bond.

Joints shall be flushed up solid at every course throughout the whole width of each course, which shall be laid on a solid bed of mortar of thickness not exceeding 10 mm, and, if plaster is required, the joints shall be raked out to form a key as the work proceeds for the extent of the area to be plastered.

The walls of a manhole, if so required in terms of the drawings or Particular Specification shall be plastered internally and steel-trowelled to a smooth and true surface free of sharp edges and corners. The thickness of plaster shall not be less than 10 mm and not more than 15 mm. All salient angles and arrises shall be slightly rounded, and all internal angles shall be finished true, square, and smooth.

The sockets of channels in manholes shall be filled in with 1:1 stiff cement mortar and the space between the channels finished off with the same mortar. Where two spigot ends abut, they shall have a layer of 1;1 cement mortar under the joint, and the space between the ends shall be filled with 1:1 cement mortar worked in and neatly finished off.

Where a pipe enters a manhole, it shall be thoroughly caulked into the wall and a 400 mm thick brick surround shall be built integral with the rest of the wall in order to ensure a watertight joint between the pipe and the manhole.

Concrete for benching in manholes shall be prescribed mix 20 with 13 mm chips. Semicircular channels and fittings, suitable for the type of pipe laid, shall be placed in position simultaneously with the concrete benching and embedded in it true to grade, level, and line.

All benching and sloping surfaces in the manhole floor shall be rendered in 20 mm thick 1:3 cement mortar and finished smooth and true with a steel trowel and rounded at corners and edges.

Step irons in manhole walls shall be in accordance with the relevant applicable standards (eg BS 1247 or similar) and shall be accurately built into the straight of the wall at 300 mm centres and staggered regularly right and left in truly vertical rows spaced at 200 mm centres horizontally.

4.1.5.10 Brick pavement

The brickwork in paving shall be laid in 1:4 cement mortar and be made with machine made bricks, and shall be laid to the specified slopes, levels, dimensions, pattern, and bonds as shown in the drawing or as directed by the Engineer.

The widths of mortar joints shall not exceed 12 mm and be fully packed with mortar. The brick pavement shall be laid over a layer of mortar of 12 mm thickness, and shall not be disturbed at least for 7 d after it has been laid and shall be kept wet for at least 10 days.

4.1.5.11 Brick soling

Dry brick soling in foundations and under flooring shall be laid flat over a compacted surface as required, and be made of machine made bricks as specified above. The dry brick soling shall be laid over a cushion of sand of 25 mm thickness unless otherwise shown on the drawings or directed by the Engineer. All joints shall be completely filled with fine sand.

4.1.5.12 Plaster

The surface to be plastered shall be brushed clean. Mortar joints of brick masonry or hollow concrete walls to be plastered shall be raked to a depth of approximately 12mm, and the surface brushed down with a stiff brush and thoroughly wetted. The surface shall be free of all dust, loose materials, grease, etc.

Before starting plaster work, the contractor shall prepare a sample panel of plastering of a size at least 1 m2 for the approval of the Engineer. The sample shall be prepared in an area designated by the Engineer. The Contractor shall obtain approval before starting work and preserve the approved sample intact until all plastering is completed.

Plaster shall be applied in two coats. The thickness of the first coast shall be just sufficient to fill all unevenness of the surface and shall be applied with even, firm pressure to insure good bond, cross scratched and shall be moist cured. After the first coat has properly cured, and allowed to dry thoroughly, the surface shall be dampened before applying the finish coat. The finish coat shall be steel trowel finished to a smooth, even, burnished surface, completely free from defects or trowel marks. The thickness of plaster in total shall not be less than 12 mm. Wall plastering shall be started from top and work down to the floor. Ceiling plastering shall be completed before starting the wall plastering. To ensure uniform thickness and vertical plaster face, plumb guider strips may be applied as required.

If required to achieve the smooth, burnished finish, the surface shall be finished with lime putty of just sufficient thickness to fill in uneven surface or defects due to coarse sand in the plaster mix. Lime mortar finish shall be applied immediately after the finish has set sufficiently firm.

In order to obtain additional strength at external angled corners, the corners shall be dusted with cement during the steel trowel finishing of the finish coat.

Care shall be taken to insure that finished plaster surfaces shall be plumb, square, straight, and true to line. All arises and corners shall be straight, clean, and sharp.

4.1.5.13 Curing of plaster works

Moist curing shall be accomplished by keeping the plaster uniformly damp by suitable means. Moist curing shall start during application and continue for not less than 7 d.

4.1.5.14 Approval by the Engineer of plaster work

All plaster work shall be subject to approval of the Engineer, and work failing to meet the requirements of the specifications or not being to the satisfaction of the Engineer shall be removed and reapplied at the Contractor's expense.

4.1.6 Tolerances

The dimensions of brickwork walls and structures such as manholes shall conform to the tolerances laid down for concrete structures (see specification 2.3), as applicable, or as directed by the Engineer. The German code DIN 18202 "Dimension Tolerances in Building Construction" may also be used as a guide, at the discretion of the Engineer.

4.1.7 Measurement and Payment

4.1.7.1 Principles

Brickwork and plasterwork will be measured as the net area, for the different types and thickness applicable. No deductions will be made for openings of area up to 0.5 m2.

4.2 STRUCTURAL STEEL AND METALWORK

4.2.1 Scope

This specification covers structural steelwork for buildings and other structures, except cranes and bridges. It does, however, include sundry items such as ladders, stairs, handrails, open grid flooring, metal doors and windows, etc., that are usually fabricated from commercial quality steel, as well as corrosion protection.

4.2.2 Interpretations

4.2.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.3 Concrete
c) 4.1 Brickwork

4.2.2.2 Application

This specification contains clauses that are generally applicable to structural steelwork construction, metal work, corrosion protection, and associated work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents).

4.2.2.3 Definitions

For the purpose of this specification, the following definitions shall apply:

Coat. A single layer of a corrosion-protection material.

Coating system. The method and degree of surface preparation, the type of coating, the method of application of the coats and the requirements of the completed system.

Grade (of a bolt). A strength designation consisting of two numbers (separated by a dot), the first number being approximately one-hundredth of the minimum specified tensile strength in MPa and the second one-tenth of the ratio (expressed as a percentage) between the stress at permanent set of 0.2 % (yield stress) and the minimum tensile strength. (For example, Grade 10.9 indicates a nominal tensile strength of 1000 MPa and a nominal set stress (0.2 %) of 900 MPa). The letter S, when added to the grade designation, eg Grade 8.8S, denotes a metric high-strength structural bolt with a heavy series hexagon head.

Normal temperature. A temperature that exceeds 15º C but does not exceed 32º C.

4.2.2.4 Abbreviations

DFT	Dry film thickness
HD-bolts	Holding-down bolts
HDG	Hot-dip galvanizing

4.2.3 Materials

4.2.3.1 Structural steel

Steel generally and section profiles used in structural steelwork and in the fabrication of sundry items shall be in accordance with the requirements of the relevant applicable standards (eg BS 4, BS 4548, IS 808).

Regardless of the standards used, the yield stress shall not exceed 450 MPA, the ratio of the tensile strength to the guaranteed yield strength shall be at least 1.2:1, and the elongation shall be at least 15 %.

All steel used in the manufacture of cold-formed sections for use as structural members in buildings shall have a minimum yield strength of at least 200 MPa.

4.2.3.2 Welding consumables

Welding electrodes shall apply with and shall be stored and handled in accordance with the requirements set out in the relevant applicable standards (eg BS 639, IS 814).

Welding consumables shall be such that they produce weld metal that has a minimum yield stress and minimum tensile strength at least equal to those of the parent metals.

4.2.3.3 Bolts, nuts and washers

Bolts and nuts shall comply with the relevant applicable standards (eg BS 709, BS 4604, IS 1367, IS 4000) and may be either ordinary black bolts, fitted bolts, or high- strength friction-grip bolts, as applicable. Nuts shall be of at least the strength grade appropriate to the grade of bolt or other threaded element with which they are used.

4.2.3.4 Coating materials

All coating materials and constituents shall be delivered in the manufacturer's original sealed containers which bear the manufacturer's labels. Each label shall display all the information necessary to ensure correct storage and traceability, and instructions for the application of the contents of the containers. Any container showing traces of leakage shall, before use, be rejected together with its contents.

The Engineer may require that the contents of any container be subjected to sample testing.

All coating materials held in storage prior to use shall be kept in an approved store which shall be dry and enclosed. Care shall be taken to avoid the accumulation of old stock.

All Site stores used for the storage of coating material shall be provided with adequate fire extinguishers placed in a prominent and accessible position outside the entrances. "No smoking" signs shall be placed inside and outside such stores. No naked flames shall be permitted inside such stores.

Stores for coating materials shall not, at any time, be used for the accommodation of personnel.

4.2.4 Plant and Equipment

Plant and equipment used in handling, fabrication and erection of steelwork shall comply with the requirements of the relevant applicable standards and safety regulation (eg BS 5531). Handling and lifting plant shall have enough capacity to ensure that steelwork is placed in its final position without distortion or undue stressing of members.

The use of cranes, lifting devices, safety belts, harnesses, nets and barricades shall, in particular, comply with the recommendations given in BS 5531.

Plant and equipment for applying the specified coating system shall be suitable for obtaining the specified result. If, however, consistent and satisfactory results are not achieved with the plant and equipment used by the Contractor, the Engineer may order the Contractor to obtain and use such plant and equipment as may be necessary to achieve the required results.

4.2.5 Construction and Workmanship

4.2.5.1 Shop detail drawings

On the basis of the Engineer's design drawings, the Contractor shall, immediately on receipt of such drawings satisfy himself that the drawings contain all the information required for the preparation of his own shop details and supporting calculations. These shop detail drawings and supporting calculations shall be submitted in duplicate to the Engineer for approval at least 1 week before commencement of fabrication. The Contractor's drawings shall be complete in every respect (including welding details and shop splices). One copy of each drawing will be retained by the Engineer and, within 1 week of the date of receipt by the Engineer, the other copy will be returned to the Contractor with the Engineer's comments or written approval, as the case may be.

Such approval given by the Engineer relates to structural adequacy and does not absolve the Contractor from his responsibility for dimensional accuracy.

Steel sections shall be provided as specified on the drawings except that substitutions will be permitted with the Engineer's prior approval.

4.2.5.2 Fabrication

All structural steel shall, before and after fabrication, be within the tolerances specified below, and, unless required to be formed to a particular shape, be flat, straight and free from twist. Any necessary straightening or forming shall be carried out by methods that neither weaken nor deface the material.

Cutting may be done by sawing, shearing, cropping or machine flame-cutting. Manual flame-cutting is permissible only when authorized.

Holes for fasteners shall be drilled, except that holes for HD-bolts may be flame-cut if specifically approved, and that holes for bolts other than fitting bolts, may be punched, if approved, and if the material to be punched is not thicker than the diameter of the hole.

Any punching through material thicker than 12 mm shall be done only with the prior approval.

The diameter of the holes for bolts other than fitted bolts and friction-grip fasteners shall not exceed the diameter of the bolt by more than 2 mm in the case of fasteners of diameter up to 24 mm and 3 mm for larger diameters. For friction-grip fasteners, the holes shall generally be not more than 2 mm larger than the bolts, and for holes for fitted bolts, the allowable tolerance shall be ñ 0.15 mm.

Slotted holes shall be formed by drilling, punching a pair of holes and flame-cutting between the holes, or slot punching in the case of material of thickness not exceeding 12 mm. All burrs shall be removed from holes before assembly.

Where a sealed hollow member is holed for a fastener or pin, provision shall be made to prevent ingress of moisture to the interior of the member.

For joints in compression, the abutting surfaces of a joint dependent on contact for the transmission of load shall so butt that the areas necessary to transmit the load are in full contact. A bearing face that is to be grouted direct to a foundation need not be machined but such a face shall be true and parallel to the upper face of the foundation.

Where required, the ends of hollow sections may be flattened, or otherwise formed, for welded or bolted connections provided that the method employed does not damage or deface the material, and the change of shape shall be gradual.

The interior of any hollow member, whether a structural hollow section or a fabricated member, shall be so sealed as to prevent the ingress of moisture.

4.2.5.3 Assembly

Before delivery to the construction Site, each peace of steelwork shall be distinctly marked, in accordance with the marking diagram, and shall bear such other marks as will facilitate assembly and erection.

The component parts shall be so assembled that the whole and all parts of the finished structure are within the tolerances specified, that no member is bent, twisted or otherwise damaged, and that specified cambers are obtained.

All matching holes for fasteners or pins shall so register with each other that the fasteners can be inserted freely. Drifting to align holes shall be so done that the metal is not distorted and the holes are not enlarged. Holes that cannot be aligned without enlargement shall be cause for rejection unless enlargement by reaming is specifically approved.

Welding shall be carried out in accordance with the recommendations of the relevant applicable standards, in particular AWS D1.1 or BS 5135.

For bolting, other than friction-grip bolting, the parts to be jointed shall be firmly drawn together and bolts shall be tensioned by hand to the limit of the torque that can be applied by the use of a standard podger spanner. High tensile bolts for major tension type or moment type connections and where fatigue is a consideration, shall be tightened to a tension of 75 % of the proof load stress of the bolt. Except in the case of fitted bolts, washers need not be used where surfaces are flat and flanges untapered, and holes have normal clearances. On tapered flanges, tapered washers shall be used to give bolts and nuts a satisfactory bearing.

The length of each bolt shall be such that after the bolt has been tightened, at least one thread projects through the nut and at least one full thread remains clear between the nut and the unthreaded shank.

Fitted bolts shall be long enough to ensure that no threaded portion is within the thickness of the connected parts required to develop the bearing load on the bolt, and shall be provided with a washer or washers, under the nut, of thickness such as to ensure that at least one full thread remains clear between the nut and the unthreaded shank. All the bolts in each group shall be re-tightened after the last bolt has been fitted.

For friction-grip fastening, the turn-of-the-nut tightening method shall be used, unless otherwise directed by the Engineer, or otherwise recommended by the manufacturer. Once friction-grip bolts of Grade

10.9S and galvanized bolts of Grade 8.8S have been tensioned, they shall not be reused, but other bolts may be re-used solely at the discretion of the Engineer.

4.2.5.4 Setting-out

Before the Contractor commences erection of steelwork on Site, he shall check that the setting-out and the levels of HD bolts and of concrete foundations, beam faces, column, etc., are in accordance with the drawings and he shall report any discrepancies immediately to the Engineer.

4.2.5.5 Erection

Before commencing erection of steelwork on Site, the Contractor shall submit to the Engineer, for his general scrutiny and information, full details of the erection procedure and methods of erection.

While it is incumbent on the Engineer to ensure that the structure or elements thereof can be erected without loss of stability or without overstress, the Contractor is responsible for the maintenance of safety standards during erection.

All pockets that are to receive HD-bolts, fittings or steelwork shall be cleaned out immediately before erection is commenced. each part of a structure shall be aligned as soon as possible after it has been erected... Members shall not be permanently connected until enough of the structure has been aligned, levelled, plumbed and temporarily connected to ensure that they will not be displaced during the erection or alignment of the remainder of the structure.

Drift pins, jacking equipment and the like shall not be used to bring improperly fabricated members into place. A moderate degree of reaming and cutting, however, may be employed to correct minor misfits only if, in the opinion of the Engineer, this will not be detrimental to the strength or appearance of the steelwork.

4.2.5.6 Grouting of supports

Grouting shall be done in accordance with the requirements of clause 2.3.5.5.12.

The Contractor shall ensure that all grouting has been completed before any imposed load is applied, and that no bedding or grouting is carried out by others until enough of the structure has been aligned, levelled and plumbed and adequately braced.

Steel wedges or packings or other levelling devices of adequate strength and rigidity shall be used to support the steelwork. Immediately before being grouted, the space and all pockets under the steel shall be cleared of all debris and free of water.

Before steel sections are embedded in concrete, the complete corrosion protection system shall be applied to each member down to at least 100 mm below the level of the concrete.

4.2.5.7 Sundry items

a) Handrails. Handrails shall be of the type and shall be purpose made in the style and shapes shown on the drawings or specified in the Particular Specification. The Contractor shall ensure, by making in-situ measurements before manufacture is started, that the handrails suit the situation in which they are to be installed. Handrails are to be supplied complete with all the necessary fixing bolts, nuts, etc.

b) Ladders. Ladders shall be manufactured in accordance with the details and general arrangements shown on the drawings or specified in the Particular Specification. Ladders shall be supplied complete with all the necessary fixing bolts, nuts, washers for fixing, etc.

c) Open grid flooring. Open grid steel covers and floor panels shall be manufactured by an approved firm specializing in such work. They shall be pressure locked or welded (or both). They shall be so designed that the deflection of any bar under design load condition does not exceed 1/200th of the clear span, or 10 mm, whichever is the lesser. looring shall be made in panels of sizes that conform to the dimensions given on the drawings, and shall be supplied prefabricated with cut-outs as required. Unless authorized by the Engineer to do so, the Contractor shall not cut or weld open grid floor panels on Site.

d) Floorplate floors. Floorplate shall be as shown on the drawings and shall have an approved raised pattern. Lifting key holes shall be provided as shown.

e) Metal Doors, Windows, Ventilators, Glazed Shutters etc. Glazed units shall be made from galvanized steel folded sheets sections or approved equivalent free from rolling defects. All steel doors, windows and glazing shall conform to IS 4351 or equal approved with electro galvanized finish conforming IS 1570 unless otherwise directed. The doors, window and ventilation frame section are made of folded plate as per manufacturer's specification to conform with the drawings. The Contractor is required to submit shop drawings for approval by the Engineer.

f) Window grills, fences, railing. Mild steel grill, fences and railing of approved pattern and manufacture, finished with one coat or red lead primer followed by one coat of aluminum paint, all complete, shall be as shown on the drawings or as directed and shall comply with the requirements of IS 800 or equal approved. Welded joints shall be neatly made, filed smooth and left clean. The Engineer is to be informed when the welded work is ready for inspection and any such work must be left unprimed until the Engineer gives his approval. The Contractor shall furnish at his own expense all necessary tools and all materials which he may require for the safe erection of the work, and remove the same when the work is completed. The Contractor shall be solely responsible for any damage done to the structure during erection and any member which has been bent or otherwise distorted either before or after erection shall be straightened or replaced in an approved mean at his own expense. The grill work shall be finished with one coat of red lead oxide paint and fixed in the opening.

g) Collapsible gates, rolling shutters. These shall be double or single collapsible gates depending upon the size of the opening. The collapsible gates shall consist of vertical channels 20 x 5 mm and top and bottom rails of T-iron 40 x 40 x 6 mm with 38 mm dia. steel pulleys or ball bearings in every 4th double channels, unless otherwise specified. Where a collapsible gate is provided with the opening and is fixed along the outer surface the T-iron at the top may be replaced by flat iron 40 x 10 mm. The collapsible gate shall be provided with necessary bolts and nuts, locking arrangement, stoppers and handles.

Unless otherwise ordered, the rolling shutters shall conform to IS 6248 and be suitable for fixing in the position ordered ie outside, inside, on or below lintel or between jambs. Shutters up to 12 m2 in area shall be manually operated or push up type while bigger sizes shall be of reduction gear type mechanically operated by chain or handles.

Laths shall be of 18 gauge best quality mild steel 75 mm wide strips interlocking, rolling centres, machine rolled and straightened with an effective bridge depth of 16 mm. Side guides and bottom rails shall be built up mild steel rolled sections. The spring assembly shall be supported on strong mild steel or malleable cast iron brackets shaped to fit the lintel. The rolling springs shall be from tested unbreakable high tensile steel wire or strip of adequate strength to balance the shutter in all positions. The shutter shall be complete with door suspension shafts, locking arrangement, pulling hooks, handles and other accessories.

4.2.5.8 Execution of corrosion protection

Safety and general workmanship

The Contractor shall, at all times, enforce adequate safety measures in terms of the legislation applicable to the work Site.

All work shall be carried out by competent workmen under the supervision of an experienced supervisor.

No cleaning or coating shall take place when Site conditions are likely to affect these operations adversely.
Equipment nameplates and identification plates shall be protected against damage or overcoating.

Any areas not required to be coated shall be masked in such a way that these surfaces are protected during all coating operations.

Dressing and repair during fabrication

All surfaces of welds shall be free from slag, slag inclusions, cracks and holes. Weld profiles shall have a smooth contour, free from irregular projections, undercut and sharp edges. Areas adjacent to welds shall be free from weld spatter and such spatter shall have been removed by grinding or scraping.

All burrs and sharp edges caused as a result of activities such as guillotining, flame cutting, drilling or hole punching shall be removed by chamfering or ground to a smooth radius of at least 1 mm.

Preparation for coating

Prior to any other form of preparation, all obvious harmful deposits on the surface of steelwork, such as oil, grease, chemical deposit, clay, bitumen, or mud, shall be removed by a method described below.

a) Abrasive blast cleaning (sand blasting) shall be carried out in accordance with the methods described in the relevant applicable standards (eg BS 4232, SIS 05 59 00). Where sprayed metal coatings are to be applied to steelwork, angular grit shall be used.

   Dry abrasive blast cleaning shall be carried out on a dry surface. When air is used, it shall be oil- free, clean and dry. Final blasting shall not be carried out if the steel temperature is less than 3 ^{0}C above dew point.

   All blast-cleaned surfaces that are to be coated shall be so within 8 h of blasting unless otherwise agreed to by the Engineer.

   In addition to or as an alternative to dry blast cleaning, it may be necessary to apply wet blast cleaning in order to remove soluble salts from the surface of steel that have been exposed to aggressive environments. Such wet blast cleaning is subject to the approval by the Engineer.

b) Cleaning by hand or with power tools. This is mainly done by wire brushing in accordance with the relevant applicable standards (eg DIN 55928).

c) Degreasing. Liquid-solvent cleaning, solvent-vapour cleaning and alkali and emulsion cleaning may be carried out at the discretion of the Engineer and in accordance with the relevant applicable standards (eg DIN 55928).

Latent material defects

Before the application of the first coat of a protective system, unacceptable defects such as cracks or laminations, that become evident after preparation of the steelwork, shall be ground out, repaired or the material rejected, as decided by the Engineer.

Cleaning of surfaces about to be coated

No coating shall be applied on a prepared surface that is contaminated with oil , grease, perspiration, rust or chemical deposits until such surface has been adequately cleaned. Uncoated steel shall not be touched with bare hands. Where contamination has occurred, it shall be removed with an approved solution or cleaning solvent. Degreasing shall be followed by rinsing with water to remove residues.

Where any coat has oxidized or become excessively hard, it shall be abraded to a matt finish and cleaned prior to the application of further coats.

Unless otherwise approved, coats shall only be applied on moisture-free surfaces.

Coating system

The coating system shall be as specified in the Particular Specification and shall be applied at the location specified.

Application of paint coatings

The method of coating application shall comply with the manufacturer's recommendation and data sheets. Multicomponent materials shall be applied with due care, the specified application techniques being used.

All coatings shall be substantially free from tears, runs, curtaining, foreign inclusions and material surface defects and shall, in addition, be free from misses.

Maximum and minimum intercoat intervals shall comply with the paint manufacturer's recommendations, taking cognizance of ambient conditions.

The colour of each coat shall be different from that of the previous coat.

Surfaces that will be inaccessible for coating after fabrication or erection shall receive the full specified coating system prior to final fabrication or erection.

All coating components, particularly two-component or multicomponent materials, shall be thoroughly mixed until a homogeneous mixture is achieved. The mixture shall be frequently agitated during application to keep the solids in suspension. The preparation time and pot life of these materials shall be closely adhered to.

Application of metal coatings (HDG, metal spraying)

All HDG shall comply with the requirements of the relevant applicable standards (eg BS 729, DIN 55928).

If a galvanized surface is to be coated to provide a duplex system of coating, the galvanized surface shall first be cleaned and prepared in accordance with the coating manufacturer's recommendations.

No drilling, cutting, welding or machining shall be carried out after metal coating. Unavoidable damage shall be repaired in accordance with clause 4.2.5.8.9 below.

Repair of damaged coatings

Damaged areas shall be cleaned down to a metal condition or to an undamaged coated surface.

Spot repairs shall re-instate each of the previous coats, or shall be made using an approved patching material. The patch shall extent at least 25 mm over adjacent surfaces which shall have been prepared by feathering with suitable abrasive paper. The repair of metal coatings shall be to a procedure approved by the Engineer.

4.2.6 Tolerances

4.2.6.1 General

The permissible deviations (PD) on the dimensions of components (such as gusset plates, cross bracing, etc.) and on the location of bolt holes in components and elements of a structure shall be ñ 2 mm. All calculated PDs shall be rounded up to the next whole millimetre.

4.2.6.2 Tolerances on dimensions, accuracy of erection, etc.

The tolerances on all dimensions (other than of rolled sections), accuracy of erection, location of HD-bolts, location of column bases, levels, etc., shall be as given below:

a)	Width of flange	± 4 mm
b)	Depth of beams	± 3 mm
c)	Off-centre of web	6 mm
d)	Tilt or warpage of flange	b/200 mm
e)	Length of a member	+ 1, -2 mm
f)	Out of plumb	< 50 or H/500 mm
g)	Straightness of members	< 25 or L/500 mm
h)	Location of HD-bolts	± 3 mm
i)	Level and position of column bases	± 3 mm
k)	Other levels	± 2 mm

4.2.6.3 Dry film thickness

At least 90 % of all coating thickness measured shall comply with the minimum requirements of the Particular Specification. Up to 10 % of all readings may be below the specified thickness, but may be not less than 70 % of the specified thickness. Where DFTs are less than those specified, remedial action shall be taken to built up the thickness to that specified. DFT in excess of the prescribed maxima shall not necessarily constitute a reason for rejection if the paint film is demonstrated to be sound in all respects.

The method used to measure DFT and the significance of the readings for each particular job shall be as agreed upon by all parties prior to commencement of work.

4.2.7 Testing and Acceptance

4.2.7.1 Testing of steelwork

If requested by the Engineer, test certificates or cast analysis certificates (or both), pertaining to the steel to be used shall be supplied to the Engineer by the Contractor.

The Engineer shall have access at all reasonable times to all places where the work is being carried out and shall be provided with all the necessary facilities for inspection during all stages of construction.

Welds shall be examined visually to check that there are no uneven leg lengths, no cracking or unacceptable undercutting or porosity and that full fusion has been achieved while welding is in progress. Dimensional checks shall be carried out in accordance with the requirements of the relevant applicable standards (eg BS 5135).

Only where so required by the Engineer shall welders be tested or destructive or non-destructive tests being carried out.

4.2.7.2 Testing of coatings

Testing of coatings by the Contractor and inspections by the Engineer shall be carried out in accordance with the requirements laid down in the relevant applicable standards (eg ISO 3233) and as directed by the Engineer.

4.2.8 Measurement and Payment

4.2.8.1 Principles

Work involving steel, platework, and sundry items will be measured by mass of steel. Such mass will be calculated from a steel density of 7850 kg/m3.

Corrosion-protection coatings will be measured in the same units as the steelwork that is to be protected. Tonnage will be measured as the gross tonnage of unpainted steel.

4.3 PLUMBING AND HOUSE DRAINAGE WORKS

4.3.1 Scope

This specification covers the general requirements for plumbing and sanitary installation required in general building construction.

4.3.2 Interpretations

4.3.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 3.3 Pressure Pipelines
c) 3.4 Sewers

4.3.2.2 Application

This specification contains clauses that are generally applicable to plumbing, sanitary installations, house water supply and drainage work, and associated work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents).

4.3.3 Materials

All pipes, fittings, and sanitary ware shall be of selected quality approved by the Engineer. It shall be suitable for the intended purpose and appropriately matched to each other. All pipes, fittings, and sanitary ware shall be supplied complete with all necessary fixing, coupling and jointing material.

Pipes for water supply shall be of galvanized seamless steel, cast or spun iron, ductile cast iron, PVC, etc., and shall be jointed by fitting, screwing, or welding, as applicable.

Pipes for drainage may be cast iron, ductile cast iron, vitrified clay (glazed earthenware), PVC/PE, AC, concrete, etc.

All fittings shall be supplied according to the pipes required, whether or not specifically called for in the drawings.

All sanitary equipment, lavatories, cisterns, urinals, toilets, water fountains, floor drains, gullies, petrol, and oil traps, etc., shall conform to the relevant applicable standards as shown below.

BS 437 and BS 1130 for cast iron drain pipes and fittings
BS 1211 for spun iron pipes and fittings
BS 2760 for pitch fiber pipes and fittings
BS 1387, IS 1293 for galvanized pipes
BS 1740, IS 1879, IS 554, IS 2633 for galvanized pipe fittings
IS 4980, IS 8008, IS 7634 for HDPE pipes and fittings
IS 1276 for covers and frames
IS 774, IS 2556 for white ceramic sanitary ware

4.3.4 Plant and Equipment

The apparatus used for the line, level, and positional control of pipelaying and installation work shall be accurate, sturdy, and in good operational condition. The Contractor may use any acceptable device for such control.

In addition to the pumps, gauges, storage tank, tools, pipes, fittings, specials, and bracing necessary for the tests required, the Contractor shall provide all plugs for the temporary stopping off of pipelines for the purposes of testing.

4.3.5 Construction and Workmanship

4.3.5.1 Sanitary fixtures

All fixtures specified or shown on the drawings shall be furnished and set by the Contractor in a neat and workmanlike manner, making connections with all supply, waste, soil and vent pipes, as specified or as directed. General requirements for fixtures shall be the following:

A sample of each type of fixture shall be subject to the approval by the Engineer. The samples shall be completely fitted and set up at the building or in some other convenient approved place.

The approved fixture samples shall not be removed and shall be protected at all times during the construction period for comparison purposes. All fixtures of poorer quality than the one of the samples will be cause for rejection.

All ceramic fixtures shall, unless otherwise shown on the drawings or directed, be of white vitreous china thoroughly fused, producing a white material which, when fractured, shall show a homogeneous mass with close grain and free from pores. All surfaces coming in contact with walls, floors, or surfaces of other fixtures shall be reasonably flat.

Enameled cast iron shall be of an approved quality and thickness. Porcelain enamel coat shall be applied so that the enamel will be smooth, of even thickness, white and free from craze, discoloration and chips. Exterior exposed surfaces not required to be enameled shall be treated with one coat of filler at the factories. The Contractor shall be responsible for any revisions of connections required to adapt the roughing sleeves and openings to the particular fixture he proposes to use.

All fixtures shall bear the manufacturer's guarantee label or trade mark for identification purposes.
All fixtures requiring hot and cold water shall have the cold water tap on the right hand side of the fixture and the hot water on the left hand side of the fixture.

All fixtures shall be of the same manufacture, unless otherwise directed by the Engineer.

The location of each fixture and the fixing method of ceramic fixtures shall be as shown on the drawings or as directed by the Engineer.

After fixtures have been mounted, the Contractor shall before leaving the job, thoroughly clean all fixtures furnished and mounted under this contract, remove all plates, stickers, rust stains and other foreign matters or discolorations on fixtures, leaving every part in perfect condition and ready for use.

4.3.5.2 Piping

The Contractor shall submit to the Engineer a piping diagramme for approval. This diagram shall show the symbols of the sanitary fixtures connected with both, the potable water supply and the drainage system. Valves, diameter of pipes, materials, etc., shall be indicated in the diagramme. The limit of the work to be executed inside the building shall begin and end 1 m beyond the outer line of the structure, unless otherwise directed.

All supply lines shall be designed for a nominal pressure of 1 MPa (10 bar), unless otherwise directed.

Before covering the pipes work pressure test shall be carried out to the satisfaction of the Engineer.

The waste water shall be drained through septic tank, soakaway drains or pits, or drainage system, as applicable, by use of vitrified clay pipes or PVC/PE pipes as directed or shown on the drawings.

Great care shall be taken in setting out and determining the general levels and falls of drain pipes, so that a fall giving a self-cleaning velocity shall be obtained.

4.3.5.3 Fixing

W.C. commodes shall be fixed to the floor with C.P. brass screws or by means or 75 mm long 6.5 mm dia counter sunk bolts and nuts embedded in the concrete floor or as per the instruction of the Engineer. The base of the pedestal of the commodes shall squarely rest on the finished floor. Any gap between the finished floor and the pedestal shall be filled with white mastic mixed with pigment to match the shade of floor or as directed by the Engineer.

The W.C. Pan (Indian or Orissa) shall be laid in floor slope towards the pan in a workmanlike manner, care being taken not to damage the W.C. pan, etc. in the process of fixing. If damaged in any way, it shall be replaced at no cost of the Employer. The pans, etc. shall be fixed on a proper base of cement concrete 1:2:4 mixer (1 cement: 2 coarse sand: 4 stone ballast of 20 mm nominal size) taking care that the cushion is uniform and even without having any hollows between the concrete base and W.C. pans, etc. Joint between the W.C. pan and finished floor shall be neatly done and no hair cracks shall be visible. Joint between the outlet of the W.C. pan and ceramic 'P' or 'S' trap shall be made with neat cement, yarn, linseed oil, white lead and waterproofing compound and made leakproof. The outlet of the ceramic traps shall be centrally placed in the rubber gasket of the socket of the HDPE pipe and shall have no leakage.

Flush valves shall be installed exposed as shown on the drawing, in accordance with the manufacturer's instruction or as directed by the Engineer. The C.P. long flush bend pipe shall be fixed to the water closet with the help of rubber adopter and shall show no signs of leakage.

Washbasins shall be supported on bracket (s) as per the manufacturer's instruction and/or on vitreous china pedestals or as directed by the Engineer. There shall not be any gap between top edge of the basin and finished face of wall.

Urinals shall be fixed to the wall by means of C.P. brass screws as per the manufacturers instruction and/or directed by the Engineer. There shall not be any gap between the back edge of the urinal and finished face of the wall.

4.3.6 Tests and Acceptance

All water services shall be subjected to a hydraulic test pressure 1.5 times the working pressure maintained for a period of two hours.

All soil waste and vent pipes shall be subjected to an air test as described in clause 3.4.7.

All drainage pipework shall be subjected to a hydraulic test pressure of 150 mm head at the highest fitting, maintained for a period of four hours.

The Contractor shall include for providing all necessary appliances and labour at these tests.

All water service pipework shall be flushed through upon completion of installation, to ensure cleanliness.
All drainage pipework shall be rodded through upon completion of installation to ensure cleanliness.

4.3.7 Measurement and Payment

4.3.7.1 Principles

The transport to site, handling, laying and jointing of pipes and fittings, including inspection, cutting, turning, welding, supply and installation of metallic tape etc., will be measured throughout the overall length without deduction of valves etc. and will be paid for by the linear meter of work performed depending on the pipe types, diameters, and location the pipe is to be installed.

The installation of stop valves, air valves, washouts, hydrants etc. will be paid by the number installed.

Testing and disinfection of mains will be paid for the linear meter of work performed depending on the pipe diameter.

An extra item will be paid for connections to be made to existing pipelines, depending on the diameter of the existing pipe.

4.4 FINISHES

4.4.1 Scope

This specification covers the general construction requirements for finishes, such as flooring, painting, roofing, water proofing, etc., required in general building construction (eg administration buildings at treatment plants, well houses, etc.).

4.4.2 Interpretations

4.4.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.2 Earthworks
c) 3.1 Concrete
d) 4.1 Brickwork

4.4.2.2 Application

This specification contains clauses that are generally applicable to finishes on walls, floors, and roofs of buildings and associated work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents).

4.4.3 Materials

Ceramic tiles shall be 100 x 100 x 6 mm size unless otherwise shown or specified on the drawings or directed by the Engineer. They shall either be ceramic vitreous tiles, with colours as selected by the Engineer, or approved glazed tiles conforming with IS 777.

Lime, cement, sand, and water used for tiling work shall be in accordance with the requirements of section 4.1.

Granular material (eg marble chips) for in-situ flooring, screeds, and skirting shall be as approved by the Engineer.

The Contractor shall submit samples of tiles for selection and approval by the Engineer, and all tiles used shall conform to the approved samples with regard to size, quality, texture and colour.

The materials for painting and colour washing of internal and external walls and similar surfaces shall conform to the requirements of the relevant applicable standards (eg IS 5410).

Waterproofing materials, such as waterproofing bituminous felt and other bituminous materials shall be in accordance with the relevant applicable standards (eg IS 1322, IS 1580).

Waterproofing additives to mortar, plaster, and concrete shall be in accordance with the requirements laid down in the relevant applicable standards (eg IS 2645) and shall be added at the rate of 2% by weight of cement or in accordance with the manufacturer's recommendations and shall be subject to the approval of the Engineer.

Pigments and other necessary additives to produce coloured plasters and mortars shall conform to the relevant applicable standards (eg IS 57) and shall be applied the rate of 1 % by weight of cement or to produce a colour and texture indicated on the drawings or as directed by the Engineer. The sample of such colour plaster shall be subjected to approval of the Engineer before applying in the work.

Caulking compounds shall be of approved manufacture such as to provide a continuous waterproof barrier installed with exposed caulking smoothly recessed from the finished steel or brick surface.

4.4.4 Plant and Equipment

Plant and equipment shall be suitable for applying the specified flooring and coating systems and for obtaining the specified results. If, however, consistent and satisfactory results are not achieved with the equipment used by the Contractor, the Engineer may order the Contractor to obtain and use such plant and equipment as may be necessary to achieve the required results.

4.4.5 Construction and Workmanship

4.4.5.1 Tiles

Wall surfaces shall be brushed clean, wetted, and fitted with on approximately 12 mm thick level and plumb scratch coat of cement mortar 1:3 applied in accordance with section 4.1. The scratch coat shall be moist cured for at least 24 h before the application of a floating coat. Before applying this floating coat, the scratch coat shall be thoroughly wetted. The floating coat, a plastic mix of neat cement of approximately 3 mm thickness shall be applied even, and with screeds to true plane. The floating coat shall be applied over areas no larger than can be covered with tiles while the mortar is still plastic (half set). Glazed tiles shall be soaked, completely immersed in clean water, at least 30 min. and drained.

Tiles shall be installed by applying a skin coat of a plastic mix of neat cement to backs of tiles and firmly pressing them into the floating coat to true plane and position. White cement shall be used for the skin coat where white joints are required.

Tiles shall be installed by dusting a thin layer of dry cement over the setting bed worked lightly with trowel or brush until damp, and tiles shall than be set with straight uniform joints 1 mm or less in width, accurately aligned in both directions and tamped solidly to the bed.

During the process of setting tiles, continuous horizontal and vertical cuts every 40 to 60 cm shall be made through the floating coat while plastic, using the point of a trowel turned edge wise. Care shall be taken to prevent cutting into the scratch coat.

Where full size tiles cannot be laid, they shall be cut (sawn) to the required size and the edges rubbed smooth to ensure a true and straight joint.

Joints in tile work shall be accurately aligned with horizontal joints level and vertical joints plumb. The joints shall be maintained uniformly wide by aligning spacer lugs on tile edges if tiles are so manufactured or by use of wetted strings.

The layout of tile work shall be so that no tile less than half size occurs. Where tiles must be cut at edges or penetrations, the cut edges shall be carefully fitted and neatly ground. No chipped, cracked or broken tile shall be used and all defective work shall be replaced and repaired to the satisfaction of the Engineer and at the Contractor's expense.

After tiles have been set firm and joint strings removed, tiles shall be dampened and joints grouted full with a plastic mix of neat cement by trowel, brush or finger application. Unless otherwise directed, grout

shall be made with white cement. During grouting all excess grout shall be cleaned off the tile surface with damp cloth sponges.

Where the setting bed is applied directly to a concrete slab, the slab surface shall be thoroughly wetted, with no free water left standing, and sprinkled with dry cement. The setting bed shall be 1:5 cement mortar and shall be placed to the required level, grade and slope and tamped firmly. Cement mortar at a rate of 4.4 kg per square meter shall then be spread. The floor tiles shall then be placed in position and tapped with a wooden mallet until the tiles are properly bedded in line and level.

Where the setting bed is applied over a waterproofing membrane, metal reinforcing wire mesh shall be installed lapped at least one full mesh at edges and supported so as to be located approximately mid-height of setting bed. At edges where wall tiles are foreseen, the mesh shall be turned up at least 80 mm.

All finishing tile work shall be adequately protected from damage during the progress of construction and any damage shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

4.4.5.2 Cast in-situ floors, screeds, skirting

Before placing of in-situ concrete flooring, the base shall be made rough and watered, and given a cement wash. A first concrete layer shall than be laid to the depth required. After laying, the concrete shall be compacted by hand or mechanical means leveled with wooden floats.

Within one hour of laying the bottom layer, the second and finishing layer shall be placed and the surface tamped lightly before finishing it of perfectly level with a straight edge float and trowel.

The finishing layer shall consist of cement-sand mixed at 1:1.

Cement skirting shall consist of 20 mm thick cement mortar mixed at 1:3. The cement skirting shall be applied to the wall surface to the line, levels and dimensions, and finished with a floating coat of neat cement.

Curing and protection of cast in situ floor shall be in accordance with the requirements of sections 2.3 and 4.1.

4.4.5.3 Waterproof Cement paint

The contents of each fresh container of the paint shall be loosened by rolling or shaking the container before opening for the first time. To one volume of water in a clean container, an equal volume of cement paint shall be added and stirred well to achieve a uniform consistency. No further dilution will be permitted.

The cement paint powder shall be kept secured from the exposure to atmosphere by properly tying up the polythene liner in the container and the lid firmly closed.

The cement paint shall be used within two hours of mixing and shall be kept stirring during use.

For application, the base surface shall be cleaned by use of a stiff brush to remove loose dust and dirt. The base surface shall be thoroughly wetted and water allowed to run off.

The first coat shall be well brushed in a manner to give a good bond of the paint with the surface. The second and subsequent coats shall be brushed or sprayed as approved. The cement paint shall be applied at the following rate:

a)	on brickwork	2 kg/m2
b)	on in situ concrete	3.5 kg/m2
c)	on concrete blocks	2 kg/m2
d)	on cement sand rendering	3.2 kg/m2

The curing of the waterproof cement paint shall be carried out by application of fine water spray at an interval of 6 to 8 h after the application of the paint for duration of at least 7 d.

The finished surface shall be protected from any damages, staining, etc., by approved means.

4.4.5.4 Oil bound distemper

All plaster surfaces shall be thoroughly cleaned and shall receive 3 or more coats. The first coat shall be a prime coat. The second and third coats shall be of oil bound distemper of approved colour, shade, and quality, and shall be mixed with petrifying liquid in accordance with the manufacturer's recommendations.

After these operations, if the work is not to the satisfaction of the Engineer, one or more coats shall be applied without extra cost until a smooth and even surface is achieved and approved by the Engineer.

4.4.5.5 Distempering

Distemper shall be dry distemper as approved by the Engineer. The distemper shall be mixed with clean water as recommended by the manufacturer and shall be stirred until the mixture attains an even consistency.

The surface shall be cleaned, cracks and holes repaired, all irregularities and inequalities sand papered smooth and wiped clean to present a fine smooth surface which shall be completely dry before distempering is started.

The mixture shall be applied evenly with a brush in long parallel strokes evenly so as not to leave any visible brush marks.

The surface of this first application shall be allowed to dry and harden. Then the second coat shall be allowed to be applied on the first coat. If a uniform surface is not achieved, a third coat shall be applied.

4.4.5.6 Plastic emulsion paint

The surface shall be prepared as specified for oil paints. First, a priming coat of primer as specified by the manufacturer shall be applied.

The second and third coats of plastic emulsion paint of approved shade and manufacture shall be applied to achieve an even surface. If the finish is not to the satisfaction of the Engineer, more coats shall be applied to achieve a smooth and even surface.

4.4.5.7 Ready-mixed enamel paint

Surfaces to be painted shall be dry, free from dust and dirt and rubbed smooth by means of sand paper or pumice stone to the satisfaction of the Engineer.

The paint shall be ready-mixed synthetic enamel or oil paint of approved make and manufacture. The primary coat shall be applied evenly with a brush. After the primary coat is applied and perfectly dried, all holes, cracks etc. shall be filled with putty and the surfaces sand papered. A second coat of paint of approved shade and manufacture shall then be evenly applied and allowed to dry. The third coat shall be carefully applied as and when required, to achieve a smooth and even surface.

4.4.5.8 French Polish

The work shall be first cleaned and sandpapered thoroughly. It then will be painted with a "filler", composed of methylated spirit, and sandpapered.

A thin coat of French Polish shall then be applied and sand papered. Subsequent coats of French Polish shall be applied till the proper finishing is achieved to the satisfaction of the Engineer.

4.4.5.9 Roofing

A water proofing coating on bare reinforced concrete roofs shall be bitumen based and shall be applied in two layers of primer and one layer of finishing coat in accordance with the manufacturer's instructions and recommendations.

Such coating shall be applied by brushing, spraying, or roller application and shall be placed on concrete which has been cured and has reached an age of not less than 3 months.

If not otherwise shown on the drawings or directed by the Engineer, the prime coats shall be applied at a rate of approximately 0.85 l/m2 and the final coat at a rate of about 1.2 l/m2.

Care shall be taken in connection with drains, gutters, etc. to achieve proper flashing and lapping with the bitumen membrane.

4.4.6 Tolerances

The tolerances for flooring work shall be as described in 2.3 and for paintwork as described in 4.2, as applicable, unless otherwise agreed between the Contractor and the Engineer prior to the commencement of the work.

4.4.7 Measurement and Payment

4.4.7.1 Principles

Finishing work will be measured as the net areas covered and no deductions made for openings of area up to 1.5 m2.

Separate items will be scheduled for each type of finish, and for different location of application, if such location will substantially effect the pricing.

Doors, windows, glazed partition walls will be paid for by area measured across the whole surface, without deducting unpainted fillings such as glazing, plastic coated boards, etc.

4.5 CARPENTRY AND JOINERY WORKS

4.5.1 Scope

This specification covers the general construction requirements for timber work, carpentry and joinery, required in general building construction (eg administration buildings at treatment plants).

4.5.2 Interpretations

4.5.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 General
b) 2.3 Concrete
c) 4.1 Brickwork

4.5.2.2 Application

This specification contains clauses that are generally applicable to timber works, carpentry and joinery for buildings and associated work. Interpretations, additions, and variations of this specification are set out in the Particular Technical Specification (Part 2, Volume 2, Tender Documents).

4.5.3 Materials

Timber for general purposes shall be approved hardwood, with quality attributes as for the normal class according to DIN 4704, or similar and planed on all sides. The timbers shall be impregnated with an odorless wood preservative.

Unless specified elsewhere or otherwise directed, the frames, architraves, etc., of doors and windows, etc., shall be of well-seasoned wood free of knots, fissures, and decay. Local wood of equivalent quality shall be used whenever possible.

Door shutters shall be of chipboard or blockboard of approved quality having both sides faced with either commercial ply 5 mm thick or other approved veneering. Samples of such shutters shall be submitted for approval.

The fittings and fixtures like hinges, hooks, anchors, locks, handles, key plates, keys, doorstops, etc., shall be of best quality and manufacture. The Contractor shall submit samples of such fittings and fixtures well in advance for approval. Except for hinges which shall be of heavy pattern of steel or brass as appropriate, all other fixtures shall be of anodized light metal, aluminium, or stainless steel, as appropriate, and as directed.

Timber and other wood material shall be straight, sound, bright, of mature growth, well seasoned and conditioned to suit the particular purpose, for which it is to be used. The material shall be cleanly sawn, square edged, and free from injurious shakes, splits, warps, wanes and knots, soft spots and rot, incipient decay and all other defects.

For the structural components which will be concealed after installation, e.g., in the case of built-in cupboards, wardrobes or wall linings, either the type of wood specified for the unconcealed structural components (spruce, fir, pine or a wood of at least equal quality) or an equally suitable material may be used at the Contractor's own choice, unless otherwise specified.

The timber shall be in a suitable condition so that the components made of it will neither crack, warp nor twist.

The moisture content of timber assemblies when leaving the manufacturer's works shall be as follows (referred to the overdry weight):

a) 8 to 12 % for interior finish components
b) 10 to 15 % for structural parts in permanent connection with the outside air.

Proof of this moisture content shall be furnished to the Engineer.

Plywood and wood chip boards, all surfaces to the veneered or seal coated shall be adequately closed.

Wooden fiber boards, veneers, coating slabs and coating foils of plastics shall be suitable for their intended applications.

Adhesives (glues) must not cause any discoloration or other damage.

Sealing compounds shall be resistant to atmospheric influences, shall not harden and shall not be aggressive.

Coating materials shall form a good bond with the base. Their surface shall be brushable and insensitive to wiping contact.

All fittings such as hinges, hooks, anchors, locks, handles key plates, keys, etc., shall be submitted to the Engineer in good time for approval.

All coating materials shall form a good bond with the base. Their surface shall be readily brushable and insensitive to wiping contact.

All polish (polishing varnish) shall be fast to light and unsuitable condition so that it provides a surface which is elastic to the greatest possible extent and resistant to scratches, water, acid and heat.

Wood preservatives shall be of an officially approved type. Where subsequent painting of the timber is required, the wood preservative shall be compatible with the paint. In interior applications, the wood preservative shall be odorless.

Treated lumber shall be accompanied by a certificate from a recognized lumber treating company, certifying the amount of treatment and the percentage of moisture after drying.

4.5.4 Plant and Equipment

Plant, equipment, and tools for the execution of timber work, carpentry and joinery shall be sufficient in number and capacity, in good working order, and in accordance with the requirements of the applicable safety regulations.

4.5.5 Construction and Workmanship

If not otherwise shown on the drawings, or directed by the Engineer, DIN 18334 shall be binding for the execution of the works as well as the other DIN Standards as follow:

DIN 1052	Timber Structures
DIN 68365	Timber for Carpenters' Work, Quality Specifications
DIN 4074	Timber for Wood Building Components
DIN 68800	Timber Protection in Building Construction
DIN 17440	Stainless Steels; Quality Specifications
DIN 18202	Dimensional Tolerances in Building Construction,

Timber as specified shall be jointed and erected in accordance with DIN 1052 and the drawings, including the required wind bracing. Posts shall be fixed to the concrete slab by means of bearing plates, straps and angles according to the structural calculations. Only non-rusting steel according to DIN 17440, Material No. 1.4571 shall be used for fixing components.

The Contractor shall supply to the Engineer shop drawings in accordance with the architectural design and Contractor's statical analysis, which are subject to approval before any execution starts.

All structural components shall not warp or crack under any circumstances including stresses due to temperature and humidity that will have to be expected.

All timber connections and miters shall be accurately fitted. The surface exposed to view shall be trimmed, eg by planing and grinding. There shall be no plane cutting marks.

Solid timbers shall be joined in such a way that in the event of variations of air humidity, the wood is free to swell and shrink without affecting the joint.

Framing timbers shall not be butted.

Dovetailing may be used subject to the Engineer's consent.

All edge surfaces of plywood, wood-chipboards and composite slabs exposed to view shall be veneered or provided with banding (insets or strips). On sealed, veneered and coated surfaces joints and irregularities of the base shall not show even after final drying.

All grained veneers shall be protected against tearing. All timbers ultimately in contact with outside air or permanently with particularly humid air or connected to masonry or concrete shall be treated on all sides with suitable wood preservative before being inserted. The manufacturer's instructions have to be observed.

4.5.6 Test and Acceptance

A selection of samples for visual inspection and dimensional checks on material and fittings may be made by the Engineer. Supplier's material and test certificates pertaining to the material to be used shall be supplied to the Engineer by the Contractor.

The Engineer shall have access at all reasonable times to all places where the work is being carried out and shall be provided with all the necessary facilities for inspection during all stages of manufacture or construction.

4.5.7 Measurement and Payment

4.5.7.1 Principles

Generally, the works shall be measured in-situ.

The method of measurement shall be based on the following:

Payment for windows and doors shall either be made by area in m2 or by number for each type and size.

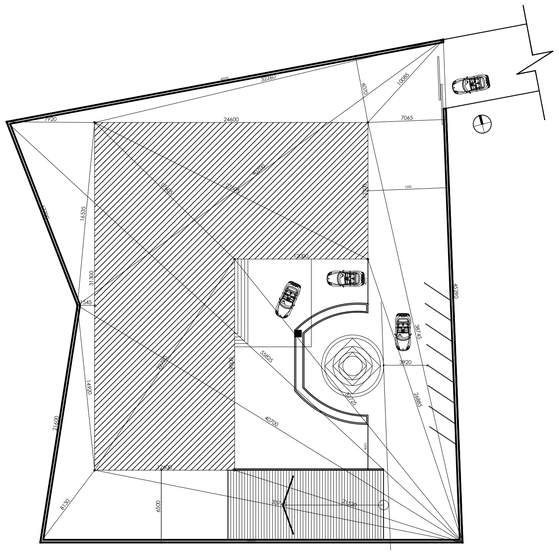
If items scheduled call for measurement by area, architraves linings, sills etc. shall not be measured separately but shall be considered as being included in the area of the opening closed by the window, door, shuttering or any other specified closure.

Wall panels or linings will be paid for by area in m2. The unit rate shall include all substructure, fasteners, doweling etc.

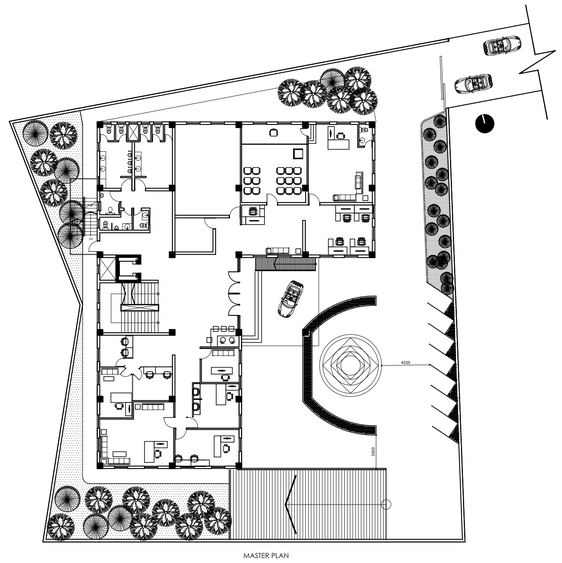
Built-in cupboards, cabinets and wardrobes will be paid for separately according to types and dimensions, by m2 of covered rear wall area.

Surface treatment will be paid separately at the area treated.

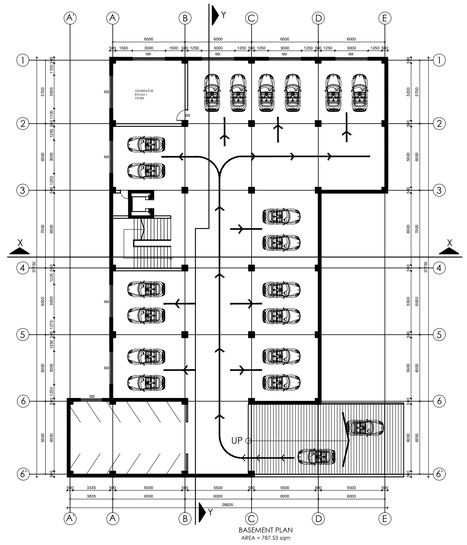
All costs for hardware and iron ironmongery shall be included in the unit rate of the relevant bill item.



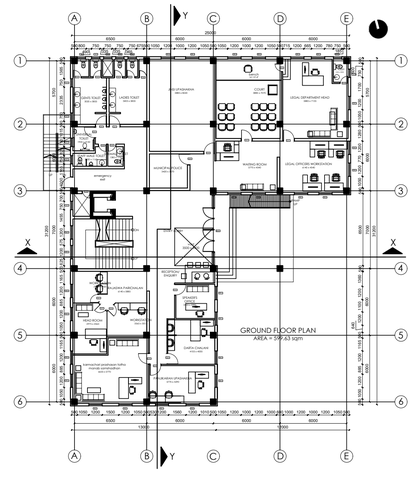
PLINTH LAYOUT PLAN
AREA = 553.40 sqm

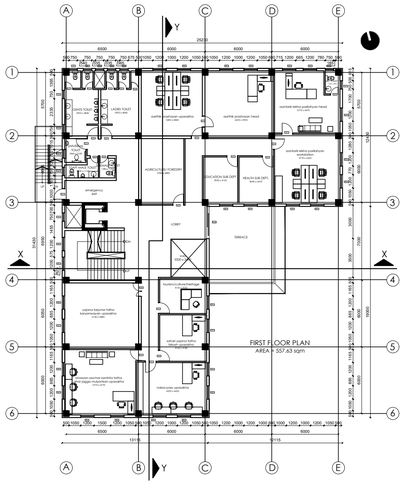


MASTER PLAN

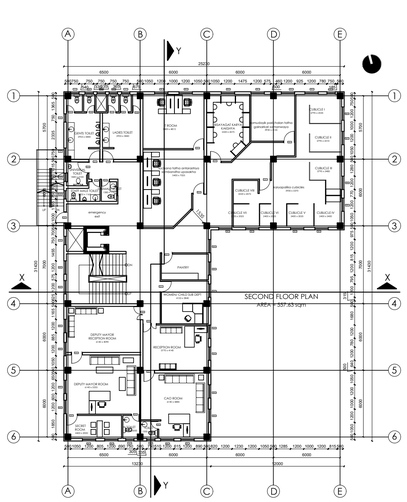


BASEMENT PLAN
AREA = 787.53 sqm

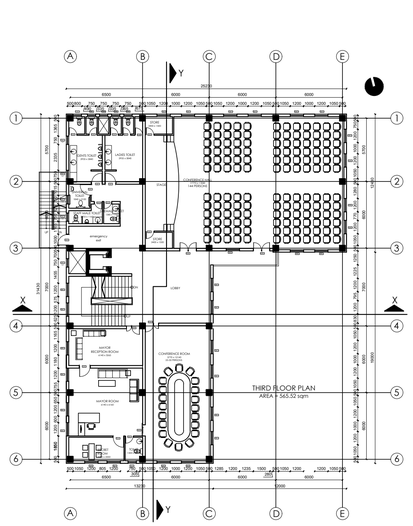




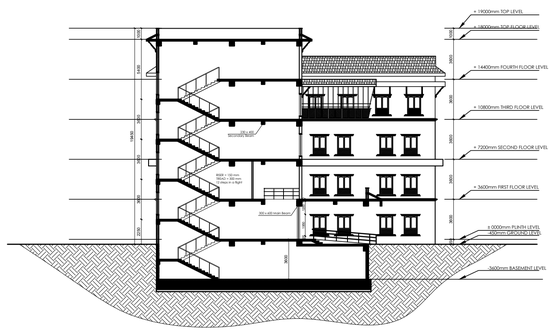
FIRST FLOOR PLAN
AREA = 557.53 sqm



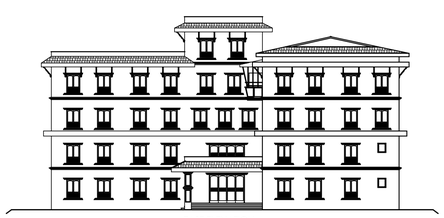
SECOND FLOOR PLAN
AREA = 557.53 sqm



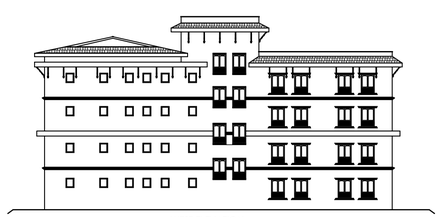
THIRD FLOOR PLAN
AREA = 565.52 sqm



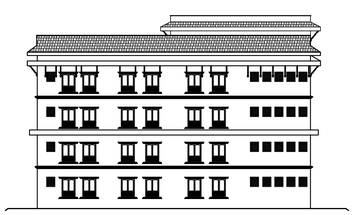
SECTION AT X-X



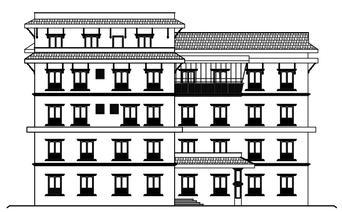
EAST ELEVATION



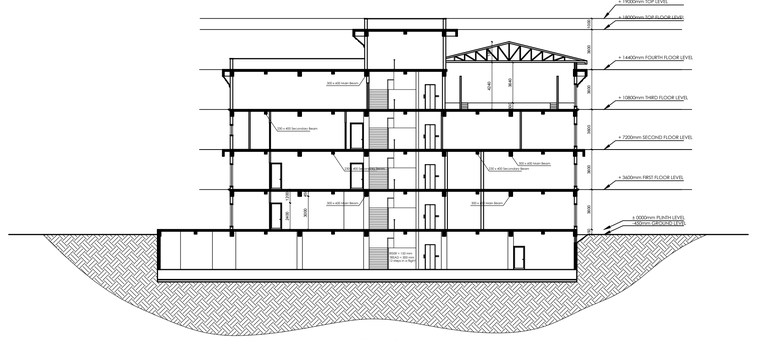
WEST ELEVATION



NORTH ELEVATION



SOUTH ELEVATION



SECTION AT Y-Y

SECTION-VII
Bill of Quantities

Preamble of Bill of Quantities

A. General

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Project Manager and valued at the rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Project Manager may fix within the terms of the Contract.

3. For any item for which measurement is based on records made before or during construction the records shall be prepared and agreed between the Engineer and the Contractor. Should the Contractor carry out such work without the prior agreement of the Engineer, the Engineer may request the Contractor to carry out investigations to confirm the extent of the work and the quantity of work certified for payment shall be solely at the Engineer's discretion. The cost of any such investigation shall be borne by the Contractor.

4. The rates and prices bid in the priced Bill of Quantities shall, except as otherwise provided under the Contract, include all construction equipment, labor, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

5. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

7. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities. The Specification Clause references where given in the item description of the Bills of Quantities are for the convenience of bidders and generally refer to the principal relevant- specification clause but do not necessarily represent the whole of the specification requirements for the work required within the item. The presence of a Specification clause reference shall not in any way reduce the Bidders obligation to complete work in accordance with all the requirements of the Specification.

8. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Project Manager in accordance with the Conditions of Contract.

9. The method of measurement of completed work for payment shall be in accordance with the Specifications.

10. The abbreviations and symbols used in this Bill of Quantities are:

[Insert as applicable]

B. Day work Schedule

a) **General**

1. Work shall not be executed on a day work basis except by written order of the Project Manager. Bidders shall enter basic rates for day work items in the Schedules. These rates shall apply to any quantity of day work ordered by the Project Manager. Nominal quantities have been indicated against each item of day work, and the extended total for day work shall, be carried forward as a Provisional Sum to the Summary Total Bid Amount. Unless otherwise adjusted, payments for day work shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.

b) Day work Labor

1. In calculating payments due to the Contractor for the execution of day works, the hours for labor will be reckoned from the time of arrival of the labor at the job site to execute the particular item of day work to the time of departure from the job site, but excluding meal breaks and rest periods. Only the time of classes of labor directly doing work ordered by the Project Manager and are competent to perform such work will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but not the time of foremen or other supervisory personnel.
2. The Contractor shall be entitled to payment in respect of the total time that labor is employed on day work, calculated at the basis rates entered by it in the " SCHEDULE OF DAY WORK RATES: 1. LABOR". The rates for labor shall be deemed to cover all costs to the Contractor including (but not limited to) i) the amount of wages paid to such labor, transportation time, overtime, subsistence allowances, ii) any sums paid to or on behalf of such labor for social benefits in accordance with Nepal law, iii) Contractor's profit, overheads, superintendence, liabilities and insurance and iv) charges incidental to the foregoing.

c) Day work Equipment

1. The Contractor shall be entitled to payments in respect of Constructional Plant already on site and employed on day work at the basis rental rates entered by him in the “SCHEDULE OF DAY WORK RATES:2 EQUIPMENT ”. The said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricant, and other consumables and all overhead, profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants also shall be included in the rate of the equipment and no separately payment shall be made for it.
2. In calculating the payment due to the Contractor for Constructional Plant employed on day work, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Project Manager, the travelling time from the part of the Site where the Construction Plant was located when ordered by the Project Manager to be employed on day work and the time for return journey there to shall be included for payment.

d) Day work Materials

1. The Contractor shall be entitled to payment in respect of materials used for day work (except for materials for which the cost is included in the percentage addition to labor costs as detailed heretofore), at the rates entered by him in the "SCHEDULE OF DAY WORK RATES: 3 MATERIALS" and shall be deemed to include overhead charges and profit as follows;

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

   (ii) the cost of hauling materials for use on work ordered to be carried out as day work, from the store or stockpile on the Site to the place where it is to be used also shall be include in the same rate.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the SCC should state the manner in which they will be used, and under whose authority (usually the Project Manager's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Employer to select such specialized contractors. To provide an element of competition among the Bidders in respect of any facilities, amenities, attendance, etc., to be provided by the successful Bidder as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Bidder to quote a sum for such amenities, facilities, attendance, etc.

Bill of Quantities

1 Provisional Sum

Procument Item Details

SL. No	Item Description	Unit	Quantity	Unit Rate(NPR)	Amount(NPR)
1	Provide insurance to permanet works and construction equipments and against accidents to work men & Engineers Staffa including third party insurance (conditions of contract clauses 14).	no.	1.0	500000.0	500,000.00
2	Maintain Engineer's Site Office , store ,equipment,with all charges for services,gardening ,temporary and permanent structural or non structural works as directed by Engineer.	no.	1.0	3000000.0	3,000,000.00
3	All requred lab test work for construction materials, steel, sand ,aggregate, bricks ,cube test etc as directed by Engineer	no.	1.0	500000.0	500,000.00

2 Construction work

2.1 Works for complete or part construction and civil engineering work

2.1.1 Building construction work

2.1.1.1 Civil Works

2.1.1.1.1 General Works

Procument Item Details

SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Provide of laptop AMD Ryzen73750H Gigahertz,16GBDDR4 memory, 512GBM.2NVMe piece15.6inch non glare full HD(1920*1080 boasts impressive colour and clarity fast120hz 3-ms energy efficient LED backlight panel,NVIDIA Ge force GTX 1660 TI 6GB GDDR6 VRAM Graphics.4 cell 48Whr,multitouch track pad with intragated buttons.	no.	2.0			
2	Procurement of 220 cc 4 stroke engine wet sump forced cooling system-air cooled with cooler fuel tank 13ltr., ground clearance 169mm ,vehicle kerb weight 156kg,max net power 19.03ps at 8400 rpm,max.torque 17.5nmat 7000rpm,gear pattern 1,down 44p.	no.	1.0			
3	Procurement of 199.19 cc 4 stroke si engine,fan cooled with viscuss paper filter, self /kick 85km/h speed,fuel tank 5.3 litr.rim size 10 inch,tube less type tyre,break size 130mm(CBS), milage 50km/hr.	no.	1.0			
4	Fixing at site a display information bord(1200mm X 1500mm) with project Name clearly written in plain sheet in tubuler pipe frame all complete.	no.	1.0			

2.1.1.2 Civil Works

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	SITE CLEARANCE & MOBILIZATION : Cleaning, levelling and layout of the site all complete as per the specification and instruction of site engineer including cutting grass and removing roots.	Sq.m	898.83			
2	EARTHWORK IN EXCAVATION : Earthwork in excavation of the hard clay using hydraulic excavator (0.8 cu. m capacity) all complete as per the specification and instruction of site engineer.	Cu.m	4770.74			
3	EARTH BACK FILLING : 'Earth back filling in foundation trenches & floor in 150 mm thick layers with sprinkling water, ramming & consolidating (using the soil received from the same site) including the transportation upto 10m all complete as per the specification and instruction of site engineer.	Cu.m	1790.2			
4	STONE SOLING : Stone soling in the building foundation trenches, floors and the ramps using the block stone and bond stone including the levelling and transportation charge upto 30 m all complete as per the specification and instruction of site engineer.	Cu.m	543.38			
5	BRICK SOLING : Flat brick soling in septic tank and manhole including the packing of the joint with sand along with the proper compaction and dressing of base up to the approved levels all complete as per the specification and instruction of site engineer.	Sq.m	22.39			
6	BRICK BATTING : Brick bat packing work in septic tank and recharge pit by broken bricks of size 15mm to 150mm all complete as per the specification and instruction of site engineer. (Remark: Per m3 630 nos. of bricks but with 30% void considered)	Cu.m	20.85			
7	LAYING POLYTHENE SHEET : Providing and laying of one layer of 500 SWG polythene sheet above the stone soling in the building foundation and ramp all complete as per the specification and instruction of site engineer.	Sq.m	968.41			
8	P.C.C (1:3:6) WORKS : M10(1:3:6) PCC work in the building foundation, floor base and foundation including haulage, supply of materials, fixing the form works, supply of required labours all complete as per drawing, Specification and instruction of technical site representative.	C u.m	88.52			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
9	P.C.C (1:2:4) WORKS : PCC (1:2:4) M15 Works in ramp, septic tank, and man hole base including haulage, supply of materials, fixing the form works, supply of required labours all complete as per drawing, specification and instruction of technical site representative.	Cu.m	16.17			
10	(1:1.5:3) P.C.C. FOR R.C.C. WORKS : PCC (1:1.5:3) M20 Works in septic tank, recharge pit and compound wall including haulage, supply of materials, fixing the form works, supply of required labours all complete as per drawing, Specification and instruction of technical site representative.	Cu.m	26.62			
11	(1:1:2) P.C.C. FOR R.C.C. WORKS : PCC (1:1:2) M25 Works in super-structure with micro silica or plastisizer including haulage, supply of materials, fixing the form works, supply of required labours all complete as per drawing, Specification and instruction of technical site representative.	Cu.m	1834.53			
12	STEEL REINFORCEMENT : Fixing Torsteel/TMT Reinforcement Grade-1 (Fe 500) conforming to I.S. 1786-1985 in R.C.C. work including cleaning, cutting, bending, placing in position on the basis of drawings, specifications, etc. Approved and tested Brands.	Mt.	284.33			
13	FORM WORKS : Supplying and laying centering, shuttering of various pattern formworks with 19/12 mm thick water proof ply wood & steel adjustable props for all kinds of RCC works for foundations, columns, shear walls, beams, slab, staircase, lintel, sill, pergola, including nails, propping scaffolding, staging, supporting and bracing in proper lines and level, sealing the joints with heavy duty brown self adhesive tape, aligning to line and levels including Ties, PVC Spacer, Providing openings/ cutouts/ pockets, applying De-shuttering chemical, De-shuttering as approved by the Engineer etc., complete at all levels as per drawing, specifications and instructions of the Engineer. Beam	Sq.m	1931.62			
14	Slab	Sq.m	3219.05			
15	Column, Raft, Shear Wall	Sq.m	2083.8			
16	Horizontal Band	Sq.m	435.47			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
17	BRICK MASONRY WORKS (1 : 6 c/s) : Providing and laying first class chimney fired brick of one or more brick thick wall in cement mortar 1:6 (1 cement : 6 coarse sand) in foundation up to plinth, superstructure and other specified places in all heights and level including the cost of single or multi stage scaffolding, soaking bricks, curing, raking joints, provision for recesses, openings, toothing etc., all complete as per drawing, specifications and instructions of the Engineer.	Cu.m	260.44			
18	HALF BRICK WORKS (1 : 4 c/s) : Providing and laying first class chimney fired brick of half brick thick wall in cement mortar 1:4 (1 cement : 4 coarse sand) in superstructure and other specified places in all heights and level including the cost of single or multi stage scaffolding, soaking bricks, curing, raking joints, provision for recesses, openings, toothing etc., all complete as per drawing, specifications and instructions of the engineer.	Cu.m	142.31			
19	DAACHI APPA WORK : Providing and laying traditional brick (small dachi appa) work in (1:1:2) lime, surkhi, and mortar all complete as per drawing, Specification and instruction of technical site representative.	Cu.m	1314.54			
20	BRICK MASONRY WORKS RAT TRAP BOND : Providing and laying first class chimney fired brick of half brick or more thick wall in cement mortar 1:6 (1 cement : 6 coarse sand) in rat trap bond including transportation distance upto 30m all complete as per drawing, Specification and instruction of technical site representative.	Cu.m	10.1			
21	DOOR FRAME WORKS : Providing and fixing of wooden sculptured door frame made of Saal wood all complete as per drawing, specification and instruction of technical site representative.	Cu.m	0.26			
22	DOOR SHUTTER WORKS : Providing and fixing of wooden sculptured door shutter made of Saal wood all complete as per drawing, specification and instruction of technical site representative.	Sq.m	24.84			
23	DOOR WORKS : Supply and fixing UPVC single door with full pannel (frame 60x60mm sash 60x100mm white colour with panel) all complete as per drawing, specification and instruction of technical site representative.	Sq.m	182.28			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
24	WINDOWS AAKHIJYAL WORKS : Providing and fixing of wooden sculptured aakhijyal made of saal wood all complete as per drawing, specification and instruction of technical site representative.	Sq.m	117.91			
25	WOODEN WINDOWS FRAME WORKS : Providing and fixing of wooden window frame made of saal wood all complete as per drawing, specification and instruction of technical site representative.	Cu.m	5.81			
26	WOODEN WINDOWS SHUTTER WORKS : Providing and fixing of wooden window made of saal wood with 38 mm x 75 mm frame including 5 mm thick glass all complete as per drawing, specification and instruction of technical site representative..	Sq.m	177.14			
27	WINDOWS & VENTILATION WORKS : UPVC sliding window with net (frame 50x80mm sash 58x36mm white colour with 5mm glass) all complete as per drawing, specification and instruction of technical site representative.	Sq.m	14.4			
28	NAS CARVING WORKS : Carved Nas 3" thick works below sun shade at 4th floor and projected window all complete as per drawing, specification and instruction of technical site representative.	R.m	195.61			
29	CEMENT SCREEDING : 38 mm thick plain cement screeding work in 1:2:4 with cement, sand and crushed aggregate including mixing, laying, compacting and wetting all complete in perfect line and level as per drawings, specifications and instruction of site engineer.	Sq.m	2216.84			
30	PUNNING WORK : 3mm Punning work in cement mortar (1:1) on floor, wall and in skirting as per specification and as directed by engineer.	Sq.m	2237.42			
31	NEAT CEMENT SKIRTING WORK : Supplying and laying 12mm thick 100mm high cement skirting in 1:4 Cement Sand mortar plaster all complete in perfect line and level as per drawings, specifications and instruction of site engineer.	R.m	1105.36			
32	MARBLE SKIRTING WORK : Supplying and fixing 16mm good quality of marble in 12.5mm thick cement sand mortar in 1:3 ratio with approved color on skirting all complete as per drawings, specification and as directed by site engineer.	Sq.m	25.38			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
33	TILE SKIRTING WORK : Supplying and laying of non glazed tile on floors in 12 mm thick cement sand mortar of (1:6) ratio with approved colour and height of 100mm as skirting all complete as per drawings, specification and as directed by site engineer.	R.m	539.5			
34	MARBLE WORK : Supplying and Fixing 16mm Good Quality of Marble in 20mm thick cement sand mortar in 1:2 ratio with approved colour on floor and wall including polishing all complete as per drawings, specifications and instruction of site engineer.	Sq.m	417.24			
35	NON-GLAZED FLOOR TILE WORK : Supplying and laying of non glazed tile on floors in cement sand mortar (1:4) ratio with approved colour on floors all complete as per drawings, specification and as directed by site engineer.	Sq.m	590.55			
36	CORNIC WORK : 20mm thick cornic at floor level all complete as per drawings, specification and as directed by site engineer.	R.m	280.3			
37	PLASTER ON INNER WALL (1:4): 12.5mm thick cement sand plaster in 1:4 c/s in required line and perfect smooth level on walls of building and septic tank ,including necessary scaffolding and proper curing for 15 days all complete as per drawings, specification and as directed by site engineer.	Sq.m	10141.44			
38	PLASTER ON CEILING (1:4) : 12.5mm thick cement sand plaster in 1:4 c/s in required line and perfect smooth level on ceiling of building and septic tank,including necessary scaffolding and proper curing for 15 days all complete as per drawings, specification and as directed by site engineer.	Sq.m	3457.88			
39	20MM THICK PLASTER : 20 mm thick cement sand plaster in 1: 4 c/s in wall, floors etc. in line, level, plumb and smoothen surface including ranking the joints, cleaning, wetting, curing and scaffolding etc in building and man hole all complete as per drawings, specification and as directed by site engineer.	Sq.m	721.43			
40	INTERIOR PAINT WORK : Supplying and applying of 2mm thick plain white wall putty on internal surface of the building of approved quality and colour over porperly cleaned surface and all complete as per specification and instruction of site engineer.	Sq.m	12619.51			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
41	INTERIOR PAINT WORK : Providing and applying two coats of plastic emulsion paint of approved manufacturer and shade over a coat of alkali resistant cement primer of approved manufacturer as per manufacturer's specifications to the surface of wall, ceiling, beams columns, canopies, staircase, lobbies etc., all complete as per drawings, specifications and instruction. The rates shall include for scraping, washing the surface with water, surface preparation, scaffolding etc., all complete as per the manufacturer's recommendations and as approved by the engineer.	Sq.m	12619.51			
42	IRON PAINT WORK : Supplying & painting work of two coats enamel paint after one coat primer for main entrance iron gate all complete as per drawings, specification and as directed by site engineer.	Sq.m	22.32			
43	WOOD PAINT WORK : Three coats spirit Chappra paint with one coat primer for main door/window and other specified wood works all complete as per drawings, specification and as directed by site engineer.	Sq.m	334.56			
44	EXTERIOR WEATHER COAT PAINT WORK : Providing and applying two or more coats of first quality hundred percent acrylic paint of approved shade and pattern to the exterior walls of buildings etc., The rates shall include for scrapping , washing the surface with water, applying a coat of approved quality water base cement primer, surface preparation, scaffolding etc., all complete as per the manufacturer's recommendations and as approved by the engineer.	Sq.m	1208.47			
45	DACHHI APPA PAINT WORK : Exterior duraseal paint (Thinner base) on Dachhi appa works all complete as per drawings, specification and as directed by site engineer.preparation, scaffolding etc., all complete as per the manufacturer's recommendations and as approved by the engineer.	Sq.m	1314.54			
46	GLAZED PORCELINE CLAY TILES : Supplying and laying of glazed porceline clay tiles on walls of toilet and bath room in cement sand motar (1:4) ratio with approved colour on wall all complete as per drawings, specification and as directed by site engineer.	Sq.m	893.39			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
47	NEW JHINGATI : Providing and fixing of new jhingati (8-3/4"*4") laying on roof with 3" clay all complete as per drawings, specification and as directed by site engineer.	Sq.m	490.35			
48	TRUSS WORK : Fabricating and providing structural steel components/elements of truss including nut bolt, gusset plate, shop drawings, facilities for inspection & testing and trial assembling all complete as per drawings, specification and as directed by site engineer.	Mt.	6.65			
49	RAILING WORK : 50 mm dia SS stair hand rail, 50mm dia 1 mtr ht. vertical stainless steel pipe placed at 2 mtr c/c , 25 mm dia 3 layer horizontal steel pipe placed between vertical pipe for Stair case Railing as per specification and instruction of site engineer all complete.	R.m	47.48			
50	MAIN ENTRANCE IRON GATE WORKS : Supplying and fitting of Iron Gate (16 guage 50x50x5 mm frame) including two coats of enamel paint over a coat of red oxide primer at the main entry as per drawing,specification and approval of engineer all complete.	Sq.m	22.32			
51	FIRE EXIT STEEL STAIRCASE : M.S. Fire escape saircase with I.S. or B.S. section including jointing, fixing, erection and primer painting with all necessary M.S. bed plates, shoe angles anchor bolts leas sheeting or cement grouting as per drawing and instructions, all complete .	Mt.	6.0			
52	ROOFING SHEET WORKS : Providing and fixing of UPVC sheet with PMMA coating and mesh (REGULAR) at roof as per specification.	Sq.m	361.7			
53	RIDGE COVER WORKS : Providing and fixing of ridge cover UPVC PMMA (3mm thick) regular at roof as per specification.	R.m	53.79			
54	FALSE CEILING WORK : Supplying and fixing modular ceiling and all work complete as per instruction of site engineer.	Sq.m	364.33			
55	PARTITION WALL WORK : Dry wall partition with metal stud : Providing fitting, fixing G.I. under frame, using GYPSTEEL branded channel fixing 12.5mm thick Gypboard or boral plater board on both side, finishing of joints with compound & tape all complete overall thickness 75mm.	Sq.m	122.12			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
56	FLORA FOUNTAIN WORK : Supply and construction of flora fountains incuding wall putty and emulsion painting all complete as per drawings, specification and as directed by site engineer.	Job	1.0			
2.1.1.3 Electrical Works						
Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Main Pannel Board and Accessories: (For 100*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 80 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 80 ampere in each three phases ,.i.e total of 240 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
2	100 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv) for main Main incomming. [For supplying power to Main Panel Boards Bus Bars]	set	1.0			
3	60 ampere TP MCCB ? 16kA	set	6.0			
4	32 Amp DP MCB	no.	12.0			
5	16 Amp DP MCB	no.	9.0			
6	20 Amp DP MCB	no.	6.0			
7	10 Amp SP MCB,	no.	6.0			
8	6 Amp SP MCB,	no.	6.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
9	40 Amp DP MCB	no.	1.0			
10	UPS Distribution Board : (UPS DB1) Supply, installation, testing and commissioning of 24 way Distribution Board (DB) with suitable color, double cover, push type switch, appropriate standard size . (ankur metal or equiv.) and installation of following accessories in this DB	set	1.0			
11	25 Amp DP MCB, for UPS main output.	no.	1.0			
12	10 Amp DP MCB, UPS Power Supply for Double Power Socket	no.	7.0			
13	6 Amp SP MCB, UPS Power Supply for light load and CCTV Power Supply	no.	8.0			
14	Sub Pannel Board 1 and Accessories: (For 60*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
15	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
16	32 Amp DP MCB	no.	12.0			
17	16 Amp DP MCB	no.	9.0			
18	20 Amp DP MCB	no.	6.0			
19	10 Amp SP MCB,	no.	6.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
20	6 Amp SP MCB,	no.	6.0			
21	40 Amp DP MCB	no.	1.0			
22	32 ampere TP MCCB ? 16kA	set	1.0			
23	40 ampere TP MCCB ? 16kA	set	1.0			
24	60 ampere TP MCCB ? 16kA	set	1.0			
25	UPS Distribution Board : (UPS DB 2) Supply, installation, testing and commissioning of 24 way Distribution Board (DB) with suitable color, double cover, push type switch, appropriate standard size . (ankur metal or equiv.) and installation of following accessories in this DB25 Amp DP MCB, for UPS main output.	no.	1.0			
26	10 Amp DP MCB, UPS Power Supply for Double Power Socket	no.	7.0			
27	6 Amp SP MCB, UPS Power Supply for light load and CCTV Power Supply	no.	8.0			
28	Sub Pannel Board 2 and Accessories: (For 60*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
29	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
30	32 Amp DP MCB	no.	12.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
31	16 Amp DP MCB	no.	9.0			
32	20 Amp DP MCB	no.	6.0			
33	10 Amp SP MCB,	no.	6.0			
34	6 Amp SP MCB,	no.	6.0			
35	40 Amp DP MCB	no.	1.0			
36	32 ampere TP MCCB ? 16kA	set	1.0			
37	40 ampere TP MCCB ? 16kA	set	1.0			
38	60 ampere TP MCCB ? 16kA	set	1.0			
39	UPS Distribution Board : (UPS DB 3) Supply, installation, testing and commissioning of 24 way Distribution Board (DB) with suitable color, double cover, push type switch, appropriate standard size . (ankur metal or equiv.) and installation of following accessories in this DB 25 Amp DP MCB, for UPS main output.	no.	1.0			
40	10 Amp DP MCB, UPS Power Supply for Double Power Socket	no.	7.0			
41	6 Amp SP MCB, UPS Power Supply for light load and CCTV Power Supply	no.	8.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
42	Sub Pannel Board 3 and Accessories: (For 60*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
43	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
44	32 Amp DP MCB	no.	12.0			
45	16 Amp DP MCB	no.	9.0			
46	20 Amp DP MCB	no.	6.0			
47	10 Amp SP MCB,	no.	6.0			
48	6 Amp SP MCB,	no.	6.0			
49	40 Amp DP MCB	no.	1.0			
50	32 ampere TP MCCB ? 16kA	set	1.0			
51	40 ampere TP MCCB ? 16kA	set	1.0			
52	60 ampere TP MCCB ? 16kA	set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
53	Sub Pannel Board 4 and Accessories: (For 60*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
54	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
55	32 Amp DP MCB	no.	12.0			
56	16 Amp DP MCB	no.	9.0			
57	20 Amp DP MCB	no.	6.0			
58	10 Amp SP MCB,	no.	6.0			
59	6 Amp SP MCB,	no.	6.0			
60	40 Amp DP MCB	no.	1.0			
61	32 ampere TP MCCB ? 16kA	set	1.0			
62	40 ampere TP MCCB ? 16kA	set	1.0			
63	60 ampere TP MCCB ? 16kA	set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
64	Sub Pannel Board 5 and Accessories: (For 60*3 Ampere Load at nearly 100% Load) Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
65	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
66	32 Amp DP MCB	no.	12.0			
67	16 Amp DP MCB	no.	9.0			
68	20 Amp DP MCB	no.	6.0			
69	10 Amp SP MCB,	no.	6.0			
70	6 Amp SP MCB,	no.	6.0			
71	40 Amp DP MCB	no.	1.0			
72	32 ampere TP MCCB ? 16kA	set	1.0			
73	40 ampere TP MCCB ? 16kA	set	1.0			
74	60 ampere TP MCCB ? 16kA	set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
75	Sub Pannel Board 6 and Accessories: (For 60*3 Ampere Load at nearly 100% Load)Supply, installation, testing and commissioning of Panel Board of around 60 Amp in each three phases of Panel Board (Panel Board accessories like bus bar and others must be such that it should able to flow current of 60 ampere in each three phases ,.i.e total of 180 ampere current through all three phases) with suitable color, floor mounted double cover, push type switch, appropriate standard size with bus bars Red, Yellow,Blue, Neutral, Ground (R,Y,B, N,G), voltmeter, ammeter, three lamps, CT , PT etc. (ankur metal or equiv.) and installation of required accessories like MCCB's and MCB's, Cable Shoes of appropriate sizes and other necessaries as per instruction on site and supply and installation of following accessories in this panel board. [Panel Board must be of modern type with door locking facility of high strength metal with all modern features]	set	1.0			
76	60 ampere TP MCCB ? 25kA (Brand: Siemens/Legrand or eqv)	set	1.0			
77	32 Amp DP MCB	no.	12.0			
78	16 Amp DP MCB	no.	9.0			
79	20 Amp DP MCB	no.	6.0			
80	10 Amp SP MCB,	no.	6.0			
81	6 Amp SP MCB,	no.	6.0			
82	40 Amp DP MCB	no.	1.0			
83	32 ampere TP MCCB ? 16kA	set	1.0			
84	40 ampere TP MCCB ? 16kA	set	1.0			
85	60 ampere TP MCCB ? 16kA	set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
86	Transformer (? 70KVA) , High Strength Metallic H - Pole or RCC house for transformer installation, L. A, DOB Fuses , TOD meter, metering unit, C.T and P.TSupply , testing and Installation of Pure Copper coil containing Transformer 3 Phase 4 Wire System of Size ?70 KVA with full of all acessories like transformer oil etc. It must be fitted with proper size of Lightening Arrestor on H-Type Pole or Better. Also Supply,testing and Installation of 1 no's H- Type or better type Metal/Steel Pole (to withstand the weight of this transformer) or RCC column and beam composition house of appropriate dimensions to install transformer on it's top , 3 no's Lightening Arrestors, 3 no.s' Transformer attached arrestors (Horn Gap/ Rod Gap Arrestor or appropriate) , 3 no's DOB Fuses. , 1 number of TOD meter,metering unit of appropriate type to be placed either in HT side or LT side of transformer, 1 set of Current Transformer (C.T), 1 set of Potential Transformer (P.T) which will be purchased as allowed by Nepal Electricity Authority (Preferably HT side TOD meter) etc. Transformers must be fitted on H-Type Metal or better pole or RCC column and Beam with Brick house. [Transformer Must be ISO Certified]	Set	1.0			
87	Main MCCB's / ACB Supply, installation, testing and commissioning of 100Amp TP MCCB ? 100kA (Adjustable) or ACB; (Brand: Siemens/Legrand or eqv) for main Main incomming. (MCCB must have feature to adjustable FOR SUPPLYING FULL LOAD current of 30 kva transformer) [For supplying power to Main Switch coming from Transformer]	Set	1.0			
88	Main SwitchSupply, installation, testing and commissioning of Main Switch 100 Amp three phase such that it should able to flow current of 150 ampere in each three phases ,.i.e total of 450 ampere current through all three phases with 4 pole.ISO Brand or Equivalent	Set	1.0			
89	Change Over SwitchSupply, installation, testing and commissioning of 3 ways input and 1 way output three phase 4 pole 100 A, 415 V Change Over Switch. Brand: Legrand or similar type ISO Equivalent.Also Supply and installation of appropriate Cable shoes required for connecting change over switch with generators, Main panel board and sub Panel boards.	Set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
90	EarthingSupply , testing and Installation of separate Earthing System and materials like Pure copper plate , Copper Pipe, SWG Cables, Charcoal, salts. etc for connecting Earthing Plate from Generators (total earthing = 2*1=2 ; 1 for Neutral Earthing ; 1 for Body Earthing), Transformers (total earthing = 1*2=2 ; 1 for Neutral Earthing ; 1 for Body Earthing), L. A of transformers (total earthing = 1*3=3 ; 1 for Each of three Phases R,Y,B) Main Panel Board and it's associated DB Earthing (Total number = 1), On line 3 phase ups output neutral point earthing (Total number = 1). The Earthing Plate Size for each must be seperate and SWG wire size to be used must be such that it is able to flow the fault current to the ground so as to have very less resistance value between earthing plate and point of earthing of associated devices. Earthing must be done under the supervision of site engineer with resistance test . The Copper Plate must be Standard Size acccording to International Standard .	Set	7.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
91	Cables , Cassing Capping (Listi), Cable Shoes ,conduit pipe and misc. Supply , testing and Installation of different types of Armored, unarmored Cables, ABC Cables, normal cables, PVC Cables etc. as required on site with , conduit Pipes , Cable Shoes, Cable Connectors, . etc and all necessary equipments. The Cable Lenghth will be as required for the whole area from Transformer /Generator to Changeover switch, Main panel board , Sub panel Board , Steel Tower, Metal Truss. etc as per required on site. The cable size may be 3.5 Core and 4 core ,XLPE cables, etc. 1100 Volt Pure copper Cables of 1.5 mm2 to 1000 mm2. and Single core of 400V Pure copper Cables of 1 mm2 to 77.2 mm2. The power Cables must be run through underground with water leakage protection scheme and concealed as well as Cassing capping as site conditions.Cables must be ISO Certified. .Also Supply , testing and Installation of different types of Cassing Capping , Cable Shoes as required on site [1 set = total required on site] [Work must be complete with complete neat and clean finishing] [Cable must be layed underground, through wall .etc with protective measures of cables from moisture and external environment or as per site requirement and way of laying cables and cables sizes must be of current rating 15 to 20 % greater than current rating of MCCB's and MCB's used since the lenght of cables in stadium goes too long and some power loss takes place in the cables.] Use one way different Gang Switches as well as regulators for lights anf fans as per drawings,	Set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
92	Stainless Steel GEWISS Cable Tray or better With Cover and accessories of BRN range ; and Stainless Steel Cable RaceWays, Cable ties, and Different gang different ways switchboards and fan regulators .Supply , testing and Installation of size 515*80 mm2 or greater better hot deep galvanised steel cable trays MV 40 175 or betteer PVC Pipes or as required on site conditions and cable Raceways of size as per required on site . Size of Cable Trays and Cable Raceways can vary as required on site conditions and as per instructed by site engineer with , Pipes , Cable Shoes, Cable Connectors . etc and all necessary equipments. (Legrand or equivalent or better) . Must be ISO Certified. [1 set = total required on site]. Complete chieseling and plastering works of the building structure must be done along with the supply and installation of cable raceways and cable trays, cable ties , cable shoes.etc . Also supply different gangs different ways switchboards along with switches (10 gang 1 way, 6 gang 1 way , 5 gang 5 way, etc as per requirement switchboards) and ceiling fan regulators of heavy size. Switch board and fan regulators must be ISO certified brand (Legrand or equivalent)	Set	1.0			
93	Normal Light Fixtures, Light Steel Towers and Fan:Supply, installation, testing and commissioning of light fixture with 2x40 W FTL/LED Mirror Optic set Fitting light including tube, holder, box, hanging metal chain if required on site etc.	No	190.0			
94	Supply, installation, testing and commissioning of light fixture with False Ceiling as well as surface light Rectangular 1x18 W LED set Fitting light including box, hanging metal required on site etc.	No	60.0			
95	Supply, installation, testing and commissioning of light fixture with False Ceiling as well as surface light Rectangular 1x18 W LED set Fitting light including box, hanging metal required on site etc.	No	100.0			
96	Supply, installation, testing and commissioning of light fixture with 1x9 W LED BULB set Fitting light including tube, holder, box, hanging metal chain if required on site etc.	No	55.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
97	LED Flood Light Supply , testing and Installation of Flood Light as following: Supply , testing and Installation of single phase LED Flood Light 150 Watt ,Water Proof and Water Resistant as following: (Features: must have acessories like capacitors , ballasts, mounting rods, fixtures, not bolts and other required necssary equipments attached (or built in) Flood Light must be able to operate in the open environment (rain , sun, wind.etc) and there must be proper casing so as to get protection form external environment conditions.)	Set	6.0			
98	Installation and Fixing of appropriate size of Steel Towers of height ? 10 meter (or as necessary on site conditions) with all works complete that includes RCC fixing of towers footing at proper depth so as to withstand the weight of tower itself and Flood light to be fitted at it's top with all the necessary angle rod at proper angle .Steel Towers must be painted with colour .	Set	3.0			
99	Supply, installation, testing and commissioning of 48" or higher Ceiling Fan/ Wall Fan [for open/no ceilling space] including regulator & switches, hanging rod and all necessary accessories as required on site. [Connect with City Line supply] Use ISI marked [Brand: Almonard, Polard, Power Pack or ISI equivalent]. Also supply hanging metallic rod of size 0.5 meter to 4 meteres or more as required on site .	set	40.0			
100	Supply, installation, testing and commissioning of Exhaust Fan & switches, supporting rod and all necessary accessories as required on site. [Connect with City Line supply]	set	5.0			
101	Power SocketSupply, installation, testing and commissioning of 13A/15A, 250 V, 50 Hz, Two gang Double Power Switched Sockets with PVC Box & all necessary materials. [For supplying UPS1 DB output]	set	120.0			
102	Supply, installation, testing and commissioning of 13A/15A, 250 V, 50 Hz, Universal (Direct) Power Switched Sockets with PVC Box & all necessary materials.	set	150.0			
103	Supply, installation, testing and commissioning of 19A/20A, 250 V, 50 Hz, AC Power Switched Sockets with PVC Box & all necessary materials.	set	12.0			
104	Supply, installation, testing and commissioning of 30/32A, 250 V, 50 Hz, 3 pin Industrial Power female Sockets with PVC Box & all necessary materials.	set	6.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
105	Supply, installation, testing and commissioning of 30/32A, 250 V, 50 Hz, 3 pin Industrial Power TOP male with PVC Box & all necessary materials.	set	6.0			
106	Telephone Point Wiring:Supply, laying, testing and commissioning of 2 pair PVC insulated Cu. telephone wire materials and concealed/listic wiring from Battery and UPS room to different room so as to attach with RJ11 socket box as per the drawings, site conditions, specifications and instruction all complete. clamping and fixing of CAT6 cable with RJ45 jack at the cable ends + Labelling with sticker at both ends + Testing cable at the both ends.	pt.	120.0			
107	Supply, laying, testing and commissioning of One 60 pair Telephone Junction Box (TJB) which must be with type RJ11 inlet and outlet points inside the Backups room as per the drawings, site conditions, specifications and instruction all complete.	set	2.0			
108	Supply, installation, testing and commissioning of Telephone Socket Single (RJ-11) with PVC Surface Box face plate	pt.	120.0			
109	Supply, laying, testing and commissioning of Telephone Set (ISO Brand or equivalent)	set	20.0			
110	Computer Network:Supply, laying, testing and commissioning of Computer point wiring with 4 pair cat-6 computer network cable with connection of RJ 45 socket box and face plate + clamping and fixing of CAT6 cable with RJ45 jack at the cable ends + Labelling with sticker at both ends + Testing with network cable tester at both ends. Use the CAT6 cable through separate casing capping double lock listic with appropriate dimenstion from Router/Switch (Battery and UPS Room) to points as shown in a diagram. (make: D-link, Digicom. or equv.)	pt.	60.0			
111	Supply CAT6 Cable of at least 2.5 meter both ends connected with RJ45 Jack in a straight through arrangement.	set	60.0			
112	Supply and Installation of Network Rack of dimensions 3 feet* 2 feet*2 feet that must have at least three divisions.	set	3.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
113	Supply, installation, testing and commissioning of heat pump split type Ceiling Cassette type Air Conditioner system complete with fully charged refrigerent inclusive of entire interconnecting insulated refrigerant pipes, insulated drain pipes, insulated fresh air supply pipe, power switches and control cables, indiviudal remote controller and supports made of MS angle/rods as per specifications and drawings of greater than or equal to 24000 BTU/hr capacity (2.0 TON) including both cooling and heating cacapity. Featues: Rotary type Compressor, less than 48 DB noise level, minimum 4 mode (cool,fan,heat, dry,auto), should have two years free services with parts replacement warranty by AC suppliers and provide warranty card to branch office after installation. . (Bypass generator supply).etc and all necessary equipments as required on site. Must be ISO certified company.	set	12.0			
114	Supply, installation, testing and commissioning of heat pump split type Ceiling Cassette type Air Conditioner system complete with fully charged refrigerent inclusive of entire interconnecting insulated refrigerant pipes, insulated drain pipes, insulated fresh air supply pipe, power switches and control cables, indiviudal remote controller and supports made of MS angle/rods as per specifications and drawings of greater than or equal to 18000 BTU/hr capacity (1.5 TON) including both cooling and heating cacapity. Featues: Rotary type Compressor, less than 48 DB noise level, minimum 4 mode (cool,fan,heat, dry,auto), should have two years free services with parts replacement warranty by AC suppliers and provide warranty card to branch office after installation. . (Bypass generator supply).etc and all necessary equipments as required on site. Must be ISO certified company.	set	3.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
115	Supply, installation, testing and commissioning of heat pump split type Ceiling Cassette type Air Conditioner system complete with fully charged refrigerent inclusive of entire interconnecting insulated refrigerant pipes, insulated drain pipes, insulated fresh air supply pipe, power switches and control cables, indiviudal remote controller and supports made of MS angle/rods as per specifications and drawings of greater than or equal to 12000 BTU/hr capacity (1.0 TON) including both cooling and heating cacapity. Featues: Rotary type Compressor, less than 48 DB noise level, minimum 4 mode (cool,fan,heat, dry,auto), should have two years free services with parts replacement warranty by AC suppliers and provide warranty card to branch office after installation. . (Bypass generator supply).etc and all necessary equipments as required on site. Must be ISO certified company.	set	2.0			
116	Router and SwitchSupply and installation of C881-K9 or any equivalent Router in a Panel Board Room in a Network Rack with at least 1 years warranty	set	1.0			
117	Supply and installation of Network Switch 24 port (in a Panel Board Room in a Network Rack with at least 1 years warranty	set	3.0			
118	Supply of UPS and Batteries Metallic RackSupply, Laying, testing, installation and commissioning of Metallic Rack of 2 steps so as to able to handle the weight of 8 set of Tubular Lead Acid batteries of 150Ah,12Volt. The Gap between the Steps of metallic Rack must be of at least 2 feet and 5 inches .Size of Metallic rack is 5 feet height and length at least 5 feet. and width at least 2.25 feet or the size can be as supervised by site incharge.	set	3.0			
119	Supply, Laying, testing, installation and commissioning of Metallic Rack of 1step as to able to handle the weight of 1 set of 3.5KVA UPS .Size of Metallic rack is 3 feet height and length at least 3 feet.and width at least 2.25 feet.or the size can be as supervised by site incharge.	set	3.0			
120	UPS, Batteries Supply and Installation Works Supply, Laying ,testing, installation and commissioning of ? 3.5 KVA Offline Ups (Transformer based) with 48 voltage dc System with at least 2 years warranty as shown places in a diagram (Brand IS Equivalent)as supervised by site incharge.	set	3.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
121	Supply , installation and testing of 12 volt dc Lead Acid batteries [Brand : Exide or equivalent] 150Ah Tubular type with appropriate size of dc cable shoe tied at both ends in the combination	set	12.0			
122	EPABX System (8-48 LINE)Supply, laying, installation, testing and commissioning of 8- 48 Line EPABX with 1 set of master telephone set of corresponding brand Panasonic, creative, Matrix or equivalent [Note: EPABX must be of such type that a receptioist person must be able to acess and by pass the incoming phone call to the extension number as per required on site conditions from any point far from the EPABX set.]	set	1.0			
123	Fire ExtinguisherSupply, laying, testing and commissioning of Portable Fire Extinguisher Class C Extinguishers (suitable for use on electrically energized fires. Each cylinder containing Class C extinguisher components weight must be of ?25 lbs and stand in height about ? 3 feet. [Install 2 in each floor]	set	10.0			
124	1 phase 2 hp Motor for pumping water on top floor in a water tank Supply and installation of 1 phase 2 hp motor for pumping water to Water Tank and Fountain with warranty at least 1 year . [Use ISO brand].	set	2.0			
125	Generator (? 90KVA)Supply , testing and Installation of Canopy type, Sound proof type, 3 Phase 4 Wire System Automatic Generator of Size ? 90 KVA of higher power factor ? 0.8 with proper Shading made of Metal Truss. Generator must be such that it contains Control Panel Board with Contactors and other necessary units Generator Must be ISO Certified. Generator must have appropriate fuel tank size so as to provide continuous output for more than 8 hours at full load). Generator must be of such a canopy type that it emit very less decible (dB) of sound.	Set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
126	Generator House (Metallic Truss and RCC foundation at the base) Construction of complete Galvanised Zinc Shade house consisting of RCC slab on earth surface and metallic pole on four sides and Zinc Shade on top for placing the generator of this project so as to protect from water and sun and provide cross - air flow from all four sides. The location of housing must be as supervised by site engineer or supervisor. The area size of Generator house to be made must be of around 2.5 times or more to that of generator canopy size . Generator house must be covered with metallic net from all four sides and must contain metallic net door and lock in one of the side.	Set	1.0			
127	Complete Elevator System : Supply, installation, testing and commissioning of Complte Elevator System for upto 5th floor from ground floor that must contain 3 phase motor of about ?40 kw motor or more so as to lift at least 7 persons at a time. Lift must contail all necessary control panels, cables, lift doors.etc and all necessary equipments sets required to operate a lift.[Elevator must be from Basement to Fourth Floor]	set	1.0			
2.1.1.4 Sanitary Works						
Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Providing and fixing in position of all work items with all necessary fittings complete with testing and ready for operation as per drawings, specifications, manufacturer's recommendations and instructions. The rate shall include for position marking, maintain line, level or grade wherever required, sand filling/compaction, earth cutting and backfilling, concrete grouting, benching etc. Cutting, chasing of walls, plasters or tiles etc. and making good and touching up to restore to original conditions wherever instructed and applicable for any of the items below. Applicable for Part A, B, C & D., CP fixtures: Jaquar or Nova or Blue Star, PVC Pipes: Panchakanya or Nepatop or equivalent, CPVC Pipes, Ball Valves and fittings: Astral/ Ashirvad/ Marvel or equivalent Flowguard, Gate Valves: Leader or GG,Stainless Steel: Grade 304,A. SANITARY INSTALLATION CP Push Cock: Jal or Viking, Sanitaryware: Hindware or Parryware, White glazed earthernware Constellation model Wash down action Water Closet 'P' or 'S' trap with flushing cistern, standard bakelite seat cover, 15 mm PVC connector with both ends couplings complete with testing and ready for operation	Set	31.0			
2	White glazed earthernware wall-hung Hand Wash basin Oval model of size 550x430mm with 15 mm PVC connector with both ends couplings, 15mm CP pillar tap, 32mm PVC bottle trap complete with testing and ready for operation	Set	20.0			
3	White glazed earthernware Large flat back urinal with 32mm PVC bottle trap, 15mm CP Push Cock, spreader complete with testing and ready for operation	Set	22.0			
4	White glazed earthernware Division Plate for Urinal	No	26.0			
5	15mm CP angle valve	No.	51.0			
6	20x600mm CP Towel Rail	No.	25.0			
7	CP Soap Dish 150x150mm	No.	25.0			
8	15mm CP Commode Spray	No.	31.0			
9	5 mm thick looking mirror of approved make with CP mirror screws and clips4'x1'6"'	No.	20.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
10	PVC Multi-floor trap with cover	No.	22.0			
11	Roof inlet with SS jali	No	5.0			
12	B. WATER SUPPLY INSTALLATION ,Astral or equivalent brand CPVC pipes SDR 11 including clamps, nails and hooks, and all necessary CPVC specials required for complete installation, cutting, jointing, sealing of joints etc, installation of pipes and specials including making holes on walls or floor and repairing the same to its original finish, excavation and backfill in any type of soil. Pipes to be installed on trenches or walls or floor as per drawings, specifications and instructions, cleaning of the system, testing and ready for operation. Measurements to be taken for running length of pipe installed. The rate shall be inclusive of all necessary fittings but excluding gate valves which shall be payable seperately.- 40 mm dia.	Rft	60.0			
13	- 32 mm dia.	Rft	55.0			
14	- 25 mm dia.	Rft	100.0			
15	- 20 mm dia.	Rft	180.0			
16	CPVC Ball Valve as shown in the drawing and as instructed by the Engineer.- 40 mm dia.	No.	5.0			
17	- 25 mm dia.	No.	5.0			
18	- 20 mm dia.	No.	13.0			
19	- 16 mm dia.	No.	15.0			
20	2000 litres capacity Nepatop or Rooftop or equivalent brand HDPE cyllindrical vertical water storage tank complete with inter-connection, overflow, washout and vents	No.	3.0			
21	Electric centrifugal water pump with motor of capacity 4000 liters per hour at 28m head (approx. 1 HP) complete with starter, electric cable, check valve, high and low level guards etc. (one set stand-by)	Set	2.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
22	C. SEWER, RAIN AND WASTE WATER INSTALLATION ,PVC pipes including cutting, jointing, sealing with rubber washer and solvent cement and all necessary rubber ringed moulded fittings such as Tees, Y-Tees, Bends (with or without doors), Reducers, Couplers, connector pieces, offsets etc. for complete installation, PVC clamps, nails and hooks. Installation of pipes and specials including making holes on walls or floor and repairing the same to its original finish, excavation and backfill (compaction as per civil works specifications) in any type of soil. Pipes to be installed on trenches or walls or floor or hung to ceilings as per drawings, specifications and instructions, cleaning of the system, testing and ready for operation. The rate shall include for all labour and materials required. The measurement shall be done for running metre, fittings etc not payable seperately.- 110 mm ED 4 kg/cm2	Rft	80.0			
23	- 75 mm ED 4 kg/cm2	Rft	160.0			
24	- 50 mm ED 6 kg/cm2	Rft	35.0			
25	D. FIRE FIGHTING INSTALLATIONMS pipes IS:1239 heavy quality with necessary sockets including excavation for pipe trench, backfilling, nailing, clamping, groove cutting, hole cutting and repairing the same to original condition after concealing the pipes, painting the pipes with black Japan paint and final coat with enamel paint of specified colour all complete as directed by site engineer. a) 100mm dia.	Rft	204.0			
26	a) 80mm dia.	Rft	52.0			
27	b) 25 mm dia	Rft	20.0			
28	100mm dia CI Sluice Valve heavy class	Set	2.0			
29	25mm dia Gun Metal Gate Valve heavy class	Set	5.0			
30	Electric drive centrifugal fire fighting pump of capacity 36000 lph against 65m head with necessary cables	Set	1.0			
31	Electric drive centrifugal fire fighting jockey pump of capacity 3600 lph against 65m head with necessary cables	Set	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
32	100mm dia Cast Iron Double Flanged Non Return Valve with flanges, nuts, bolts, testing and ready for operation	Set	2.0			
33	100 mm dia CI Y Strainer	Set	2.0			
34	100 mm dia Flexible coupling	Set	2.0			
35	25mm dia Air Release valve	Set	1.0			
36	63 mm dia external Fire Hydrant with Fire Brigade connection complete set	Set	1.0			
37	Impact, abrasion and weathering resistant rubberised fabric lined (RRL) hose pipe of 20 mm dia and 30m length with gunmetal instantaneous male and female couplings all complete ISI.	Set	5.0			
38	ABC type fire extinguishers of approved make 5 kg	Set	13.0			
39	100 liters MS Pressure Tank with pipe connections	Set	1.0			
40	Single headed external landing valve (hydrant) with 63mm female instantaneous outlet conncection, with blank caps and chains with suitable orifice plate assembly all complete ISI	Set	6.0			
41	Electric control panel board for starting the Approx. 20 H.P. Centrifugal pump as per the specification as specified. Comprise of the following relays and control,Auto transformer one no.,Over and under voltage protection., Overload thermal protection relay., Amp meter with three way selector switch., Current transformer for three phase for measuring the amps drawn on each phase, Volt meter with three way selector switch for reading the three phase voltage difference,.Main Air break contactor of Mitsubishi make, rated for 2.5 times the full load current of the respective submersible motor. (Star and Delta contactor), Auxilliary contactor of suitable ratings and suitable timer.Capacitors of suitable rating for three phase.Complete set enclosed in a fabricated panel both sides painted with epoxy paint three coat	Set	1.0			
42	Providing, fixing, setting, testing and commissioning of different type pressure switches for operation of fire pumps 5 to 10 kg/cm2	Set	1.0			
43	MS Firehose cabinet powder coated	No	6.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
44	MS angles, plate, nuts, bolts etc for fabrication and fixing of clamps	Kg	115.0			
Total of Procument Items						
Total Item Price						
VAT						
Grand Total						

Part III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

Table of Clauses

SECTION-VIII

General Conditions of Contract

General Conditions of Contract

A. General	
1. Definitions	1.1 Boldface type is used to identify defined terms. (a) The **Accepted Contract Amount** means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects. (b) The **Activity Schedule** is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works in a lump sum contract. It includes a lump sum price for each activity, which is used for valuations and for assessing the effects of Variations and Compensation Events. (c) The Adjudicator is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in GCC 23.2 hereunder. (d) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid. (e) **Compensation Events** are those defined in GCC 50 hereunder. (f) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC 68.1. (g) The **Contract** is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC 2.3 below. (h) The **Contractor** is the party whose Bid to carry out the Works has been accepted by the Employer. (i) The **Contractor's Bid** is the completed bidding document submitted by the Contractor to the Employer. (j) The **Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract. (k) **Days** are calendar days; months are calendar-months. (l) **Dayworks** are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant. (m) A **Defect** is any part of the Works not completed in accordance with the Contract. (n) The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor. (o) The **Defects Liability Period** is the period calculated from the Completion Date where the Contractor remains responsible for remedying defects. (p) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract. (q) The **Employer** is the party who employs the Contractor to carry out the Works, as **specified in the SCC**. (r) **Equipment** is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works. (s) **Force Majeure** means an exceptional event or circumstance: which is

	beyond a Party's control; which such Party could not reasonably have provided against before entering into the Contract; which, having arisen, such Party could not reasonably have avoided or overcome; and, which is not substantially attributable to the other Party. (t) The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance. (u) **In writing** or **written** means hand written, type written, printed or electronically made, and resulting in permanent record. (v) The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is **specified in the SCC**. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order. (w) **Letter of Acceptance** means the formal acceptance by the Employer of the Bid and denotes the formation of the contract at the date of acceptance. (x) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works. (y) **Party** means the Employer or the Contractor, as the context requires. (z) **SCC** means Special Conditions of Contract (aa) **Plant** is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function. (bb) The **Project Manager** is the person **named in the SCC** (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract. (cc) **Retention Money** means the aggregate of all monies retained by the Employer pursuant to GCC 54.1. (dd) **Schedules** means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Bids, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices. (ee) The **Site** is the area defined as such in the SCC (ff) **Site Investigation Reports** are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site. (gg) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager. (hh) The **Start Date** is given i**n the SCC**. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates. (ii) A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site. (jj) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.

	(kk) A **Variation** is an instruction given by the Project Manager which varies the Works (ll) The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as **defined in the SCC**.
2. Interpretation	2.1 In interpreting these GCC, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC. 2.2 If sectional completion is **specified in the SCC**, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works). 2.3 The documents forming the Contract shall be interpreted in the following order of priority: (a) Contract Agreement, (b) Letter of Acceptance, (c) Letters of Technical Bid and Price Bid, (d) Special Conditions of Contract, (e) General Conditions of Contract, (f) Specifications, (g) Drawings, (h) Bill of Quantities (or Schedules of Prices for lump sum contracts), and (i) Any other document **listed in the SCC** as forming part of the Contract.
3. Language and Law	3.1 The language of the Contract and the law governing the Contract are **stated in the SCC**.
	1.2. Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in the Employer's country when (a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's Country prohibits any import of goods from, or any payments to, a particular country, person, or entity. Where the borrower's country prohibits payments to a particular firm or for particular goods by such an act of compliance, that firm may be excluded.
4. Contract Agreement	4.1 The Parties shall enter into a Contract Agreement within 15 days after the Contractor receives the Letter of Acceptance, unless the Special Conditions establish otherwise. The Contract Agreement shall be based

	upon the attached Contract forms in Section X.
5. Assignment	5.1 Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party (a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party; and (b) may, as security in favor of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.
6. Care and Supply of Documents	6.1 The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, one copy of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.
	6.2 Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.
	6.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times. 6.4 If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.
7. Confidential Details	7.1 The Contractor's and the Employer's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify the Contractor's compliance with the Contract and allow its proper implementation.
	7.2 Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.
	7.3 Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.

8. Compliance with Laws	8.1 The Contractor shall, in performing the Contract, comply with applicable Laws.
9. Joint and Several Liability	9.1 If the Contractor is a joint venture of two or more entities , all such entities shall be jointly and severally liable to the Employer for the fulfillment of the provisions of the Contract, and shall designate one of such persons to act as a leader with authority to bind the joint venture. **The contractor shall not handover the responsibility of the contract to any one member or some members of Joint Venture or any other parties, not involved in the contract.** The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.
10. Project Manager's Decisions	10.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.
11. Delegation	11.1 The Project Manager may delegate any of his duties and responsibilities to other people after notifying the Contractor, and may cancel any delegation after notifying the Contractor.
12. Communications	12.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.
13. Subcontracting	13.1 **For GoN Funded:** A list of approved Subcontractors including its value/works is included as Article 2 (k) of contract Agreement. Approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties, or responsibilities under the contract. **For DP Funded :** The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations. Bidders may propose subcontracting up to the percentage of total value of contracts as **specified in the SCC.** The Sub contractor shall meet the qualification requirement as specified in SCC.
14. Other Contractors	14.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, **as referred to in the SCC**. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification
15 Personnel and Equipment	15.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid to carry out the Works, or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid. 15.2 If the Project Manager asks the Contractor to remove a person who is a

	member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract. 15.3 If the Employer, Project Manager, or Contractor determines, that any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or other prohibited practices during the execution of the Works, then that employee shall be removed in accordance with Clause 15.2 above.
16. Employer's and Contractor's Risk	16.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.
17. Employer's Risks	17.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Employer's risks: (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or (ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor. (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed. 17.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer's risk except loss or damage due to (a) a Defect which existed on the Completion Date, (b) an event occurring before the Completion Date, which was not itself an Employer's risk, or (c) the activities of the Contractor on the Site after the Completion Date.
18. Contractor's Risks	18.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.
19. Insurance	19.1 The Contractor shall provide insurance in the joint names of the Employer and the Contractor from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles **stated in the SCC** for the following events which are due to the Contractor's risks: (a) loss of or damage to the Works, Plant, and Materials; (b) loss of or damage to Equipment; (c) loss of or damage to property (except the Works, Plant, Materials,

	and Equipment) in connection with the Contract; and (d) Personal injury or death.
	19.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the proportions of Nepalese Rupees required to rectify the loss or damage incurred. 19.3 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due. 19.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager. 19.5 Both parties shall comply with any conditions of the insurance policies.
20. Site Investigation Reports	20.1 The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to **in the SCC**, supplemented by any information available to the Contractor.
21. Contractor to Construct the Works	21.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.
22. The Works to Be Completed within intended Completion Date	22.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them within the intended Completion Date.
23. Design by contractor and Approval by the Project Manager	23.1 The contractor shall be responsible for the design of permanent works as **specified in SCC**. 23.2 Contractor shall be responsible for design of the Temporary Works. The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, for his approval. 23.3 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, shall be subject to prior approval by the Project Manager before their use. 23.4 The Project Manager's approval shall not alter the Contractor's responsibility for design of temporary works.
24. Safety, Security and Protection of the Environment	24.1 The Contractor shall, throughout the execution, and completion of the works and remedying of any defects therein: a. Have full regard for the safety of all persons entitled to be upon the site and keep the site (so as the same is under his control) and the works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons.

	b. Provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when necessary or required by the Project Manager or by any duly constituted authority, for the protection of the Works of for the safety and convenience of the public or others. c. Take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. d. Ensure that any cut or fill slopes are planted in grass or other plant cover as soon as possible to protect them from erosion. e. Any spoil or material removed from drains shall be disposed of to designated stable tipping areas as directed by the Project Manager. f. Shall not use fuel wood as a means of heating during the processing or preparation of any materials forming part of the works. g. The Project Manager shall have the power to disallow any working practice or activity of the Contractor or direct that such practices or activities be modified should the Project Manager consider, on the advice of the relevant Government Departments, that the practices or activities will be harmful to wildlife. h. Provide on the Site such lifesaving apparatus as may be appropriate and an adequate and easily accessible first aid outfit or such outfits as may be required by any government ordinance, factory act, etc., subsequently published and amended from time to time.
25. Discoveries	25.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.
26. Possession of the Site	26.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date **stated in the SCC**, the Employer shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.
27. Access to the Site	27.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.
28. Instructions, Inspections and Audits	28.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located. 28.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub consultants to keep accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs. 28.3 The Contractor shall permit the GoN/DP and/or persons appointed by the GoN/DP to inspect the Site and/or the accounts and records of the Contractor and its sub-contractors relating to the performance of the

	Contract, and to have such accounts and records audited by auditors appointed by the GoN/DP if required by the GoN/DP. The Contractor's attention is drawn to Sub-Clause 73.2 which provides, inter alia, that acts intended to materially impede the exercise of the GoN's/DP's inspection and audit rights provided for under this Sub-Clause constitute a obstructive practice subject to contract termination.
29. Dispute Settlement	29.1 The Employer and the Contractor shall attempt to settle amicably by direct negotiation any disagreement or dispute arising between them under or in connection with the Contract. 29.2 Any dispute between the Parties as to matters arising pursuant to this Contract which cannot be settled amicably within thirty (30) days after receipt by one Party of the other Party's request for such amicable settlement may be referred to Arbitration within 30 days after the expiration of amicable settlement period.
30. Procedures for Disputes	30.1 In case of arbitration, the arbitration shall be conducted in accordance with the arbitration procedures published by the Nepal Council of Arbitration (NEPCA) at the place **given in the SCC**.
B. Staff and Labor	
31. Forced Labor	31.1 The Contractor shall not employ forced labor, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor, or similar labor–contracting arrangements.
32. Child Labor	32.1 The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where national laws have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.
33. Non-discrimination and Equal Opportunity	34.1 The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where national law provides for non-discrimination in employment, the Contractor shall comply with national law. When national laws are silent on nondiscrimination 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.
B. Time Control	
34. Program	34.1 Within the time **stated in the SCC**, after the date of the Letter of

	Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works. In the case of a lump sum contract, the activities in the Program shall be consistent with those in the Activity Schedule. 34.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities. 34.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period **stated in the SCC**. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the SCC from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall Provide an updated Activity Schedule within 15 days of being instructed to by the Project Manager. 34.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.
35. Extension of the Intended Completion Date	35.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost. 35.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information at least 21 days prior to the intended completion date. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.
36. Acceleration	36.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Employer accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Employer and the Contractor. 36.2 If the Contractor's priced proposals for acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.
37. Delays Ordered by the Project Manager	37.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

38. Management Meetings	38.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure. 38.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.
39. Early Warning	39.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible. 39.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.
C. Quality Control	
40. Identifying Defects	40.1 The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.
41. Tests	41.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.
42. Correction of Defects	42.1 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is **defined in the SCC**. The Defects Liability Period shall be extended for as long as Defects remain to be corrected. 42.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.
43. Uncorrected Defects	43.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.
D. Cost Control	
44. Contract Price	44.1 In the case of a Unit Rate contract, the Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill

	of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item. 44.2 In the case of a lump sum contract, the Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for Materials on Site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.
45. Changes in the Contract Price	45.1 In the case of an Unit Rate contract: (a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 2 percent of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change. (b) The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 10 percent, except with the prior approval of the Employer. (c) If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities. 45.2 In the case of a lump sum contract, the Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.
46. Variations	46.1 All Variations shall be included in updated Programs, and, in the case of a lump sum contract, also in the Activity Schedule, produced by the Contractor.
	46.2 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered. 46.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs. 46.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event. 46.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning. 46.6 In the case of an Unit Rate contract, if the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated

	in **GCC 45.1** or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.
47. Cash Flow Forecasts	47.1 When the Program, or, in the case of a lump sum contract, the Activity Schedule, is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast.
48. Payment Certificates	48.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously. 48.2 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor within 30 days of submission by contractor. 48.3 The value of work executed shall be determined by the Project Manager. 48.4 The value of work executed shall comprise: (a) In the case of an Unit Rate contract, the value of the quantities of work in the Bill of Quantities that have been completed; or (b) In the case of a lump sum contract, the value of work executed shall comprise the value of completed activities in the Activity Schedule. 48.5 The value of work executed shall include the valuation of Variations and Compensation Events. 48.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
49. Payments	49.1 Payments shall be adjusted for deductions for advance payments and retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 30 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest as **indicated in the SCC** on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made. 49.2 If an amount certified is increased in a later certificate or as a result of an award by an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute. 49.3 Items of the Works for which no rate or price has been entered in BOQ shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

50. Compensation Events	50.1 The following shall be Compensation Events: (a) The Employer does not give access to a part of the Site by the Site Possession Date pursuant to GCC 26.1. (b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract. (c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time. (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects. (e) The Project Manager unreasonably does not approve a subcontract to be let. (f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site. (g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons. (h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor. (i) The advance payment is delayed. (j) The effects on the Contractor of any of the Employer's Risks. (k) The Project Manager unreasonably delays issuing a Certificate of Completion. 50.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended. 50.3 As soon as information demonstrating effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event. 50.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.

51. Tax	51.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 30 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC 53.
52. Currency	52.1 The currency of Contracts shall be Nepalese Rupees.
53. Price Adjustment	53.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for **in the SCC**. If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due. 53.2 Adjustment Formulae[1]: The formulae will be of the following general type: $$pn = A + b\frac{Ln}{Lo} + c\frac{Mn}{Mo} + d\frac{En}{Eo} + etc.$$ Where: *pn* is a price adjustment factor to be applied to the amount for the payment of the work carried out in the subject month, determined in accordance with Clause 49; *A* is a constant, specified in the Bidding Forms- Table of Price Adjustment data, representing the nonadjustable portion in contractual payments;[2]b, c, d, etc., coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) in the Works or sections thereof, net of Provisional Sums, **as specified in the SCC;** *Ln, Mn, En,* etc., are the current cost indices or reference prices of the cost elements for month "n," determined pursuant to Sub-Clause 53.4, applicable to each cost element; and *Lo, Mo, Eo,* etc., are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 53.4
	53.3 Sources of Indices and Weightings: The sources of indices shall be those listed in the Bidding Forms- Table of Price Adjustment data, as approved by the Project Manager and stated in SCC. Indices shall be appropriate for their purpose and shall relate to the Contractor's proposed source of supply of inputs on the basis of which his Contract shall have been computed. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightings and Source of Indices in the Bidding Forms, which shall be

[1] For complex Works involving several types of construction work with different inputs, a family of Formulae will be necessary. The various items of Day work may also require different formulae, depending on the nature and source of the inputs

[2] Insert a figure for factor A only where there is a part of the Contractors' expenditures which will not be subject to fluctuation in cost or to compensate for the unreliability of some indices. A should normally be 0.15. The sum of A, b, c, d, etc., should be one.

	subject to approval by the Project Manager. 53.4 Base, Current and Provisional Indices: The base cost indices or prices shall be those prevailing on the day 30 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 30 days prior to the last day of the period to which a particular Interim Payment Certificate is related. If at any time the current indices are not available, provisional indices as determined by the Project Manager will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available. 53.5 Weightings: The weightings for each of the factors of cost given in the Bidding Forms shall be adjusted if, in the opinion of the Project Manager, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or instructed under Clause 46 or for any other reason.
	53.6 Where, price adjustment provision is not applicable pursuant to Sub-clause 53.1 then the Contract is subject to price adjustment only for construction material in accordance with this clause. If the prices of the construction materials stated in the contract is increased or decreased in an unexpected manner in excess of ten (10%) percent in comparison to the base price construction material stated in Section –IV, Bidding Forms-Table of Price Adjustment Data, then the price adjustment for the increase or decrease of price of the construction material beyond 10% shall be made by applying the following formulas: For unexpected increase in price $P = [R_1 - (R_0 \times 1.10)] \times Q$ For unexpected decrease in price P $= [R_1 - (R_0 \times 0.90)] \times Q$ Where: "P" is price adjustment amount "R_1" is the present price of the construction material (Source of indices shall be those listed in the Bidding forms) "R_0" is the base price of the construction material "Q" is quantity of the construction material consumed in construction during the period of price adjustment consideration If the Base price and source is to be proposed by the Bidder as per the provision made in Section –IV, Bidding Forms-Table of Price Adjustment Data then the Base price and source filled by Bidder for the construction material stated in the Bidding Form shall be subject to the approval of the Project manager and shall be as **stated in SCC**.. 53.7 The Price Adjustment amount shall be limited to a maximum of the initial Contract Amount **as specified in the SCC**. 53.8 The Price Adjustment provision shall not be applicable for delayed period if the contract is not completed in time due to the delay caused

	by the contractor or the contract is a Lump sum Contract
54. Retention	54.1 The Employer shall retain from each payment due to theContractor the proportion stated in the SCC until Completion of the whole of the Works. 54.2 Upon the issue of a Defects Liability Certificate by the Project Manager, **in accordance with GCC** 70.1, half the total amount retained shall be repaid to the Contractor and half when the Contractor has submitted the evidence of submission of tax return to the concerned Internal Revenue Office. On completion of the whole works, the Contractor may substitute retention money with an "on demand" bank guarantee.
55. Liquidated Damages	55.1 The Contractor shall pay liquidated damages to the Employer at the rate per day **stated in the SCC** for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount **defined in the SCC**. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities. 55.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in GCC.49
56. Bonus	56.1 The Contractor shall be paid a Bonus calculated at the rate per calendar day **stated in the SCC** for each day (less any days for which the Contractor is paid for acceleration) that the Completion is earlier than the Intended Completion Date. The Project Manager shall certify that the Works are complete, although they may not be due to be complete.
57. Advance Payment	57.1 The Employer shall make advance payment to the Contractor of the amounts stated in the SCC in two equal installments by the date **stated in the SCC**, against provision by the Contractor of an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal. in a form acceptable to the Employer in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.
	57.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager. 57.3 The advance payment shall be repaid by deducting proportionate

	amounts, **as stated in SCC**, from payments otherwise due Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.
58. Securities	58.1 The Performance Security, including any additional security required as per ITB 35.5 and ITB 40.1, shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount **specified in the SCC,** by a Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.acceptable to the Employer, and denominated in Nepalese Rupees. The Performance Security shall be valid until a date 30 days from the date of issue of the Defect Liability Certificate in the case of a bank guarantee. Any additional performance security required as per ITB 35.5 shall be valid until a date 30 days from the date of issue of the certificate of Completion in the case of a bank guarantee. Any additional performance security required as per ITB 40.1 shall be valid until a date 30 days from the date of issue of the certificate of DLP in the case of a bank guarantee. 58.2 The performance security issued by any foreign Bank outside Nepal must be counter guaranteed by Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.
59. Day works	59.1 If applicable, the Day works rates in the Contractor's Bid shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way. 59.2 All work to be paid for as Day works shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done. 59.3 The Contractor shall be paid for Day works subject to obtaining signed Day works forms.
60. Cost of Repairs	60.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.
F. Force Majeure	
61. Definition of Force Majeure	61.1 In this Clause, "Force Majeure" means an exceptional event or circumstance, (a) which is beyond a Party's control; (b) which such Party could not reasonably have provided against before entering into the Contract;

	(c) which, having arisen, such Party could not reasonably have avoided or overcome; and (d) which is not substantially attributable to the other Party.
	61.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied: (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies; (b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war; (c) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel; (d) munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity; and (e) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.
62. Notice of Force Majeure	62.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.
	62.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.
	62.3 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.
63. Duty to Minimize Delay	63.1 Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure.
	63.2 A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.
	64.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given

64. Consequences of Force Majeure	under GCC 62, and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC 30 to (a) an extension of time for any such delay, if completion is or will be delayed, under GCC35 ; and (b) if the event or circumstance is of the kind described in sub-paragraphs (a) to (d) of GCC 61.2 and, in the case of subparagraphs (b) to (d), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destructed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in GCC 19.
	64.2 After receiving this notice, the Project Manager shall proceed in accordance with GCC 10 to agree or determine these matters.
65. Force Majeure Affecting Subcontractor	65.1 If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's nonperformance or entitle him to relief under this Clause.
66. Optional Termination, Payment and Release	66.1 If the execution of substantially all the Works in progress is prevented for a continuous period of 90 days by reason of Force Majeure of which notice has been given under GCC 62, or for multiple periods which total more than 150 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with GCC 72.5.
	66.2 Upon such termination, the Project Manager shall determine the value of the work done and issue a Payment Certificate, which shall include (a) the amounts payable for any work carried out for which a price is stated in the Contract; (b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal; (c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works; (d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the

	Contractor's works in his country (or to any other destination at no greater cost); and (e) the Cost of repatriation of the Contractor's staff and labor employed wholly in connection with the Works at the date of termination.
67. Release from Performance	67.1 Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises, which makes it impossible or unlawful for either or both Parties to fulfill its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance, (a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract; and (b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under GCC 66 if the Contract had been terminated under GCC 66.
G. Finishing the Contract	
68. Completion	68.1 The Contractor shall request the Project Manager to issue a certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the work is completed. 68.2 In addition to the other provisions, before acceptance of the completed works, Employer shall verify and assure that such works are within the set objective, quality and appropriate to operate and use.
69. Taking Over	69.1 The Employer shall take over the Site and the Works within seven days of the Project Manager's issuing a certificate of Completion.
70. Final Account	70.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 60 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 60 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.
71. Operating and Maintenance Manuals	71.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the **dates stated in the SCC**. 71.2 If the Contractor does not supply the Drawings and/or manuals by the dates **stated in the SCC** pursuant to **GCC 71.1,** or they do not receive the Project Manager's approval, the Project Manager shall withhold the

	amount **stated in the SCC** from payments due to the Contractor.
72. Termination	72.1 The Employer may terminate the Contract at any time if the contractor; a. does not commence the work as per the Contract, b. abandons the work without completing, c. fails to achieve progress as per the Contract. 72.2 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. 72.3 Fundamental breaches of Contract shall include, but shall not be limited to, the following : (a) The Contractor uses the advance payment for matters other than the contractual obligations, (b) the Contractor stops work for 30 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager; (c) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days; (d) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation. (e) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 90 days of the date of the Project Manager's certificate; (f) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager; (g) the Project Manager gives two consecutive Notices to update the Program and accelerate the works to ensure compliance with GCC Sub clause 22.1 and the Contractor fails to update the Program and demonstrate acceleration of the works within a reasonable period of time determined by the Project Manager; (h) the Contractor does not maintain a Security, which is required; (i) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, **as defined in the SCC**; and (j) If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract, pursuant to GCC 73.1. 72.4 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC 72.3 above, the Project Manager shall decide whether the breach is fundamental or not. 72.5 Notwithstanding the above, the Employer may terminate the Contract for convenience. 72.6 If the Contract is terminated, the Contractor shall stop work

	immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.
73. Fraud and Corruption	73.1 If the Employer determines that the Contractor has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices, in competing for or in executing the Contract, then the Employer may, after giving 15 days notice to the Contractor, terminate the Contractor's employment under the Contract and expel him from the Site. 73.2 Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with GCC Clause 15. For the purposes of this GCC 73; (i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party. (ii) "fraudulent practice"[5] is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; (iii) "collusive practice"[6] is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party; (iv) "coercive practice"[7] is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; (v) "obstructive practice" is (aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (bb) acts intended to materially impede the exercise of the GON's/DP's inspection and audit rights provided for under GCC28.3.
74. Black Listing	74.1 Without prejudice to any other rights of the Employer under this Contract, GoN, Public Procurement Monitoring Office (PPMO), on the recommendation of procuring entity, may blacklist a Bidder for its conduct for a period of one (1) to three (3) years on the following grounds and seriousness of the act committed by the bidder: (a) if it is established that the Contractor has committed substantial defect in implementation of the contract or has not substantially fulfilled its obligations under the contract or the completed work is not of the specified quality as per the

	contract. (b) If convicted from a court of law in a criminal offense liable to be disqualified for taking part in procurement contract, (c) If it is established that the Contractor has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.
75. Payment upon Termination	75.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer. 75.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.
	75.3 If the Contract is terminated because of fundamental breach of Contract or for any other fault by the Contractor, the performance security shall be forfeited by the Employer. In such case, amount to complete the remaining works as per the Contract shall be recovered from the Contractor as Government dues.
76. Property	76.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default.
77. Release from Performance	77.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.
78. Suspension of DP Loan/Credit/Grant	78.1 In the event that the DP suspends the loan/ credit/grant to the Employer from which part of the payments to the Contractor are being made: a. the Employer is obligated to notify the Contractor of such suspension within 7 days of having received the DP's suspension notice; and b. if the Contractor has not received sums due him within the 30 days for payment provided for in GCC 49.1, the Contractor may immediately issue a 15-day termination notice.
79. Eligibility	79.1 The Contractor shall have the nationality of an eligible country as specified in Section V of the bidding document. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, and operates in conformity with the

	provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.
	79.2 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries as specified in Section V of the bidding document and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the Contractor may be required to provide evidence of the origin of materials, equipment, and services.
	79.3 For purposes of GCC 79.2, "origin" means the place where the materials and equipment are mined, grown, produced, or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.
80. Project Manager's Duties and Authorities	80.1 The Project Manager's duties and authorities are restricted to the extent as **stated in the SCC**.
81. Quarries and Spoil Dumps	81.1 Any quarry operated as part of this Contract shall be maintained and left in a stable condition without steep slopes and be either refilled or drained and be landscaped by appropriate planting. Rock or gravel taken from a river shall be removed over some distance so as to limit the depth of material removed at any one location, not disrupt the river flow or damage or undermine the river banks. The Contractor shall not deposit excavated material on land in Government or private ownership except as directed by the Project Manager in writing or by permission in writing of the authority responsible for such land in Government ownership, or of the owner or responsible representative of the owner of such land in private ownership, and only then in those places and under such conditions as the authority, owner or responsible representative may prescribe.
82. Local Taxation	82.1 The prices bid by the Contractor shall include all taxes that may be levied in accordance to the laws and regulations in being in Nepal on the date 30 days prior to the closing date for submissions of Bids on the Contractor's equipment, plant and materials acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in Nepal on profits made by him in respect of the Contract.
83. Value Added Tax	83.1 The Contract is not exempted from value added tax. An amount specified in the schedule of taxes shall be paid by the Contractor in the concerned VAT office within time frame specified in VAT regulation.
84. Income Taxes on Staff	84.1 The Contractor's staff, personnel and labor will be liable to pay personal income taxes in Nepal in respect of their salaries and wages, as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions

	as may be imposed on him by such laws and regulations. 84.2 The issue of the Final Account Certificate pursuant to clause GCC 70 shall be made only upon submittal by the Contractor of a certificate of income tax clearance from the Government of Nepal.
85. Duties, Taxes and Royalties	85.1 Any element of royalty, duty or tax in the price of any goods including fuel oil, and lubricating oil, cement, timber, iron and iron goods locally procured by the Contractor for the works shall be included in the Contract rates and prices and no reimbursement or payment in that respect shall be made to the Contractor. 85.2 The Contractor shall familiarize himself with GON the rules and regulations with regard to customs, duties, taxes, clearing of goods and equipment, immigration and the like, and it will be necessary for him to follow the required procedures regardless of the assistance as may be provided by the Employer wherever possible. 85.3 The Contractor shall pay and shall not be entitled to the reimbursement of cost of extracting construction materials such as sand, stone/boulder, gravel, etc. from the river beds or quarries. Such prices will be levied by the local District Development Committee (DDC) as may be in force at the time. The Contractor, sub-contractor(s) employed directly by him and for whom he is responsible, will not be exempted from payment of royalties, taxes or other kinds of surcharges on these construction materials so extracted and paid for to the DDC.
86. Member of Government, etc, not Personally Liable	86.1 No member or officer of GoN or the Employer or the Project Manager or any of their respective employees shall be in any way personally bound or liable for the act or obligations of the Employer under the Contract or answerable for any default or omission in the observance or performance of any of act, matter or thing which are herein contained.
87. Approval of Use of Explosives	87.1 No explosives of any kind shall be used by the Contractor without the prior consent of the Employer in writing and the Contractor shall provide, store and handle these and all other items of every kind whatsoever required for blasting operations, all at his own expense in a manner approved in writing by the Employer.
88 Compliance with Regulations for Explosives	88.1 The Contractor shall comply with all relevant ordinances, instructions and regulations which the Government, or other person or persons having due authority, may issue from time to time regarding the handling, transportation, storage and use of explosives.
89. Permission for Blasting	89.1 The Contractor shall at all times maintain full liaison with and inform well in advance, and obtain such permission as is required from all Government authorities, public bodies and private parties whatsoever concerned or affected, or likely to be concerned or affected by blasting operation.
90. Records of Explosives	90.1 Before the beginning of the Defects Liability Period, the Contractor shall account to the satisfaction of the Project Manager for all explosives brought on to the Site during the execution of the Contract and the Contractor shall remove all unused explosives from the Site on

	completion of works when ordered by the Project Manager.
91. Traffic Diversion	91.1 The Contractor shall include the necessary safety procedures regarding and pedestrian traffic diversion that is needed in execution of the works. The Contractor shall include in his costing of works, any temporary works or diversion that are needed during the construction period. All traffic diversion should be designed for the safety of both the motoring public and the men at work. It shall ensure the uninterrupted flow of traffic and minimum inconvenience to the public during the period concerned. As such, adequate warning signs, flagmen and other relevant safety precautionary measures shall be provided to warn motorists and pedestrians well ahead of the intended diversion as directed by the Project Manager. All traffic devices used shall be designed in accordance with the instruction of Project Manager.

SECTION-IX

Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

A. General	
GCC 1.1 (q)	The Employer is Chandragiri Municipality,Kathmandu Chandragiri Municipality,Kathmandu, Balambu, Kathmandu, Nepal
GCC 1.1 (v)	The Intended Completion Date for the whole of the Works shall be 01-01-2021 Sectional completion is not applicable
GCC 1.1 (bb) & 10.1	The Project Manager is Rabindra Rijal. The Project Manager and Engineer are synonyms.
GCC 1.1 (ee)	The Site is located at Chandragiri Municipality, Balambu Kathmandu and is defined in drawings No. 1
GCC 1.1 (hh)	The Start Date shall be 09-09-2019
GCC 1.1 (ll)	The Works consist of Construction of Chandragiri Municipality Office Building
GCC 2.2	Sectional Completions are: N/A
GCC 2.3 (i)	The following documents also form part of the Contract: N/A
GCC 3.1	The language of the contract is ENGLISH/NEPALI The law that applies to the Contract is the law of NEPAL
GCC 11.1	The Project Manager may delegate any of his duties and responsibilities
GCC 13.1	Maximum percentage of subcontracting permitted is: 0 % of the total contract amount Nature of Works that can be sub contracted: Not Applicable Qualification Criteria: Not Applicable

GCC 14.1	Schedule of other contractors: N/A
GCC 19.1	The minimum insurance amounts and deductibles shall be: 1. The minimum cover for loss of or damage to the Works, Plant and Materials is: 115 % of the Contract Amount. 2. The maximum deductible for insurance of the Works and of Plant and Materials is: 500000 3. The minimum cover for loss or damage to Equipment is : 100000 4. The maximum deductible for insurance of Equipment is: 100000 5. The minimum for insurance of other property is: [insert amount] with unlimited number of occurrences 6. The maximum deductible for insurance of other property is: [insert amount] 7. The minimum cover for personal injury or death insurance i. for the Contractor's employees is that specified in the Labor act of Nepal and ii. for other people is :300000 with an unlimited number of occurrences
GCC 20.1	Site Investigation Reports are: N/A
GCC 23.1	The following shall be designed by the Contractor: N/A
GCC 26.1	The Site Possession Date(s) shall be: with in 7 days after signing contract
GCC 30.1	The place of arbitration shall be: Chandragiri Municipality
B. Time Control	
GCC 34.1	The Contractor shall submit for approval a Program for the Works within 7days from the date of the Letter of Acceptance.
GCC 34.3	The period between Program updates is 60 days The amount to be withheld for late submission of an updated Program is 100000 NPR
C. Quality Control	
GCC 42.1	The Defects Liability Period is N/A
D. Cost Control	
GCC 49.1	Prevailing Interest Rate N/A %

GCC 53.1

The Contract is subject to price adjustment, and the following information regarding coefficients does apply.

The coefficients and indices for adjustment of prices in Nepalese Rupees shall be as specified in the Table of Adjustment Data submitted by bidder together with the Letter of Price Bid which is approved by the Project manager.

Sl No.	Index Description	Source of Index	Base Value	Base Date	Employer's Proposed Weighting coefficient Range from	Employer's Proposed Weighting coefficient Range to
1	Non-Adjustable(A)				0.15	0.15
2	Labor (b)	NRB	0	Bid Submission date - 30 days	0.0125	0.13
3	Materials (c)	NRB	0	Bid Submission date - 30 days	0.65	0.69
4	Equipment usage (d)	NRB	0	Bid Submission date - 30 days	0.025	0.03

GCC 53.6

Base Price of Construction Materials applicable for price adjustment shall be as per the Table of Adjustment Data submitted by Bidder together with the Letter of Price Bid which is approved by the Project manager.

GCC 53.7

The Price Adjustment amount shall be limited to a maximum 15 % of the initial Contract Amount

GCC 54.1

The proportion of payments retained is: 5 %

GCC 55.1

The liquidated damages for the whole of the Works are 0.05 % of the final Contract Price per day. The maximum amount of liquidated damages for the whole of the Works is 10 % of the final Contract Price.

GCC 56.1

The Bonus for the whole of the Works is 0.05 % per day.
The maximum amount of Bonus for the whole of the Works is 0 % of the final Contract Price.

GCC 57.1

The Advance Payments shall be 20.00 % and shall be paid in two equal installments to the Contractor.

Installment	Percentage	Requirement
First	10.0	After Signing Contract and submitting Bank Guarantee
Second	10.0	After full mobilization at site

GCC 57.3	Deductions from Payment Certificates will commence in the first certificate in which the value of works executed exceeds 30% of the Contract Price. Deduction will be at the rate of 40% of the respective Monthly Interim Payment Certificate until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the end of 80% of the approved contract period.
GCC 58.1	The Performance Security amount is NRs 5
E. Finishing the Contract	
GCC 71.1	The date by which operating and maintenance manuals are required is N/A
GCC 71.2	The date by which 'as built' drawings are required is N/A The amount to be withheld for failing to produce "as built" drawings and/or Operating and maintenance manuals is N/A
GCC 72.3 (i)	The maximum number of days is 200 days
GCC 80	The Project Manager has to obtain the specific approval of the Employer for taking any of the following actions : a.Approving subcontracting of any part of the works under General Conditions of Contract Clause 13; b.Certifying additional costs determined under General Conditions of Contract Clause 50; c.Determining start date under General Conditions of Contract Clause 1; d.Determining the extension of the intended Completion Date under General Conditions of Contract Clause 35; e.Issuing a Variation under General Conditions of Contract Clause 1 and 46, except in an emergency situation, as reasonably determined by the Project Manager; emergency situation may be defined as the situation when protective measures must be taken for the safety of life or of the works or of adjoining property. f.Adjustment of rates under General Conditions of Contract Clause 45;

SECTION-X

Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Section X: Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Letter of Intent
[on letterhead paper of the Employer]

Date: ... ……

To: .....***Name and address of the Contractor***.....

Subject: …… Issuance of letter of intent to award the contract.....

This is to notify you that, it is our intention to award the contract ..... ***[insert date]*** .....for execution of the ... . ***[insert name of the contract and identification number, as given in the Contract Data/SCC]*** to you as your bid price ..... ***[insert amount in figures and words in Nepalese Rupees]*** as corrected and modified in accordance with the Instructions to Bidders is hereby selected as substantially responsive lowest evaluated bid.

Authorized Signature: ……

Name: ... ……..

Title: ……..

CC:
[Insert name and address of all other Bidders, who submitted the bid]

[Notes on Letter of Intent
The issuance of Letter of Intent is the information of the selection of the bid of the successful bidder by the Employer and for providing information to other unsuccessful bidders who participated in the bid as regards to the outcome of the procurement process. This standard form of Letter of Intent to Award should be filled in and sent to the successful Bidder only after evaluation and selection of substantially responsible lowest evaluated bid.]

Letter of Acceptance

[on letterhead paper of the Employer]

Date: ……..

To: ……***Name and address of the Contractor***……...

Subject: ……*Notification of Award*

This is to notify that your Bid dated .....***date*** ……..for execution of the……..***name of the contract and identification number, as given in the Contract Data/SCC*** ……... for the Contract price of Nepalese Rupees ***[insert amount in figures and words in Nepalese Rupees],*** as corrected in accordance with the Instructions to Bidders is hereby accepted in accordance with the Instruction to Bidders.

You are hereby instructed to contact this office to sign the formal contract agreement within 15 days with Performance Security of **NRs**. ……. in accordance with the Conditions of Contract, using for that purpose the Performance security Form included in Section X (Contract Forms) of this Bidding Document.

Authorized Signature: ……...

Name and Title of Signatory: ……

Contract Agreement

THIS AGREEMENT made the .....day of…..between…….. name of the Employer ***……(hereinafter "the Employer"),*** of the one part, and ……name of the Contractor ……(hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as …….... name of the Contract .....should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects in the sum of NRs ***…….[insert amount of contract price in words and figures including taxes]***(hereinafter "the Contract Price").

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 Letters of Technical and Price Bid;
   (c) the Addenda Nos ..... **Insert addenda numbers if any** ……
   (d) the Special Conditions of Contract;
   (e) the List of Eligible Countries that was specified in Section V of the bidding document,
   (f) the General Conditions of Contract;
   (g) the Specification;
   (h) the Drawings;
   (i) Bill of Quantities (or Schedules of Prices for lump sum contracts), and
   (j) Table of Price Adjustment Data
   (k) List of Approved Subcontractors *[For GoN funded project]*
   (l) ....**[Specify if there are any other document]**

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

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

Signed by …….
for and on behalf the Contractor in the presence of

Witness, Name Signature, Address, Date

Signed by……..
for and on behalf of the Employer in the presence of

Witness, Name, Signature, Address, Date

List of Approved Subcontractors

In accordance with GCC Sub-Clause 13.1,The following Subcontractors are approved for carrying out the work as specified below.

Name of Subcontractors	Description of Works	Value/Percentage of subcontract

Performance Security

(On letterhead paper of the Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.)

..... ***Bank's Name, and Address of Issuing Branch or Office*** .....
Beneficiary: ..... Name and Address of Employer …….....
Date: .....

Performance Guarantee No.:…….

We have been informed that ..... ***[insert name of the Contractor]*** (hereinafter called "the Contractor") has been notified by you to sign the Contract No. …….. ***[insert reference number of the Contract]*** for the execution of …….. ***[insert name of contract and brief description of Works]*** (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we... ..... ***[insert name of the Bank]*** hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of .....***[insert name of the currency and amount in figures*] (…..... insert amount in words)*** such sum being payable in Nepalese Rupees, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the……..Day of …… **, and any demand for payment under it must be received by us at this office on or before that date.

……

Seal of Bank and Signature(s)

Note:
All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

* The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract in Nepalese Rupees.

** Insert the date thirty days after the date specified for the Defect Liability Period. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".

Advance Payment Security

(On letterhead paper of the Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.)

…….. Bank's Name, and Address of Issuing Branch or Office.....

Beneficiary: ……***Name and address of employer***

Date : ……

Advance Payment Guarantee No……..

We have been informed that ……has entered into Contract No. ..... ***Name and Address of Employer***……***name of the Contractor***……(hereinafter called "the Contractor")..reference number of the Contract……dated …… with you, for the execution of ...contract and brief description of Works ……. (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum……. name of the currency and amount in figures****…(.... amount in words .....)*** is to be made against an advance payment guarantee.

At the request of the Contractor, we... ..... ***name of the Bank*** ……. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of……..name of the currency and amount in figures****.....…(…… amount in words ... .)*** upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the ..... day of .....**, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

……

Seal of Bank and Signature(s)

Note:

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

*The Guarantor shall insert an amount representing the amount of the advance payment in Nepalese Rupees of the advance payment as specified in the Contract.

** Insert the date Thirty days after the expected completion date. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".