SIT Property Development Ltd
A subsidiary of Sugar Investment Trust

BIDDING DOCUMENTS

FOR

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR

CONTRACT NO: SPDL/RFP/C2024/29

(Volume 1 of 2)

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PART 1

BIDDING PROCEDURES

SECTION I

INSTRUCTIONS TO BIDDERS

PART 1 – Bidding Procedures

Section I - Instructions to Bidders

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Section I - Instructions to Bidders

A. General

1. Scope of Bid

1.1 The Employer, as **indicated in the BDS**, issues this Bidding Document for the procurement of the Works as specified in Section V (Employer's Requirements) through Open Advertised Bidding (open for local and overseas bidders). The name, identification, and number of contracts of this bidding 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 Fund

2.1 The Works shall be financed by the Employer's own budgetary allocation, **unless otherwise stated in the BDS**.

3. Public Entities Related to Bidding Documents & to challenge & appeal

3.1 The public entities related to these bidding documents are the Public Body, acting as procurement entity, the Procurement Policy Office, in charge of issuing standard bidding documents and responsible for any amendment these may require, and the Independent Review Panel, set up under the Public Procurement Act 2006 (hereinafter referred to as the Act.)

3.2 Sections 43, 44 and 45 of the Act provide for challenge and review mechanism. Unsatisfied bidders shall follow procedures prescribed in Regulations 48, 49 and 50 of the Public Procurement Regulations 2008 to challenge procurement proceedings and award of procurement contracts or to file application for review at the Independent Review Panel. Challenges and Applications for Review shall be forwarded to the addresses indicated in the BDS;

4. Fraud and Corruption

4.1 It is the policy of the Government of the Republic of Mauritius to require Public Bodies, as well as bidders, suppliers, and contractors and their agents (whether declared or not), personnel, subcontractors, sub-consultants, service providers and suppliers, observe the highest standard of ethics during the procurement and execution of contracts. In pursuance of this

policy, the Government of the Republic of Mauritius:

a) defines, for the purposes of this provision, the terms set forth below as follows:

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

(ii) "fraudulent practice" is any act or omission, including 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" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

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

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the Employer's 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 Employer's inspection and audit rights provided for under sub-clause 4.2 below.

b) 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 in competing for the contract in question; and

c) will sanction a firm or an individual, at any time, in

accordance with prevailing legislations, including by publicly declaring such firm or individual ineligible, for a stated period of time: (i) to be awarded a public contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a public contract.

4.2 In further pursuance of this policy, Bidders shall permit the Employer to inspect any accounts and records and other documents relating to the Bid submission and contract performance, and to have them audited by auditors appointed by the Employer.

4.3 Bidders, suppliers and public officials shall also be aware of the provisions stated in sections 51 and 52 of the Public Procurement Act which can be consulted on the website of the Procurement Policy Office (PPO) : *ppo.govmu*.org

4.4 The Employer commits itself to take all measures necessary to prevent fraud and corruption and ensures that none of its staff, personally or through his/her close relatives or through a third party, will in connection with the bid for, or the execution of a contract, demand, take a promise for or accept, for him/herself or third person, any material or immaterial benefit which he/she is not legally entitled to. If the Employer obtains information on the conduct of any of its employees which is a criminal offence under the relevant Anti-Corruption Laws of Mauritius or if there be a substantive suspicion in this regard, he will inform the relevant authority (ies)and in addition can initiate disciplinary actions. Furthermore, such bid shall be rejected.

5. Eligible Bidders

5.1 (a) In accordance with CIDB Act 2008, Contractors and Sub-contractors, whether local or foreign under an existing or intended joint venture operating in the construction industry have the statutory obligation to be registered with the Construction Industry Development Board (CIDB), as appropriate, prior to bidding for the project.

(b) Bidders are strongly advised to consult the website of the CIDB cidb.govmu.org for further details concerning registration of contractors.

5.2 A Bidder may be a natural person, private entity, or government-owned entity—subject to ITB 5.6—or any combination of them in the form of a joint venture, under an existing agreement, or with the intent to constitute a legally-enforceable joint venture. Unless otherwise **stated in the BDS**, all partners shall be jointly and severally liable for the execution of the Contract in

accordance with the Contract terms.

5.3 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country except in the case of open national bidding where the bidding documents may limit participation to citizens of Mauritius or entities incorporated in Mauritius, if so qualified in the BDS. 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 subcontractors or suppliers for any part of the Contract including related services.

5.4 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if :

(a) they have a controlling partner 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 information about or influence on 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. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the party is involved. However, this does not limit the inclusion of the same subcontractor in more than one bid; or

(f) a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; or

(g) a Bidder, or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Engineer for the contract.

5.5 (a)A firm that is under a declaration of ineligibility by the Government of Mauritius in accordance with applicable laws at the date of the deadline for bid submission and thereafter shall be disqualified

(b) Bids from contractors appearing on the ineligibility lists of African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank Group and World Bank Group shall be rejected.

Links for checking the ineligibility lists are available on the PPO's website: *ppo.govmu.org.*

5.6 Government-owned enterprises in the Republic of Mauritius 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 Government.

5.7 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

5.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

5.9 Firms shall be excluded if 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 Republic of Mauritius prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.

6. Eligible Materials, Equipment and Services

6.1 The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 5.2 above 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.

6.2 For the purpose of ITB 6.1 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 Document

7. Sections of Bidding Document

7.1 The Bidding Document consist of Parts 1, 2, and 3, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 9.

PART 1 Bidding Procedures
Section I – Instructions to Bidders (ITB)
Section II – Bid Data Sheet (BDS)
Section III – Evaluation and Qualification Criteria
Section IV – Bidding Forms

PART 2 Requirements
Section V – Works Requirements

PART 3 Conditions of Contract and Contract Forms
Section VI – General Conditions (GC)
Section VII – Particular Conditions (PC)
Section VIII – Contract Forms

7.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.

7.3 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.

7.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

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

8.1 A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer's address **indicated in the BDS** or raise his inquiries during the pre-bid meeting if provided for in accordance with ITB 8.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than 14 days prior to the deadline for submission of bids. The Employer shall respond to such request at latest 7 days prior to the deadline for submission of bids and forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 7.3, 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 9 and ITB 23.2.

8.2 The Bidder is encouraged 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.

8.3 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.

8.4 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.

8.5 The Bidder is requested, as far as possible, to submit any question in writing, to reach the Employer not later than one week before the meeting.

8.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any response prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 7.3. 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 9 and not through the minutes of the pre-bid meeting.

8.7 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

9. Amendment of Bidding Document

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

9.2 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 7.3.

9.3 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 23.2.

C. Preparation of Bids

10. Cost of Bidding

10.1 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.

11. Language of Bid

11.1 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.

11.2 Notwithstanding the above, documents in French submitted with the bid may be accepted without translation.

12. Documents Comprising the Bid

12.1 The Bid shall comprise the following:

(a) Bid Submission Form;

(b) completed Schedules, in accordance with ITB 13 and 15, or **as stipulated in the BDS**;

(c) Bid Security or Bid Securing Declaration, in accordance with ITB 20;

(d) alternative bids, at Bidder's option and if permissible, in accordance with ITB 14;

(e) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.2;

(f) documentary evidence in accordance with ITB 18 establishing the Bidder's qualifications to perform the contract;

(g) Technical Proposal in accordance with ITB 17;

(h) in the case of a bid submitted by a joint venture (JV), the JV agreement, or letter of intent to enter into a JV including a draft agreement, indicating at least the parts of the Works to be executed by the respective partners; and

(i) any other document **required in the BDS**.

13. Bid Submission Form and Schedules

13.1 The Bid Submission Form, Schedules, and all documents listed under Clause 12, shall be prepared using the relevant forms in Section IV (Bidding Forms), if so provided. 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.

14. Alternative Bids

14.1 Unless otherwise **indicated in the BDS**, alternative bids shall not be considered.

14.2 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.

14.3 When **specified in the BDS** pursuant to ITB 14.1, and subject to ITB 14.4 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.

14.4 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 V (Employer's Requirements). The method for their evaluation will be stipulated in Section III (Evaluation and Qualification

Criteria).

15. Bid Prices and Discounts

15.1 The prices and discounts quoted by the Bidder in the Bid Submission Form and in the Schedules shall conform to the requirements specified below.

15.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section IV, Bidding Forms. In case of admeasurement contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.

15.3 The price to be quoted in the Bid Submission Form shall be the total price of the Bid, excluding Value Added Tax and any discounts offered.

15.4 Unconditional discounts, if any, and the methodology for their application shall be quoted separately in the Bid Submission Form, in accordance with ITB 13.1.

15.5 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 15.3, provided the bids for all contracts are submitted and opened at the same time.

15.6 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 Schedule of Adjustment Data in Section IV (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.

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

15.8 The bidder shall submit his bid price exclusive of VAT.

16. Currencies of Bid and Payment

16.1 The currency(ies) of the bid shall be as **specified in the BDS**.

16.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the prices shown in the appropriate form(s) of Section IV, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.

17. Documents Comprising the Technical Proposal

17.1 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.

18. Documents Establishing the Qualifications of the Bidder

18.1 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).

19. Period of Validity of Bids

19.1 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.

19.2 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 20, it shall also be extended for a corresponding 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.

19.3 In the case of fixed price contracts, if the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the Contract price shall be adjusted by a factor specified in the request for extension. Bid evaluation shall be based on the Bid Price without taking into consideration the above correction.

20. Bid Security

20.1 Unless otherwise **specified in the BDS**, the Bidder shall either furnish as part of its bid, in original form, a bid security or subscribe to a Bid Securing Declaration in the Bid Submission

Form **as specified in the BDS**. In the case of a bid security, the amount shall be **as specified in the BDS**.

20.2 The Bid Securing Declaration shall be in the form of an undertaking by the Bidder in the Bid Submission Form.

20.3 If a Bid Security is specified pursuant to ITB 20.1, the Bid Security shall be in the form of an unconditional guarantee, issued by a local / reputed overseas bank or local insurance company.

The Bid Security shall be submitted either using the Bid Security Form included in Section IV (Bidding Forms) or in another substantially similar format approved by the Employer prior to bid submission. In either case, the form must include the complete name of the Bidder. The Bid Security shall be valid for thirty days (30) beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 19.2.

20.4 Any bid not accompanied by an enforceable and substantially compliant Bid Security or not containing a subscription to a Bid Securing Declaration in the Bid Submission Form, if required, in accordance with ITB 20.1, shall be rejected by the Employer as nonresponsive.

20.5 If a Bid Security is specified pursuant to ITB 20.1, the bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to ITB 42.

20.6 If a Bid Security is specified pursuant to ITB 20.1, the bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.

20.7 The Bid Security may be forfeited or the Bid Securing Declaration executed:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Bid Submission Form, except as provided in ITB 19.2 or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 41; or

(ii) furnish a performance security in accordance with ITB 42.

20.8 The Bid Security or the Bid Securing Declaration of a JV shall be in the name of the JV that submits the bid. If the JV has not been constituted into a legally-enforceable JV, at the time of bidding,

the Bid Security or the Bid Securing Declaration shall be in the names of all future partners as named in the letter of intent mentioned in ITB 5.2.

21. Format and Signing of Bid

21.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 12 and clearly mark it "ORIGINAL". Alternative bids, if permitted in accordance with ITB 14, 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.

21.2 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 as **specified in the BDS.**

21.3 Any amendment 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

22. Sealing and Marking of Bids

22.1 Bidders may always submit their bids by mail or by hand. When so **specified in the BDS**, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows:

(a) Bidders submitting bids by mail or by hand shall enclose the original and each copy of the Bid, including alternative bids, if permitted in accordance with ITB 14, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL", "ALTERNATIVE" and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with ITB sub-Clauses 22.2 and 22.3.

(b) Bidders submitting bids electronically shall follow the electronic bid submission procedures **specified in the BDS**.

22.2 The inner and outer envelopes shall:

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

(b) be addressed to the Employer as **provided in the BDS** pursuant to ITB 23.1;

(c) bear the specific identification of this bidding process indicated in accordance with ITB 1.1; and

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

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

23. Deadline for Submission of Bids

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

23.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 9, 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.

24. Late Bids

24.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 23. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

25. Withdrawal, Substitution, and Modification of Bids

25.1 A Bidder may withdraw, substitute, or modify its bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 21.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 21 and ITB 22 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," "MODIFICATION;" and

(b) received by the Employer prior to the deadline prescribed for submission of bids, in accordance with ITB 23.

25.2 Bids requested to be withdrawn in accordance with ITB 25.1 shall be returned unopened to the Bidders.

25.3 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Bid Submission Form or any extension thereof.

26. Bid Opening

26.1 The Employer shall open the bids at the address, date and time **specified in the BDS** in the presence of Bidders` designated representatives who choose to attend. Any specific electronic bid

opening procedures required if electronic bidding is permitted in accordance with ITB 22.1, shall be as **specified in the BDS**.

26.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening. Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding bid being substituted, and the substituted bid shall not be opened, but returned to the Bidder. No bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at bid opening. Envelopes marked "MODIFICATION" shall be opened and read out with the corresponding bid. No bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at bid opening. Only envelopes that are opened and read out at bid opening shall be considered further.

26.3 All other envelopes shall be opened one at a time, reading out: the name of the Bidder and the Bid Price(s), including any discounts and alternative bids and indicating whether there is a modification; the presence of a bid security or the subscription with respect to the Bid Securing Declaration in the Bid Submission Form, if required; and any other detail as the Employer may consider appropriate. Only discounts and alternative offers read out at bid opening shall be considered for evaluation. No bid shall be rejected at bid opening except for late bids, in accordance with ITB 24.1.

26.4 The Employer shall prepare a record of the bid opening that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; the Bid Price, per contract if applicable, including any discounts and alternative offers; and the presence or absence of a bid security, if one was required. 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

27. Confidentiality

27.1 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 person not

officially concerned with such process until information on Contract award is communicated to all Bidders.

27.2 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.

27.3 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.

28. Clarification of Bids

28.1 To assist in the examination, evaluation, and comparison of the bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its bid. 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 prices or substance of the bid shall be sought, offered, or permitted, except to confirm the correction of arithmetical errors discovered by the Employer in the evaluation of the bids, in accordance with ITB 32.

28.2 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.

29. Deviations, Reservations, and Omissions

29.1 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.

30. Determination of Responsiveness

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 ITB12.

30.2 A substantially responsive bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or

performance of the Works specified in the Contract; or

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

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

30.3 The Employer shall examine the technical aspects of the bid submitted in accordance with ITB 17, Technical Proposal, in particular, to confirm that all requirements of Section 6 (Employer's 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.

31. Nonconformities, Errors, and Omissions

31.1 Provided that a bid is substantially responsive, the Employer may waive any non-material non-conformity in the bid.

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

31.3 Provided that a bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price may 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).

32. Correction of Arithmetical Errors

32.1 Provided that the bid is substantially responsive, 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; and

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

33. Conversion to Single Currency

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

34. Margin of Preference

34.1 **Unless otherwise specified in the BDS**, Margin of Preference shall not apply.

35. Evaluation of 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 bid, the Employer shall consider the following:

(a) the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities for admeasurement contracts or Schedule of Prices for lump sum contracts, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 32.1;

(c) price adjustment due to discounts offered in accordance with ITB 15.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 33;

(e) adjustment for non-conformities in accordance with ITB 31.3;

(f) 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 discount offered in the Bid Submission Form, is specified in Section III (Evaluation and Qualification Criteria).

35.5 If the bid for an admeasurement contract, which results in the lowest Evaluated Bid Price is seriously unbalanced or front loaded or if any item in the Bill of Quantities is front loaded or contains an erroneous amount 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 analysis of the prices the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

36. 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. Qualification of the Bidder

37.1 The Employer shall determine to its satisfaction whether the Bidder that is selected as having submitted the lowest evaluated and substantially responsive bid meets the qualifying criteria specified in Section III (Evaluation and Qualification Criteria).

37.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 18.1.

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

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

38.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

39. Award Criteria

39.1 Subject to ITB 38.1, the Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document or at a negotiated price **as provided in the BDS**, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

40. Notification of Award

40.1 Prior to the expiration of the period of bid validity, the Employer shall, for contract amount above the prescribed threshold, notify the selected bidder of the proposed award and accordingly notify unsuccessful bidders. Subject to Challenge and Appeal the Employer shall notify the selected Bidder, in writing, by a Letter of Acceptance for award of contract. The Letter of Acceptance shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price") and the requirement for the Contractor to remedy any defects therein as prescribed by the Contract. Within seven days from the issue of Letter of Acceptance, the Employer shall publish on the Public Procurement Portal *(publicprocurement.govmu.org)* and the Employer's website, the results of the Bidding Process identifying the bid and lot numbers and the following information:

(i) name of the successful Bidder, and the Price it offered, as well as the duration and summary scope of the contract awarded; and

(ii) an executive summary of the Bid Evaluation Report.

40.2 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

41. Signing of Contract

41.1 The contract agreement shall be signed within 28 days after the successful bidder receives the letter of acceptance unless the parties agree otherwise.

42. Performance Security

42.1 Within twenty-eight (28) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security, in the amount **specified in the BDS**, in accordance with the conditions of contract, subject to ITB 35.5, using for that purpose the Performance Security Form included in Section VIII (Contract Forms), or another form acceptable to the Employer.

42.2 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.

Preference Security

42.3 The successful bidder having benefitted from a Margin of Preference shall provide a Preference Security, **as specified in the BDS**. The amount for the Preference Security shall be the difference between the price quoted by the selected bidder and that of the lowest evaluated bid which would have been selected for award of contract, if the said Margin of Preference was not applicable.

42.4 The successful bidder shall submit post qualification information **as specified in the BDS.** Failure to submit such information 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.

43. Adjudicator

43.1 The Employer proposes the person **named in the BDS** to be appointed as Adjudicator under the Contract, at the hourly fee **specified in the BDS**, plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in his Bid. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority designated in the Particular Conditions of Contract (PCC) pursuant to Clause 24.1 of the General Conditions of Contract (GCC), to appoint the Adjudicator.

44. Plants and Materials on site

44.1 Unless otherwise specified in BDS interim payment for Plant and Material on site is applicable as per GCC 39.7.

45. Debriefing

45.1 The Employer shall promptly attend to all requests for debriefing for the contract, made in writing, and within 30 days from the date of the publication of the award or date the unsuccessful bidders are informed about the award, whichever is the case, by following regulation 9 of the Public Procurement Regulations 2008 as amended.

Section II – Bid Data Sheet (BDS)

A. Introduction

ITB 1.1	The Employer is: **SIT Property Development Ltd** The Name of the Project is: **Infrastructure Works to Sites S6, S7, S8, S9 & S10 in Morcellement Area Living Harmony, Cote D'Or.** The Procurement Reference no. of the Project is: **SPDL/RFP/C2024/29.** The Works, which are detailed in the Bill of Quantities and forming part of this Bidding Document consist mainly of the following: a) Construction of approximately 1650m of 6m wide road in premix asphalt, including concrete footpath on both sides of the roads. b) Construction of approximately 1650m roadside covered drain. c) Construction of approximately 1650m of PE pipelines of 90mm to 110mm, together with house connection tappings onto newly laid service main to each plot, complete with the main connection to CWA Mains. d) Construction of approximately 1650m wastewater network in 200mm uPVC sewer pipelines complete with Y-branches and intercepting chambers (IC A) for each plot. e) Supply and Installation of 3nos. transformers together with the construction of 3no. transformer rooms and laying of approximately 3500m of 160mm diameter yellow uPVC ducting, complete with service cable pillars and underground plot connections. f) Construction of underground street lighting network complete with the installation of 56nos. 6m high lamp posts complete with LED lanterns. g) Supply and installation of approximately 6,500m of 45mm diameter telecom duct complete with manholes, cubicles and draw box for each plot. h) Construction of approximately 150m of retaining in reinforced concrete wall and masonry varying between 1m to 4m. i) Ancillary works as defined in the Specifications and shown on drawings such as, but not limited to, landscaping works.
ITB 3.1	**Not applicable**
ITB 3.2	**Not applicable**
ITB 5.2	The individuals or firms in a JV, *shall* be jointly and severally liable.

ITB 5.3	The Bidding Method is: **Open Advertised Bidding (National)** **Participation is limited to citizens of Mauritius or entities incorporated in Mauritius. Joint Ventures should be among entities incorporated in Mauritius**

B. Bidding Documents

ITB 7.1	The Bidding Documents consist of Parts 1, 2 and 3, which include all the sections indicated below in 2 volumes and should be read in conjunction with any Addenda issued in accordance with ITB 9. **VOLUME 1 OF 2** **PART 1: BIDDING PROCEDURES** Section I – Instructions to Bidders (ITB) Section II – Bid Data Sheet (BDS) Section III – Evaluation and Qualification Criteria Section IV – Bidding Forms **PART 2: EMPLOYER'S REQUIREMENTS** Section V – Specifications – Bill of Quantities **PART 3 CONDITIONS OF CONTRACT AND CONTRACT FORMS:** Section VI – General Conditions of Contract Section VII – Particular Conditions of Contract Section VIII – Contract Forms **VOLUME 2 OF 2** **PART 2: EMPLOYER'S REQUIREMENTS** Section V – Drawings

ITB 8.1	For **clarification purposes** only, the Employer's address is: Attention: **The Officer In Charge** Address : **SIT Property Development Ltd,** **Ground Floor, NG Tower,** **Cybercity, Ebène, Mauritius** Tel : **+230 406 4747** Fax No. : **+230 466 6566** E-mail : **kmamode@sit.mu** *Note:* a) Requests for clarification should be solely in writing; b) Requests for clarifications should be addressed to the Employer; c) Requests for clarification should be received by the Employer no later than **fourteen (14)** days before the deadline date for submission of bids, i.e **Monday 09th December 2024** latest; d) The Employer will reply to all queries not later than **seven (7)** days prior to the Bid Submission date.
ITB 8.4	A Pre-Bid visit/ meeting **shall** take place as follows: **Date: Wednesday 04th December 2024** **Time: 10.00hrs (Local Time)** **Meeting Place: Round About on Cote D'Or Link Road**

C. Preparation of Bids

ITB 11.1	The language of the bid is **English**
ITB 12.1 (i)	The Bidder shall submit with its bid the following additional documents: a) Any separate Memorandum/information submitted by the bidder with his bid; b) List of suppliers of main materials (pipes, fittings, valves, manhole covers, asphalt and so on); c) Origin of materials to be incorporated in the works; d) Audited accounts as filed with Registrar of Companies for the last five (5) years;

	e) Bank Testimonial Bidder to submit documentary evidence from its Auditor for Liquid Assets and/or a Certificate in original, from a commercial bank with respect to credit facilities mentioning the name and reference of the project and the amount of **MUR 25 Million**; f) CV of Key Personnel; g) Forms for General Experience, Specific Experience and Specific Experience in Key Activities. h) All required information under Section III – "*Evaluation and Qualification Criteria*".
ITB 14.1	Alternative bids **shall not be** permitted.
ITB 14.2	Alternative times for completion **shall not be** permitted.
ITB 15.6	The prices quoted by the Bidder **shall not be** subject to adjustment during the performance of the Contract.
ITB 16.1	The currency of the bid and the currency of payment shall be **Mauritian Rupee (MUR)** only.
ITB 19.1	The bid validity period shall be: **One Hundred and Twenty (120) days** as from the deadline set for the submission of bid. The deadline being counted as day **one** of the validity period. **The Bid shall be valid up to 21st April 2025.**
ITB 20.1	The Bidder shall furnish a Bid Security in the amount of **Mauritian Rupees One Million (MUR 1,000,000),** in the format contained in *Section IV – Bidding Forms*.
ITB 20.3	The Bid Security shall be in the form of an **"Unconditional Bank Guarantee only"**. Bid Security shall be valid up to **30** days beyond the validity period set for the bid. The closing date for submission of bids shall be considered as day **one**. **The Bid Security shall be valid up to 21st May 2025.**
ITB 21.1	In addition to the original of the bid, the number of copies is: **Two (2) HARD COPIES & ONE (1) SOFT COPY.** The copies shall be identical to the original.

ITB 21.2	a) This authorization shall consist of written confirmation and shall be attached to the bid. It may include a delegation of power by resolution of the Board of a company or from the CEO, himself holding power from the Board or through a Power of Attorney. The name and position held by each person signing the authorization must be typed or printed below the signature. 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, if so required in accordance with ITB 5.1, 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."] *Note:* *The power of Attorney or other written authorization to sign may be for a determined period or limited to a specific purpose.*

D. Submission and Opening of Bids

ITB 22.1	Bid shall be submitted **by hand** only.
ITB 23.1	For **bid submission purposes** only, the Employer's address is: **The Officer In Charge** **SIT Property Development Ltd** **Ground Floor, NG Tower,** **Cybercity, Ebène, Mauritius** **The deadline for bid submission is:** Date: **Monday 23rd December 2024** Time: **15.00 hours (local time) at latest**
ITB 26.1	The bid opening shall take place at the following place: **Board Room** **SIT Property Development Ltd,** **Ground Floor, NG Tower,** **Cybercity, Ebène** **Mauritius** Date: **Monday 23rd December 2024** Time: **15.30 hours (local time)**

E. Evaluation and Comparison of Bids

ITB 33.1	**Not applicable**
ITB 34.1	**Not applicable**

F. Award of Contract

ITB 40.1	Delete Sub-Clause 40.1 and replace by the following: - Prior to the expiration of the bid validity prescribed, the Employer shall notify the successful bidder by fax, confirmed by registered Letter, that its bid has been accepted. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") shall specify the sum which the Employer shall pay the Contractor in consideration of the execution and completion of the Works and the remedying of any defects therein by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called " Accepted Contract Amount").
ITB 42.1	The Performance Security shall be 10% of the Contract Price inclusive of Provisional Sum and Contingencies, excluding VAT. The Performance Security shall be in the form of an **"Unconditional Bank Guarantee only"**.
ITB 42.3	**Not applicable**
ITB 42.4	**Not applicable**
ITB 43.1	**Not applicable**
ITB 44.1	Interim payment for **Materials** on site **is applicable** as per Clause 14.5 of the Conditions of Contract and Appendix A to Bid.
ITB 45.1	**Not applicable**

Section III - Evaluation and Qualification Criteria

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1. Evaluation

In addition to the criteria listed in ITB 35.2 (a) – (e) the following criteria shall apply:

1.1 Adequacy of Technical Proposal

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

1.2 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: **NOT APPLICABLE**

1.3 Completion Time

An alternative Completion Time, if permitted under ITB 14.2, will be evaluated as follows: **NOT APPLICABLE**

1.4 Technical Alternatives

Technical alternatives, if permitted under ITB 14.4, will be evaluated as follows: **NOT APPLICABLE**

1.5 Margin of Preference

NOT APPLICABLE

2. Qualifications

Pursuant to ITB 5.1, Bids will be considered from Contractors who are **duly registered** with the **CIDB** under the **grade** and **specialization** that cover adequately the size and type of works related to the project.

In case the works requires certain specialization not covered adequately under the registration of CIDB, those field of specialization shall be defined by the Employer in section 2.4.2 (a) and Specific Experience in key activities in section 2.4.2 (b) which the contractor has to meet as qualification**.**

Factor	2.1 Eligibility					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture, Consortium or Association			
			All partners combined	Each partner	At least one partner	
2.1.1 Nationality	Nationality in accordance with ITB 5.3.	Must meet requirement	Existing or intended JV must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
2.1.2 Conflict of Interest	No- conflicts of interests as described in ITB 5.4.	Must meet requirement	Existing or intended JV must meet requirement	Must meet requirement	N / A	Bid Submission Form
2.1.3 Country Ineligibility	Not having been declared ineligible by the PPO as described in ITB 5.5.	Must meet requirement	Existing JV must meet requirement	Must meet requirement	N / A	Bid Submission Form
2.1.4 Government Owned Entity	Compliance with conditions of ITB 5.6	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
2.1.5 Ineligibility based on a United Nations resolution or Mauritian Law	Not having been excluded as a result of the laws of Republic of Mauritius or official regulations, or by an act of compliance with UN Security Council resolution, in accordance with ITB 5.9	Must meet requirement	Existing JV must meet requirement	Must meet requirement	N / A	Bid Submission Form

Factor	2.2 Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture, Consortium or Association			
			All partners combined	Each partner	At least one partner	
2.2.1 History of non-performing contracts	Non-performance of a contract did not occur within the last **Five (5)** years prior to the deadline for application submission, based on all information on fully settled disputes or litigation. A fully settled dispute or litigation is one that has been resolved in accordance with the Dispute Resolution Mechanism under the respective contract, and where all appeal instances available to the bidder have been exhausted.	Must meet requirement by itself or as partner to past or existing JV	N / A	Must meet requirement by itself or as partner to past or existing JV	N / A	Form CON - 2

Factor	2.2 Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture, Consortium or Association			
			All partners combined	Each partner	At least one partner	
2.2.2 Pending Litigation	All pending litigation against the bidder shall in total not represent more than **Twenty percent (20 %)** of the Bidder's net worth and shall be treated as resolved against the Bidder.	Must meet requirement by itself or as partner to past or existing JV	N / A	Must meet requirement by itself or as partner to past or existing JV	N / A	Form CON – 2

Factor	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture, Consortium or Association			
			All partners combined	Each partner	At least one partner	
2.3.1 Historical Financial Performance[1]	Submission of audited balance sheets or if not required by the law of the bidder's country, other financial statements acceptable to the Employer, for the last **Five [5]** years to demonstrate the current soundness of the bidders financial position and its prospective long term profitability. Bidders shall demonstrate having earned **profit after tax** in at least **One (1) year** during the past **Five (5) years.**	Must meet requirement	N / A	N / A	Lead Partner must meet requirement	Form FIN – 3.1 with attachments

[1] (a) Local bidders who are not required to file Audited Accounts should submit copies of Financial Statements filed at the Registrar of Companies prior to deadline set for the submission of bids.

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Factor	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture, Consortium or Association			
			All partners combined	Each partner	At least one partner	
2.3.2.	**Clause Deleted**					
2.3.3. Financial Resources	The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet: (i) the following cash-flow requirement: **Mauritian Rupees Twenty Five Million (MUR 30.0 Million)** and (ii) the overall cash flow requirements for this contract and its concurrent commitments.	Must meet requirement	Must meet requirement	N/A	N/A	Form FIN –3.3 Form CCC

Factor	*2.4 Experience*					
Sub-Factor	*Criteria*					*Documentation Required*
	Requirement	*Bidder*				
		Single Entity	*Joint Venture, Consortium or Association*			
			All partners combined	*Each partner*	*At least one partner*	
2.4.1 General Experience	Contractors have to be registered with the CIDB under the grade, classes and specialization indicated hereunder: **Grade:** The contractor should be duly registered with the CIDB under the grade that would allow him to perform the value of works for which he is submitting his bid **Classes of works of contractors:** Civil Engineering Construction Works					Valid registration certificate with the CIDB

Factor	*2.4 Experience*					
Sub-Factor	*Criteria*					*Documentation Required*
	Requirement	*Bidder*				
		Single Entity	*Joint Venture, Consortium or Association*			
			All partners combined	*Each partner*	*At least one partner*	
2.4.2 (a) Specific Experience	Participation as contractor, management contractor, or subcontractor, in at least **Two (2)** contracts within the last **Ten (10) years** , each with a value of at least **Mauritian Rupees Once Hundred and Fifty Million (MUR 150 Million),** that have been successfully and 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 V, Employer's Requirements.	Must meet requirement	Must meet requirements for all characteristics	N / A	N / A	Form EXP 2.4.2(a)

Factor	*2.4 Experience*					
Sub-Factor	*Criteria*					*Documentation Required*
	Requirement	*Bidder*				
		Single Entity	*Joint Venture, Consortium or Association*			
			All partners combined	*Each partner*	*At least one partner*	
2.4.2 (b) Specific Experience in key activities	For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum experience in the following key activities **within a single project**: a) Construction of at least 10,000 sqm of Asphalted road complete with street lighting and other road furniture. b) Construction of at least 1,500m of Reinforced Concrete Drains. c) Water works comprising of Ductile Iron/ PE pipe laying of diameter up to 160mm over a length of at least 1,500m, including valve chambers.	Must meet requirements	Must meet requirements	N / A	Must meet requirements	Form EXP-2.4.2(b)

Factor	*2.4 Experience*					
Sub-Factor	*Criteria*					*Documentation Required*
	Requirement	*Bidder*				
		Single Entity	*Joint Venture, Consortium or Association*			
			All partners combined	*Each partner*	*At least one partner*	
	d) Sewer works comprising of 200mm diameter uPVC pipelaying over a length of at least 1,500m, including construction of reinforced concrete manholes. e) Electricity works comprising of 160mm diameter uPVC pipelaying over a length of at least 1,500m, including construction of 30nos. reinforced concrete service cable pillars and 2no. Transformer rooms. f) Telecom works comprising of 45mm diameter PVC pipelaying over a length of at least 1,500m, including construction of reinforced concrete manholes and	Must meet requirements	Must meet requirements	N / A	Must meet requirements	Form EXP-2.4.2(b)

Factor	*2.4 Experience*					
Sub-Factor	*Criteria*					*Documentation Required*
	Requirement	*Bidder*				
		Single Entity	*Joint Venture, Consortium or Association*			
			All partners combined	*Each partner*	*At least one partner*	
	cubicles. g) Earthworks comprising of bulk excavation and Engineering Fill of a Combined Volume of 25,000 m^3. h) Construction of Reinforced Concrete or Masonry Retaining Wall with height of at least 3m over a length of 25m.					

2.5 Personnel

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

No. of Personnel	Position	Qualification Requirements	Experience in Similar Works
1	Contract Manager	Civil Engineer Registered with the Council of Registered Professional Engineers with minimum 10 years of experience as Contract Manager Or Quantity Surveyor Registered with the Professional Quantity Surveyors' Council with minimum 10 years of experience as Contract Manager Or Diploma in Civil Engineering or Quantity Surveying with minimum of 15 years' experience as Contract Manager.	2 projects (over last 10 years)
1	Site Manager	At least Diploma Holder in Civil Engineering with minimum of 10 years' experience as Site Manager	2 (over last 5 years)
2	Site Engineer	A degree in Civil Engineering with a minimum of 10 years' experience as Site Engineer	2 (over last 5 years)
1	Foreman (Road works)	At least 10 years' experience in road and drainage works.	2 (over last 5 years)
2	Foreman (Pipe laying)	At least 10 years' experience in Pipe laying works.	2 (over last 5 years)
1	Land Surveyor	At least 5 years' experience in Civil Engineering Works .	2 (over last 5 years)
1	Pipe Fitter	At least 5 years' experience in Ductile Iron pipelaying works and PE electro-fusion works	2 (over last 5 years)
1	Health & Safety Officer	Diploma in Occupational Health and Safety	2 (over last 5 years)

Each CV shall be initiated and signed by the proposed personnel himself/herself not more than 14 days prior to submission of bid. The approved personnel shall be on a full-time basis for this Contract *(Except for Contract Manager and Health & Safety Officer).*

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

2.6 Equipment

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

Equipment	Minimum No Required
90hp Tracked Excavator	3
Concrete Mixer -- min. 2 m^3 capacity	2
Tipping Lorry – min. 10 ton capacity	3
Dumper	2
Steer Skid Loader	3
Pipeline Testing Equipment	2
Poker Type Concrete Vibrator	2
50 mm Delivery Water Pump and Motor	2
PE Pipe Electro-fusion machine with report printing facility	1
Mobile Generator	2
Asphalt Cutter	1
Air Compressor – 250 l/s capacity	2
Hand Operated Frog Hammer	2
Grader	1
Tandem Roller – min. 7 ton capacity	1
Pneumatic Roller – min. 10 ton capacity	1
Asphalt Paver	1

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

Section IV - Bidding Forms

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Bid Submission Form

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR.

PROCUREMENT REFERENCE NO.: SPDL/RFP/C2024/29

Date:……

To:

The Officer In Charge,
SIT Property Development Ltd
Ground Floor, NG Tower
Cybercity, Ebène
Mauritius

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 9;

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

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

_____exclusive of VAT;

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

_____;

(e) Our bid shall be valid for a period of **120 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) I/We hereby confirm that I/we have read and understood the content of the Bid Security attached herewith and subscribe fully to the terms and conditions contained therein, if required. I/We understand that non-compliance to the conditions mentioned may lead to disqualification.

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

(h) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries;

(i) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 5.4;

(j) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 5.4, other than alternative offers submitted in accordance with ITB 14;

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

(l) We are not a government owned entity / We are a government owned entity but meet the requirements of ITB 5.6;[2]

(m) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: [3]

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

(n) We have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud and corruption as per the principles described hereunder, during the bidding process and contract execution:

i. We shall not, directly or through any other person or firm, offer, promise or give to any of the Public Body's employees involved in the bidding process or the execution of the contract or to any third person any material or immaterial benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

ii. We shall not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelisation in the bidding process.

iii. We shall not use falsified documents, erroneous data or deliberately not disclose requested facts to obtain a benefit in a procurement proceeding.

[2] *Use one of the two options as appropriate.*

[3] *If none has been paid or is to be paid, indicate "none".*

We understand that transgression of the above is a serious offence and appropriate actions will be taken against such bidders.

(o) We understand that this bid, together with your written acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

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

(q) If awarded the contract, the person named below shall act as Contractor's Representative:

Name: .....

In the capacity of: .....

Signed: .....

Duly authorized to sign the Bid for and on behalf of: .....

Date: .....

Seal of Company .....

Form of Bid Security (Bank Guarantee)

.....*Bank's Name and Address of issuing Branch or Office*.....

Beneficiary: **SIT PROPERTY DEVELOPMENT LTD**
GROUND FLOOR,
NG TOWER
CYBERCITY
EBENE

Date: .....

BID GUARANTEE No.: .....

We have been informed that .....*name of the Bidder*..... (hereinafter called "the Bidder") has submitted to you its bid dated..... (hereinafter called "the Bid") for the execution of **[INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AREA LIVING HARMONY, COTE D'OR]** under Invitation for Bids Reference No: **SPDL/RFP/C2024/29**.

Furthermore, we understand that, according to your conditions, bids must be supported by a bid security.

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 **MAURITIAN RUPEES ONE MILLION (MUR 1,000,000)** 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 modified or withdrawn its Bid after the deadline for submission of its bid during the period of bid validity specified by the Bidder in the Form of Bid; or

(b) has refused to accept a correction of an error appearing on the face of the Bid; or

(c) having been notified of the acceptance of its Bid by the Public Body during the period of bid validity, (i) has failed or refused to sign the contract Form, if required, or (ii) has failed or refused to furnish the performance security, in accordance with the Instructions to Bidders.

This guarantee shall expire: (a) if the Bidder is the successful bidder, upon our receipt of copies of the contract signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; or (b) if the Bidder is not the successful bidder, upon the earlier of (i) our receipt of a copy of your notification to the Bidder of the name of the successful bidder; or (ii) thirty days after the expiration of the Bidder's Bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before .....*Public Body to insert date*.....

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

Technical Proposal

Technical Proposal Forms

Personnel

Equipment

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Others

Forms for 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.

1.	**Title of position**
	Name
2.	**Title of position**
	Name
3.	**Title of position**
	Name
4.	**Title of position**
	Name
5.	**Title of position**
	Name
6.	**Title of position**
	Name
etc.	**Title of position**
	Name

Form PER – 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below.

Position		
Personnel information	**Name**	**Date of birth**
	Academic/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 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*

Forms for 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.

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	**Telex**
Agreements	**Details of rental / lease / manufacture agreements specific to the project**	

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Others

Bidder's Qualification

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

Form ELI 1.1

Bidder Information Sheet

Date: _____

Bidder's Reference Bidding No.: _____

Page _____ of _____ pages

1. Bidder's Legal Name
2. In case of JV, legal name of each party:
3. Bidder's actual or intended Country of Registration:
4. Bidder's Year of Registration:
5. Bidder's Legal Address in Country of Registration:
6. Bidder's Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:
7. Attached are copies of original documents of: ☐ Articles of Incorporation or Registration of firm named in 1, above, in accordance with ITB Sub-Clauses 5.2 and 5.3. ☐ In case of JV, letter of intent to form JV including a draft agreement, or JV agreement, in accordance with ITB Sub-Clauses 5.2 ☐ In case of government owned entity from the Employer's country, documents establishing legal and financial autonomy and compliance with the principles of commercial law, in accordance with ITB Sub-Clause 5.6. ☐ Attach Registration Certificate with the CIDB for the Bidder including those for the members of the Joint Venture, and for the joint venture, if applicable.

Form ELI 1.2

Party to JV Information Sheet

Date: _____

Bidder's Reference No.: _____

Invitation for Bid No.:_____

Page _____ of_ _____ pages

1. Bidder's Legal Name:
2. JV's Party legal name:
3. JV's Party Country of Registration:
4. JV's Party Year of Registration:
5. JV's Party Legal Address in Country of Registration:
6. JV's Party Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:
7. Attached are copies of original documents of: ☐ Articles of Incorporation or Registration of firm named in 1, above, in accordance with ITB Sub-Clauses 5.2 and 5.3. ☐ In case of government owned entity from Mauritius, documents establishing legal and financial autonomy and compliance with the principles of commercial law, in accordance with ITB Sub-Clause 5.6.

Form CON – 2

History of Non-Performing Contracts

Bidder's Legal Name: _____ Date: _____
JV Partner Legal Name: _____ _____
Bidder's Reference No.: _____
Page _____ of _____ pages

Non-Performing Contracts in accordance with (Evaluation and Qualification Criteria)			
☐ Contract non-performance did not occur during the stipulated period, in accordance with Sub-Factor 2.2.1 of Section III (Evaluation and Qualification Criteria) ☐ Contract non-performance during the stipulated period, in accordance with Sub-Factor 2.2.1 of Section III(Evaluation and Qualification Criteria).			
Year	Outcome as Percent of Total Assets	Contract Identification	Total Contract Amount (current value, MUR equivalent)
_____	_____	Contract Identification: Name of Employer: Address of Employer: Matter in dispute:	_____
Pending Litigation, in accordance with Section III (Evaluation and Qualification Criteria)			
☐ No pending litigation in accordance with Sub-Factor 2.2.2 of Section III (Evaluation and Qualification Criteria) ☐ Pending litigation in accordance with Sub-Factor 2.2.2 of Section III (Evaluation and Qualification Criteria), as indicated below			
Year	Outcome as Percent of Total Assets	Contract Identification	Total Contract Amount (current value, MUR equivalent)
_____	_____	Contract Identification: Name of Employer: Address of Employer: Matter in dispute:	_____
_____	_____	Contract Identification: Name of Employer: Address of Employer: Matter in dispute:	_____

Form CCC

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.

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

Financial Situation

Historical Financial Performance

Bidder's Legal Name: _____ Date: _____
JV Partner Legal Name: _____
Bidder's Reference No.: _____

Page _____ of _____ pages

To be completed by the Bidder and, if JV, by each partner

Financial information in MUR equivalent	Historic information for previous _____ (__) years (MUR equivalent in millions)						
	Year 1	Year 2	Year 3	Year …	Year n	Avg.	Avg. Ratio
Information from Balance Sheet							
Total Assets (TA)							
Total Liabilities (TL)							
Net Worth (NW)							
Current Assets (CA)							
Current Liabilities (CL)							
Information from Income Statement							
Total Revenue (TR)							
Profits Before Taxes (PBT)							

☐ Attached are copies of financial statements (balance sheets, including all related notes, and income statements) for the years required above complying with the following conditions:

- Must 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 accountant
- 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)

Form FIN 3.3

Financial Resources

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

Supporting documents include Bank Certificate in the format as given hereunder.

Source of financing	Amount (MUR equivalent)
1.	
2.	
3.	
4.	

Form EXP – 2.4.2(a)

Specific Experience

Bidder's Legal Name: _____ Date: _____
JV Partner Legal Name: _____Bidder's Reference No.: _____

Page _____ of _____ pages

Similar Contract Number: ___ *[insert specific number]* **of** ___*[insert total number of contracts* **required.**	**Information**		
Contract Identification	_____		
Award date Completion date	_____ _____		
Role in Contract	☐ Contractor	☐ Management Contractor	☐ Subcontractor
Total contract amount	_____		MUR_____
If partner in a JV or subcontractor, specify participation of total contract amount	_____%	_____	MUR_____
Employer's Name:	_____		
Address: Telephone/fax number: E-mail:	_____ _____ _____ _____		

Form EXP – 2.4.2(a) (cont.)

Specific Experience (cont.)

Bidder's Legal Name: _____ Page _____ of _____ pages
JV Partner Legal Name: _____

Similar Contract No. *__[insert specific number]* **of** *___[insert total number of contracts]* **required**	**Information**
Description of the similarity in accordance with Sub-Factor 2.4.2a) of Section III (Evaluation and Qualification Criteria):	
Amount	_____
Physical size	_____
Complexity	_____
Methods/Technology	_____
Physical Production Rate	_____

Form EXP – 2.4.2(b)

Specific Experience in Key Activities

Bidder's Legal Name: _____ Date: _____

JV Partner Legal Name: _____ Bidder's Reference No.: _____

Subcontractor's Legal Name: _____ Page _____ of _____ pages

	Information		
Contract Identification	_____		
Award date Completion date	_____ _____		
Role in Contract	☐ Contractor	☐ Management Contractor	☐ Subcontractor
Total contract amount	_____		MUR_____
If partner in a JV or subcontractor, specify participation of total contract amount	_____%	_____	MUR_____
Employer's Name:	_____		
Address: Telephone/fax number: E-mail:	_____ _____ _____ _____		

Form EXP – 2.4.2 (b)(cont.)

Specific Experience in Key Activities (cont.)

Bidder's Legal Name: _____ Page ____ of _____pages

JV Partner Legal Name: _____

Subcontractor's Legal Name: _____

	Information
Description of the key activities in accordance with Sub-Factor 2.4.2(b) of Section III (Evaluation and Qualification Criteria):	

PART 2

EMPLOYER'S REQUIREMENTS

Section V - Employer's Requirements

- SPECIFICATIONS
- DRAWINGS
- BILL OF QUANTITIES

SECTION V – EMPLOYER'S REQUIREMENTS

SPECIFICATIONS

SPECIFICATION SECTIONS

Section	Title
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3	EARTHWORKS AND PIPELAYING
4	TESTING OF PIPELINES
5	CONCRETE
6	ROADWORKS
7	CATCHMENT AND ROAD DRAINAGE
8	ELECTRICAL WORKS FOR SITE INFRASTRUCTURE
9	SAFETY, HEALTH AND ENVIRONMENT
10	ARCHITECTURAL WORKS
11	TELECOMMUNICATION SERVICES
12	PLATFORMING/ ENGINEERING FILL
13	LANDSCAPING WORKS

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO.: SPDL/RFP/C2024/29

SPECIFICATION

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Section 1

GENERAL

SECTION 1 - GENERAL

1.1 LOCATION OF SITE OF WORKS

The Site of Works is shown in the Location and Site Plans enclosed in the Volume 2 of the Bid Documents: "*Employer's Requirements: Tender Drawings*".

For the purpose of the tender, the Site of Works shall be defined as all places within the Site Location Plans referred to above, on, and under which the Works described in these documents are to be performed.

For the Scope of Works and a brief description thereof , please refer to Clause 1.6 below.

1.2 CONTRACT DOCUMENTS

For the purpose of carrying out the Contract, the Contractor will be supplied with one copy of the Specification, Bill of Quantities, Conditions of Contract and the Contract Drawings.

The whole of the Works shall agree with the levels, measurements and details contained in the Drawings accompanying the Specification and with such other drawings as may from time to time be supplied by the Engineer or may be supplied by the Contractor and approved by the Engineer.

The Contract Documents will consist of and incorporate all the documents given to the Contractor for the purpose of tendering together with the contractor's documents submitted for the tender, and all the pre-award correspondences up to the signature of the Contract Document, and finally of all the documents listed in the Contract Agreement.

1.3 CONTRACT DRAWINGS

The Drawings referred to in the Conditions of Contract are listed in the Volume 2 of the Bid Documents: *"Employer's Requirements - Tender Drawings*".

Additional drawings and details called Working Drawings will be issued to the Contractor during the course of the Contract, should the need thereof arise. For this purpose, the Contractor shall furnish all the necessary baseline data including surveys as specified in Clauses 1.17 and 1.18 of these Specifications.

1.4 STANDARDS

For convenience, and in order to establish the necessary standards of quality, reference has been made to specifications issued by national or other widely recognized bodies. Such specifications shall be referred to as "*Standard Specifications*" and shall be the latest editions of such standard specifications issued prior to the issue of the Bidding Documents, together with such additions and amendments as may have been issued prior to the same date. The list of such standards shall be supplied by the Contractor to the Engineer at his own cost.

The standards mentioned herein are issued by the Organizations listed in Table 1-1 where the abbreviations used are defined.

The Contractor's attention is drawn that this list is indicative only. The applicable standards are specified at Annex 2A at the end of Section 2 in these Specifications.

Table 1-1: Names and addresses of standards issuing bodies.

Name and Address	*Abbreviation*
American Society for Testing Materials 1916, Race Street PHILADELPHIA PA 19103, USA	ASTM
American Water Works Association 6666, West Quincy Avenue DENVER CO 80235, USA	AWWA
Association Française de Normalisation 23, rue Notre Dame des Victoires 75002 - PARIS, France	AFNOR
British Standard Institution 2, Park Street LONDON W1A 2BS, England	BS BSCP
Deutsches Institut für Normung Benth Vertrich Strass 1 BERLIN 30, West Germany	DIN
International Electrotechnical Commission Boite Postale 56 1211 GENEVA 20, Switzerland	IEC
International Standard Organization Code Postale 563 1211 GENEVA 20, Switzerland	ISO
Mauritius Standards Bureau Villa Road MOKA, Mauritius	MS

Subject to the written approval of the Engineer, any other internationally accepted standard which requires an equal quality of work may be used.

If the Contractor proposes to use a Standard Specification other than that specified, three copies of the proposed Standard Specification shall be submitted to the Engineer not less than **14 days** before approval of the Standard Specification is required.

Copies, in English language, of all Standards used in connection with the Works shall be supplied to the Engineer. During the execution of the works, any latest edition of the *"Standard Specification"* as mentioned in this Specification shall supersede the previous one.

1.5 UNITS

In this Specification, in the Drawings, and in the Bills of Quantities, the metric system of dimensioning has been adopted except where it is understood that suppliers and manufacturers are not yet able to provide material in metric sizes.

Where dimensions are given in metric units for materials which are only available in Imperial dimensions, and vice versa, the Contractor may, subject to his obtaining the prior approval of the Engineer, substitute the nearest equivalent available standard size in the other system.

1.6 SCOPE OF WORKS

Works for the purpose of this project indicatively comprise of the following:

Road and Drainage Works

- Construction of approximately 1.65km of 6m wide road in premix asphalt, including concrete footpath on both sides of the roads and road furniture.
- Construction of approximately 1.65km of roadside covered absorption drain.
- Construction of Outlet Structures.
- Supply and installation of Heavy Duty Handrails.

Water Works

- Construction of on-site Water works comprising of approximately 1650m of PE pipes with diameter ranging from 90mm to 110mm, together with house connection tappings onto newly laid service main to each plot, complete with the main connection.

Electricity

- Supply and Installation of 3nos. transformers together with the construction of 3 transformer rooms.
- Laying of approximately 3.5 km of 160mm diameter yellow uPVC ducting for LV/HT, complete with service cable pillars and approximately 2 km of 80mm diameter yellow uPVC ducting for underground plot connections.

Telecommunication Works

- Supply and installation of approximately 6,500m of 45mm diameter telecom duct complete with manholes, cubicles and draw box for each plot.

Sewerage Works

- Construction of approximately 1,650m wastewater network in 200mm uPVC sewer pipelines complete with Y-branches and intercepting chambers (IC A) for each plot.

Ancillary Works

- Construction of Retaining Walls
- Earthwork including Engineering Fill to plots.
- Ancillary works as defined in the Specifications and shown on drawings such as, but not limited to, landscaping works.

1.7 PROGRAMME, PLAN AND CO-ORDINATION OF OPERATIONS

The whole of the Works to be constructed by the Contractor under this Contract shall be completed within the time stated in Appendix A to Tender at the end of the Instructions to Tenderers.

The Contractor shall, in accordance with Sub Clause 8.3 of the Conditions of Contract and before commencing work on Site submit to the Engineer, for his approval, a full detailed programme showing the order of procedure and method by which he proposes to carry out the construction and completion of both building and infrastructure Works, and particulars of the organization and staff proposed to direct and administer the performance of the Contract.

The programme shall take into account the fact that the whole periphery/perimeter wall of the morcellement site shall be constructed and completed within the first four (4) months of the contract period. The Contractor shall do so in order to allow the external planting (landscaping) works to be started and proceeded with by the Landscaping Nominated Sub-Contractor, in order that the plants/trees shall have enough growing time to reach a reasonable height by the time the whole project is completed within the time stated in Appendix A to Tender.

The Engineer may ask the Contractor to amend the programme at this or any other time. The above programme of Works shall be in the form of an MS Project Gantt Chart or any other form as may be agreed by the Engineer. The programme shall clearly indicate the sequence of each activity, the proposed start and completion dates of each activity and, the final completion date of the whole project. The critical path shall be clearly indicated on the programme highlighting all the critical activities and their respective durations.

While preparing the above programme, the Contractor shall take into consideration that Authorities such as District/ Municipal Council, the Traffic Management and Road Safety Unit (TMRSU), the Traffic Superintendent, the Road Development Authority (RDA) amongst others, may require that no excavation works are to be carried out and no trench or pit shall be left opened during Public Holidays and/or Festive Periods. Furthermore, for connection/disconnection to CWA Mains, water cut shall not be granted on Mondays, Fridays, Saturdays, on eve of or on Public Holidays and from Mid – December to second week of January. Thus, all actions deemed necessary by the Contractor , shall be taken into consideration while preparing the programme of works. Hence, no extension of time, with or without cost, shall be granted for delays arising for an of the above –mentioned reasons.

The Works shall be carried forward to completion with the greatest possible expedition, to the satisfaction of the Engineer, in accordance with the programme. The Contractor's work plan, co-ordination and work methodology shall aim at achieving the following targets:

(i) Smooth and trouble-free construction of the infrastructures.

(ii) Satisfactory working progress at all times

(iii) Completion of the entire works in accordance with the specified time of completion.

The Contractor must allow in his methods of working the necessity to ensure safety of the public, to minimize nuisance to road users, to provide vehicular accesses to the residents and the commercial buildings as well as the through traffic. In this respect, the requirements of Authorities concerned such as the District/ Municipal Council, the National Transport Authority (NTA), the Ministry of Public Infrastructure, Land Transport & Shipping (MPILTS), the Traffic Management and Road Safety Unit (TMRSU), the Traffic Superintendent, the Road Development Authority (RDA), nearby sugarcane field owners, organizations and the local residents as the case may be, must be checked **before** tendering and respected during the Construction Stage to ensure smooth and timely execution of the works. It shall be the Contractor's responsibility to ensure adequate vehicular access to industrial premises and for emergency services throughout the Contract.

1.8 TRAFFIC MANAGEMENT AND COORDINATION

The Engineer's Representative will chair a traffic co-ordination committee, at regular intervals, with the Contractor and all relevant public and private Authorities for the traffic management of the overall Project and streets/roads found nearby the project site. The Contractor shall attend all meetings and shall take action accordingly.

The Engineer's Representative shall thereafter consider the works programme submitted and the associated traffic diversion scheme submitted by the Contractor as per Clauses 1.7, 1.9 and 1.32, so as to ensure the implementation and sequencing of the building and infrastructure work components in an optimum manner. He will also ensure that the works programme and traffic diversion scheme of one particular street does not interfere with those of another street and does not clash between them.

The Contractor shall make his own arrangements to comply with the requirements of the different Authorities as applicable including the Traffic Management and Road safety Unit (TMRSU), the Road Development Authority (RDA) and the instructions of the Engineer's Representative. He shall provide all required traffic diversion road signs, barricading of trenches and other requirements for health and safety aspects and public safety as per Clause 1.9 below.

1.9 TRAFFIC DIVERSION AND POLICE SUPERINTENDENCE

The Contractor shall at all times arrange for and ensure the safe and trouble-free movement of prevailing traffic along sections, streets, roads and accesses (whether public or private) where construction works are being carried out.

Over and above vehicular access, the Contractor shall have the obligation to ensure the safety of the pedestrians and road users at all times of the day and night within the area under construction.

He shall accordingly provide for all necessary flagmen guards, fences, barriers and temporary traffic stop-go signs as may be necessary for the safety and direction of the public as required by the Laws of Mauritius or local Bye-Laws or as ordered by the Engineer and all such arrangements shall receive the approval of the Engineer and the relevant Authority.

In the event that any Statutory Authority requests for temporary stop-go signs, the Contractor shall provide same to the full satisfaction of the concerned Authority, without any extra cost.

The Contractor shall erect and maintain at all working fronts and at prescribed points on all approaches to the Works all traffic and warning signs necessary for the direction and proper control of traffic, being given that the site is found within built-up area.

In the event of the Contractor requiring any road closures for construction, he shall make his own arrangements and comply with the requirements of the relevant Authorities. Any diversion scheme for any particular stretch of road, inclusive of temporary traffic signs, warning signs, marking signs, diversion barricades, structures, beacon lights, flashing lights, plastic bollards, traffic cones and their respective locations used for any traffic diversion shall be submitted for approval to the Engineer, the Traffic Management and Road Safety Unit, and the District/ Municipal Council as the case may be, 28 days prior to the start of any excavation works. Traffic signs shall be of the reflectorised type and shall be illuminated by night for security reasons in accordance with GN 154 of 1990 and as per Clause 6.18.1 of Section 6. Excavation works shall not start until the written approval of the diversion scheme has been duly obtained from either the TMRSU, the RDA and the District/ Municipal Council as the case may be.

The above temporary signs to be provided shall include mounting, dismantling, maintenance in good condition at all times and appropriate means against vandalism or theft. One copy of all submission approved by the appropriate Authorities should be supplied to the Engineer's Representative before the work starts.

The Contractor shall also maintain in good running condition all temporary roads, tracks and accesses used for the diversion of temporary traffic.

After completion of the works at appropriate stretches, the Contractor shall make good and restore the road and accesses (whether public or private) to their original conditions, all to the satisfaction of the respective owners or statutory body, as the case may be.

The Contractor shall provide for police superintendence for control of traffic which would be required while excavation works are carried out in busy streets and roads and also as required by the relevant Authorities. No trench will be allowed to be opened if such police superintendence has not beforehand been secured. Item 1.1.13 of the P&G Bill has been inserted for this purpose.

1.10 TRAFFIC RESTRICTION

The Contractor shall not run tracked vehicles or tracked equipment on any public or private road without the written approval of the Engineer's Representative and the responsible Authority or Owner; all conditions imposed by the relevant Authority or Owner shall be strictly observed.

The Contractor shall observe all weight and dimensions restrictions which apply to roads and tracks in Mauritius and he shall comply with all restrictions which may from time to time be imposed by the Engineer's Representative, Employer, Police, responsible Authority or Owner. Where damage to roads and tracks is caused by the Contractor, same shall be repaired at the Contractor's expense. In particular the Contractor shall regularly fill all potholes in roads and road infrastructure when these are caused by his equipment using such roads.

The Engineer's Representative shall have the power to restrict the Contractor's use of any roads, either in direction of traffic, speed of traffic or numbers of vehicles in order to preserve such roads or to make such roads safe for use by the general public.

Where other Contractors require the use of these roads or tracks, the Engineer's Representative may prescribe times of usage, or any other form of control, which shall be executed by the Contractor, including the supply of traffic lights, flagmen, or any other requirement.

The Contractor shall not be compensated in any way for these restrictions and impositions.

1.11 OBSTRUCTION OF STREETS AND FOOTPATHS

All work affecting traffic on public roads shall be in a manner acceptable to the District/ Municpal Council, TMRSU, RDA, the Police and the Engineer’s Representative. Before commencing work, the Contractor shall produce an agreed phased program for such work, including drawings for the diversions and/or one-way traffic as per Clauses 1.8, 1.9 and 1.10 respectively .

The Contractor shall not occupy or obstruct by his operations more than half of the width of any main road in which Works are being executed, and he will include in his rates for on-the-spot removing excavated spoil to an approved tip and return when required for backfilling.

Permission to close any street or road to vehicular through traffic must be requested from the Engineer’s Representative in writing. The Contractor will be responsible also to obtain the necessary authorizations from the relevant Authorities for closure of any roads.

When roads are closed to traffic or otherwise restricted, the Contractor shall supply, erect and maintain, for the duration of the Works, adequate warning and traffic diversion signs and any other signs or control light signals including lighting facilities which may be considered necessary and should be in strict accordance with the requirements of TMRSU, RDA and District/ Municipal Council regulations as per Clause 1.8 above.

The Contractor must advise and obtain the consent of the Engineer before commencing excavation in any street or road for any off-site work. In addition, the Contractor will be responsible for notifying the District/ Municipal Council, the Traffic Superintendent, the Ministry of Public Infrastructure, Land Transport & Shipping, the Traffic Management and Road Safety Unit, Road Development Authority, the National Transport Authority and any other interested Authority of his intention to carry out excavation in any street or road and shall comply with all instructions of such Authorities. Such notice shall reach the relevant Authority at least 28 days before excavation is to commence, with copy to the Engineer.

Unless otherwise specified, and/or if and where applicable, the cost of providing all diversions, lights, signs, signal operators, flagmen and the like will be at the Contractor's expense and shall be deemed to be included in the rates entered in the Bill of Quantities.

In no case, without the written permission of the Engineer's Representative, shall more than 50 metres of trench in one place be opened in advance of having completed adjacent stretch of pipeline; on completion of each 50 metres of pipeline, the street and footpath surfaces shall be restored to their original condition.

The Contractor shall also abide to the restriction being imposed by the District/ Municipal Council, TMRSU and RDA to the length of excavated trench along any particular street or road.

The Engineer's Representative shall be at liberty to instruct the Contractor to reduce/increase the length of open trench excavation where, in the Engineer's Representative's opinion, the exigencies of the traffic render it necessary and where the approach to places of business is likely to be seriously affected.

The Contractor shall not be entitled to any claim for loss or damage or extension of time by reasons of such conditions being imposed.

1.12 PARKING FACILITIES

Any road closure will prevent the residents from driving their vehicles inside their premises. Thus, prior to effecting any road closure, the Contractor shall survey and locate such places where temporary parking facilities could be provided. Parking shall be maintained with adequate security services on a round- the- clock basis for vehicles of residents who cannot access their residences due to road closures. The Contractor shall at all times submit the written consent from each individual owner from whom the Contractor shall hire the plot of land for parking facility .

In particular, the Contractor shall provide for:

(i) Hiring the plot of land required for parking facilities including all associated costs.

(ii) Site clearing, dismantling, removing, carting away and demolishing and shall include for the removal of the material so obtained, stacking or depositing it on the site, or carting to tip as applicable.

(iii) Providing appropriate access and leveling of the terrain with crusher-run and

maintaining the surface in good condition throughout the duration of use of the parking area.

(iv) Security to the parking zone 24 hours a day.

(v) Reinstate the plot of land to the approval of the Engineer's Representative/rightful owner after its use.

(vi) All plant, equipment, labour, tools, transport that may be required.

(vii) Towing facilities shall be made available for the prompt removal of any breakdown vehicle at any part of the Site as and when required.

The expenses related to the provision of parking facilities shall be deemed to be included in the other P&G rates and no separate payment will be effected.

1.13 LIAISON WITH POLICE AND OTHER OFFICIALS

The Contractor shall keep close contact with the Police and other officials of the areas concerned regarding their requirements in the control of workmen, movement of traffic, or other matters and shall provide all assistance or facilities which may be required by such officials in the execution of their duties.

The Contractor shall liaise with the District/ Municipal Council, the Police, the Ministry of Public Infrastructure, Land Transport & Shipping, the Traffic Management and Road Safety Unit, the National Transport Authority, the Road Development Authority, the Mauritius Telecom, the Central Electricity Board, the Central Water Authority and other interested Authorities and shall comply with their requirements.

Payment for this task is provided for under Bill No.1 item 1.1.13 of the "*Preliminaries and General Items*".

1.14 PROGRESS REPORTS AND PHOTOGRAPHS

The Contractor shall submit weekly and monthly reports to the Engineer's Representative, payable under Bill No.1 item 1.1.9 of the "*Preliminaries and General Items*", as detailed below:

(i) Weekly Reports shall include:

(a) General weather report including average, maximum and minimum daily ambient temperatures and humidity; wind direction/velocity and rainfall data.

(b) Contractor's labour and equipment returns.

(c) Status on the order and delivery of materials, plant and equipment

(d) Brief summary of work completed.

(ii) Monthly Reports shall include:

(a) Description of the extent and nature of the month's work.

(b) Details of any problems relating to the Works with substantiating documentation if relevant.

(c) Cumulative summaries of each work component such as building works, roadwork, water work, sewerage works, telecom works, electrical works, drainage work, footpath and so on as per the format required by the Engineer's Representative.

(d) Copies of quality assurance documents, test results and certificates of materials, equipment and plant tested with copies of test results where relevant – both for the building works and the infrastructure works.

(e) Charts illustrating physical progress achieved compared to the Contract Programme – both for the building works and the infrastructure works..

(f) Coloured progress photographs illustrating progress and work completed on each section of the building and infrastructure Works from positions to be selected by the Engineer's Representative. Progress photographs shall be taken on a daily basis irrespective of the amount of work completed.

Photographs shall not be less than 15cm x 10cm and shall be inscribed with the location, date when taken and a brief description or title. Each set of photographs shall comprise of three prints. All soft copies, in an approved format, shall be numbered and retained on the site. On completion of the works the soft copies on CD shall become the property of the Employer.

One print of each photograph shall be signed and dated on the back by the Engineer's Representative and the Contractor and retained by the Engineer's Representative as an agreed record.

Photographs shall be measured as the number of sets, each consisting of one soft copy on CD and three prints. The corresponding rate, included in Bill No. 1 of the Bill of Quantities, shall be inclusive of all costs involved in taking the photographs, processing them and delivering them to the Engineer's Representative in the required number of copies

(g) Charts illustrating the financial status of the Contract including value of works completed, certified, and monies received against planned disbursement.

(h) A detailed programme of work both for the building works and the infrastructure works to be carried out in the following month and a general forecast of works for the coming three months. The detailed programme of works shall be in compliance with the programme of works submitted at the beginning of the contract and shall comply with the restrictions imposed by any relevant Authority. Mitigating measures for any delay or cost over-runs should be elaborated in the monthly report.

(i) Any other details as may be required by the Engineer's Representative.

The Contractor’s attention is drawn to the fact that any payment is conditional upon the Engineer having received all the above reports due in the Contract in that period as per Clause 14.3 of the Conditions of Contract.

1.15 CONTRACTOR'S WORKING AREA

The Contractor shall provide and maintain on site suitable offices. He shall also provide and maintain on approved locations on the site, sufficient stores, tanks and workshops for the proper storage of materials, fuel, plant and equipment. The stores shall be of such size and construction that they shall provide adequate storage and protection of stocks of materials, fuel, spares, etc., in quantities ensuring uninterrupted progress of the work, and the workshops shall be suitably equipped to provide for carrying out repairs, overhaul or modification by the Contractor of all plant and equipment in or on the Works. The Contractor shall allow in his rates for all charges incurred by him for the offices and workshops.

The Contractor shall make his own arrangements with the Employer, landowners or other Contractors working in or around the Site for land which he wishes to use as access for the storage of his plant, materials and for the use of his own labour and all costs in this connection shall be borne by the Contractor.

The location of all offices and stores shall be agreed beforehand with the Engineer and shall be such as to avoid obstruction or nuisance to the public.

1.16 ENGINEER'S SITE OFFICE

The Contractor shall price for the site engineer's office complete with suitable sanitary facilities, electricity, telephone, internet and WIFI facilities and water supply, together with office requirements, inclusive of stationery and consumables for office equipment, for the Engineer for the whole duration of the Contract plus two (2) months. Protective installations for the offices and protective equipment for the Engineer's staff (for a minimum of three persons) shall be provided. The payment of all the above facilities will be effected under the relevant and applicable Bill No.1 item 1.1.11 of the "*Preliminaries and General Items*".

To enable the Contractor to price for the site office, the minimum requirements shall be as detailed below, which shall be no less than the following:

(i) Office area of 20m^2 in concrete block (subdivided into two offices) or alternatively, two 20 feet container offices, complete with 2No. office desks complete with 4No. arm chairs, one steel cupboard and a four-drawer lockable filing cabinet;

(ii) Over and above item (i), office space of 8m x 4m shall be provided with one conference table accommodating 15No. chairs for the purpose of holding site meetings;

(iii) The office shall be provided with kitchen and first-aid box facilities;

(iv) Supply and installation of one multi-function fax/scan/copy A3 Colour machine of make RICOH (or similar) and internet wifi access.

(v) Two laptops with the following minimum specifications *(Core I7 Processor, 32BG Memory, 1TB SSD Hard Disk, 8GB GPU and 16 Inch Screen).* All necessary software including Microsoft office with Project and AutoCAD civil 3D, PDF Writer should be readily installed.

(vi) Supply of two 27-inch desktop monitors and a binding machine A3.

After completion of the Contract, all the above facilities will revert back to the Contractor.

In addition to the above, the Contractor shall provide a full-time office attendant at the site to maintain and keep the office in a clean condition throughout the contract period plus two (2) months after.

1.17 DATUM AND BENCHMARK

The levels of the building works and infrastructure works in the tender drawings are related to a temporary benchmark used for the purpose of tender drawings.

The Contractor's Land Surveyor shall perform a closed traverse which will be utilised for the creation of an appropriate number of benchmarks suitably spaced in the construction area, including at least two (2) permanent stations in concrete. For this purpose, the Contractor shall use the reference benchmark already fixed on site by the Employer's Sworn Land Surveyor and which shall be indicated to him by the Employer's Sworn Land Surveyor and which shall thereafter form the sole point of reference for the execution of the works.

The Contractor shall be responsible for the visibility and accessibility to all boundary pegs, boundary stones or any other feature shown and handed over to him from the beginning of the contract. These should be kept visible and accessible at all times and properly referenced such that in case of loss of boundary limits or benchmarks, same can be restored. Fixing and any re-fixing shall only be carried out by a Sworn Land Surveyor – employed by the Contractor.

All temporary benchmarks required by the Contractor shall be provided by the Contractor at his own expense, and shall be cross-checked by the Engineer's Representative and maintained for the whole duration of the contract or as directed by the Engineer's Representative. The list of reference benchmarks and temporary benchmarks shall be submitted to the Engineer's Representative in an appropriate and approved format.

Within fifteen (15) days from the Commencement Date, the Contractor shall supply to the Engineer, in duplicate, maps and records in the form of AutoCAD drawings giving details of the location and levels of each benchmark set up or established by the Contractor.

1.18 SURVEY TO ESTABLISH ALIGNMENTS AND LEVELS

The Contractor shall carry out, according to a programme to be agreed upon with the Engineer's Representative, surveys to establish the existing ground levels over the whole project area both for the building works and the infrastructure works together with other physical features of relevance and alignments and levels of existing services whether overhead or underground, should any work be done along public roads, private lands and access ways and submit same within fifteen (15) days from the Commencement Date . He shall also collect all data that would be required for the acquisition of wayleaves through public and private properties and access ways.

After completion of the surveys or part thereof, as the case may be, the Contractor shall produce drawings to show the exact alignment, levels, dimensions, types of existing pipes

and other details and submit to the Engineer -- who shall produce the appropriate Working Drawings should in his opinion, such details are substantially different from those in the tender drawings.

The Contractor shall use all the trial pits results obtained as per Clause 1.32 in finalising these drawings, which should be submitted to the Engineer's Representative 30 days prior to the start of excavation works. Upon receipt of the survey drawings from the Contractor in the required and agreed format, working drawings shall be issued to the Contractor within a period of 15 days; such working drawings shall be issued by the Engineer in such a way as not to delay the Contractor's work.

The Contractor shall effect joint topographical and land surveys with the Engineer's Representative. Existing ground levels shall be taken at 25 m intervals maximum along the pipe routes, with additional spot levels on steep gradients, ditches and river crossings and on any other special ground feature as appropriate and/or directed by the Engineer's Representative. Levels shall be transferred within an accuracy of $5\sqrt{K}$ mm, where K is the length in kilometres of the leveling circuit.

The method of surveying shall be to the approval of the Engineer. Field books and tabulated data shall be well maintained and made available for inspection and checking by the Engineer. During the survey, the Contractor shall identify and locate all existing services, man-made and natural physical features as well as any corridor earmarked for Government projects (roads, highways, public utility services etc.), which will lay on the alignment of the pipelines.

Transect surveys shall be done on the entire road width and road reserves where such exists, or as directed by the Engineer's Representative, including storm drains, location and depth of manholes and inspection pits of existing utilities as applicable such as Sewer lines, Water pipelines, Mauritius Telecom, CEB etc, top covers, any poles, constructions, natural obstacles, property limits, boundary walls specifying type, height and construction material, trees, gates, etc...). Property boundary limits alongside the roads, paths, bridges, accesses shall also be surveyed.

The Contractor shall inform the Engineer of any major discrepancy between the survey information provided by him and the information contained in the Tender Drawings. Any discrepancy shall not relieve the Contractor of any obligations under these Specifications.

Drawings recording the survey shall be submitted to the Engineer in A1 format. The Contractor shall supply two prints and one soft copy in an approved AutoCAD format on writable CD ROM.

1.19 SETTING OUT

The Contractor shall appoint and employ the necessary qualified and experienced staff to survey and set out the work accurately. He shall establish and locate all lines and levels and be responsible for the correct location of all works.

Before work commences, the Contractor shall satisfy himself that existing ground levels, as indicated in the Contract, are correct. Should the Contractor wish to dispute any levels he shall submit a schedule of such disputed levels to the Engineer and existing ground levels relevant to these levels shall not be disturbed before the Engineer's decision as to the correct values is given.

Where directed by the Engineer's Representative, the Contractor shall take such levels and dimensions as may be required prior to disturbance of the ground for the purpose of design and measurement and these shall be agreed between the Contractor and the Engineer's Representative in writing before any of the surface is disturbed or covered up.

For trenching works the Contractor shall erect sight rails at intervals of not more than **15** m. The rails shall be painted white and kept clean. The top edge shall be planed true and straight. A **25** mm wide black line and nail shall be placed to indicate the centre of trench, and the node number, invert level and length of traveller to be used shall be painted clearly on the boards.

These sight rails will be erected at least **24** hours before excavation starts and the Engineer's Representative shall be informed when they are ready for checking. They shall be maintained until the pipes have been laid and the trench backfilled. The Contractor shall provide the traveller for each line and shall provide men to operate it whenever the Engineer's Representative wishes to check the work. The sight rails shall be supported securely on at least 2 no. 75 mm diameter poles firmly embedded and the height from the ground shall be at least 0.6 m.

The cost of such surveys and the correct setting out of the Works is deemed to be included in the Contractor's rates.

1.20 CONSTRUCTION AND CHECKING OF WORK

The Contractor shall be solely responsible for and shall provide all labour, tools, plant, lifting tackle and other equipment required for the construction of the Works.

No operative shall be allowed to execute any type of work which is normally carried out by a skilled tradesman unless he is thoroughly experienced and proficient in the trade concerned. Supervisors and operatives may be required to demonstrate their proficiency or produce a certificate of competence to the satisfaction of the Engineer.

Note: *This is specially required for tradesmen employed on the welding of the joints on PE pipes.*

As each part of the Works is erected, it shall be subject to the approval of the Engineer. A list of all the critical stages of the building (Transformer room) and infrastructure Works which are subject to inspection and approval by the Engineer and/or its Representatives prior to undertaking the overlying works, will be discussed and finalised with the Contractor at the onset of the project.

The Contractor shall submit on a daily basis a Programme of Works to the Engineer in order to enable his staff to oversee the activities being executed on site. In addition to this, the Contractor shall submit an Approval Request for each item of the building and infrastructure works that needs to be inspected by the Engineer prior to undertaking the overlying works.

Any approval given by the Engineer's Representative shall not relieve the Contractor from his responsibilities and obligations to do the works as per Contract drawings and Specifications.

1.21 SURVEY INSTRUMENTS AND CHAINMEN

The Contractor shall provide, as and when required by the Engineer's Representative, modern and accurate survey equipment as listed below:

- 1 No. modern total station and tripod, with targets (6 No) and tripods (4No) and all communicating facilities,
- 1 No. modern Theodolite T2 or equivalent,
- 1 No. modern automatic level and tripod,
- 2 Nos. staff 5 m long graduated at 0.005 m intervals,
- 2 Nos. 30 m steel tapes,
- 2Nos. Portable Electronic Cover Meter,
- 2 No. 3 m steel tapes,
- 10 No. ranging rods, 2.5 m long,
- 2 Nos. digital measure odometer (mini),
- 6 Nos. legged adjustable ranging pines,

The instruments and equipment are to be properly calibrated and in first class condition. The ownership of the instruments will revert to the Contractor at the completion of the Contract Period.

The Contractor shall also supply all other requisites necessary for checking the setting out and for measurement of the Works. The Contractor shall insure the instruments against loss or damage.

The Contractor shall provide the services of two experienced chainmen throughout the Contract Period. The deployment of the chainmen and the equipment shall be at the discretion of the Engineer during normal working hours.

1.22 TRANSPORT FOR ANCILLARY WORKS AND SERVICES ON SITE

The Engineer will provide for its own means of transport for the purpose of supervision of the contract. Notwithstanding the above, the contractor shall provide a means of transport on site for ancillary inspections required by Authorities.

The vehicle will be required for liaison by the Contractor, after receiving approval from the Engineer's Representative, with all necessary Authorities for the smooth running and constant supervision of the works and also for the following tasks:

- Provision of ways and means of attending sites by representatives of relevant Authorities for the purpose of witnessing tests and/or providing necessary site details such as surveys and drawings with the view of speeding up such approvals for the smooth and uninterrupted running of the site.
- Soil tests that may be exceptionally and quickly required at any time by any Statutory Authority.
- Collection of fittings by the Contractor, after receiving approval from the Engineer's Representative, made available by the relevant Authorities.
- Provision of facilities to representatives of relevant Authorities for approval of pre-determined stages of work to facilitate issue of final clearance at the end of the works

In this respect, a monthly rate has been included in the Bill of Quantities to meet the expenses relating to the provision of a vehicle and driver and associated costs such as insurance, road tax, fuel, lubricants for a vehicle in good running condition to be used as transport by the Contractor for the above purposes after receiving the necessary instruction from the Engineer's Representative. The Contractor shall provide such transport facilities as and when required and as directed by the Engineer and pay for all expenses associated therewith in accordance with the terms of the Contract.

The time period for the provision of the transport and driving facilities has been calculated as the time of construction PLUS two additional months in order to wind up the contract after the issue of Taking- Over Certificate.

The expenses associated with the provision of the said transport for the specified purposes shall be claimed under Bill Item 1.1.13 of the Bill No.1 - "*Preliminaries and General Costs*".

1.23 CONTRACTOR'S SUPERINTENDENCE

In addition to the requirements of Clauses 6.8 and 6.9 of the Conditions of Contract, the Contractor's Representative/Site Agent shall have full authority in respect of the Works and at least two of his technical assistants shall be able to speak English fluently and a reasonable proportion of foremen shall have a working knowledge of the English language.

Correspondence between the Contractor and/or the Site Agent and the Engineer or the Engineer's Representative shall be in English.

1.24 CONTRACTOR'S EMERGENCY RESPONSE UNIT

The Contractor shall set up from within his site staff, an Emergency Response Unit, to be headed by a Senior Representative, and the responsibility of this Unit shall be to respond to any emergency brought to the attention of the Contractor, at any time. The Unit will be composed of the Site Agent, any other member of the Contractor's personnel and an adequate number of skilled Contractor's labour force.

This Team shall be available 24 hours a day, seven days a week and even during public holidays – in preparedness for any emergency occurrence.

A current list of names, addresses and telephone numbers of the Contractor's staff responsible for organising emergency work outside of normal working hours shall be provided to the Engineer's Representative and kept updated. The Contractor's emergency response team shall be available 24 hours a day in case of emergency generated by the works.

This team shall be required to mobilise on the problem area within 60 (sixty) minutes from receiving the complaint/communication. After ascertaining the nature of the problems/emergencies, the remedial action to be taken shall be communicated to the Engineer's Representative, within the next 30 (thirty) minutes.

Immediately upon approval of the Engineer' Representative, the Contractor shall proceed with the implementation of the required action.

In cases where an emergency occurs affecting the safety of life or of the Works or adjoining properties, the necessary immediate remedial action shall be taken by the Emergency Response Unit even without previous approval by the Engineer's Representative.

However, this action shall not relieve the Contractor from his obligations under the Contract.

The expenses related to this emergency response team, shall be allowed under Bill item No. 1.1.13 of Bill No.1- Preliminary and General Items of the Bill of Quantities.

1.25 PUBLIC INFORMATION AND PUBLIC RELATIONS

The Contractor shall designate, within his site organisation, a Public Relation Officer, who shall be fluent in written and spoken English, French and Creole, whose responsibility shall be to ensure good public relations on a daily basis. Such public relations shall be continually maintained with the members of the public of the locality of the works for the duration of Works.

The Contractor shall notify residents, management of industrial/commercial premises, Directors of Schools/Colleges, Educational Institutions and any other relevant bodies in the locality of the works of his intention to excavate and lay pipelines outside entrances to their premises at least 14 days before commencement of operations.

The Contractor shall also give 14 days advance notice to agricultural land owners or local residents, whose property or operations may be affected by the works. Such notice shall be to the approval of the Engineer.

The Contractor shall make his representatives available for meetings set up by the Engineer's Representative, or by the Employer, for public relations exercises, both during and outside normal working hours as necessary, as well as on week-ends.

Prior to start of works in any street for any off-site work, the public relations exercises which shall be undertaken by the Contractor are listed below:

- Distribution of pamphlets to all stakeholders, at least 14 days before works start in that particular street. The contents of the pamphlets will be vetted by the Engineer and the Employer.
- The pamphlets shall be in the form of a folded A 4 printed page for easy reading in three languages namely English, French and Creole.
- The content will clearly indicate when works start, their duration and a road map will be inserted to show the working area and any traffic diversion plan judged necessary.
- In densely populated areas prior to the start of the off-site works, meetings shall be held with the "*Forces Vives*" (civil society organizations) of the locality. During the meetings, the residents will be requested to notify the Employer and the Contractor well in advance for arrangements to be made for special occasions (e.g. Wedding, or religious Ceremony etc.) during execution of the works. The Contractor will be responsible for the organisation of all meetings with the public and/or local representatives (Forces Vives) including provision of all logistics.
- Final confirmation should be conveyed to the residents and relevant bodies 1 day prior to the start of excavation works.

A list of contact persons, including office telephone and mobile telephone numbers, shall be given to the residents of the street/road in question by the Contractor. The Contractor shall designate within his personnel competent staff who will liaise with the members of the public and any other individual or organisation concerned with the Works for attending to complaints and ensuring a satisfactory and systematic interaction with members of the public. For cases where the works to be undertaken will have a major impact on the daily routine of people other than the local residents (e.g. closure of a major traffic route) press notice shall be published about 3 to 4 days in advance or as per the requirements of the TMRSU. The Contractor will be responsible for the above.

The above requirements for public relations are not exhaustive and the Contractor shall carry out any other activity deemed necessary or instructed by the Engineer's

Representative, to establish a satisfactory public relation at all times during the execution of the Works.

The cost incurred to cover the public relations related items is covered under the Bill item No. 1.1.13 of Bill No.1- Preliminary and General Items of the Bill of Quantities.

1.26 SUBCONTRACTORS

Piecework workers employed or paid in gangs are deemed to be Sub-Contractors, and as such shall be subject to the requirements of Clause 4.4 of the General Conditions of Contract. Individual pieceworkers directly under the control of the Contractor's supervisory staff will not be deemed to be Sub-Contractors. In his separate memorandum accompanying the bid the bidder shall submit the following information:

- item and element of work to be subcontracted,
- approximate value of the work to be subcontracted,
- names and addresses of the proposed subcontractors,
- details of experience of the proposed subcontractors in works of similar nature including description, location and value of work, year completed and name and address of the Employer and the Supervising Engineer.

Notwithstanding such information, the Bidder shall remain entirely and solely responsible for the satisfactory completion of the works.

1.27 WORKS EXECUTED BY THE EMPLOYER OR BY OTHER CONTRACTORS

The Employer reserves the right to execute on the site works not included under this Contract and to employ for this purpose either his own employees or another contractor whose contract may be either a subcontract under this Contract, or an entirely separate contract. The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operations of the Employer, or his contractor employed on such works and the same obligations shall be imposed on the Employer or Contractor in respect of work being executed under this Contract.

The Contractor shall co-ordinate his programme for the building works with that of the infrastructure works to ensure concurrent execution without one delaying the other. If any delay occurs due to the Contractor's failure to effectively carry out such coordination, such delay shall not form a basis for a claim for extension of time by the Contractor.

1.28 TEMPORARY WORKS AND ACCESS

After the Contract is awarded and before the Works on Site commence, the Contractor shall submit to the Engineer drawings showing the proposed location and general arrangement of his offices, workshops, stores, quarters, access roads and other temporary works required for the proper and expeditious execution of the permanent works. It will be the Contractor's responsibility to acquire sites for his offices, etc.

The Contractor shall obtain his own information with regard to access to all parts of the Site of the Works and if he wishes to make use of routes through private property then he must make all arrangements with the owners. The conditions of the surfaces of the private roads, paths or yards used or crossed by him for the purpose of the Contract shall be kept in reasonable repair during the progress of the works, and on completion he shall put the roads, paths yards in proper repair at least equal to the original condition of the roads, paths or yards used or crossed by him and to the satisfaction of the Engineer, all at his own cost. In general, the Contractor is to regulate the character of his transport to ensure that no undue damage is caused to any roads, tracks or properties within the area of the Works, public or otherwise. He shall, in this respect, provide for all the necessary facilities to the Engineer for the taking of the relevant photographs.

The whole of the temporary works, plant, equipment and appliances used on the Works will be the liability of the Contractor in regard to construction, sufficiency, safety, maintenance and removal on completion of the Contract and approval by the Engineer shall in no way relieve the Contractor of his liability.

The Contractor shall provide and allow in his rates and prices for all temporary works, bridges, pumping, access steel plates across trenches or other work required in the construction of the Works.

During the sugar harvest season the Contractor shall make all reasonable arrangements to allow sugar transport to use normal routes. The Contractor will alter his program if necessary to maintain access for sugar traffic if so directed by the Engineer's Representative at no extra cost.

Furthermore, in preparing his programme of works, the Contractor shall take due account of all the Religious festivals and major national events which could interfere with his works.

1.29 PIPELINES IN SERVITUDES

Across servitudes over occupied land, the Contractor shall carry out the work as expeditiously and with as little inconvenience as possible to occupiers of premises. He shall take all the necessary precautions for the protection of buildings and property. He shall not permit his workmen and labourers to use the servitude as a temporary right of way. The Contractor shall take strict measures for replacing topsoil when refilling trenches and for reinstating all ground to its original condition to the approval of the Engineer and the respective owners.

1.30 PROTECTION FROM WATER AND SEWAGE

The Contractor shall keep the whole of the Works free from water and sewage as the case may be and take all necessary precautions to eliminate the risks of flooding from any cause whatsoever. The Contractor shall provide and maintain the necessary pumping plant to deal with all water and sewage which may flow into trenches or excavations and shall

allow in his prices for such plant and all temporary check dams, pumping, shoring, temporary drains, sumps, etc. and shall clear away and make good at his own cost and to the satisfaction of the Engineer any damage caused.

1.31 EXISTING SERVICES

Most of the streets and roads found within the project area and along which off-site works are to be carried out are occupied with existing services such as Sewer pipes, Telecom cables, CEB cables, Potable water pipes, drains, etc. Thus, the position of all existing services which may be affected by the Works shall be ascertained and re-confirmed by the Contractor before work commences. For that purpose, trial pits shall be excavated to re-confirm the location of these services and the contractor shall afterward submit to the Engineer detailed drawings in an approved AutoCAD format, showing all the services as more fully described at Clause 1.32 below.

The contractor shall ascertain for himself through trial pits or any other method in his discretion (such as acoustic surveys or other investigation methods) of the exact alignments, sizes and other details, and shall produce the relevant drawings to enable the Engineer to re-confirm the alignments and levels indicated in the tender drawings before commencing excavations.

Based on these information, where and when there are apparent clashes, the final alignment of the proposed water pipe to be laid will be decided by the Engineer, through the production and submission to the Contractor, of the necessary working drawings.

The Contractor may also liaise with all the Local Authorities where applicable such as the Wastewater Management Authority, Central Water Authority, the Central Electricity Board, the Mauritius Telecom, the District/ Municipal Council to obtain any additional drawings and further information showing positions of their existing buried services, drains and culverts along the routes of the proposed pipeline.

The Contractor shall make such provisions as may be required by the Authorities concerned for the support and protection of any water main, sewer, telephone cable, power cable or other services met with on the site, making good at his own expenses any damage to services other than those covered by Clause 1.33 below. Any new work or any alterations as necessary which the Engineer may order to be carried out by the Contractor shall be paid for at agreed rates, but should the Authorities concerned prefer to carry out the work with their own workmen, the Contractor shall be paid net amounts plus five per cent on such work. The Contractor shall pay such amounts and recover the costs through payment certificates.

Where existing fences, walls, or other boundary features have to be temporarily opened to provide access, they shall be reinstated as found and to the satisfaction of the Engineer and their respective owners and the cost of this work shall be paid at agreed rates.

The Contractor shall be responsible for any diversion of existing drain or any other services. Records of existing and diverted services shall be maintained to the satisfaction of the Utility Authorities and that of the Engineer.

1.32 EXPLORATORY EXCAVATIONS

The location of existing services shown on the drawings as obtained from the relevant Authorities and produced by the Engineer is only indicative. Therefore, where necessary before carrying out any demolition or excavation for pipelaying works, the Contractor shall accurately re-confirm the locations of all the existing services within the Site of the off-site Works whether indicated or not on the Drawings.

For this purpose, the Contractor will be required to carry out exploratory excavations (trial pits) to establish types, sizes and ascertain, complement and clarify exact position of the existing services as described in Clause 1.31 above, and geotechnical logs, wherever applicable, at the start of the Contract. These trial pits will be carried out under the supervision of the Engineer's Representative and/or relevant Authorities/companies inspectors/supervisors.

Hence, co-ordination meetings with Mauritius Telecom, CWA, CEB and WMA and any other relevant Authority as applicable will be held prior to any excavation of trial pits. The Contractor will have to submit a programme of execution of trial pits as per Clause 1.7 for approval by the Engineer's Representative and the relevant Authorities. Trial pits along any street or road should be carried out at least 35 days prior to start of excavation for the laying of pipes, cables etc.

The Contractor shall furnish to the Engineer's Representative, within 48 hours after opening of the trial pits, with three (3) copies of the relevant information which shall be in the form of a written report, including sketch, drawing and photographs relevant to the information/data obtained from each trial excavation. The format of submission shall be as agreed with the Engineer's Representative. This will identify the type of surface, its condition and depth below ground level and any other relevant information.

Whenever deemed necessary by the Contractor or instructed by the Engineer's Representative, the Contractor shall carry out trial excavations and/or other non-destructive methods of investigation to reveal existing buried services or for other reasons.

The trial excavations shall normally be carried out by hand unless otherwise agreed and shall be excavated to a suitable size as directed by the Engineer's Representative.

No excavation for trial pits shall be backfilled until the report or sketch has been supplied and the Engineer's Representative has carried out a site inspection and has given his agreement to backfill.

The Contractor shall include, in his pricing of Item 1.1.18 of the Bill of Quantities for carrying out these confirmatory surveys, for the following:

(i) Provision of barricading, safety precautions and any other requirements by Authorities concerned;

(ii) Cutting of asphalt in straight lines, excavation, backfilling, reinstatement strictly as per the requirements of the District/ Municipal Council and the Road Development Authority;

(iii) All necessary temporary Traffic signs as required by the Traffic Management and Road Safety Unit;

(iv) Submission of written report, including sketch, drawing and photographs relevant to the information/data obtained from each trial excavation;

(v) Submission of detailed drawings in an approved AutoCAD format showing all the services and inclusion of same in the survey drawings as per Clause 1.18;

(vi) Any other item of work deemed necessary by the Contractor for the proper and safe execution of these confirmatory surveys.

Trial excavations shall be backfilled and temporarily reinstated on the same day, unless otherwise agreed with the Engineer's Representative and the relevant Authorities. Any services damaged by the Contractor during his work operation shall be made good at his own cost.

1.33 DAMAGE TO ESSENTIAL PUBLIC SERVICES

In the event of the Contractor damaging water, sewerage, electricity or telephone services, whether these have been marked or not, the Contractor shall immediately inform the Authority concerned.

The Authority concerned will carry out the repairs, and shall inform the Contractor through the Engineer in writing of the damage and repairs carried out.

In some cases where water supply pipelines, existing electrical network, telephone services and existing road infrastructure are damaged by the Contractor, he may be instructed to effect the necessary repairs under the supervision of the Central Water Authority, the District/ Municipal Council, the Road Development Authority, the Central Electricity Board, the Mauritius Telecom as the case may be. Consequently, close liaison will be required on the part of the Contractor, with all these Authorities. The Bidder's attention is drawn to the fact that there is no bill item for repair works under the responsibility of the Contractor. All such costs shall be deemed to be included in the Contractor's rates for other items such as excavation and pipelaying and hence, no payment shall be effected to the Contractor for the above works.

The Contractor shall pay for the cost of repairs within one month of receiving the account from the above Authorities.

In the event of the Contractor failing to pay the account within one month, the Engineer's Representative will, if required to do so, inspect the accounts to ensure that they are reasonable and shall then request the Employer to deduct the sum which is assessed as reasonable from any monies due to the Contractor.

1.34 DAMAGES TO PROPERTIES

During excavation works in public road or in the vicinity of neighbouring boundary walls or buildings , the use of Pneumatic rock breaker will produce vibration which could result in damage to nearby properties.

The attention of the Bidder is drawn to the following environmental conditions with which he must abide at all times and for which he must price in his bid:

(i) The main sources of ground vibration are excavators, hydraulic rock breakers and vibratory rollers.

(ii) Actual vibration levels will be dependent on construction plants, soil and geological conditions, distance from the source to the receptor and the structural characteristics of the receptor.

(iii) The physical receptors may be "*engineered*" structures which are less prone to damages from vibrations or "*non-engineered*" structures such as boundary walls and many residential buildings which are of sub-standard construction quality and are, therefore, more prone to damages from vibrations.

(iv) In addition, roads within certain residential zones are narrow so that distances from the source of vibration, originating from the breaking of rocks by means of heavy hydraulic hammers, to receptors such as boundary walls and residential buildings may be as close as 1 to 2m.

(v) Consequently, there will be a high risk of the vibrations from heavy rock hammering causing damages to nearby boundary walls and buildings.

The Contractor shall therefore ensure that the Insurance Cover provides for making good of damages to boundary walls, buildings and other appurtenances during construction. The Contractor shall provide for its repair either directly or refunding the affected owner.

The Contractor shall make good any such damages within a reasonable time to be agreed upon with the Engineer. Under whatever circumstances, action for making good any such damage shall be initiated by the Contractor within a month of the date of the occurrence /complaint being notified to him,

The provisions of this clause shall be deemed to have been covered by the contractor in his Contractor's All Risk Insurance policy, for which payment is allowed for in Bill No.1, *"Preliminaries and General"* of the BoQ.

1.35 DEMOLITION, DAMAGE AND MAKING GOOD

The necessary care shall be taken when demolishing or carting away existing work or dismantling existing plant such that no adjacent work is unnecessarily damaged. Any damages shall be made good at the Contractor's own cost. If required by the Engineer's Representative, the Contractor shall submit detailed proposals for demolition, dismantling, and temporary supports for the approval of the Engineer's Representative 14 days before the commencement of the works at the relevant part of the Site.

All materials arising from demolition work, except as otherwise provided for in this clause, shall be disposed by the Contractor as surplus material at his own cost.

Any pipes, fittings and valves retrieved from demolished or dismantled structures, existing services and pipelines shall, if required by the Employer, be delivered to and stocked at a designated place to be directed by the Engineer's Representative. Pipes, fittings and valves not required by the relevant Authority shall be disposed of as surplus material at the Contractor's cost.

Underground structures and chambers shall be demolished to the levels shown on the drawings,' cleared out and filled with approved material.

Exposed raw faces of existing concrete or blockwork which will not have new work built on to them shall be made good with cement rendering or new blockwork as applicable.

All trees and shrubs shall be protected, if necessary with fencing, unless written permission is given to fell or lop by the relevant Authority.

Where any building, land, hedge, wall, fence or other existing feature is disturbed or damaged in any way, the permanent reinstatement shall be made with materials similar, and not inferior, to those in the undamaged portion, at the Contractor's own cost.

1.36 EXPLOSIVES

The Contractor shall not use any explosive for the purpose of the excavation of the works. Rock excavation should normally be carried out by the use of wedges and sledgehammers or pneumatic tools or excavators. The non-approval by the Engineer of blasting as a means of excavation in rock shall not entitle the Contractor to any extension of time or any adjustment of the tender sum.

1.37 WATER AND POWER SUPPLY FOR USE ON THE WORKS

The Contractor shall be solely responsible for the location, procurement and maintenance of a water supply adequate in quality and quantity to meet his obligations under the Contract.

The Contractor shall also make his own arrangements for power supply and shall be solely responsible for the location, procurement and maintenance of a power supply, adequate to meet his obligations under the Contract.

The rates entered in the Bill of Quantities shall be deemed to include for all obligations for the location, procurement and maintenance of adequate water and power supply and shall be deemed to include for all costs in association therewith.

The Contractor shall also supply all the required services to the Engineer’s Site office; these costs are deemed to be covered in the relevant items of the Bill of Quantities.

1.38 PROTECTION AGAINST FIRES

The Contractor is advised that at all times, it is necessary to guard against fires starting within the site or in the environs thereof, particularly as the result of the Works or from the actions of his employees. The Contractor shall have available at all times, fire-fighting equipment and shall deal with all fires howsoever caused.

The Contractor's attention is drawn that there are existing sugarcane plantations surrounding the site, therefore, he should take all precaution to guard the premises, the building being constructed and other buildings surrounding the site as well as the infrastructure works against any fire which may start at any time in the sugarcane fields, whether willful or accidental.

1.39 HEALTH, SAFETY AND ACCIDENTS

The Contractor shall use his best endeavours to ensure the health, safety and welfare at work of his employees including those of his subcontractors, of the public and of all other persons on and around the Site. His responsibilities shall include:

(i) To ensure that all employees of the Contractor and any subcontractor are trained in site working practices and systems of work.

(ii) Wherever it is reasonably, practicable copies of written safe systems of work should be provided.

(iii) The presentation to the Engineer of copies of his Contractor's All Risk Insurance Policy and public liability insurance which should provide cover for the duration of the project.

(iv) The submission of a copy of his safety policy or equivalent according to local Requirement to the Engineer's Representative, duly signed by a registered Health and Safety Officer.

(v) Provision and maintenance of safe and properly illuminated equipment, such as night beacons and lamps.

(vi) Establishment of safe and well illuminated systems of working.

(vii) Measures to avoid health risks in connection with the use, handling, storage and transportation of harmful substances.

(viii) Provision and maintenance in operative conditions of all equipment to render first-aid in case of accidents or other emergencies, to be kept in readiness at all sites of the works.

(ix) Appointment of a qualified Health and Safety Officer, duly registered with the Ministry of Labour and Industrial Relations. The Health and Safety Officer shall be fluent in English and have specific knowledge of safety regulations and have had experience of safety precautions on similar works with a minimum of 5 years' experience and shall advise the Contractor on all aspects of health and safety onsite.

(x) Compliance with the safety requirements of the Employer.

(xi) Ensuring that all current statutory health and safety requirements relative to notification procedures, the keeping of registers and all other matters are fulfilled.

(xii) Prompt reporting of accidents arising out of or in connection with the performance of the work that caused death, personal injury or damage to property, giving full details and statements of witnesses. Reports of accidents shall be made to the Engineer both verbally and in writing.

If any claim against the Contractor or any subcontractor arises as a result of any accident, the Contractor shall promptly report the facts in writing to the Engineer giving full details of the claim. The Contractor shall have, at all times, safety outfits for his employees and prepare such outfit for the employer during inspection. The Contractor should ensure minimum measures to be taken to allow for emergency vehicles to have access at any time. All costs associated to the above shall be borne by the Contractor within his rates and prices.

Note: *Please refer to* Section 9 *entitled "Safety, Health and Environment" – which expands more fully on the specifications relating to safety, health and environment.*

1.40 OVERHEAD POWER LINE

Where work is being carried out in the vicinity of overhead power lines, the Contractor shall be responsible for ensuring that all persons working in such areas are made 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. The Contractor's attention is drawn to BS EN 61936-1:2010 which gives safe clearance for the various voltage. The latter shall also seek clearance from the Central Electricity Board prior to carrying out works with machinery in the vicinity of overhead power lines.

Thus, prior to the start of works on site, the Contractor shall issue a letter to the Engineer confirming that he has done so.

1.41 MATERIALS FOR THE WORKS

All materials supplied by the Contractor shall comply with the appropriate applicable Standard Specification, and shall be supported by a Statement indicating the country of origin, a Certificate of Conformity from the MSB and the appropriate experience of the Manufacturer/Supplier for the material in question.

The Contractor shall, before placing any order for materials, manufactured articles or machinery for incorporation in the Works, submit for the approval of the Engineer the names of the firms from whom he proposes to obtain such materials, etc. together with a list of materials, manufactured articles and machinery, giving the origin, quality, weight, strength, description, etc. which he proposes that the firms should supply. No materials, manufactured articles or machinery shall be ordered or obtained from any firm which the Engineer has not previously approved in writing.

All materials shall be delivered to the site a sufficient period of time before they are required for use in the Works to enable the Engineer to take such samples as he may wish for testing and approval. Any materials condemned as unsuitable for the Works shall be immediately removed from the site at the Contractor's expense.

1.42 CONTRACTOR'S ORDERS TO BE APPROVED

The Contractor shall ensure that the goods are supplied with a maximum delivery period of 4 months following the issue of the Letter of Acceptance, so as not to delay the start of the civil works and completion of the Contract by the Completion Date.

Before ordering any materials for incorporation in the Works, the Contractor shall inform the Engineer of the names of the persons or firms from whom he desires to obtain such materials, and except as regards minor and unimportant matters, no order of such materials shall be placed except with the approval of the Engineer. The Contractor shall keep the Engineer fully advised of all orders and delivery dates of all materials.

Notwithstanding the fact that approval shall have been given in accordance with the above paragraph, the Engineer may forbid the use of any such materials if upon delivery, they are found to be defective, or he considers them unsuitable for incorporation in the Works. Such rejected materials shall be removed from the site forthwith.

The Contractor shall have no claim against the Employer in respect of any financial loss which he may suffer as a result of the rejection of any such materials, and he shall also bear the cost of removing them from the site of the Works.

1.43 ALTERNATIVES

The Contractor is at liberty to put forward alternatives for items of plant or methods of construction for which he claims advantages to that indicated in the Specification and Drawings, providing the mode of operation and method of construction is fully detailed and is at least equal to that shown on the Drawings or implied in this Specification. The Contractor shall fully state his reasons for submitting any alternatives and the Contractor shall price separately any reduction in his rates if and where applicable.

Notwithstanding this provision, the Contractor shall initially and first and foremost submit his bid in conformity with the drawings and specifications; thereafter, he can submit any alternative as per this Clause.

1.44 REJECTED MATERIALS AND DEFECTIVE WORK

Materials or work, which in the opinion of the Engineer, do not comply with the Specification, shall be classified as rejected materials or defective work and shall be cut out and removed from the Works and replaced as directed by the Engineer.

1.45 RECORD OF PRE-CONSTRUCTION CONDITIONS

Prior to any construction works the Contractor shall carry out a pre-work survey of structures, general condition of streets/roads, fences, pavements, boundary walls, etc. which are adjacent to and may be affected by the Works. All existing deformations and defects shall be identified, recorded and photographed. The Contractor shall arrange for representatives of the Engineer, the CWA, the CEB, the MT, the District/ Municipal Council, the Ministry of Public Infrastructure, Land Transport & Shipping, the Road Development Authority any other relevant Authority and the respective Owners to be present during the survey and records of such defects to be agreed between them.

A pre-work survey report including colour photograph records shall be submitted to the Engineer as part of his application to commence work. All necessary details shall be recorded and shall include:

- location of all boundary pegs
- survey beacons
- conditions of buildings, surfaces, terracing (if any)
- presence of ditches, watercourses, roads, tracks, fences
- any other useful information relating to the Site and its surroundings which may be affected by the Contractor's operations.

Owners and occupiers shall be consulted, where appropriate, in writing and a copy shall be provided to the Engineer's Representative.

It shall be the sole responsibility of the Contractor to record and submit to the Engineer all levels, photographs of visible damages as well as signs and indications thereof on all those existing structures likely to be affected by the excavations, jacking or piling works. Crack measurement devices shall be provided to monitor closely the transformation of cracks. It is the Contactor’s responsibility to notify the Engineer, if he has any reasons to believe that his work will cause further damage to the existing structures.

The Contractor shall not commence any work until all necessary and desirable information on the conditions of existing structures have been collected, properly recorded and submitted to the Engineer. If necessary, the Contractor must submit the endorsement of a Professional Engineer that it is safe to execute the work.

The Contractor shall on the Engineer’s instruction repair all damages to existing properties when such faults are detected after commencement of work. All repair works shall be done and completed within reasonable periods to the entire satisfaction of the Engineer. If required by the Engineer, the Contractor shall submit his proposal for the remedial works for approval prior to commencement of such works. In addition, the Contractor shall bear all direct and consequential damages and losses arising from the execution of the works.

In the case of wayleaves for the Works, the boundaries of the wayleave will be defined by the relevant Authorities and the Contractor shall provide, erect and maintain in position substantial timber stakes or similar approved markers not less than 1.5m high indicating

the position of the boundary at 100m or other such intervals as the Engineer's Representative may require.

In the event of any boundary or survey mark being disturbed or displaced as a result of the Contractor's operations, he shall forthwith replace the beacons and shall employ the services of an approved Sworn Land Surveyor for this purpose.

The record shall be updated with details of any further subsoil drainage or other underground features that are uncovered as work proceeds.

Such records will establish the pre-construction site conditions and will act as baseline data should any circumstances arise during the contract which in the opinion of the contractor may entitle him to extra payment. The above work is deemed to be included in the Contractor's rates.

1.46 WASTE DISPOSAL AND SITE CONTAMINATION

The Contractor shall provide for the prevention of site contamination due to spillages of various materials and also at all locations of temporary waste storage. Particular attention shall be given to fuel and oil storage and usage, plant maintenance areas, concrete batching and grout mixing areas.

The Contractor shall classify the waste arising from the works and agree with the Ministry of Local Government, Department of the Environment, Ministry of Health and all other relevant Authorities for the temporary storage and acceptable disposal of each class of waste. Such classifications and agreements shall be submitted to the Engineer for his approval. The Contractor's attention is drawn to the fact that it is an offence to indiscriminately dump any spoil material.

1.47 LATRINES

The Contractor shall provide throughout the period of construction of the Works and shall maintain and clean suitable and sufficient latrines for the use of his employees. He shall ensure that his employees do not foul the Site but make proper use of the latrines. Such on-site sanitary domestic waste facilities provided by the Contractor for his employees shall be to the approval of the District/ Municipal council and/or any other relevant Statutory Authority.

1.48 ENVIRONMENTAL MONITORING AND POLLUTION CONTROL

The Contractor shall appoint a suitably qualified member of his site staff to be responsible for environmental matters, including environmental monitoring and pollution control, arising from the works.

The responsibilities shall include:

(i) Proper and safe storage and disposal of wastes and spoil.

(ii) Clearance of approved vegetation only.

(iii) Stockpiling and safeguarding of topsoil.

(iv) Erection and maintenance of all approved safety fencing, barriers, warning signs, diversion signs, to safeguard the public from the Works.

(v) Protection of watercourses from pollution arising from the Works.

(vi) Provision and maintenance of approved wastewater disposal systems.

(vii) Safe storage of all potential polluting substances required for the Works.

(viii) Prevention of spills.

(ix) Maintenance of the plant to avoid public nuisance due to fumes, noise, leakages, etc.

(x) Dust control.

(xi) Noise control to minimize disruption and to allow access for residents.

(xii) Cleaning of roads and footpaths during construction.

(xiii) Reporting of any accidents or environmental incidents to the Engineer and to the relevant Authorities, together with organization of required remedial action.

(xiv) Site restoration, cleaning, planting on completion of the Works.

Note: *The Contractor's attention is drawn to Section 9 entitled "Safety, Health and Environment" which fully details the specifications relating to safety and environment.*

1.49 PROVISION OF WATCHMAN

The Contractor shall provide watchmanship as necessary for the safe custody of the entire site and its surroundings where off-site works are being carried out for the whole duration of the Contract.

He shall provide watchmanship to achieve fully the following:

(i) day and night security of his sites and locations of works within the site,

(ii) day and night security to locations of work outside the site of works, with respect to any off-site infrastructural works being carried.

(iii) day and night security to the storage yards and other premises related to the contract, around the site or at the site as the case may be.

The Contractor shall be deemed to have visited the site and to have ascertained himself with the number of watchmen required at all times in accordance with the above.

1.50 UNAUTHORIZED PERSONS

No unauthorized persons are to be allowed on to any part of the Site and the Contractor shall take step to prevent this and instruct his staff and watchmen accordingly.

1.51 RATES AND PRICES

The rates and prices inserted by the Contractor are to be full and inclusive value of the work described. They are to cover all costs, expenses and general risks which may be involved, together with all liabilities and obligations set forth or implied in the Specification and other documents on which the bid is based. They must include all plant, tools, materials, transport of men and materials, insurance and labour of every description. They must also take into account the conditions referred to in the Conditions of Contract and

include the time lost due to weather, payment of guaranteed minimum leave and holidays with pay. The cost of any travelling time, subsistence and incentives such as overtime, etc. must be included in the rates and prices. Where any special risks, liabilities and obligations mentioned above or otherwise, cannot be dealt with in the rates, then the price thereof is to be separately stated in an item or items provided for the purpose or added by the bidder. If any items are left unpriced it will be assumed that their value is included in other items and that they are not to be separately charged.

1.52 INSPECTION BY ENGINEER DURING DEFECTS NOTIFICATION PERIOD

The Engineer will give the Contractor due notice of his intention to carry out any inspections during the Defects Liability Period and the Contractor shall upon receipt of such notice arrange for a responsible representative to be present at the time and dates named by the Engineer. This representative shall render all necessary assistance and take note of all matters and things to which his intention is directed by the Engineer. Any remedial or other work instructed by the Engineer shall be executed forthwith.

1.53 PROJECT IDENTIFICATION SIGNBOARDS

Signboards shall be erected by the Contractor at locations to be given by the Engineer. The signboards shall be made up of 5 no. wooden planks, 2.5 m long, 200 mm wide and 25 mm thick, bolted on 50 mm diameter galvanised pipes embedded in concrete and properly braced against wind loadings. The planks shall be painted off-white and the lettering dark-blue.

The Contractor shall obtain instructions from the Engineer in respect of the information to be displayed on the signboards and the quantity thereof. All necessary permission and wayleave for the fixing of signboards should be under the Contractor's responsibility.

An item is included in the Bill of Quantities to cover the cost of supply and erection of the signboards.

1.54 PROGRESS MEETING

The Contractor's Agent and/or approved representatives of the Contractor shall attend regular progress meetings on Site which will be convened by the Engineer, the frequency of which shall be jointly decided at the start of the works on site. In addition, the approved representatives of the Contractor shall attend further meetings in cases of emergencies or for other reasons when called upon by the Engineer.

1.55 AS-BUILT DRAWINGS

By means of GPS or otherwise, the Contractor shall ascertain in the course of construction the exact location and coordinates of all installed services and shall furnish all such data by means of as-built drawings to the Engineer in three (3) hard copies and two (2) digital copies in DWG format.

All as-built drawings for the whole project, shall be prepared by the Contractor and submitted, within 30 days after the completion of the relevant section of work, to the Engineer's Representative for revision and approval. The As- built drawings *(related to the master benchmark as per Clause 1.17*) shall be in AutoCAD format similar to the Working (Construction) Drawings and shall comprise of the following:

(i) <u>On-Site infrastructure</u>

- *Water works:*
  - Layout plan of water network, position of relevant house/ property connections;
  - Longitudinal profiles for all pipelines laid;
  - Schedule of fittings for all connection points and valves;
  - Valves arrangements and valve chambers reinforcement details.

- *Road and Drainage works:*
  - Layout plan of road and drainage networks;
  - Longitudinal profiles for all roads and drains;
  - Kerbs and gully ;
  - Absorption pit;
  - Drain reinforcement and grating;
  - Road marking layout;
  - Road signs and posts;
  - Footpath layout and reinforcement.

- *Electrical and Street Lighting works:*
  - Layout plan of underground network, position of transformer rooms, service cable pillars, draw pits and property connections;
  - Street lantern details and concrete base reinforcement details.

- *Ancillary works:*
  - Any landscaping works

(ii) <u>Any other details as shall be required by the Engineer's Representative.</u>

These as-built drawings shall be approved with or without comments by the Engineer's Representative within 30 days after receiving them. If any amendment is required, this shall be carried out by the Contractor within 15 days. After finalisation, the As-Built

Drawings shall be submitted in 5 hard copies and 2 digital copies in DWG format. The copyright of these submissions shall remain the property of the Employer.

Note: *The Contractor shall update the drawings as may be required during the Defect Notification Period*.

1.56 ACCESS TO THE WORKS

The Contractor shall duly investigate all issues pertaining to access to the site of work prior to the submission of his bid. No claim or extension of time will be entertained on the ground that the access was difficult or otherwise.

Note: The successful Contractor shall not, as far as possible, hinder the movement of vehicles along any public or private road under any circumstances. For this purpose, he shall install all necessary road signs deemed necessary by the relevant Authorities to ensure safety of all road users.

The Contractor's attention is drawn to the fact that he must exercise particular care to avoid damage to existing infrastructure in particular the existing electrical high tension lines which run pass the site or along any public or private road.

1.57 GUIDANCE TO CONTRACTOR

The Bidder is advised to read carefully these general clauses of the Specifications and to ensure that he has complied therewith in all respects on submitting his Bid.

(a) The Bidder should check that he is in possession of the complete Bidding Documents. By reference to the titles and sub-titles, appendices, drawing numbers etc., he should ascertain himself that all the pages, sheets and schedules are in the correct sequence and that no such page, sheet or schedule is missing. Any such missing part of the Bidding Document should be immediately notified to Employer **(The Officer In Charge, SIT Property Development Ltd, Ground Floor, NG Tower, Cybercity, Ebène)** with copy to the Engineer for rectification as may be required.

1.58 DISCREPANCY

Should the Bidder conclude from the Bidding Documents that there exists any inconsistency, discrepancy or conflict within the contents thereof, or be in doubt as to the true meaning of any part of the Bidding Documents, he must notify the Employer with copy to the Engineer in writing, for clarification. Such notification must be delivered to the Employer not later than **seven days** (7 days) prior to the date set for the submission of Bids. Any revisions, additions or deletions to the Bidding Documents will be made only by formal addenda duly issued by the Employer/Engineer, and addressed to all the bidders not later than four (4) days prior to the Tender Submission date.

1.59 PRICES OF MATERIALS

The Bidder shall submit with his bid the basic prices of materials on which his bid is based. The prices should be broken down into their various components such as cost price, transport, handling and storage etc.

1.60 GENERAL CLAUSES WITHIN THE SPECIFICATION

Some clauses within this Specification relate to materials or items of work that are of a general nature and may not be specifically required under this Contract.

1.61 WORK IN CLASSIFIED RDA ROADS AND DISTRICT/ MUNICIPAL COUNCIL ROADS

The Contractor shall pay special attention to all the additional requirements and specifications of RDA and District/ Municipal Council which shall be respected and complied with at all times, while working on any street or road.

1.62 NOTIFICATIONS TO AUTHORITIES AND SUBMISSIONS OF DATA TO ENGINEER

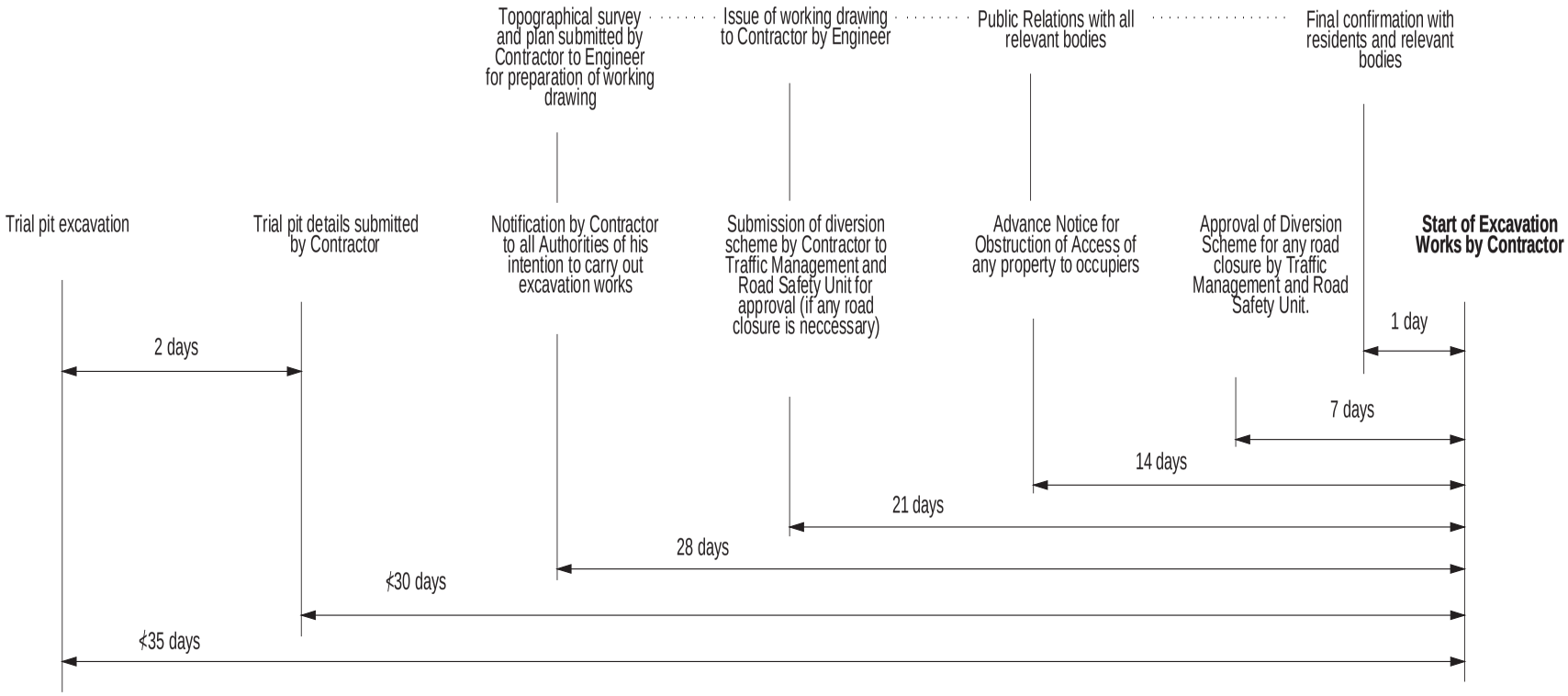
The requirements on the part of the Contractor for the time sequence of notices to the relevant Authorities prior to the start of excavation and site works within any street or road have been covered in the various relevant Clauses of the Specifications.

To enable the Contractor to understand and grasp the overall scheduling of such notifications, a schedule entitled *"Notifications and Submissions Schedule"* has been inserted as part of this Clause, to which the Contractor shall pay special attention prior to pricing his bid.

Such notifications have invariably to be followed by certain tasks and submissions of the relevant applicable data to the Engineer prior to start of works. All these requirements are fully included and described in the following schedule.

Any failure on the part of the Contractor to consult this schedule prior to his bid submission, shall not relieve him from his obligations and responsibilities under the Contract.

NOTIFICATIONS AND SUBMISSIONS SCHEDULE



1.63 SAMPLES OF MATERIALS

Notwithstanding the provisions of Clauses 1.41 and 1.42 of these Specifications, the Contractor shall supply within a period of 1 month following the award of contract, samples of materials for approval by the Engineer, before any bulk ordering for such materials is made by the Contractor.

Section 2

MATERIALS AND WORKMANSHIP

SECTION 2 - MATERIALS AND WORKMANSHIP

2.1 MATERIALS – GENERAL

All materials such as pipes, fittings, valves, aggregates, cement, bitumen, road marking paints, etc. used in the works shall be to the latest applicable versions of the relevant British Standards (BS), American Standard (ASTM), British Standard codes of Practice (BSCP), French Standard (AFNOR), German Standard (DIM), International Standards (ISO), Mauritius Standards (MS) and European Standard (EN) and shall be clearly marked with the standard mark, where appropriate, manufacturer's name or mark, date of manufacture, nominal size and class of pipe, as the case may be. Copies of those Standards and Specifications shall be provided by the Contractor, at his own cost.

Wherever in the Specification tests on materials, and tests on completed items are called for or implied, they shall be carried out according to the Specification and to the appropriate standards listed at Annex 2A at the end of Section 2 and/or their equivalents, copies of which shall be produced by the Contractor at his own cost.

All materials to be used in the permanent works should be approved by the Engineer and the Contractor should provide test and compliance certificates and for this purpose where appropriate even samples. All materials used in the production of pipes, fittings, valves and other accessories to be used for conveyance of potable water intended for human consumption shall be in accordance to BS 6920: 2014.

2.2 PIPEWORK

Pipes and fittings shall be of the flexible joint type scheduled in this Specification or on the Drawings and shall comply with the appropriate Standards listed at Annex 2A or their latest equivalents.

Flexible joints between pipes having integral sockets shall be formed by a shaped rubber gasket fitted within the socket or by a rubber of circular cross-section (O-ring) placed on the pipe spigot. The type of flexible joint to be used shall be subject to the approval of the Engineer.

2.3 TRANSPORT AND STORAGE

During transportation the Contractor shall ensure that any precautions specified by the manufacturer of materials, plant and equipment for handling of their products are strictly adhered to.

The vehicles on which pipes are to be transported shall have a body of such length that the pipes do not overhang. This is particularly applicable to PE and uPVC pipes in 6 m or 12 m lengths. During handling, the pipes shall not be dropped or allowed to strike one another or be rolled freely down inclines and they shall not be dragged on the ground.

All materials, including couplings and joints which are likely to deteriorate or be damaged by exposure of the elements, shall be stored in weatherproof building.

Pipes shall be stacked lengthways, clear of the ground and to a height of 2.0 m or less having regard to the recommendation of the Manufacturer and the adequacy of the Contractor's stacking arrangement. The first layer shall be placed on a firm foundation of timber set level and the pipes firmly anchored to prevent spreading. Subsequent layers shall be placed using timber spacers. Timber spacings and nests shall be such that pipe flanges or sockets do not take any load.

All pipes and fittings supplied as spares shall have end covers which are proof against the entry of sand and vermin.

End covers and protection shall not be removed until incorporation of the pipes and fittings into the works.

Sufficient space shall be left between stacks to enable plant to pass between without causing damage to the pipes.

Each consignment of each material shall be stored separately so as to provide easy access for inspection. After they have been approved by the Engineer, consignment shall be used in the order in which they were delivered on site.

Two weeks after receipt of the Letter of Commencement the Contractor shall submit to the Engineer for approval a plan of the storage area that he intends to provide whether on site or elsewhere for the storing of materials, plant and equipment as well as arrangements he proposes to take to ensure proper handling and guarding of the materials, plant and equipment.

2.4 PIPES AND FITTINGS FOR WATER RETICULATION

2.4.1 Polyethylene Pipes for Water Mains

The polyethylene (PE) pipes to be used for the construction of water distribution pipelines shall be of material class PE100 with SDR11. These pipes shall be manufactured in accordance with MS ISO 4427 and shall conform to BS EN 12201 -1 and BS EN 12201-2. The nominal pressure of the polyethylene pipe shall be 160 kPa (PN 16). The pipes shall be manufactured with polyethylene having a minimum density of 0.93 g/cm^3 and a melt flow index of 0.3g/10min and shall conform with Table 1 of BS EN 12201-1.

The pipes shall be jointed by means of electrowelded joints or other types of jointing to the approval of the Engineer. The connections and fittings shall have a nominal pressure rating and a material Class identical to the polyethylene pipe on which they shall be mounted and they shall fit the said pipe exactly.

2.4.2 Polyethylene Communication (House Connection) Pipes

The polyethylene (PE) pipes to be used as communication (house connection) pipes shall be of material class PE100 with SDR11. These pipes shall be manufactured in accordance with MS ISO 4427 and shall conform to BS EN 12201-1 and BS EN 12201-2. The PE communication pipes shall have a nominal pressure rating of 16 bars at a temperature of + 20 ^{o}C. The assembled joints shall be as specified in Clause 2.2.10 hereto.

The pipes shall be made of materials in conformity with Table 1 of BS EN 12201-1. Re-worked materials shall not be used.

The pipes shall be supplied by the manufacturer in coils having a maximum length of 100 m. The pipes shall be coiled at a temperature inferior to 30^{o}C and the minimum permissible ratio between the radius of coiling and the external diameter of the pipe shall be 15 and as per the requirements of Clause 6.4 of BS EN 12201-2.

2.4.3 Polyethylene Fittings

Polyethylene fittings to be supplied shall be of the electrofusion types with material class PE100 and shall conform to BS EN 12201-3. In addition, the polyethylene fittings shall be as described below:

(i) Polyethylene electrofusion fittings shall have embedded heating coils with contact terminals or shall alternatively be supplied with electrofusion couplers.

(ii) The fittings shall have deep insertion lengths with a wide fusion zone and a cold zone in the centre or shall alternatively be supplied with electrofusion couplers. They shall also have fusion indicators.

(iii) The fittings made of polyethylene shall be of black colour and withstand 16 bars test pressure. They shall also have be of high tensile and compressive strengths with a density of approximately 0.9 g/cm^3 at 23^{0}C. Their melt index shall be within the range of 0.4 to 1.3 gm/10min. i.e. MFI 190/5 within the melt flow index groups 005 and 010.

(iv) The fittings shall have a bar code label which can be read by the reader wand of the electrofusion equipment. They shall be compatible for electrofusion with HDPE pipes with melt flow index groups voltage within the range of 16 volt to 48 volt to suit the electrofusion welding equipment to be used by the Contractor.

(v) Tapping tees shall be suitable for electrofusion on live mains with a metal threaded drive cutter of limited cutting depth to protect the opposite pipe wall from damage. The cutter shall also allow the disc cut from the pipe wall to be retained in the cutter and shall not produce debris while cutting through the pipe wall.

(vi) Electrofusion tapping tees and branching saddles shall comprise a lower half and upper half under and over the pipe bolted together with anti-corrosion bolts and nuts for tight clamping on the PE pipes prior to electrofusion.

(vii) The Contractor may propose alternatives to the type of jointing proposed, subject to the Engineer's approval.

2.4.4 Polyethylene Pushfit Fittings

Polyethylene pushfit fittings shall conform to BS EN 12201-3. The Polyethylene pushfit fittings shall be used with Polyethylene pipes which are specified in the preceding Clauses. Metal threaded fittings including adaptors shall be of 'BSP' type. The grip ring shall be made of PVC. The material of the "O" ring shall be EPDM or nitrile elastomer to BS EN 681. The insert shall be of copper C106 to BS EN 1172, BS EN 1652, BS EN 1653 and BS EN 1654. The pressure seal shall withstand 48 bar pressure.

2.4.5 Polyethylene Adaptor and Reducing Connector

(i) P.E. adaptor and reducing connector shall of mechanical type to BS EN 12201-3.

(ii) Material used shall be high grade polymer

(iii) The P.E. adaptor and reducing connector shall comprise of a high grade polymer body and nut, acetal split ring and insert and a nitrile rubber O-ring.

2.4.6 Transition fittings - Polyethylene/Other Pipe Connections

(i) All Specifications (BS EN 12201-3) for Polyethylene fittings shall apply

(ii) The Polyethylene side shall have integral heating coil or provided with long end for electrofusion couplers. Electrofusion safety manufactured as per specifications of the relevant pipe connector.

(iii) The transition fitting shall be a monolithic product guaranteed to axial bursting and internal pressure tightness.

2.4.7 Flanged Adaptors

(i) Flanged Adaptor shall be polyethylene except where otherwise specified, and shall be of the type which can be safely electrofused with electrofusion couplers. Length of the adaptors shall therefore be sufficient to allow proper fusion widths.

(ii) Relevant clauses of the Specifications for Polyethylene fittings shall also apply.

(iii) The flange adaptors shall be compatible with the steel flange complying with BS EN 1092-1 and ISO 9624, unless otherwise specified on the Drawing.

2.4.8 Mechanical Joints for PE Pipes

Notwithstanding Clause 2.2.2 above, mechanical joints may also be used for connecting PE pipes of bigger diameter i.e. as from 160 mm diameter. The Contractor shall in this respect follow the instructions of the Engineer or his representative. All mechanical joint compression fittings for use with polyethylene pressure pipes in the water supply system shall conform to MS ISO 14236.

2.4.9 Assembled Joints for Communication Pipes

Electrofusion connections shall be used for jointing polyethylene communication pipes to other pipes and fittings. All joints shall conform to the requirements of BS EN 12201-5. The

connections shall fit the polyethylene pipes having a pressure rating of 16 bars. The fitting itself shall be designed and manufactured for the aforesaid nominal pressure. These joints shall be manufactured in accordance with ISO S8.

2.4.10 Flanges and Bolting for Pipes, Valves and Fittings

Flanges and bolting for pipes, valves and fittings shall all be to BS EN 1092-or ISO 2084 or to any other standard to the approval of the Engineer, provided that they are each compatible with the other for the purposes of jointing like-sized components and are such that corrosion by galvanic action shall be avoided. Unless otherwise specified the rating and test pressure of the flanges shall not be less than the rating and test pressure of the pipeline on which they are being used.

2.4.11 Bolts, Nuts and Washers

Black hexagonal bolts and nuts and flat washers shall be to BS 4190 or other standard approved by the Engineer.

2.4.12 Gaskets and Joints Rings

Gaskets and Joints rings shall be manufactured from natural or approved synthetic rubber conforming to BS 7874, BS EN681-1/2 and BS EN682.

Flanged joint gaskets shall be of the inside bolt circle type, unless specified otherwise, and shall comply with BSEN 1514-1.

2.4.13 Flexible Couplings and Flange Adaptors

Flexible couplings for steel and cast-iron pipes and flange adaptors at Valves and specials as shown on the Drawings shall be of the high-grip type or similar approved couplings suitable for use with water at a maximum temperature of 40^{o}C and for the appropriate pipes test pressure. Such couplings shall provide for full-end restraint while also allowing for axial movement, and shall be easy to fit and corrosion resistant. Pressure rating shall be 16 bar.

Flanges for pipes, valves, fittings and accessories shall comply with BS EN 1092-2:1997. Flexible couplings and flange adaptors exposed in chambers shall be protected internally and externally with an approved nylon or epoxy coating to minimum thickness 250 microns. Bolts and nuts shall have similar coating or be in stainless steel to BS EN10088-3. Buried couplings shall be protected by approved molten bitumen moulding or paste and tape wrappings.

Flange adaptors and couplings shall be without central registers but with locating plug unless specified otherwise. The end ring, centre sleeve and flange adaptor body shall be of spheroidal graphite (S.G) iron to BS EN 1563:2011. The gripper and carrier shall be of acetal copolymer grade M25 or equivalent. Bolts, nuts and washers shall be stainless steel to BS EN10088-3, coated to prevent galling. The sealing gasket shall ensure full seal and shall be of EPDM compound grade E to BS EN 681-1:1996 WA.

2.4.14 Ductile Iron Pipes and Fittings

Ductile iron pipes and fittings with push-in joints shall be manufactured in accordance with BS EN 545:2010 or ISO 2531:2009 for 16 bar nominal pressure rating. Joints shall be approved flexible type joints with rubber joint rings in accordance with BS EN 681-4:1996. Flanged pipes and fittings shall comply with BS EN 545:2010 or ISO 2531:2009, and flange joints shall comply with BS EN1092-1:2007+A1:2013 "*Flanges and Bolting for Pipes, Valves and Fittings*". Flanges will generally be drilled to BS EN 1092:2002 Table 16/11 unless otherwise specified in the Drawings.

Ductile iron pipes and fittings shall have approved external protective coatings and internal cement mortar protective linings as specified in BS EN 545:2010 or ISO 2531:2009.

Ductile iron pipes shall be manufactured and generally tested in accordance with BS EN 545:2010 or ISO 2531:2009.

All ductile iron pipes of nominal diameters up to 300mm shall be Class 40. No lower class shall be accepted. All ductile iron pipes shall be supplied in standardized lengths of 5.5 metres so as to fit into a 20-feet container. They shall be in accordance with Table 4 of BS EN 545:2010. If however, the supplier/manufacturer can confirm that a 6-metres length pipe can fit into a 20-feet container, such a length would be preferred.

Pipes with flexible joints and with flanged end will be required to withstand the PFA, PMA and PEA of the components in accordance with Annex A of BS EN 545:2010.

After satisfactory hydraulic testing, the pipes shall be coated externally using metallic zinc as specified in sub-clause 4.5.2 of BS EN 545:2010 and hot-applied bitumen based material conforming to the requirements specified in Clause 4.5 of BS EN 545:2010 or equivalent. The pipes shall be lined internally with cement mortar in accordance with sub-clause 4.5.3 of BS EN 545:2010 or equivalent. The thickness of the lining shall be as stated in Table 9 of BS EN 545:2010, and in accordance with sub-clause 6.8 of BS EN 545:2010.

Flexibly jointed pipes shall have an approved push-fit joint incorporating a suitably retained and shaped rubber ring in compliance with sub-clause 5.2 of BS EN 545:2010. Each joint after installation shall be capable of accommodating a deflection in accordance with sub-clause 5.2.1 of BS EN 545:2010. The performance tests for the joints shall meet the requirements of Table 11 of BS EN 545:2010.

All pipes shall be carefully finished internally and the linear measure of surface roughness for the pipes in the form of the parameter in the Colebrook-White equation shall be equal to or smaller than 0.03 mm.

Ductile iron fittings shall be manufactured and tested in accordance with BS EN 545:2010, or ISO 2531:2009 or other approved standards. They will be required to withstand a minimum works leak tightness test pressure as specified in sub-clause 6.5 of BS EN 545:2010.

The bore of all fittings shall be true, smooth, clear and coated externally with metallic zinc as specified in BS EN 545:2010 and approved hot-applied bitumen based material in accordance with BS EN 10300 or equivalent, or with cold-applied black bitumen material in accordance with BS 3416 or equivalent. Internally fittings shall be coated with an approved

hot-applied bitumen based material in accordance with EN 545:2010 or with cold-applied black bitumen material to BS 3416 or equivalent or with cement mortar incorporating sulphate resisting Portland cement to BS 4027 or equivalent.

The outer surface of all fittings shall be truly cylindrical in shape and concentric with the bore. Wall thicknesses shall comply with the following clauses and sub-clauses of BS EN 545:2010, namely Clauses 4.3, 8.3 and 8.4.

Where spigot fittings are specified these shall have an internal diameter compatible for jointing with standard ductile iron pipe joints. Where flanged ends are specified these shall be cast integrally with the fittings to a thickness and drilling pattern specified in ISO 2531:2009 or equivalent to suit PN 16 flanges. Flange jointing material comprising galvanised, or cadmium plated nuts, bolts, washers and rubber gaskets shall be as specified in Sub- Clause 4.1.3 of BS of EN 545:2010 and of the sizes and numbers required for one set for every flanged joint. Furthermore, the short and long term characteristics of the rubber for the gaskets shall be in compliance with EN 681-1.

Ductile iron pipes shall be cut with an approved mechanical pipe cutter and in conformity with the pipe manufacturer's recommendations. The edges of the cut shall be clean, true and square. The use of an oxacetylene flame cutter will not be permitted in any circumstances. The edges of the cut together with those parts of the pipes from which the coating has been removed shall be given two coats of bituminous paint and the internal lining repaired, if damaged, to the approval of the Engineer. When the cut pipe is to be inserted in a joint it shall be beveled for 10mm at 30^0 to pipe axis to remove sharp or rough edges.

For the purpose of the repairs mentioned above, the Contractor shall ensure that the relevant repair kits normally obtainable from the manufacturer be available at all times on the site.

2.4.15 Tapping Saddles for DI Pipes

The Tapping Saddles or Saddle Straps shall be of the Flat Boss Type manufactured from Gunmetal Bronze to BS1400 grade LG2 (BS EN 1982 grade CC491K), suitable for mounting on Ductile Iron pipes to BS EN 545:2010 or ISO 2531:2009.

The flat boss strap shall be of single band design, shaped to the pipe diameter to which it is to be fitted. All straps shall be in two parts, top and bottom, bolted at both sides. Straps shall be drilled in accordance with ISO 7/1 and BS21: 1985 and shall be capable of withstanding a working pressure up to 16 bars without leaking.

The flat boss strap shall be designed for making service connections into ductile iron mains, such that ferrules can be inserted into the main via the strap boss by using drilling and tapping machine. As far as possible, the straps shall be pre-drilled to the required size by the supplier as this will make the tapping of the connection easier on site. The design shall be suitable for use with standard pattern 360^0 swivel ferrules.

The saddle straps shall be supplied complete with stainless steel or aluminium bronze bolts and nuts, rubber sealing ring and all accessories to enable connection to polyethylene pipes via the swivel ferrules.

2.4.16 Swivel Ferrules for DI Pipes

All Swivel ferrules shall be designed as a main stem with a 360^0 swivel outlet at 90^0 with control of water flow via a threaded inner plug. The inlet shall be a male taper thread to BS 21: 1985 (ISO 7/1). The ferrule shall be designed and shall be capable to withstand pressures up to 16 bars without leakage. The ferrule shall be easily 'shut off' by means of spindle extending from the top cap.

The design of the ferrule shall allow service pipe installation via conventional drilling and tapping machines mounted onto the ferrule/ strap assembly to drill the ductile iron main via the ferrule stem dry or under-pressure.

The ferrule stem, banjo, threaded spindle and top cap shall be manufactured of gunmetal/ bronze to BS 1400 LG2 (BS EN 1982 grade CC491K). The banjo washers and the top cap washer shall be manufactured in EPDM rubber to BS EN 681-1: 1996.

2.4.17 Marking of Pipes and Fittings

Each pipe, special and fitting shall be clearly and indelibly marked at the place of manufacture with:

(i) The name or distinctive mark of the manufacturer.

(ii) The date of manufacture.

(iii) The class or pressure rating.

(iv) The nominal diameter.

(v) The manufacturing standard to which it has been produced.

(vi) The angle of bends or branches.

(vii) The name of the Employer.

(viii) Where appropriate, the pipework item reference number.

2.4.18 Protection of Mechanical Joints

Where instructed by the Engineer, Ductile Iron pipes and fittings shall be protected by an approved mastic paste and tape wrapping system. The system shall be based on tape consisting of a synthetic fibre carrier impregnated and coated with petrolatum compound, specifically designed for corrosion protection.

Before wrapping, pipes and fittings shall be cleaned and primed in accordance with the manufacturer's instructions. In addition, the contours of the flanged joints and flexible joints shall be eased by the application of a mastic paste acceptable to the Engineer to cover all protruding edges, bolt heads and sharp edges of flanges so as to give a smooth external profile, according to the manufacturer's instructions prior to wrapping.

The wrapping and protective tape of a type acceptable to the Engineer shall be applied in two separate layers. Each layer shall be wound with an overlap equal to half the tape width and shall extend at least 150 mm beyond the area requiring protection.

2.5 PIPES AND FITTINGS FOR SEWER RETICULATION

2.5.1 Unplasticised Polyvinyl Chloride Pipes and Fittings

All underground waste/sewage pipework shall be installed in accordance with EN 1610 and as per the relevant Sub-Clauses of Section 3 of this Specification.

The underground waste and sewer network shall be of gravity system with suitable structured wall uPVC pipes to MS EN 13476 or BS EN 13476 with stiffness class **SN8**. All underground pipes and fittings shall be of same stiffness rating and all fittings shall be of swept type. Pipelines should be laid underground with all necessary fittings and accessories, warning tapes and necessary protection, etc.

2.6 VALVES

2.6.1 Assembly of Equipment and Protection

Except where otherwise specified all valves and generally all pipeline equipment shall be completely assembled at the manufacturer's workshop as no item shall be imported as unassembled components. They shall have also received their complete protective coatings before despatch from the manufacturer's works and shall be additionally protected by approved means for the period of transit, storage and erection against corrosion and accidental damage.

2.6.2 Installation, Operation and Maintenance Manuals

The Contractor shall supply to the Engineer with the material, plant or equipment, all the manuals and drawings describing the recommended procedures for their assembling, dismantling, installation and operation. These documents shall give their dimensions, weight and space required for operation and maintenance of the said plant and equipment. The maintenance manual shall also be submitted by the Contractor to the Engineer.

A draft of these documents shall first of all be submitted for approval by the Engineer one month prior to installation on site. After approval by the Engineer, the Contractor shall submit within two weeks three copies of the approved documents suitably bound under hard cover to the Employer and two further copies to the Engineer.

2.6.3 Gate or Section Valves

Unless otherwise specified by the Engineer, gate valves shall be double flanged and manufactured in accordance with BS EN 1074 or BS EN 1171 or other equivalent approved

standard and shall be of the wedge type. All valves shall have a drain plug, and easing screws shall be fitted on all sizes above 200 mm nominal diameter.

The valves shall have inside screw spindles and shall close clockwise. The spindle shall be shouldered to allow repacking of the gland whilst the pipeline remains in service.

The spindle shall be made of stainless steel at least equivalent to X20 C13. The wedge gate shall be solid and the wedge facing rings and body seats shall be made of stainless steel or alternatively of bronze or gun-metal.

The valves which are to be installed in the ground shall be of the double flanged type with fully enclosed gearing and operating mechanism and shall be so designed that no bolts, nuts, etc, are exposed to the soil and shall be in stainless steel 1.43.01 according to DIN 17440.

The valves which are to be directly installed in the soil shall be provided with surface boxes which can withstand a 10-tonne load and shall be supplied complete with protection tube, extension spindles and accessories at no extra charge. The extension spindles and protection sheath shall be of such a design that, if necessary, cutting to the true total length is possible. The surface boxes, protection sheaths and extension spindles shall be protected from corrosion by a 150 micron coating of bitumen epoxy.

The extension spindles shall be equipped with square headed key handles with dimensions of 19mm x 19mm for all sizes of valves. The valves to be installed in chambers shall be supplied with either a cast-iron or malleable iron hand wheel.

The valves to be installed directly in the ground shall be supplied with cast-iron caps and one solid forged valve tee key for every five valves to be supplied. The flanged valves shall be supplied with flange adaptors and connecting bolts and nuts at no extra charge where specified or required.

The Contractor shall submit to the Engineer the manufacturer's certificates which shall confirm that the valves and their components comply with the above specified requirements. The minimum nominal pressure rating shall be PN 16 or higher as specified by the manufacturer; and flanges and drilling shall be to BS EN 1092.

2.6.4 Air Valves

Air valves shall comply with BS EN 1074-4. Air valves for automatically exhausting or admitting air from and into pressure pipelines are specified on the Drawings. The orifice of these valves shall allow large volume of air to be released during pipe filling and admit large volumes of air into the pipeline during emptying.

The orifice of the air valves shall be designed to prevent premature closure whilst air is being released from the pipeline. The floats shall be made of rubber coated carbon steel.

The valves shall be fitted with a gauged outlet orifice designed to prevent water hammer resulting from the sudden filling of the drained air pocket by the flow of water.

The valves shall allow the evacuation of small volumes of air that can accumulate at the highest points of the pipeline during normal operation.

All the air valves shall be fitted with an isolating valve to allow safe dismantling during operation. Such isolating value shall be deemed to be included in the price of the air value.

The Contractor shall indicate in writing to the Engineer the manufacturer's recommended diameter of the pipes on which each size of air valve can be mounted. The dimensions given on the Drawings and in the Bill of Quantities are indicative of the recommended sizes and do not prejudge the manufacturer's recommendations which shall prevail.

2.6.5 Non-Return Valves

Non- Return valves shall comply with BS EN 1074-3. The non-return valves shall be double-flanged and made of a corrosion resistant material. They shall be designed and manufactured to prevent the return of fluid in a direction opposite to the normal flow direction.

The non-return valves shall be watertight when closed and, when open, the water shall flow through the valve without turbulence. The operation shall be silent. If flat type valves are supplied, special care shall be taken to check the closure time and the head loss of the valves.

The non-return valves shall be fitted to the pipeline by means of dismantling joints which shall be supplied free of charge with the valves.

2.6.6 Drain Valves

The low points of the pipeline shall be fitted with drain valves where specified on the Drawings. Two types of drain valve arrangements are specified with either direct draining into existing drains or draining by means of a sump pump. The drain valves shall be of 100 mm nominal diameter and shall comply with BS EN 1074-2 or an approved equivalent standard. The gate valves for drain valves shall be as specified in Clause 2.3.3 hereto.

2.6.7 Altitude Valves

Altitude valves shall comply with BS EN 1074-5. An altitude valve is used at reservoirs to control the level of water; the main valve shall be controlled by a ball cock in a small tank. Small-bore copper piping shall connect the ball cock to the underside of the diaphragm in the relay valve.

The small-bore copper piping shall be supplied and connected to the main valve by the Contractor during installation and the cost of this shall be deemed to be included in the rate for fixing the main valve.

The altitude valves shall have weights corresponding to their diameters as listed in Table 2.1 below.

Table 2-1: Pipe Diameter and corresponding Weight of Altitude Valves.

Nominal Diameter (mm)	*Weight (kg)*
500	600
450	500
400	430
350	380
300	270
250	160
200	105
150	76

2.6.8 Flow Control Valves

Flow Control valves shall comply with BS EN 1074-5. Flow control valves shall be double flanged to PN 16 and shall be suitable for use at pipeline pressures up to 16 bars.

Each pressure control valve shall maintain a constant flow in the pressure pipelines and shall be hydraulically controlled by a pilot activated by a depression flow meter and balanced by a spring or counter-weight. The tightness of the spindles and pistons shall be ensured by the required necessary O-rings.

2.6.9 Flow Meters

Flow meters shall be of the inferential type complying with ISO 4064 or similar approved by the Engineer.

All meters shall be double flanged, the flanges being drilled to BS EN 1092-1 and shall be provided with 7 days chart recorders actuated by mechanical drive. The chart readers shall be deemed to be included in the price of the flow meters.

2.6.10 Fire Hydrants

(a) <u>Standard Specification</u>

Fire Hydrants shall be of the **Screw- Down Type 2** streamline or medium pattern with 63.5 mm **Round Thread** outlets to BS 750:2012, and shall be fitted and tested in accordance with this standard. They shall also conform to BS EN 14339 and BS En 1074-6 with regard to dimensional, material and performance requirements. Furthermore, the fire hydrants shall be of ductile iron construction with gunmetal stopper and shall be capable of a minimum flow of 2000 Litres per minute at a constant pressure of 1.7 bars at the Hydrant Inlet.

The direction of rotation of the Fire Hydrant shall be clockwise-closing, and shall be operated by means of spindles fitted with cap tops of the same dimensions as those fitted

to the sluice valves. The outlet of the hydrants shall be round and of threaded type, suitable for fixing to a 80mm Hydrant Tee Outlet Flange drilled to BS EN 1092-2.

(b) Hydrant Surface Boxes

Hydrant surface box frames and covers shall be to BS750:2012 and BS 5834-2. Surface box Grade A shall be used in carriageways and Grade B on footpath, verges etc, and as particularly specified in Clause 3.23 of the Specifications.

The minimum clear opening in surface box frames and covers at ground level (for screw down- Type 2 hydrant) shall be 230 mm × 380 mm as per Clause 14.5 of BS BS750:2012. The depth of frame shall be not less than 100mm for grade A and 75mm for grade B. The minimum bedding width of the frame shall be 50 mm as per Clause 14.6 of BS BS750:2012.

Marking on the surface box shall be as per Clause 15 of BS BS750:2012. The Hydrant surface box covers shall be clearly marked by having the words **"FIRE HYDRANT"** in letters not less than 30 mm high or the initials **"F H"** in letters not less than 75mm high, cast into the cover. Furthermore, the marking "BS 5834-2 and BS 750 Grade A" or "BS 5834-2 and BS 750 Grade B" shall be clearly cast into the cover and frame. As per the requirements of the Mauritius Fire and Rescue Service (MFRS), the surface box shall be chained to the frame internally, to act as an Anti-Theft device.

(c) Hydrant Pit / Chambers

Hydrant pits/ chambers shall be of sound concrete construction cast in-situ or alternatively of precast concrete interlocking rings jointed in cement mortar, to the approval of the Engineer and as per Clause 3.22 of the Specifications. The size or area of the pit/ chamber shall not be smaller than the minimum clear opening of the hydrant surface box. The dimensions of the precast rings shall be as per Table 3.3 of Clause 3.22.1.

2.6.11 Steel Berths for Gate Valves

All gate or section valves to be installed in chambers shall be fixed to their concrete supports by means of galvanised steel berths as shown on the relevant drawing.

The distance between the external faces of the vertical flaps shall fit the distance between the internal faces of the flanges of the valves they are supporting.

The vertical flaps shall be flanged to BS EN 1092-1. The bolts to be supplied with the valves shall have a length sufficient to accommodate the thickness of the steel flaps which shall be 8 mm. The steel berths shall be fixed to the concrete support by means of 4No. 12 mm anchor bolts.

2.6.12 Pressure Reducing Valves

Pressure Reducing Valves (PRV) shall comply with BS EN 1074-5. Pressure reducing valves shall be designed to reduce a constant or variable inlet pressure to a predetermined constant outlet pressure, at flows varying from the maximum capacity of the valve to zero

flow. Adjustment of the outlet pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating downstream pressure shall be incorporated, and shall be deemed to be included in the price of the PRV.

Pressure Reducing Valves (PRV) shall be of the demand-sensing pressure type and be of fail-safe design. They shall be used to control the outlet pressure in response to variations in flows in the pipeline. The valve shall be of the Y-pattern diaphragm actuated type, and be pilot controlled.

2.6.13 Pressure Sustaining Valves

Pressure Sustaining Valves (PSV) shall comply with BS EN 1074-5. Pressure sustaining valves shall be designed to maintain the pressure in the pipeline immediately upstream of the valve at or above a preset value, irrespective of the flow and pressure conditions downstream of the valve. Adjustment of the upstream pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating upstream pressure shall be incorporated, and shall be deemed to be included in the price of the PSV.

2.6.14 Pressure Relief Valves

Pressure Relief Valves shall comply with BS EN 1074-5. Pressure relief valves shall be designed to prevent the pressure in the pipeline immediately upstream of the valve from rising above a preset value. The valve shall remain closed at lower pressures.

Adjustment of the pressure at which the valve opens to relieve pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating upstream pressure shall be incorporated, and shall be deemed to be included in the price of the pressure relief valve.

2.6.15 Butterfly Valves

Butterfly valves shall conform to BS EN 593and shall be suitable for the working pressures compatible with PN16 rated pipeline material. They shall be provided with flexible joints to prevent development of excessive strains and to enable removal.

Rates quoted by tenderers shall be inclusive of above.

Butterfly valves shall have a high-grade cast-iron body to BS EN 1561 or equivalent designed to the specified working and test pressures. The pressure rating of the valve shall be cast in the valve body.

The disc shall be of high-grade cast-iron to BS EN 1561 or equivalent or nodular cast-iron to BS EN 1563 or equivalent to the defined working and test pressures. It shall have a convex shape designed to achieve low head-loss characteristics. The valve shafts shall be of stainless steel operating in self-lubricating bushes in the body.

The valve seat shall be of gunmetal to BS EN 1982 or equivalent. The sealing ring shall be of high quality nitrile rubber attached to the disc edge by a sectional bronze retaining ring to form a reliable and durable seal.

The valves shall be fitted with hand-wheel actuators not exceeding 500 mm diameter incorporating gearing to allow opening and closing by manual operation at the given pressure using an effort no greater than 26 kg on the hand-wheel supplied.

In all cases, the gearing shall be designed to close the valve, from the fully-open position the to fully closed position in a period not less than 10 minutes with this effort. Actuators shall be designed so as to close the valves when the hand-wheel is turned in a clockwise direction; the direction of closing shall be clearly cast and indicated on the hand wheel. Position indicators shall be fitted to all actuators.

A performance curve, relating percentage valve travel open area and discharge coefficient shall be submitted to the Engineer. The head-loss coefficient with valve fully open shall be defined and duly submitted to the Engineer.

All valves shall be tested in accordance with BS EN 593 or equivalent and pressure and material test certificates shall be submitted to the Engineer for approval. The body, disc and seat shall be tested as defined below:

Valve Rating (bar)	*Seat Test*		*Body Test*	
	Pressure (bar)	**Duration (mins)**	**Pressure (bar)**	**Duration (mins)**
10	10	5	15	10
16	16	5	21	10
25	25	5	30	10

2.7 PAINTING AND PROTECTION

With the exception of stainless steel and rotating gland or bearing surfaces, all surfaces of all control equipment and all installations shall be adequately protected by the Manufacturer against corrosion and erosion for the design life of the equipment and installations. Where dissimilar metals are in close proximity to each other giving rise to electrolytic action, the mating surfaces shall be insulated.

All valves and pipe work in chambers shall be painted with two coats of black bituminous paint to BS 3416 Type II, or approved equivalent, suitable for use in tropical climates.

2.8 MANHOLE/CHAMBER COVERS AND FRAMES AND SURFACE BOXES

2.8.1 Manhole/Chamber Covers and Frames

Manhole/Chamber covers and frames shall comply with the requirements of BS EN 124 and with the following applications:

(i) In road: Class D 400, minimum clear opening 600 mm diameter

(ii) In footpaths driveways and parking area: Class C 250, minimum clear opening 600 mm diameter.

(iii) In gardens, fields, etc.: Class B 125, minimum clear opening 600 mm diameter.

2.8.2 Surface Boxes and Chamber Covers

Surface boxes and chamber covers shall be either cast iron or ductile iron and coated with a black bituminous solution.

Surface boxes over gate valves shall be hinged and chained and shall generally comply with BS 5834 or equivalent.

They shall be heavy duty with 150 x 150 mm nominal clear opening.

Surface boxes for hydrant chambers shall have a 380 x 230 mm clear opening and shall comply with BS 750 or equivalent.

Covers to air valve and other chambers shall be to the dimensions and loading requirements shown on the Drawings. Circular covers shall be provided with square frames. Covers shall be suitable for the following maximum safe centre static loads:

Light duty: 250 kg

Medium duty: 1500 kg

Heavy duty: 5000 kg

Where applicable, covers shall comply with BS 497 or equivalent.

Lifting keys shall be provided for each type of surface box or cover supplied. One set of keys shall be provided for every ten surface boxes or covers subject to a minimum of ten sets of keys or the actual number of covers if less than ten.

2.9 MATERIALS FOR BEDDING AND BACKFILL

2.9.1 General

Pipes shall be generally laid on a carefully compacted granular bedding with approved selected excavated material carefully placed and compacted around and on top of the pipe as detailed in the typical trench drawings.

2.9.2 Granular Materials for Pipe Bedding

For flexible, semi-rigid and rigid pipes, granular bedding material shall consist of graded aggregate of maximum size of 6 mm and/or as detailed in drawings.

2.9.3 Concrete Protection to Pipes

Where the cover over the pipe is less than 1.2m under roads/paved areas subject to vehicular loads or less than 0.9m under any stretch subject to non-vehicular loads, the pipe shall be laid in a concrete bed and haunch as detailed on the Drawings.

Concrete shall be Grade C20/40/C.

A 15 mm wide joint filled with approved filler shall be provided at every pipe joint along the section to be anchored or encased. Under no circumstances, will concrete be allowed to be cast direct onto the PE pipes; where a concrete surround is warranted e.g. at road crossings, the PE pipe will first be laid in PVC ducts of bigger diameter.

2.9.4 Selected Fill

Selected fill shall consist of uniform soil, free from stones larger than 10 mm, clay lumps larger than 75 mm, tree roots, rubbish and organic material and/or as detailed in drawings.

2.10 CONCRETE

2.10.1 Cement

Ordinary Portland cement and rapid-hardening Portland cement shall comply with the requirements of BS EN 197 - Portland Cement (Ordinary and Rapid - Hardening). Sulphate Resisting Portland cement should comply with BS 4027.

Each consignment of cement shall be accompanied by the manufacturer's certificate giving results of tests. If such certificate is not made available, representative samples shall be taken from different bags or containers of each consignment, suitably packed and sent for testing to prove its compliance with the requirements of BS EN 197 to an approved laboratory or where directed by the Engineer, all at the Contractor's expense.

All cement shall be stored in a waterproof shed on a wooden floor raised at least 150 mm above the surrounding ground and any cement which shall have become injuriously affected by damp or other causes shall at once be removed from the Site.

Cement which has been re-bagged either by the importing agent or by the Contractor, whether through the breakage of the original bag or any other cause, shall not normally be accepted but may be in special cases and certain parts of the Works if the approval of the Engineer in writing is first obtained.

2.10.2 Aggregates

The stone for use in the Works shall be obtained from approved quarries and consist of hard, tough, heavy, compact basalt, or other approved rock quarried, broken, screened and graded as specified hereafter to the satisfaction of the Engineer and free from flat, flaky, elongated, soft decomposed pieces, excess dust and any dirt or acids or other deleterious substances. Prior to commencing the Works and as required during the progress thereof grading, crushing, specific gravity, abrasive, voids and other tests will be carried out by the Engineer. Sampling and testing shall be carried out in accordance with BS 812.

The grading curves of all aggregates shall have even lines without discontinuities. All aggregates shall be stored in bins or in stockpiles with concrete or timber floors and walls so as to avoid contamination and the mixing of different classes of aggregates.

The aggregate for use in concrete work shall comply with the requirements of the BS EN 12620:2002 + A1:2008 with a flakiness index not exceeding 35 and shall consist of cubical broken stone. Coarse aggregate shall be uniformly graded from the maximum size required down to 4.8 mm.

Fine aggregate for use in the concrete work and cement mortar shall consist of approved crushed rock sand, clean and free from mica, clay, organic matter and other impurities and shall be in accordance with BS EN 12620:2002+A1:2008 for Fine Aggregate, Table 2 - Zone 2 or 3.

Sand shall be washed before use, if required by the Engineer's Representative.

2.10.3 Water

Water for making concrete, mortar grout, and for curing shall be clean, fresh and free from matter in solution or suspension in such amounts that may impair the strength or appearance of the concrete, mortar, rendering or grout. The Contractor shall make all arrangements for obtaining water from sources approved by the Engineer. Water shall comply with the requirements of the Appendix to BS EN 1008:2002.

If required by the Engineer, the Contractor shall take samples of mixing water and send them for testing to a nominated laboratory. If the results of the test show that the water is

unsuitable, then the Contractor will be responsible for the cost of the tests, otherwise the costs will be recoverable by the Contractor from the Employer.

2.10.4 Steel Reinforcement

The steel reinforcement for concrete shall comply with the requirements of BS 4449 with Type 2 bond classification.

All hard drawn steel wire mesh fabric shall conform to BS 4483. The main wires shall be held rigidly at the correct spacing by cross-wires electrically welded to them.

2.10.5 Admixtures

The use of admixtures for improved workability, accelerating or retarding setting, or for any other purpose, shall only be used with the Engineer's written approval. In such instances, the method of use shall be strictly in accordance with the manufacturer's instructions or recommendations.

2.10.6 Thrust Blocks

Concrete thrust blocks shall be formed at bends, tees and valves in accordance with the typical sections shown in the Drawings or otherwise as directed by the Engineer. The additional excavation shall be made after the bends, etc have been jointed and the concrete shall then be placed with all possible speed. The back of supports and blocks shall abut on to solid ground with all loose material being removed before concreting.

The concrete used for thrust and anchor blocks shall be Grade C20 or as shown on the Drawings and after placing shall be kept in view for not less than six hours. No pressure shall be applied in any section of main until the concrete has had at least three day's curing.

Flexible joints shall not normally be cast into thrust blocks. Where the size of thrust block does not make this possible, additional flexible joints shall be provided no greater than half the pipe diameter beyond each face of the block.

2.10.7 Marker Posts

Precast concrete marker posts as detailed on the Drawings shall be erected along the line of buried pipelines at intervals and locations directed by the Engineer's Representative and at all gate valves, air valves, hydrants, washouts and changes in direction. Plates shall be fixed to the post annotated as shown on the Drawing.

Posts alongside a roadway shall be set back against the nearest wall, hedge or similar and the appropriate horizontal and vertical distance to the valve or pipeline to the nearest l00mm shall be shown on the post or marker plate. The annotation shall be thus 2.1H/1.2V, indicating 2.1m horizontal distance in front of the post and 1.2m vertical distance below ground.

2.11 PRECAST CONCRETE UNITS

2.11.1 General

Precast concrete units shall be provided by an approved specialist supplier or may be manufactured by the Contractor if the Contractor's samples and workmanship are approved.

2.11.2 Precast Concrete Blocks

Precast Concrete Blocks shall conform to BS 771-3 and BS 1364 Type A Dense Aggregate Blocks. Blocks shall be solid or hollow, of the sizes required and shall be made in approved moulds of metal construction of sufficient strength to ensure the manufacture of blocks of even size and shape.

Concrete blocks for general walling shall be of an approved size. Cutting where necessary shall be such that clean sharp arises are produced without fracture or cracking of the portion to be used. Voids in cut blocks shall be filled solid with concrete.

Where concrete blocks are described as 'hollow', cavities are not to exceed ⅓ of the bearing surface and the material is in no case to be less than 50 mm thick.

The face of concrete blocks to be plastered shall have a reasonably dense fair finish from moulds.

The face of concrete blocks for finishing fair face shall have a smooth and dense finish from the mould.

2.11.3 Non-Structural Precast Concrete

Non-Structural Precast Concrete units shall be made to the form, surface finish and dimensions specified or shown on the Drawings. Any units damaged during manufacture, hoisting or fixing will be rejected.

The Contractor must allow for any moulds, for any light reinforcement which may be necessary to prevent breakage or damage in handling, for casting in specified lengths, for hoisting and, unless otherwise described, for bedding and jointing where necessary in 1:3 cement: sand mortar.

2.11.4 Structural Precast Concrete

Structural Precast Concrete materials and workmanship shall be in accordance with BS EN 1992.

The precast units shall be cast under cover and shall so remain for at least 7 days during which period they shall be kept damp or otherwise efficiently cured. No units shall be erected until 21 days after casting except with the written approval of the Engineer.

No unit shall be erected until it has been approved by the Engineer as being free from defects and all surfaces are to the required standard.

All precast units shall be marked with an individual identification. Lifting hooks are to be attached only to those positions shown on the detail Drawings or as specified by the Engineer.

2.12 CEMENT MORTAR

Mortar, except for blockwork, shall consist of cement and fine aggregate (as specified hereinbefore) mixed in the proportions of one part of cement to three parts of fine aggregate with the addition of clean fresh water of such a quantity so as to form a final mixture of plastic consistency. The mortar shall be mixed in such small quantities as may from time to time be required and any mortar which has begun to set or has been mixed for a period longer than one half hour shall not be used in the Works.

2.13 CEMENT GROUT

Grout shall consist of cement and clean fresh water mixed in the proportion of two parts by weight of cement to one part by weight of water. Any grout which has been mixed for a period longer than one hour shall not be used in the Works.

2.14 STEP IRONS

Step irons shall be galvanised malleable cast iron in accordance with BS EN 13101.

2.15 SAFETY CHAINS

Safety chains should be made of low carbon steel or of stainless steel, 10 mm nominal size, short-link, smooth welded chain to BS EN 818-1. When made of low carbon steel they should be protected by hot dip galvanizing in accordance with BS EN ISO 1461.

2.16 SPECIFICATIONS FOR CONCRETE

The specifications for concrete given in Clauses 2.7, 2.8, 2.9 and 2.10 above should also be read in conjunction with Section 5 entitled "*Concrete*".

2.17 APPROVAL OF WORKMANSHIP

Workmanship for in-situ works as well as precast works shall be approved by the Engineer, and where applicable, by the concerned Authority.

2.18 SUBMISSION OF SAMPLES AND TEST CERTIFICATES

As soon as possible after the Contract has been awarded, the Contractor shall submit to the Engineer a list of suppliers from whom he proposes to purchase the materials necessary for the execution of the Works. Each supplier must be willing to admit the Engineer, or his representative, to his premises during ordinary working hours for the purpose of obtaining samples of the materials in question. Alternatively, if required by the Engineer, the Contractor shall deliver the samples of the materials to the Engineer's office. Samples shall be taken in accordance with the relevant British Standards where applicable. Materials subsequently supplied shall conform within any specified tolerances to the quality of samples which have been approved.

The information regarding the names of the suppliers may be submitted at different times, as may be convenient, but no sources of supply shall be changed without prior approval.

When any material or article is required to comply with a British Standard, such material or article or its container shall bear the stamp of the registered certification trademark of the British Standards Institution. Alternatively, the Contractor shall submit to the Engineer test certificates from a recognized Standards Laboratory indicating compliance with the relevant British Standard.

The Contractor shall provide all facilities to test the materials, workmanship and the finished products at the manufacturer's works and the cost thereof shall be deemed to be included in the rates tendered. The tests shall be carried out in accordance with the procedures laid down in the relevant Standard Specification.

When the Contractor delivers the items on the site, these will be inspected visually for any damage during transportation. Physical tests especially to check any damage during transport may be carried out as appropriate at the Contractor's expense.

Any British Standard or British Standard Code of Practice referred to in the Documents relating to the Contract or any other British Standard or British Standard Code of Practice that may be substituted thereafter shall be held to be the latest edition published two months prior to the last date for submission of tender. All relevant particulars and conditions in British Standards or British Standard Codes of Practice relating to standard of material, quality and workmanship, shall be complied with and, except as otherwise noted, all tests specified shall be conformed to. In cases where no particular specification is given for any article or material to be used under the Contract, the relative British Standard or British Standard Code of Practice, where one exists, shall apply.

Other equivalent national standard specifications may be submitted for the above at the sole discretion of the Engineer if requested by the Contractor.

2.19 HANDLING AND STORAGE OF MATERIALS

2.19.1 Bulk Storage for Bitumen and Cement

The Contractor may use bulk storage for bitumen and cement provided he can satisfy the Engineer that the capacities are adequate.

2.19.2 Topsoil

Topsoil to be used later for verges or to cover embankment slopes and borrow pits shall be stockpiled on well-drained ground, to the approval of the Engineer. The Contractor shall not remove any topsoil from the site except with a written approval of the Engineer.

2.19.3 Borrow Pits and Spoil Tips

The Contractor may be required to obtain naturally occurring materials for the works from sources outside the area occupied by the permanent works.

The Contractor will also be required to locate, prove and propose for the Engineer's approval sources of fill materials. Such approved sources shall be designated "*Borrow Pits*".

The Contractor shall be required to make all the necessary arrangements for the availability of the required extent of land for the above.

2.19.4 Boulders of Basalt

Only clean, dense and unadulterated boulders of basalt shall be used for the production of aggregates.

Prior to the crushing of the aggregates, the Contractor shall submit for the approval of the Engineer the methodology he intends to follow for the selection of boulders of the above specifications.

2.19.5 Materials for Embankment

The materials for the construction of the main body of the embankments shall comply with the following requirements:

Plasticity Index: not more than 30%

Maximum Size: 300 mm

The materials for the construction of the top 300mm of embankment and for filling of holes and depressions shall comply with the following requirements:

Plasticity Index: not more than 25%

Maximum Size: 100 mm

C.B.R. value after 4 days soaking, at 95% of the BS Heavy Maximum Dry Density: not less than 10% (CBR. specimen prepared at BS Heavy Optimum Moisture Content + 2%)

Swelling: not more than 1 %

2.19.6 Subgrade in Cut

The Plasticity Index of materials in the top 300mm of subgrade in cut shall not be more than 40%. If they do not comply with this requirement, they shall be removed as directed by the Engineer and replaced by selected materials.

2.19.7 Material For Surfacing Side Slopes and Verges

Surfacing materials for side slopes and verges shall consist of approved suitable top soil obtained from the general excavations or from other approved sources and shall be free from all sticks, roots and stones of nominal size 30 mm. Topsoil shall not be handled when it is so wet that it will become densely compacted during its placement.

2.19.8 Material For Drainage Layer

- Quality and source of supply of materials to be used for drainage layer shall be subject to the approval of the Engineer.
- Coarsely crushed basalt materials, spalls macadam or natural selected basalt pebbles can be used.
- The materials shall be clean and free from impurities and vegetable matter (not more than 1%)
- Maximum Size: not more than 100 mm
- Proportion of particles less than 2 mm: not more than 10%
- Rough coral sand without mud, silt or clay offering good drainage quality may be proposed, subject to the approval of the Engineer.

2.20 ROAD STRUCTURE

2.20.1 Stone Aggregate Generally

Generally, the aggregate for use in the road works and road structures shall be obtained from approved quarries or stockpiles of boulders of basalt and consist of hard, tough, heavy, compact basalt, or other approved rock, washed before crushing if necessary, broken, screened and graded as specified hereafter, to the satisfaction of the Engineer and free from flat, flaky, elongated, soft or decomposed pieces, excess dust and any dirt or acids or other deleterious substances.

Aggregate for different purposes are classified hereafter.

2.20.2 Grading Limits for Sub-Base and Granular Base

The grading of the materials shall be within the limiting curves given in sub-clauses 2.20.3 and 2.20.4 and shall approximately match the envelopes of these limiting curves.

2.20.3 Materials for Sub-Base Course

The grading of crushed basalt shall be within the limits given in Table 2-2 below:

Table 2-2: Grading Curves of Aggregate for Sub-Base

Nominal Size of the Sieve (mm)	*Percentage Weight Passing %*
50	100
20	65 - 90
10	35 - 62
5	27 - 46
2	14 - 34
0.5	5 - 20
0.2	3 - 14
0.08	2 - 10

Additional criteria for the crushed basalt aggregate shall moreover be as follows:

The Los Angeles Value shall not exceed 32

The Sand Equivalent Value shall be more than 50.

2.20.4 Material For Base Course

The grading of crushed basalt shall be within the limits given in Table 2-3:

Table 2-3: Grading Curves of Aggregate for Base Course

Nominal Size of the Sieve (mm)	*Percentage Weight Passing %*
30	100
20	75 - 100
10	47 - 75
6.3	35 - 60
2	18 - 3
0.5	7 - 22
0.2	4 - 15
0.08	2 - 10

Additional criteria for the crushed basalt aggregate for base course shall moreover be as follows:

- The Flakiness Index shall not exceed 40%
- The Sand Equivalent Value shall be more than 60.
- The Los Angeles Value shall not exceed 30.

2.21 BITUMINOUS COURSE

2.21.1 Aggregates - General

Aggregate for bituminous course shall be obtained by mixing 3 or more classes dmm/Dmm of materials defined for each class, by the maximum size (Dmm) and minimum size (dmm) of particles.

Dimensions D and d will be chosen in the following series of sieve sizes: 2-6.3–10–14-20.

Crusher run 0/20 may be used for the production of bituminous course provided that all required specifications are satisfied; such proposal from the Contractor shall, prior to use, be approved by the Engineer.

Before the start of the Works, the Contractor shall submit to the Engineer's approval the grading curve of reference for material of each class.

The grading curves of reference for each class shall satisfy the following requirements:

- Percentage by weight of material retained by sieve Dmm: not more than 10%.
- All material shall pass sieve 1:25 Dmm
- Percentage by weight of material passing sieve dmm: not more than 10%
- All material shall be retained by sieve 0:63 dmm
- Percentage by weight of material passing sieve Dmm + dmm: within the range 1/3 – 2/3
- The total variations, by percentage, a round the grading curve of reference for each class of material shall not exceed the values given in Table 2-4 below.

Table 2-4: Grading Variations

Sieves (mm)	*Classes*						
	0/2	0/4	2/6,3	4/6,3	6,3/10	1014	6,3/14
0,08	+-4	+-3					
0,20	+-6	+-4					
0,63	+-7	+-5					
1,25	+-7	+-6	0				
2,00	-10	+-6	+10				
2,50	0	+-6	+ - 6	0			
4,00		-10	+ - 7	+10			
5,00		0	-10	+ - 8	0		0
6,30			0	-10	+10		+10
8,00				0	+ - 12	0	+ - 8
10,00					-15	+10	+ - 8
12,50					0	+ - 12	+ - 8
14,00						-15	-15
18,00						0	0

- Notwithstanding the above, the Contractor may submit for the Engineer's approval production of classes 0/3 instead of 0/2, depending on the characteristics of the crusher plant acting as source of the material.
- Coral sand shall not be used, and only rock sand will be allowed for use.

2.21.2 Aggregates for Bituminous Base Course

The grading of the aggregate to be used in bituminous base course shall be within the limits set out in Table 2.5 below.

Table 2-5: Grading of Aggregate for Bituminous Base Course

Nominal Size of the Sieve (mm)	*Percentage Weight Passing %*
20	100
16	80 - 100
10	60 - 80
5	40 - 60
2	25 - 40
0.5	8 - 20
0.08	6-8

Additional specification criteria for the aggregate to be used in bituminous base course shall be as follows:

The Flakiness Index shall not exceed 35%

The Los Angeles Value shall not exceed 30

The Sand Equivalent Value on 0/2 portion shall be more than 60.

2.21.3 Filler

Filler defined for the purpose of these Specifications as the portion of material passing No.200 B.S Sieve shall consist of Portland Cement or dust of crushed basalt, and shall satisfy the following requirements.

The Plasticity Index shall not be measurable.

Passing 0.08 mm>80%

Passing 0.20 mm = 100%

2.21.4 Aggregate for Bituminous Wearing Course

Aggregate used for bituminous wearing course and reshaping shall comply with the requirements of Sub-Clause 2.18.1. The grading of the aggregate to be used in bituminous wearing course shall be within the limits set out in Table 2-6 below.

Table 2-6: Grading of Aggregate for Bituminous Wearing Course

Nominal Size of the Sieve (mm)	*Percentage Weight Passing %*
12.5	100
10	80 - 95
5	40 - 55
2	25 - 40
0.63	15 - 30
0.080	6-10

Additional specification criteria for the aggregates to be used in bituminous wearing course shall be as follows:

The Flakiness Index shall not exceed 25

The Los Angeles Value shall not exceed 25

Note: *The Los Angeles Value shall be measured on 6/10 and 10/14 or 6/14 material after removal of flaky portion.*

The Sand Equivalent Value shall be more than 60

The percentage of particles <0.5 mm, obtained by washing 1kg of coarse aggregate, shall not exceed 2%.

2.21.5 Aggregate for Bituminous Surface Treatments

Aggregates used for bituminous surface treatment shall be hard, tough and free from vegetable matter, dirt, lumps or ball of clay, adherent film of clay or any other matter which will prevent the adherence of the bitumen and, if required by the Engineer, shall be mechanically washed with an adequate supply of clean water, to the approval of the Engineer.

2.21.6 Chippings for Bituminous Surface Treatment

Chippings to be used in bituminous surface treatments shall be satisfy the following specification criteria.

The chipping shall comply with the following grading:

- First Application: 10/14 mm
- Second Application: 4/6 mm
- The grading shall be in accordance with Table 2-3 of Sub-Clause 2.17.4
- The Los Angeles Value shall not exceed 25
- The Flakiness Index shall not exceed 20
- The proportion of particles less than 0.5 mm size shall not exceed 1%

2.21.7 Sand for bituminous Surface Treatment

The sand used for the sealing coat will be 0/3 mm crushed basalt sand, carefully washed in order to have a portion of filler (<0.08 mm) lesser than 8%. The washing shall be to the approval of the Engineer.

The Sand Equivalent Value of crushed basalt sand used for sealing coat shall exceed 75%.

2.22 MASONRY WORK

2.22.1 Stone – General

Stone for use masonry work shall consist of sound undecomposed basalt obtained from approved boulders, and shall be provided from sources to be approved by the Engineer. The stone shall be of even texture and colour.

2.22.2 Stone for Pitching and Stone Facing

Stone for pitching to drains, inlets and outlets, embankment and around structures shall consist of sound, undecomposed basalt with thickness not less than 15 cm and facing dimension not less than 22 cm.

2.22.3 Stone For Rip Rap

Stone for use as rip rap shall consist of reasonably well-shaped, hard, dense, and durable rock.

2.22.4 Hardcore

Hardcore filling shall be either clean hard quarry chips, or clean basalt or hard broken stone or other approved material broken to 75mm gauge. All hardcore fillings shall be laid in layers not exceeding 150mm thick, well packed, rammed and blinded on top with fine stone or other approved fine material and watered receive the final top layer (concrete or earth etc), as the case may be, to the approval of the Engineer.

2.23 BITUMEN PRODUCTS

2.23.1 Bitumen Products – General

The following types of bitumen products will be the ones which will be allowed by the Engineer to be used in the works:

- For the bituminous concrete, straight run bitumen penetration grade 35/50 shall be used.
- For the prime coat, cut back bitumen MC30 shall be used
- For the tack coat, cutback bitumen RC 3000 (or cut back 400/600) or rapid setting bitumen, emulsion (with 60% of bitumen grade 80/100) shall be used.
- Bitumen products shall comply with AASHTO or ASTM requirements. Some of the requirements for different grades of bitumen are indicated in Table 2-7 below.

Table 2-7: Requirements for Grades of Bitumen

Grade	*80/100*	*60/70*	*35/50*
Softening Point	1-51	43 –56	47 – 60
Penetration Test	80-100	60 –70	40 – 50
Density (25C)	1 – 1,07	1 – 1,1	1 - 1,1
Flash Point	> 230	> 230	> 250
Ductility (25C)	> 100	> 80	> 60
Solubility CS2	> 99,5	> 99	
Loss of heating	> 99,0	> 99,0	> 99
163C, 5h	> 2%	< 1%	< 1%
Penetration of residue from rolling thin film over test at 25	< 1%		
100 gas % of original	> 70%	> 70%	> 70%

2.23.2 Emulsions

Emulsions shall be of the cationic type. They shall comply with the following specifications:

- The water content shall not exceed the required nominal rate by more than 1% of the weight of emulsions.
- The sensitivity to temperature of the emulsion shall be such that its viscosity shall not decease by more than 30% if the temperature increases from 200C to 400C.
- The emulsion shall not contain free particles likely to obstruct the sparge pipes.

The following additional specifications shall apply:

(i) Any bitumen or bitumen emulsion delivered in leaking or deteriorated containers will be rejected by the Engineer.

(ii) At any time during the course of the contract, the Contractor shall, at his own expense, satisfy the Engineer that the bitumen and bitumen products being used are in accordance with the Specification. He shall in this respect arrange for the necessary laboratory testing in an approved laboratory, to the satisfaction of the Engineer.

2.23.3 Hydrated Lime

Lime for stabilization shall be Hydrated Calcium Lime (not Magnesium) and shall generally comply with BS EN 459, Class B, and with a free lime content of 50%.

The proportion of filler shall be more than 90%.

Locally manufacture lime may be proposed by the Contractor for the approval of the Engineer. In that case, the Contractor shall submit at his own expense, the manufacturer's certificate in respect of all the individual consignments that the hydrated lime fully complies the relevant British Standard, namely BS 890.

2.24 GUARD RAILS AND HAND PARAPET

Hand parapets shall comply with BS 7818, and shall be of the type and dimensions as shown on the Drawings. They shall also comply with Clause 5.39 "*Metal Parapets*" of Section 5 of these Specifications.

Guardrails and highway parapets shall comply with BS 6779 and shall be of the type and dimensions as shown on Drawings.

2.25 MATERIALS AND COLOUR FOR ROAD SIGNS

2.25.1 General

Permanent traffic signs shall be of Diamond Grade, reflectorised and shall comply in all respects with GN 154 of 1990, the Contract Drawings and Section 5 of the Specifications.

The Contractor shall at his own expense, if and when required by the Engineer, provide a manufacturer's and/or an approved laboratory's test certificate showing that the road signs comply with this Clause.

Standard colours to be used for Signs, Posts and Fittings shall be as described in the relevant BS as listed below:

Red	BS 381C No.537
Blue	BS 4800 No.0-013
Yellow	BS 381C No.355
Grey for posts fittings and	
black for signs	BS 2660 No.9-101
Cream	BS 381C No.352
Black	BS EN 12899-2
White	Ditto

2.25.2 Road Studs

Road Studs are the horizontal guiding devices that reflect incident light by means of retroreflectors in order to warn, guide or inform road users. These are bonded to, anchored within or embedded within the road surface. Road Studs should comply with BS EN 1463.

Placing of these reflectors shall comply in all respects with the manufacturer's instructions for placing, as well as BS EN 1463.

2.25.3 Paint for Road Marking

The paint to be used for road surface marking shall be specifically manufactured for such purpose. It shall be suitable for applying by brush, low pressure spraying equipment and high pressure spraying equipment to give a chemically stable film of uniform thickness.

It shall be **thermoplastic** paint, type and shall be stored and applied in all respects in accordance with the manufacturer's instructions. Unless otherwise specifically agreed by the Engineer, paint shall be applied without the use of thinners or other additives. All road marling materials shall be applied to BS EN 1824.

2.25.4 Colour

White

The colour appearance of white markings after application shall be to BS EN 1871 and BS EN 1824. The pigment used shall be titanium dioxide type A Anatase or type R (Rutile) complying with BS 3483.

Yellow

The colour appearance of yellow markings after application shall be to BS EN 1871 and BS EN 1824.

2.25.5 Surface Drying Time

The surface drying time of the road marking paint shall be determined in accordance with BS 3900 part C2; it shall be less than 5 minutes.

2.25.6 Hard Drying Time

The hard drying time of the road marking paint shall be determined in accordance with BS 3900 part C3; it shall be less than 15 minutes. Moreover, the adhesion to concrete or bituminous surfaces shall be satisfactory and shall be approved by the Engineer.

2.25.7 Testing for Drying Times

Testing to be carried out by the Contractor to determine the respective drying times shall be in accordance with BS 3900 parts C2 and C3, and shall be carried out on test panels prepared in accordance with BS 3900 part A3, all to the approval of the Engineer.

2.26 REFLECTORISATION

2.26.1 Internal Reflectorisation

Internally reflectorised plaint shall be specifically manufactured for this purpose and shall contain ballotini to the general requirements of BS EN 1871 and BS EN 1824 with a luminance factor of not less than 7% skid resistance of not less than 45 and heat stability of not less than 65%. The ballotini shall meet the grading requirements as given in Table 2-8 below.

Table 2-8: Grading: Ballotini

BS Test Sieve	*% Passing*
212 micron	100
150 micron	75 –100
75 micron	0 – 25
65 micron	0 - 10

The quantity of ballotini beads shall be between 18 % and 22% by weight of total mix or such other quantity as may be proposed by the Contractor, subject to the Engineer's approval.

2.26.2 Surface Reflectorisation

Surface reflectorisation shall be by application of ballotini beads to the wet paint film. The balootini shall comply with the general requirements of BS 3262 Part I and shall comply with the grading requirements as given in Table 2-9 below.

Table 2-9: Grading: Ballotini

BS Test Sieve	*% Passing*
0.850 mm	100
0.600 mm	80 –100
0.300 mm	18 – 35
0.150 mm	0 – 10
0.075 mm	0 – 2

The Ballotini shall be spread on the wet paint at between 0.7 and 0.9 kg/litre of paint or at such other rate as may be proposed by the Contractor, subject to the Engineer's approval.

2.27 GEOTEXTILE

All Geotextile material shall be of the non-woven type and of the continuous filament needle punched or thermo-bonded type for subgrades needle punched type only for drains. They shall possess the characteristics as defined in Table 2-10 below.

Table 2-10: Geotextile Characteristics

Characteristic	*Subgrade Drains*	*French Drains*
Mass per unit area	$\geq$ 250 g/m^2	$\geq$ 200 g/m^2
Tensile strength	$\geq$ 20 KN/m	$\geq$ 15 KN/m
Penetration load (GBR) at rupture	$\geq$ 3 KN	$\geq$ 2.5 KN
Elongation	$\geq$ 60%	$\geq$ 60%
Pore size 0_{90} (dry)	< 100 Mm	< 100 Mm
Permeability (10cm head)	$\geq$ 130 L/m^2.s	$\geq$ 160 L/m^2.s
Thickness	$\geq$ 2.4 mm	$\geq$ 2.0 Mm

Geotextiles shall be delivered in rolls, wrapped in a protective layer of plastic to avoid degradation from direct sunlight, ingress of dust, mud and water during storage.

Full details regarding the above shall be supplied by the Contractor to the Engineer for approval.

2.28 METALLIC GRATINGS

Metallic gratings shall be of either the ductile iron type or grey iron, and shall comply with BS EN 124 and shall be approved by the Engineer. Such gratings shall usually be installed on angle iron frames to allow maintenance and to protect the concrete edges of the concrete drain.

The gratings shall incorporate specially-designed directional non-slip studs which facilitate the washing away of leaves and break up the water sheet.

The gratings shall be fitted with ductile iron spring locks to allow for easy snapping into place.

The Contractor shall provide a set of six (6) crowbars to be used as levers for the removal of the gratings for maintenance purposes.

The side 40 x 40 mild steel angle-iron bar into which the metallic gratings will fit shall be welded with 6mm hold-down rods at 800mm centre to centre which shall be cast into concrete.

2.29 APPLICATION AND EQUIVALENCE OF STANDARDS AND NORMS

In these specifications, several standards and norms have been specified, and their lists have been produced at Annex 2A – "List of Standards" at the end of Section 2.

Equivalent standards and norms will normally be accepted if such equivalence is duly demonstrated by the contractor and/or the manufacturer.

In order to establish standards of quality, reference has moreover been made in this Specification to certain British Standards (BS) and to certain other National or International Standards.

The British or other Standards referred to shall be the latest edition published at the date of issue of the bid documents.

All the conditions and particulars as to standard of materials, workmanship and tests contained in such British or other Standards shall be complied with for the various items. Other equivalent National or International Standard Specifications, which will ensure equal or higher qualities of materials or workmanship, may be substituted at the sole discretion of the Engineer if requested by the Contractor.

Annex 2-A

LIST OF STANDARDS

LIST OF STANDARDS

American Standards

Ref. No.	Title
ASTM A 105 – 76	Forgoing carbon steel for piping components, Spec. for
ASTM C 40 – 73	Organic impurities in sands for concrete
ASTM C 88 – 76	Soundless of aggregate by use of sodium sulfate or magnesium sulphate - Test
ASTM C 105 – 47	Ground fire clay as a refractory mortar for laying up fire clay brick,
ASTM C 227 – 75	Air content of freshly mixed concrete by the pressure method - Test
ASTM 289 – 71	Potential reactivity of aggregates (Chemical Method), Test for. (1976)
ASTM D 946	Cement asphalt
ASTM D 1074	Bituminous mixtures
ASTM D 1559	Bituminous mixtures
ASTM D 1751 – 73	Performed expansion joint fillers for concrete paving and structural construction (non extruding and resilient bituminous types), Spec. for
ASTM D 1752 – 67	Performed sponged rubber and corked expansion joint fillers for concrete paving and structural construction, Spec. for
ASTM GI 72	Preparing, cleaning and evaluating corrosion test specimens, rec. Practice for
ANSI A 21- 5	Protection of DI fittings with polyethylene sleeve
AWWA C 105	Polyethylene Encasement for Ductile-Iron Pipe Systems
ANSI A 2150	Thickness design of ductile cast iron pipes
ANSI A 2151	Ductile iron pipes centrifugally cast in metal moulds or sand line moulds, for water and other liquids
AWWA 200-75	Steel water pipes 6 inches and longer
AWWA C 500-71	Gate valves 3 inches and through 48 inches, for water

British Standards

Ref. No.	Title
BS 21	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).
BS 336	Specifications for fire hose couplings and ancillary equipment
BS 639	Covered electrodes for the manual metal arc welding of carbon- manganese steels
BS 750	Specification for underground fire hydrants and surface box frames and covers
BS 812	Methods of sampling and testing of mineral aggregates, sands and fillers (4 parts)
BS 903	Method of testing vulcanized rubber
BS 970	Wrought steels in form of blooms, billets, bars and forgings
BS 1198	Building sands from natural sources
BS 1200	Sand for mortar for plain or reinforced brickwork blockwalling and masonry
BS 1247	Manhole step irons (malleable cast iron)
BS 1364	Precast concrete blocks
BS 1377	Methods of test for soil for Civil Engineering purposes
BS 1521	Waterproof building papers
BS 1769	Specification. Unified black hexagonal bolt, screws and nuts (UNC and UNF threads)
BS 2571	Specification for general purpose flexible pvc compounds for moulding and extrusion
BS 2633	Class I arc welding of ferritic steel pipework for carrying fluids
BS 2782	Methods of testing plastics.
BS 2971	Class II metal arc welding for steel pipelines and pipe assemblies for carrying fluids
BS 3416	Black bitumen coating solutions for cold application
BS 4190	ISO Metric black hexagonal bolts, screws and nuts
BS 4449	Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification
BS 4483	Steel fabric for the reinforcement of concrete
BS 4515	Specification for welding of steel pipelines on land and offshore
BS 4550	Method of testing cement
BS 4962	Plastics pipes and fittings for use as subsoil field drains.
BS 4991	Specification for propylene copolymer pressure pipe
BS 5000	Electrical machines for miscellaneous application
BS 5163	Double flanged cast iron wedge gate valves for water works purposes
BS 5404	Specifications for plastic laboratory ware
BS 5911	Precast concrete pipes, fittings and ancillary products.

Ref. No.	Title
BS 6004	PVC insulated cables masonry units, Parts 1 and 2
BS 6319	Testing of resin and polymer/cement compositions for use in construction.
BS 7664	Specification for undercoat and finishing paints.
BS 7956	Specification for primers for woodwork.
BS 8010	Code of practice for pipelines.
BS 8500	Concrete. Complimentary to BS EN 206-1. Specification for constituents, materials and concrete.
BS 8666	Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete. Specification.

Euro Norms

Ref. No.	Title
EN 63	Methods of testing plastics. Glass reinforced plastics. Determination of flexural properties. Three point method
BS EN ISO 75	Plastics. Determination of temperature of deflection under load. General test method
BS EN 124	Gully tops and Manhole tops for vehicular and pedestrian areas.
BS EN ISO 178	Plastics. Determination of flexural properties
EN ISO 179	Plastics. Determination of Charpy impact properties. Non-instrumented impact test
BS EN 196	Method of testing cement
BS EN 197	Cement. Composition, Specification and Conformity criteria for common cements.
BS EN 206	Concrete, specifications, performance, production and conformity
BS EN 295	Vitrified clay pipe systems for drains and sewers
BS EN 476	General requirements for components used in drains and sewers.
BS EN 512	Fibre-cement products. Pressure pipes and joints
BS EN ISO 527	Plastics. Determination of tensile properties
BS EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.
BS EN 588	Fibre-cement pipes for sewers and drains
BS EN 598	Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods
BS EN 638	Plastics piping and ducting systems. Thermoplastics pipes. Determination of tensile properties.
BS EN 642	Prestressed concrete pressure pipes, cylinder and non-cylinder, including joints, fittings and specific requirement for prestressing steel for pipes.

Ref No.	Title
BS EN 681	Elastomeric seals. Material requirements for Pipe joint seals in water and drainage applications.
BS EN 712	Thermoplastics piping systems. End-load bearing mechanical joints between pressure pipes and fittings.
BS EN 713	Plastics piping systems. Mechanical joints between fittings and polyolefin pressure pipes. Test method for leak tightness under internal pressure of assemblies subjected to bending
BS EN 714	Thermoplastics piping systems. Non-end load bearing elastomeric sealing ring type joints between pressure pipes and moulded fittings. Test methods for leak. under internal hydrostatic pressure without end thrust.
BS EN 728	Plastics piping and ducting systems. Polyolefin pipes and fittings- Determination of oxidation induction time (PE).
BS EN 744	Plastics piping and ducting systems. Thermoplastics pipes. Test method for resistance to external blows by the round the clock method.
BS EN 752	Drain and sewer systems outside buildings
BS EN 761	Plastics piping systems: GRP pipes- Determination of the creep factor under dry condition.
BS EN ISO 899	Plastics. Determination of creep behaviour
BS EN 1008	Mixing water for concrete. Specification for sampling, testing and assessing the suitability of water, including water recovered from processed in the concrete industry.
BS EN 1011	Welding. Recommendations for welding of metallic materials
BS EN 1053	Plastics piping systems. Thermoplastics piping systems for non-pressure applications. Test methods for watertightness.
BS EN 1054	Plastics piping systems. Thermoplastics piping systems for soil and waste discharge. Test method for airtightness of joints.
BS EN 1056	Plastics piping and ducting systems. Plastics pipes and fittings. Method for exposure to direct (natural) weathering.
BS EN 1090	Execution of Steel structures and Aluminium structures.
EN 1091	Vacuum sewerage systems outside buildings
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges.
BS EN 1119	Plastics piping systems. Joints for glass-reinforced thermosetting plastics (GRP) pipes and fittings. Test methods for leak tightness and resistance to damage of non-thrust resistant flexible joints with elastomeric sealing elements.
BS EN 1120	Plastics piping systems. Glass-reinforced thermosetting plastics (GRP) pipes and fittings. Determination of the resistance to chemical attack from the inside of a section in a deflected condition.
BS EN 1123	Pipes and fittings of longitudinally welded hot-dip galvanized steel tube with spigot and socket for waste water systems. Dimensions
BS EN 1124	Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for wastewater systems
BS EN ISO 1167	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids.

Ref No.	Title
BS EN 1169	Performance criteria for glass-fibre reinforced cement.
BS EN 1170	Precast concrete products.
BS EN 1171	Specification for cast iron gate valves
BS EN 1170	Test method for glass-fibre reinforced cement. Cyclic weathering type test
BS EN 1226	Plastics piping systems. Glass-reinforced thermosetting plastics (GRP) pipes. Test method to prove the resistance to initial ring deflection
BS EN 1228	Plastics piping systems. Glass-reinforced thermosetting plastics (GRP) pipes. Determination of initial specific ring stiffness.
BS EN 1229	Plastics piping systems. Glass reinforced thermosetting plastics (GRP) pipes and fittings.
BS EN ISO 1269	Plastics. Homopolymer and copolymer resins of vinyl chloride. Determination of volatile matter (including water).
BS EN 1277	Plastics piping systems. Thermoplastics piping systems for buried non-pressure applications. Test methods for leaktightness of elastomeric sealing ring type joints.
BS EN 1295	Structural design of buried pipelines under various conditions of loading.
BS EN 1339	Concrete paving flags. Requirements and Test Methods.
BS EN 1393	Plastics piping systems. Glass-reinforced thermosetting plastics (GRP) pipes. Determination of initial longitudinal tensile properties.
BS EN 1393	Plastics piping systems. Glass reinforced thermosetting plastics (GRP) pipes. Determination of initial longitudinal tensile properties.
BS EN 1394	Plastics piping systems. Glass reinforced thermosetting plastics (GRP) pipes. Determination of the apparent initial circumferential tensile strength.
BS EN 1401	Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system .
BS EN 1411	Plastics piping and ducting systems. Thermoplastics pipes. Determination of resistance to external blows by the staircase method.
BS EN 1452	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U).
BS EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.
BS EN 1514	Flanges and their joints. Dimensions of gaskets for PN-designated flanges
BS EN 1561	Founding. Grey Cast Irons.
BS EN 1610	Construction and testing of drain sewers.
BS EN 1671	Pressure sewerage systems outside buildings
BS EN 1680	Plastics piping systems. Valves PE piping systems. Test methods for leak tightness under and after bending applied to the operating mechanism.
BS EN 1796	Plastics piping systems for water supply with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP).
BS EN 1825	Grease separators.

Ref No.	Title
BS EN 1852	Plastics piping systems for non-pressure underground drainage and sewerage. Polypropylene (PP). Specifications for pipes, fittings and the system
BS EN 1862	Plastics piping systems. Glass-reinforced thermosetting plastics (GRP) pipes. Determination of the relative flexural creep factor following exposure to a chemical environment.
BS EN 1916	Concrete pipes and fittings, unreinforced, steel fibre and reinforced.
BS EN 1917	Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced
BS EN 1979	Plastics piping and ducting systems. Thermoplastics spirally-formed structured-wall pipes. Determination of the tensile strength of a seam.
BS EN 1982	Copper alloy ingots and copper alloy castings.
BS EN 1991	Actions on Structures
BS EN 1992	Design of concrete structures.
BS EN 1993	Design of steel structures.Design of joints. Eurocode 3
BS EN ISO 2039	Plastics. Determination of hardness
BS ISO 3310	Technical Requirements and Testing. Test sieves of perforated metal plates.
BS EN ISO 4600	Plastics. Determination of environmental stress cracking (ESC). Ball or pin impression method.
BS ISO 4649	Rubber, vulcanized or thermoplastic. Determination of abrasion resistance using a rotating cylindrical drum device.
BS EN ISO 6252	Plastics. Determination of environmental stress cracking (ESC). Constant-tensile-stress method.
BS EN ISO 6506	Metallic materials. Brinell hardness test.
BS EN ISO 6603	Plastics. Determination of multi-axial impact behaviour of rigid plastics.
BS EN ISO 6721	Plastics. Determination of dynamic mechanical properties.
BS EN ISO 7539	Corrosion of metals and alloys.
BS EN ISO 7765	Plastics film and sheeting. Determination of impact resistance by the free-falling dart method. Staircase methods
BS EN ISO 7686	Plastics piping systems. Plastics pipes and fittings. Determination of the opacity.
BS EN ISO 8256	Plastics. Determination of tensile-impact strength.
BS EN ISO 8407	Corrosion of metals and alloys. Methods for removal of corrosion products from corrosion test specimens.
BS EN ISO 8503	Preparation of steel substrates before application of paints and related products
BS EN ISO 8796	Insert type fittings test method.
BS EN ISO 9227	Corrosion tests in artificial atmospheres. Salt spray tests.
BS EN ISO 9352	Plastics. Determination of resistance to wear by abrasive wheels.
BS EN ISO 9967	Thermoplastics pipes. Determination of creep ratio.

Ref No.	Title
BS EN ISO 9969	Thermoplastics pipes. Determination of ring stiffness.
BS EN 10056-1	Specification for structural steel equal and unequal angles. Dimensions
BS EN 10067	Hot rolled bulb flats. Dimensions and tolerances on shape, dimensions and mass.
BS EN 10113	Hot-rolled products in weldable fine grain structural steels
BS EN 10210-2	Hot finished structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties
BS EN 10220	Seamless and welded steel pipes tubes. Dimensions and masses per unit length.
BS EN 10224	Steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption
BS EN 10240	Internal and/or external protective coatings for steel tubes. Specification for hot dip galvanized coatings applied in automatic plants
BS EN 10255	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions
BS EN 10293	steel castings for general engineering purposes.
BS EN 10298	Steel tubes and fittings for onshore and offshore pipelines. Internal lining with cement mortar.
BS EN 10300	Steel tubes and fittings for onshore and offshore pipelines. Bitumen hot applied materials for external coating.
BS EN 10310	Steel tubes and fittings for onshore and offshore pipelines. Internal and external coating with 2 layer coating with epoxy resin and polyamide based coating,
BS EN ISO 10545	Ceramic tiles.
BS EN ISO 11295	Guidance on the classification and design of plastics piping systems used for renovation
BS EN 12050	Wastewater lifting plants for buildings and sites.
BS EN 12100	Plastics piping systems. PE valves.
BS EN 12151	Machinery and plants for the preparation of concrete and mortar. Safety requirements
BS EN 12201	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE)
BS EN 12350	Testing Fresh Concrete
EN 12380	Ventilating pipework. Air admittance valve system (AVS). Part 2. Test methods.
BS EN 12390	Testing hardened Concrete
BS EN 12500	Protection of metallic materials against corrosion. Corrosion likelihood in atmospheric environment. Classification, determination and estimation of corrosivity of atmospheric environments.
BS EN 12502	Protection of metallic materials against corrosion – Corrosion likelihood in water conveying systems.
BS EN 12842	Ductile iron fittings for PVC-U or PE piping systems. Requirements and test methods.
BS EN 12889	Trenchless construction and testing of drains and sewers.

Ref No.	Title
BS EN 12620	Aggregates for concrete.
BS EN 12666	Plastics piping systems for non-pressure underground drainage and sewerage. Polyethylene (PE). Specifications for pipes, fittings and the system
BS EN 13101	Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity.
BS EN ISO 13260	Thermoplastics piping systems for non-pressure underground drainage and sewerage. Test method for resistance to combined temperature cycling and external loading
BS EN 13380	General requirements for components used for renovation and repair of drain and sewer systems outside buildings.
BS EN ISO 13478	Thermoplastics pipes for the conveyance of fluids. Determination of resistance to rapid crack propagation (RCP). Full-scale test (FST).
BS EN 13508	Investigation and assessment of drain and sewer systems outside buildings.
BS EN 13566	Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks.
BS EN 13689	Guidance on the classification and design of plastics piping systems used for renovation
BS EN ISO 13783	Plastics piping systems. Unplasticized poly(vinyl chloride) (PVC-U) end-load-bearing double-socket joints. Test method for leaktightness and strength while subjected to bending and internal pressure.
BS EN ISO 13846	Plastics piping systems. End-load-bearing and non-end-load bearing assemblies and joints for thermoplastics pressure piping. Test method for long-term leaktightness under internal water pressure.
BS EN ISO 13967	Thermoplastics fittings. Determination of ring stiffness.
BS EN ISO 13968	Plastics piping and ducting systems. Thermoplastics pipes. Determination of ring flexibility.
BS EN 14188	Joint fillers and sealants. Specifications for hot applied sealants.
BS EN 14364	Plastics piping systems for drainage and sewerage with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP). Specifications for pipes, fittings and joints.
BS ISO 16132	Ductile iron pipes and fittings. Seal coats for cement mortar linings.
BS EN ISO 22088	Plastics. Determination of resistance to environmental stress cracking (ESC). Bent strip method.
BS EN 50525	Electric cables. Low voltage energy cables of rated voltages up to and including 450/750V (U0/U). Cables for general applications

British Code Of Practice

Ref. No.	Title
BSCP 121	Brick and Block Masonry
BSCP 231	Painting of buildings
BSCP 310	Water Supply
BSCP 2001	Site Investigation
BSCP 2003	Earthworks
BSCP 2008	Protection of iron and steel structures from corrosion
BSCP 2010	Pipelines (4 parts)

International Standards

Ref. No.	Title
ISO 7	Pipe threads ware pressure-tight joints are made on the threads. Part I - Designation, dimensions and tolerances
ISO 160	Asbestos cement pressure pipes and joints
ISO 161	Thermoplastic pipes for the transport of fluids - Nominal outside diameter and nominal pressure Part I - Metric Series
ISO 264	Unplasticised polyvinyl chloride fittings with plain sockets for pipes under pressure. Laying lengths - Metric Series
ISO 881	Asbestos Cement pipes, joints and fittings for sewerage and drainage (1980).
ISO 1167	Plastic pipe for transport of fluid - Determination of the resistance to internal pressure
ISO 2084	Pipeline flanges for general use - Metric series - Mating dimensions
ISO 2531	Ductile iron pipes, fittings and accessories
ISO 3212	Polypropylene (PP) pipes – burst pressure requirement
ISO 3458	Assembled joints between fittings and polyethylene (P.E) pressure pipes. Test of leak proofness under internal pressure
ISO 3459	Polyethylene pressure pipes - Joints assembled with mechanical fittings - Internal under sure test Method and requirements
ISO 3501	Assembled joints between fittings and polyethylene pressure pipes - Test of resistance to pull out
ISO 3503	Assembled joints between fittings and polyethylene pressure pipes - Test of leak proofness under internal pressure when subjected to bending
ISO 3607	Polyethylene - tolerances on outside diameter and wall thickness.
ISO 4064	Measurement of water flow in closed circuits (2 parts).
ISO 4179	Ductile iron pipes for pressure pipelines. Centrifugal mortar lining. General requirements.
ISO 4483	Field pressure testing of asbestos cement pipelines, 1979.
ISO 7186	Specification for ductile iron products for sewage applications (Draft ,94/705389 DC) *–(straightness and hardness).*
ISO 8242	Polypropylene (PP) valves for pipes under pressure; basic dimensions; metric series
ISO 13480	Polyethylene pipes-Resistance to slow crack growth – Cone test method. *Wall thickness of > 5mm.*

Ref No.	Title
ISO 13953	Polyethylene (PE) pipes and fittings. Determination of tensile strength of test specimen from butt-fused joints.
ISO 13955	Plastic pipes and fittings. Determination of crushing decohesion test for (PE).

Mauritian Standards

Ref. No.	Title
MS 5	Standard for unplasticised PVC cold water pipes
MS 10	Standard for steel used in the reinforcement of concrete

Section 3

EARTHWORKS AND PIPELAYING

SECTION 3 - EARTHWORKS AND PIPELAYING

3.1 SITE CLEARANCE, LEVELLING AND TOPSOIL REMOVAL

Site clearance and levelling shall be carried out over the areas to be occupied by the Permanent Works and for working space. The site clearance shall be carried out before beginning excavation or other works, and shall include the clearance of all trees, stumps, bushes and other vegetation and the grubbing out of all roots and the removal of all boulders and rock heaps. The limits of the areas to be cleared shall be as defined by the Engineer. Prior to the felling of trees, the Contractor shall liaise with and obtain the necessary clearance/approval from the Forestry Services.

Following the establishment of ground levels, the Contractor shall carry out a preliminary site levelling over the areas where works will be carried out. The works involved cutting of heaps and filling of low spot places.

Top soil removal shall be carried out over the whole width of the road and trench to a depth up to 300 mm. The topsoil so removed shall be set aside at an *approved spoil tip for re-use for landscaping works* or disposal as directed by the Engineer.

Topsoil is defined as the surface layer of soil which by its humus content supports vegetation. This layer of soil is unsuitable, due to weathering and vegetable content, as a formation to roads and concrete structures or as a backfill or bedding material. The presence, extent and depth of topsoil that needs removal shall be agreed with the Engineer.

Subject to the requirement of this Clause, all other materials arising out of site clearance shall be disposed by the Contractor off the Site, or on the site in manner and place to be approved by the Engineer.

Where shown on the Drawings or as directed by the Engineer, trees shall be uprooted or cut down as near to the ground level as possible and all timber shall be deemed to become the property of the Client. The Contractor shall cut and stack timber as directed by the Engineer.

Bushes, undergrowth, small trees, stumps and tree roots shall, where directed by the Engineer, be grubbed out, burnt and deposited off the site in dumps to be provided by the Contractor. All holes left by the stumps or roots shall be backfilled with suitable material in a manner approved by the Engineer.

The Engineer may require that individual trees, shrubs and hedges are to be preserved and the Contractor shall take all necessary precautions to prevent their damage.

Some areas may require reinstatement of the topsoil after pipelaying. This should be done to the satisfaction of the Engineer.

3.2 WATCHING, FENCING AND LIGHTING

From the time that any portion of the Works shall be commenced, until the end of the Defects Liability Period, the Contractor shall be responsible for protecting the public from anything dangerous to persons or property and for the safe and easy passage of pedestrians and vehicular traffic. Reference is made to Clauses 4.8, 4.18 and 4.22 of the Conditions of Contract.

The whole responsibility for the efficient barricading, lighting and watching of Works for the proper protection of pedestrian, vehicular traffic and property rests with the Contractor. Every vehicular or road crossing over an open trench shall be protected on both sides by a stout wooden barricade, the uprights being at least 75 mm in least dimension, set into the ground to a depth of 0.6 m and projecting at least 1.2 m above the ground with two horizontal rails at least 110 mm wide.

Where boards are used to form bridges, they shall be battened together on the underside to prevent sliding and tipping.

At least four lamps are to be placed at every footbridge crossing and at every road bridge crossing between the hours of sunset and sunrise.

All trenches, chamber excavations and excavations for structures must be fenced on all sides. The fences shall consist of at least three 20 mm diameter hemp ropes or No 8 gauge wire stands stretched tightly together between poles securely fixed in solid ground, well clear of the excavation and also enclosing the spoil. The poles shall not be more than 4.5 m apart and the ropes or wires shall be stretched tightly at heights of approximately 0.4 m, 0.8 m and 1.2 m above the ground. Reflective tape shall be prominently suspended from the fencing around all sides of excavations and shall be inspected and maintained regularly throughout each day and particularly at the end of each working day.

All barricades must be erected prior to commencement of the excavation.

At night, between the hours of sunset and sunrise, at least two flashing beacons shall be placed at each end of the trench where vehicular traffic is affected. Where excavation works are carried out along main roads or at road crossings, additional flashing beacons shall be provided and placed as directed by the Engineer or as required by the Traffic Management and Road Safety Unit.

When a road or street is completely closed or partially closed to traffic, warning boards with flashing beacons if required, depicting warning signs in fluorescent paint in accordance with the prevailing traffic regulations, shall be placed on either side of the obstruction and also at distances of approximately 100 m on either side of the obstructions or at the closest road intersection, as per the requirements of the TMRSU.

The Contractor shall light and barricade all materials of whatsoever type obstructing roads and footpaths. The Contractor shall employ watchmen to guard the Works both by night and by day to ensure that barricades and lights are kept in good working condition at all times.

The cost of such additional safety measures shall be deemed to be included in the rates for excavation.

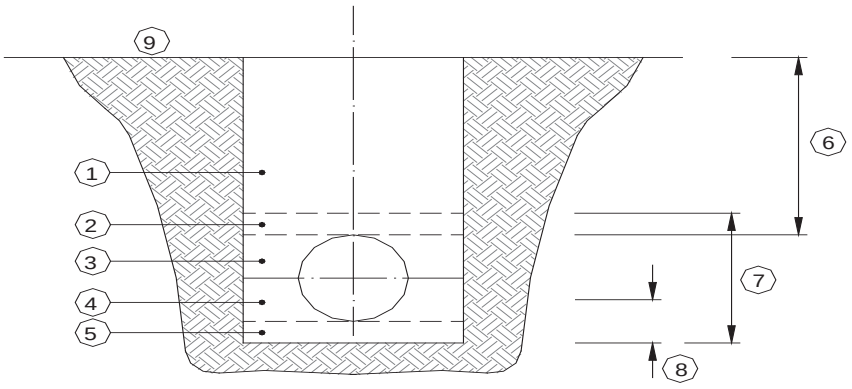
3.3 ACCESS TO PREMISES

The Contractor shall provide at all times, by means of headings, temporary bridges etc., access for vehicles and pedestrians to their premises for owners and occupiers of land along the route of the Work and for all emergency services. Provision must be made to allow the sanitary services to be unimpeded.

If for any reason, the access to any property is obstructed, satisfactory alternative arrangements shall be provided by the Contractor to the satisfaction of the Engineer's Representative and specially the rightful owner as per Clause 1.12.

3.4 TRENCHING TERMINOLOGY

For ease of reference, the latest trenching terminology and installation terms as given in EN805:2000 "*Water Supply – Requirements for Systems and Components outside Buildings*" have been detailed below for the benefit of tenderers/bidders.



KEY

1. Main backfill including road construction,if any
2. Initial backfill
3. Side fill
4. Upper bedding
5. Lower bedding
6. Depth of cover
7. Embedment
8. Bedding
9. Ground surface

3.5 BULK EXCAVATIONS AND EARTHWORKS

3.5.1 Constructional Plant

Before any Constructional Plant for excavation and earthworks is ordered or delivered to Site, the Contractor shall submit to the Engineer full details of the plant he proposes to use and the arrangements he proposes to make.

3.5.2 Ground Levels

The Contractor shall satisfy himself that the existing ground levels as indicated in the Contract Drawings are correct.

Before any excavation or earthworks is commenced, the site of the excavation or earthworks shall be surveyed by the Contractor in a manner and to the extent required by the Engineer. Drawings recording the survey shall be signed by the Contractor and the Engineer as a true record and the Contractor shall then supply two prints and one transparency of the drawings to the Engineer.

Such records shall not be altered in any way unless such alterations are agreed and signed by both the Contractor and the Engineer.

3.5.3 Excavated Surfaces

All excavated surfaces shall be finished neatly to the lines and levels shown on the Drawings

Excavated surfaces which will remain permanently exposed on completion of the Permanent Works shall be cleared of all loose material, pieces of rock, debris, rubbish and the like and left neat and tidy.

3.5.4 Support to Excavations

The responsibility of the Contractor for the safety and care of the Works under the Contract shall include taking the following measures:

(i) The Contractor shall excavate the sides of excavations which are not positively supported to slopes which will remain stable.

(ii) The sides of excavations which are not cut to a stable slope shall be properly and adequately supported to the extent necessary to ensure stability during the period of construction of the Permanent Works and the excavation shall then be backfilled unless otherwise indicated on the Drawings.

(iii) No materials, plant or other load shall be placed so close to any excavation that the stability of the sides of the excavation is endangered.

(iv) The Contractor shall remove or otherwise secure by barriers, netting or other means any material which might fall and thereby cause damage to the Permanent Works or injury to any person.

The Contractor shall be responsible for the installation and subsequent removal of all necessary sheeting, timbering, strutting, shoring and the like to secure the excavations, to prevent any movement of adjacent ground and to ensure the safety of workmen and freedom from damage to structures, buildings, streets, sewers, drains, walls, services or any other thing.

Where temporary underpinning is required, the Contractor shall submit to the Engineer full details of the design, materials to be used and method of working proposed.

3.5.5 Slips and Over-excavation

The Contractor shall avoid excavating beyond the lines and levels shown on the Drawings, disturbing ground adjacent to excavations, or damaging material beyond the limits of the required excavation except to provide the minimum adequate working space.

Slippages, excavation for working space, over-excavation and damaged areas shall be made good to the satisfaction of the Engineer. In the case of surfaces on which or against which Permanent Works are to be constructed, this remedial work shall comprise replacing the slipped, over-excavated or damaged material with suitable filling material or with concrete as instructed by the Engineer.

Slips, falls, subsidences and other damage which have the effect of removing or reducing support to existing or proposed structures, services and the like shall be made good in concrete or otherwise in a manner acceptable to the Engineer.

In the case of permanently exposed surfaces, remedial work shall comprise replacing and compacting material similar to that which has been removed in order to provide a surface not less satisfactory than adjacent correctly excavated surfaces. If this is not possible, remedial works shall be as instructed by the Engineer.

3.5.6 Records of Excavation

After completion of each section of Permanent Works excavation, the Contractor shall provide the Engineer with a record of the excavation. The record shall comprise all relevant information including the following:

(i) the location and extent of the excavation;

(ii) the elevation of the original ground and of any groundwater which is encountered during the excavation;

(iii) the measures taken to deal with groundwater;

(iv) the elevation, thickness and classification of all strata encountered;

(v) the instructed and actual profiles of the excavation.

3.6 EXCAVATION OF TRENCHES AND PITS

When excavation is being carried out in trenches, pits and similar confined areas, the sides of the excavation shall be properly shored or close sheeted and the Contractor shall follow the appropriate recommendations of BS 6031 – Code of Practice for Earthworks, EN805:2000 "*Water Supply – Requirements for Systems and Components outside Buildings*" and EN1610:2015 "*Construction and Testing of Drains and Sewers*".

All excavation shall be executed in the dry within such properly close timbered and sheeted sides as may be necessary and so that any existing structures and the excavations themselves shall be secured against the risk or subsidence and injury. Suitable precautions shall also be taken to prevent water entering the excavations during construction operations.

Excavation near existing buildings, walls and so on should be carried out manually.

The Contractor shall comply with all instructions of the Engineer regarding the supporting of the sides of excavations and shall not be relieved of his responsibilities under the Contract because no objection has been raised to the condition of the work.

Where necessary, the sides of excavations shall be properly shored up and supported with proper shuttering, planking and wallings, and shall be close sheeted where necessary to prevent the entry of mud, etc., or to ensure the safety of workmen. The cost of all such shoring, planking, sheeting, etc., shall be included by the Contractor in his rates for excavation. The cost of any of the above left in the excavation by the Contractor either for the safety of his workmen or because of any difficulty there may be in its removal shall be deemed to be included in the rates for excavation, and no extra price will be allowed except where ordered by the Engineer.

No greater length of trench shall be opened at one time than is approved by the Engineer's Representative and in accordance with prevailing conditions of competent Authorities. If there is a danger of erosion of trenches, then sections shall be left unexcavated until absolutely necessary.

Trenches for pipework shall be excavated below the invert level of the pipe to a depth that will allow the minimum thickness of granular bedding material or concrete as shown on the Drawings to be placed.

Excavations shall be trimmed and leveled by hand and the bottom layer of 150 mm above trench formation level shall not be removed until immediately prior to the commencement of pipelaying or bedding operations in order to minimize disturbance and deterioration of the bottom of the excavation.

The bottom of excavations for manholes, chambers and other structures shall be compacted to 90 % BS Heavy with mechanical rammers or a small vibrating roller or plate.

Should the Contractor wish to place a blinding layer in trench bottom or carry out any other work to facilitate his operations in trenches to additionally comply with Clauses 1.33 and Clause 3.7, then it shall be clearly understood that any costs arising from such works shall be deemed to be included in the rates for excavation.

Prices for 'excavation' shall be "all-inclusive" and shall therefore include for excavation in any material and shall further include for all necessary labour, tools, equipment, shoring, strutting, planking or alternative form of support, the handling of water (howsoever arising) and each and every other expense in the forming of the excavation to the lines and profiles required, save where specific items are provided in the Bill of Quantities. It shall also, where applicable, include for backfilling of the excavations in the manner prescribed and with the materials specified herein, and for the disposal of any surplus excavated material as directed by the Engineer. Furthermore, the all-inclusive excavation rate shall also include for each and every additional cost necessary in the performance thereof, including for removal and disposal of the excavated rock as directed by the Engineer.

3.7 EXCESS EXCAVATION

Should excavation be taken out in excess of the Contract requirements, or overbreakage occur in the excavations or slips in the excavations or banks during the execution of the Works or during the period of maintenance from any cause whatsoever, the Contractor shall execute the necessary remedial work with concrete in the case of foundations for structures or with concrete or suitable fill material in other cases to the approval of the Engineer. Voids caused by such overbreakage or slip shall be filled solid simultaneously with the foundations. No allowance whatever will be made or measurement taken for overbreakage.

No measurement will be taken and no payment will be made for concrete or fill material filling excess excavation, slips, or overbreakage, which shall be held to be a risk included in the rates for the excavation.

The pipes and the particular type of bedding shown on the Drawings or set out in the Bill of Quantities have been selected to be suitable for narrow trench conditions. To conform to this condition, trenches for pipelaying shall be excavated so that the width of trench between formation level and a point not less than 300 mm above the crown of the pipe does not exceed the width set out in Table 3.1 below.

Table 3-1: Pipe Diameter and Maximum Trench Width.

Nominal Pipe Diameter (mm)	*Maximum Trench Width 300 mm above Crown of Pipe (mm)*	*Trench width for Measurement and Payment (mm)*
Water Reticulation Pipe		
63	–	450
90	–	450
110	–	450
160	–	600
200	–	600
250	-	750
Sewerage Reticulation		
110	-	600
160	-	600
200	-	600

In the case of excess excavation, overbreakage of slips, whereby the trench widths given are exceeded, then higher strength bedding may be required over that shown on the Drawings to allow for the additional loading on pipes. The Engineer shall direct the Contractor to provide suitable pipe protection and any costs incurred by the Contractor in complying with the above shall be deemed to be included in the rates for excavation.

3.8 EXCAVATED MATERIAL

In depositing spoil, care must be taken not to damage adjoining fences, hedges, gardens or buildings. Any claims in this respect will be the liability of the Contractor.

3.9 PIPE BEDDING AND PROTECTION

Details of pipe bedding are shown on the Drawings.

Granular material shall be 6 mm single-size aggregates to BS EN 12620.

Class A bedding shall comprise of 120 degrees cradle of C15/20/C in situ unreinforced concrete under the pipe with selected backfill material to a depth of 300 mm above the crown of the pipe.

Class B bedding shall comprise of 180 degrees bed of single-size aggregates, with selected backfill material to a depth of 150 mm above the crown of the pipe.

Class S bedding shall comprise a complete surround of single-size aggregates to depth of 150 mm above the crown of the pipe.

Where pipes are to be bedded in granular material the bedding shall be evenly spread and carefully compacted up to the underside of the pipe barrel and the surface trued to the required gradient. After laying the pipe, the granular material shall be brought up to halfway up the pipe barrel.

Granular bedding and selected backfill, placed around and to a thickness of 300 mm above the crown of the pipes shall be placed simultaneously on both sides of the pipe in layers not exceeding 150 mm thickness and compacted by the use of hand rammers taking particular care to compact the material under the barrel of the pipe and around joints.

Where pipes are not surrounded with concrete, trenches shall be backfilled to a level of 300 mm above the top of the pipe with suitable and approved selected fill fine material free from organic matter and particles of a size greater than 10 mm which shall be compacted at its optimum moisture content in 150 mm layers.

Where pipes are surrounded by concrete and the Contractor elects to use shuttering to the sides of the concrete surround, the void between the concrete and the side of the trench shall be backfilled with approved granular non-plastic material which shall be saturated with water and well compacted before backfilling above the concrete surround is commenced. No backfilling shall be commenced within 24 hours of the pouring of the concrete surround of haunches unless otherwise directed by the Engineer's Representative.

3.10 BACKFILLING AND COMPACTION

Backfilling of trenches that have been timbered shall be carried out with utmost care and constant supervision. Where, in the opinion of the Engineer, there is a risk of collapse, the timbers shall be carefully withdrawn one at a time. Any voids behind the timbering shall be filled with sand or other non-plastic material. The rate of lifting the timbers shall not be in advance of the backfilling by more than 150 mm.

The backfilling of trenches other than in roadways shall then be completed in 150 mm layer to a level of 75 mm above the surrounding ground with selected material which shall be free from clay lumps, boulders or rock fragments having any one dimension greater than 50 mm.

Each layer shall be separated, compacted by use of a vibrating roller or air or diesel operated frog rammer. Use of hand rammers will not be acceptable. Compaction of each layer shall be approved before the next layer is placed. Strict attention shall be paid to the moisture content of the backfill material to ensure maximum density of the compacted material. If necessary water shall be added during spreading of the material. Backfilling of trenches in roadways shall be carried out in 150 mm layers, watered and compacted as described herein.

Topsoil in open areas shall be replaced as topsoil.

Where backfill is necessitated behind surface water drains due to the Contractor's operations, this will be carried out with granular material well saturated and the top 100 mm shall be finished with concrete Class C all at the Contractor's expense.

Excavations for structures shall be backfilled with approved selected material only after the work has been measured and approved by the Engineer.

All filling shall be deposited in layers with a compacted thickness not exceeding 150 mm. The Contractor shall carry out tests on the material used for backfilling and determine the maximum dry density and optimum moisture content. The results of these tests shall be reported to the Engineer. Before and during compaction of a layer the moisture content of the material shall be adjusted to within ± 2 % of the optimum moisture content. The material shall then be compacted to 95 % BS Heavy for its full depth and to 98% BS Heavy for the road base

Timber and framing shall be withdrawn ahead of the layer to be compacted, care being taken to keep the sides of the excavation solid and to fill completely the spaces left by withdrawn timber.

3.11 WARNING TAPE

A plastic warning tape of colour blue or as agreed by the CWA of at least 200mm wide, marked "**WATER MAINS – LM/CI/OC23/16"** in 12cm high lettering font along the whole length of trench shall be laid on the final backfill as shown on drawings, prior to backfilling with crusher run for the construction of the road structure.

Similarly, the warning tape for sewer works shall be brown in colour and of same dimensions as that for water works and marked **"SEWER – LM/CI/OC23/16".**

3.12 IMPORTED FILL

When and where insufficiency of suitable excavated material occurs, the Contractor shall import such suitable material either from borrow pits or from stockpiles to be determined by him with the approval of the Engineer. The importation of selected fill material and disposal of any surplus excavated material shall be deemed to be covered by the rate for excavation.

3.13 BUTTRESSES

The Contractor shall obtain the Engineer's approval before leaving buttresses in excavation. Generally in soft material buttresses left for the purpose of supporting the sides of excavations and maintaining access to premises shall be broken down as refilling proceeds.

3.14 MEASUREMENT OF EXCAVATION IN TRENCHES AND PITS

The depth of excavation in pipe trenches shall be taken as the vertical depth from ground level to the invert of the pipe. The cost of excavating below this level to trench formation level for concrete bed or granular bedding is to be included in the item allowed for such bed or bedding in the Bill of Quantities. Details of minimum cover requirements for pipes are given on the Drawing of Standard Details. The Contractor shall ensure that at any point the width of the pipe trench is sufficient to permit the pipe to be laid and protection and backfilling to be placed around the pipe in a manner to the Engineer's satisfaction. The width of excavation which will be used for measurement purposes will be as indicated in Clause 3.7., Table 3-1.

The depth of excavation other than for trenches shall be taken as the vertical depth from ground level to the underside of the blinding layer.

The size of chamber excavations shall be taken as the net size of the foundation slab and the Contractor shall allow in his rates for any extra excavation necessary for working space.

In normal ground the term "ground level" shall be deemed to be the level of the ground after it has been cleared. In fill area, "ground level" shall be deemed to be the level of the filling executed before trench excavation is commenced.

3.15 PRICES FOR EXCAVATION IN OPEN CUT

Prices for excavation shall be held to include for the following:

(a) Saw-cutting of road surface before the surface is broken, to any depth.

(b) Removal of road metal, paving slabs, etc breaking through roadside and storm drains, fences, hedges, etc and setting aside for subsequent reinstatement.

(c) Removal of grass, scrubs, bush, etc.

(d) Protecting existing work.

(e) Excavating in any and all materials met, including all kinds of soil, gravel, boulders, rock whether single or bed, shale, clay and vegetable matter to the specified width, depth and grade including trimming sides to lines and profile required.

(f) Supplying, placing and striking timbering and extra excavations necessary for same where required.

(g) Dealing with water from any source whatsoever and sewage, if any.

(h) Breaking down strips of original ground left to support sides of excavations, heading etc.

(i) Cutting away or entirely removing any rock or boulder or other obstruction which may project from the sides or bottom of trenches and for filling and ramming as necessary the spaces so excavated.

(j) Making good any subsidences.

(k) Shaping and trimming the bottom of the trench to formation level.

(l) Supplying, placing and compacting selected fill material around and to 300mm above the crown of the pipe as detailed on the Drawings, and then compacting fill material in layers as specified to the surface, including the disposal of any surplus material and reinstatement of the surface, access trenches, paths, roadside and storm drains, fences and hedges except where separately provided for in the Bill of Quantities.

(m) Dewatering of the trenches and any support work deemed necessary.

Excavation of trenches shall be measured by the cubic metre in depth to respective invert levels from ground level as stated in the Bill of Quantities except where indicated to the contrary.

Excavation of pits for chambers, structures and thrust blocks shall be measured by the cubic metre, unless otherwise stated, outside the normal excavation for trenches. Rates shall include, where applicable, for the same items as listed in paragraphs (a) to (m) above for trench excavations and for any additional excavation for working space.

For measurement of excavation by the cubic metre, all measurement shall be the net in-situ volume obtained from the difference between the lines, levels and profiles of the ground or rock surface agreed with the Engineer, before excavation in the relevant material is commenced and the lines, profiles and invert of pipes as shown on the Drawings, or as may be ordered by the Engineer as necessary for the Works.

The Contract rates for trench excavation shall, except where otherwise specified, include for all necessary timbering, strutting and sheeting, and for all labour in fixing and removing it, pumping and keeping the excavations free of water and for all additional excavation

required for timbering or for working space, sorting of excavated material, backfilling and reinstatement.

Subject to Clause 24 of the Preamble to Bill of Quantities, payment for trench excavation for pipelines will become due only when the trench has been backfilled over the pipe to the original ground level and the site cleaned up. However, at the discretion of the Engineer, up to 50 % of the applicable rate may be allowed for a trench backfilled to the depth of 0.3 m over the barrel. No payment will be made for open pipe trenches which, in the opinion of the Engineer, are unduly far ahead of the pipelaying work.

3.16 EXCAVATION IN ROCK

Excavation in rock is not applicable to this contract, in the light of the stipulations of section 3.6 "*Excavation of Trenches and Pits*" – which specify " all-inclusive rates for excavation.

3.17 LAYING TO CURVES

Where flexible jointed pipes are to be laid to curves, the deflection at each joint shall not exceed that recommended by the pipe or joint Manufacturer. For sharper curves purpose made bevel pipes, bevel adaptors or standard bends shall be provided.

3.18 ANCHOR AND THRUST BLOCKS

Anchor and thrust blocks shall be provided at horizontal bends, vertical bends, tees, crosses and end caps and at other locations ordered by the Engineer.

They shall be made from concrete Grade 20/20/B and constructed to the dimensions shown on the Drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the Contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown. All thrust blocks shall bear against undisturbed ground. Anchoring of curves formed by jointing standard straight pipe lengths will not normally be required.

3.19 PIPEWORK GENERALLY

3.19.1 Setting out Pipelines

The Contractor shall be responsible for setting out from information approved by the Engineer and shall include for such work in his excavation rates. Prior to laying a section of pipeline sight rails shall be erected at each end and at each change in gradient and direction with a maximum distance apart of 15 metres. Sight rails and boning rods shall be of substantial construction and shall be painted black and white in such manner as to indicate the lines and levels to be worked to. The Contractor shall include the cost of this work in his excavation rates.

3.19.2 Handling and Storage of Pipes

Prior to undertaking any work the Contractor shall submit to the Engineer for approval his proposals for the handling and storage of pipes and all fittings thereto. Such proposals shall ensure that all pipes are properly handled and stored both by his staff and by any cartage Contractor. During storage or transport, pipes shall not be allowed to rest on narrow cross-members or uneven ground or anything else that might give concentrated loads due to weight of the pipe or bumping of vehicles, but shall be properly supported on soft material. Sufficient labour and equipment shall be on hand before loading or unloading is commenced and under no circumstances shall any materials be dropped from a vehicle.

Rubber sealer rings and gaskets shall be stored in a cool dry place away from grease, oil and sunlight until required.

The Contractor when formulating his proposals for handling and storing pipes shall take into account the manufacturer's recommendations for such operations.

The Engineer shall have the right to reject consignments or stocks or piping from which failed pipes have been drawn.

3.19.3 Laying of Pipelines

Each pipe immediately before being laid shall be carefully brushed and tested for soundness. Care shall be taken to ensure pipes and fittings remain clean during laying. Particular attention should be paid to the avoidance of damage to any protective coating or lining. Any damage thereto shall be rectified immediately in accordance with the manufacturer's recommendations and to the satisfaction of the Engineer.

In trenches, pipes with flexible joints, except where concrete protection is provided as specified hereafter, shall be laid on well compacted granular bedding material extending for the full width of the trench and with sufficient materials at the sides to permit the pipes being worked into the approved material and firmly supported to true line and level. Sufficient space should be left to enable the joints to be made, tested and inspected but the Contractor shall ensure that at least three quarters of the pipe length is fully supported.

After the pipeline has been tested and approved by the Engineer the trench shall be carefully filled to the level of the horizontal diameter of the pipe barrel with granular bedding material. This filling shall be carefully compacted by a method approved by the Engineer to avoid disturbing the pipes or joints. This entire operation is referred by the Engineer to avoid disturbing the pipes or joints. This entire operation is referred to in the Bill of Quantities as " *Granular Bed*".

3.19.4 Jointing Pipes

Unless otherwise detailed or stated in the Bill of Quantities, joints on spigot and socket pipes shall be flexible and sealed with a rubber ring or flexible gasket which shall be approved by the Engineer and shall withstand the various tests specified herein for

pipelines. For pipes up to and including 600 mm nominal bore the joints shall be capable of standing a deflection of not less than one and a half degrees in any direction and for pipes over 600 mm nominal bore a half degree in any direction. All pipes shall be capable of withstanding a draw of 13mm over and above the initial jointing allowance. The initial jointing allowance is the gap between the spigot and the shoulder of the socket measured parallel to the centreline of the pipeline and shall not be less than 6 mm or greater than 13 mm

Minimum requirements for the above rubber ring shall be in accordance with the appropriate part of ISO/R. 1398 (nearest BS equivalent is BS 2494). The physical characteristics of the rubber ring shall be appropriate to the type of pipe and joint supplied. All joints shall be made strictly in accordance with the manufacturer's instructions.

Spigot and socket flexible joints in pipes shall have the annular space between the pipe and the socket protected to prevent the ingress of loose material or concrete by a hessian ring or band or other method approved by the Engineer.

3.19.5 Concrete Protection to Pipes

Concrete protection to pipes shall consist of plain concrete bed and concrete surround as shown on the drawings and shall be of concrete Class 15 along such lengths as are shown on the Drawings or ordered by the Engineer in writing. In carrying out his work the Contractor shall take care to pack the concrete under and around the pipes to ensure even bedding and consistency of the concrete.

The concrete surround or haunching shall be placed until the pipework concerned has been inspected and approved by the Engineer. No backfilling shall commence until the completed concrete surround or haunching has been inspected and approved by the Engineer. The concrete protection shall be placed the full width of the trench and never less than 150mm wider on each side than the barrel of the pipe.

When support of excavation is provided, building paper shall be placed against that support before concreting to facilitate withdrawal of the support.

In the cast of spigot and socket pipes with flexible joints, the concrete protection at each joint shall be interrupted in a vertical plane at the edge of the socket by a strip of fibreboard or other material approved by the Engineer and of the following thickness:

Up to 300 mm nominal bore	13 mm
Over 300 and up to 600 mm nominal bore	25 mm
Over 600 and up to 1200 mm nominal bore	38mm

3.19.6 Polyethylene Film Encasement to Ductile Iron Pipes and Fittings

Wherever specified by the Engineer, ductile iron pipes and fittings being installed in aggressive soils should be protected by a polyethylene encasement. The latter is simply a sheet of polyethylene film wrapped around the exterior of the pipe to act as a corrosion protection system as per BS 5473: 1977 and CP 2010: Part 3.

This tubular polyethylene sleeving shall be loose and shall not be bonded to the pipe or completely sealed. The composition and properties of the tubular polyethylene film shall comply with the relevant Clauses of BS 6076: 1996 and the nominal thickness of the film shall be within the range of 200 to 250 microns. The melt index of the base polymer when determined in accordance with BS 2782: Method 720A shall not be greater than 2.5.

The Tensile strength, in both machine and transverse directions shall not be less than 11 MPa when tested in accordance with BS EN ISO 527-3:1996 and BS 2782-3: Method 326E: 1995. Furthermore, the elongation of the film at break, in either the machine or the transverse direction, shall not be less than 300% when determined in accordance with BS EN ISO 527-3:1996 and BS 2782-3: Method 326E: 1995.

The plastic sheeting shall be free from pinhole voids, tears and any other form of discontinuities. The nominal layflat width of the polyethylene sheeting for the various pipe diameters shall be as per Table 1 of BS 6076: 1996. The sleeving for underground pipes to be used for the conveyance of potable water shall be blue in colour and any other sleeving shall be in black colour.

3.19.7 Pipes and Joints Adjacent to Reinforced Concrete Structures

Where a pipeline passes into or out of structures, including a thrust block or a chamber, two flexible joints shall be formed on each side. The first joint shall be as close as practicable to the structure and the second shall be at the other end of the first pipe.

This first pipe length shall be not more than 600mm for pipes up to and including 150mm diameter, not more than 1000mm for diameters from 200 up to 600mm, and not more than 2000mm for diameters from 700mm up to 1200mm. Where significant settlement is likely to occur, the Engineer may require more than two flexible joints at each location.

The end of all pipes connected to manholes or other structures shall be properly built-in and neatly finished off. Cutting of pipes shall be carried out by a method approved by the pipe manufacturer and the Engineer to provide a clean square end.

Ductile iron pipes shall be provided with puddle flanges where they pass through the walls of underground or water retaining structures. Where thrusts will be transmitted from the pipework to the wall, the puddle flanges shall be integrally cast into the wall of the chamber and the contractor shall ensure that no honeycombing is formed near the puddle flange.

In the case of **sewer pipes**, the recommended maximum length of rocker pipes shall be as per Table NA.23 of BS EN 752:2008.

3.20 CONNECTION TO EXISTING UTILITY

3.20.1 Connecting New Water Pipeline on Existing CWA Main

Connections to existing pipelines shall only be effected in close liaison with and after obtaining the authorisation of the Operations Sections of the CWA; so long as such authorisations are not unreasonably delayed, the Contractor shall not be entitled to claim for any delay whatsoever. The Contractor is required to give prior advance notice of at least 96 hours to the Engineer for such connection works.

Except where the Contractor may be required to carry out work on existing supply pipelines on a specific instruction by and under the close supervision of the Engineer's Representative, the Contractor shall on no account interfere with the CWA's apparatus.

Where connections are to be made to existing pipelines which are in use, the Contractor shall make all necessary arrangements to deal with any discharge of water from these existing pipelines. Any tees, valves or other pipework used to make the connections shall be sterilized to the satisfaction of the Engineer and the CWA. The Contractor shall take all steps necessary to minimize interruption to the supply of water to the public.

Refilling of pipelines which have been emptied to make connections shall be done under the supervision of the Engineer's Representative, and/or the CWA.

Items are provided in the Bill of Quantities for the connecting of new pipework to existing mains. The prices inserted by the Contractor against these items shall be deemed to cover all costs and obligations arising from making such connections.

The rates should also include for:

- Excavation and/or re-excavation, backfilling and reinstatement as per the Specifications of the Road Development Authority or District/ Municipal Council as the case may be, inclusive of any cut-back as specified;

- Supply, Installation, jointing, testing and disinfection of all pipes and fittings to ensure a complete connection;

- Any additional supervision as deemed necessary by CWA;

- Pumping operations to deal with any discharge of water from the existing pipelines, disconnections of old pipelines (if any) after commissioning and working to CWA's requirements;

- Continuous non-stop work until completion of connection in order to cause minimum disruption to water supply, etc.

3.20.2 Connecting New Sewer Pipeline on Existing WMA Reticulation or Structures

The Contractor shall inspect and determine the extent of work involved in connecting the new sewers to the existing reticulation or structures and agree with the Engineer and the WMA, the procedure to be adopted for making the new connection in each case. The Contractor shall provide labour and material for discontinuing flow in manholes and for overpumping as required.

When the Contractor has made all preparations in readiness for breaking into the existing reticulation or structures he shall confirm to the Engineer and WMA in writing 48 hours in advance of proceeding with the work his intention to commence making the connection.

The Contractor, when carrying out concrete work in such places as benching, backdrops and collars to pipework, shall use rapid hardening cement in all work covered under this Clause and shall allow in this rates for any additional cost incurred.

The Contractor shall be responsible for establishing the total flow of sewerage to be pumped in order that sufficient pump capacity is made available for pumping the flow. If through any breakdown of pumping equipment roads or streets become fouled with raw sewage, the Contractor will be held responsible for clearing and removing all soil and detritus that may have spilled from the manhole. No surcharging of any manholes will be permitted while pumps are out of service and any blockage caused through such breakdown of pumping equipment will require to be rectified by the Contractor.

The Contractor must establish the total number of manholes that require to be plugged prior to commencement of interconnecting work proceeding. The Contractor shall include in his rate for each individual manhole for the supply, laying and testing of all pipework including specials required for making the connection.

3.21 REINFORCED CONCRETE CHAMBERS FOR WATER WORKS

Water reticulation chambers shall be constructed at positions of Air Valves, Gate Valves, washouts, etc.

Step irons, covers and other fixtures shall be installed as detailed in the drawings and as per other clauses of these Specifications.

These chambers shall be constructed in reinforced concrete with in-situ Grade C25/20/A concrete and reinforcements wherever indicated by the Engineer or as shown on the relevant drawings. Unless otherwise agreed by the Engineer, chambers shall be constructed after pipes have been laid, except that bases may be constructed earlier to avoid disturbance or deterioration of the formation level.

3.21.1 Dimensions of Reinforced Concrete Chambers

Reinforced concrete manholes and chambers shall conform to the following minimum dimensions as indicated in Table 3-2 below and/or as indicated on drawings and Bill of Quantities.

Table 3-2: Minimum Dimensions of Reinforced Concrete Chambers

Depth to Invert (m)	*Minimum Internal Dimensions (mm)*	*Minimum Cover Size (mm)*	
	Rectangular (L x W)	Rectangular (L x W)	Circular Diameter
1.5 or less	1400 X 1400	600 X 600	600
> 1.5	1400 X 1400	600 X 600	600

3.22 PRECAST RING CHAMBERS FOR WATER WORKS

Precast ring chambers shall be used for water works wherever indicated by the Engineer or as shown on drawings and, where access to the valves and fittings are not required frequently. These precast ring chambers shall be in concrete grade 25, and shall be inspected and approved by the Engineer prior to placing in the trench. Any damaged precast ring shall be discarded and removed from site immediately after the Engineer has instructed the Contractor to do so.

3.22.1 Dimensions of Precast Ring Chambers for Water Works

Precast ring chambers for water works shall have the minimum dimensions given in Table 3-3 below. The Contractor shall take into consideration the minimum bedding width required as per the Tables 3 and 4 of BS 5834-2 and the dimension of the surface box from the supplier in order to obtain the minimum internal dimensions of the precast rings.

Table 3-3: Minimum Dimensions of Precast Ring Chambers

Type of Valve	*Minimum Internal Dimensions (mm)*	*Minimum Surface Box Size (mm)*
	Rectangular (L x W)	Rectangular (L x W)
Fire Hydrant	230 X 380	230 X 380
Single Orifice Air Valve	300 X 300	300 X 300
Gate Valve DN100 or less	300 X 300	300 X 300

3.23 COVERS FOR REINFORCED CONCRETE AND PRECAST RING CHAMBERS FOR WATER WORKS

Chamber covers shall be air tight, made of cast iron or ductile iron, and shall comply with the requirements of BS EN 124: 1994 or equivalent and surface boxes shall conform to BS5834: 2011. They shall be of the classes or grades given in Table 3-4 below.

Table 3-4: Class or Grade of Chamber Covers for Water Works

Type and location of Valve chambers	**Class of Manhole Covers** *(BS EN 124)* *(Min. size 600mmx 600mm)*	**Grade of Surface Boxes** *(BS 5834)* **(Max. size 450mm x 450mm)**
Fire Hydrant; Single Orifice Air Valve; Gate Valve (DN100 or less)	n/a	Grade A
Double Orifice Air Valve; Pressure Reducing Valve	Class D400	n/a
Drain Valve, Gate Valve (DN 150 or greater)	Class D400	n/a

Before being incorporated in the work, all frames, gratings and covers shall be thoroughly cleaned including the removal of all grease and rust and shall then be coated immediately with an approved bituminous or other compound. The frames of manhole covers shall be set in roads, paths, etc so that the cover shall be flush with the surface of the road or path and elsewhere 300 mm protruding above the surrounding ground. The frames shall be adjusted to the correct level by the use of Class 15 concrete and then set in 1:3 cement mortar.

3.24 REINFORCED CONCRETE MANHOLES FOR SEWERAGE WORKS

For sewerage reticulation, manholes shall be constructed at every change of gradient, change of directions, intersections of pipeline, change in size of pipeline and/or where directed by the Engineer , in the positions and to the levels shown on the Drawings.

Step irons, covers and other fixtures shall be installed as detailed in the drawings and as per other clauses of these Specifications.

For sewer manholes and inspection chambers, benching and channels of manholes shall be in Grade C20/20/B concrete finished with 25 mm thick cement mortar on top of the channels and benchings. The channels and benching shall conform to the requirements of NA.12.4.6 of BS EN 752:2008. Where applicable, half round pipe shall be set in floor of the manhole to form the channel. The ends of all pipes are to be properly built in and neatly finished off, and pipe sockets are to be cut off.

Furthermore, backfilling around completed reinforced concrete manholes shall be with suitable material deposited equally all round and compacted in layers not exceeding 300mm.

The maximum allowable lift of concrete in the construction of walls shall be 1.2m. The cost of forming key joints as directed by the Engineer shall be deemed to be included in the rates for concrete in manholes.

The tops of the manholes and shaft walls shall be made level all round to give a proper bearing to the cover slabs which shall be securely bedded and pointed in cement mortar. The manhole cover frames shall be carefully set in cement mortar to the level of the ground or finished road surface.

Where precast concrete manholes are permitted to be used they shall comply with BS 5911: 2010 and shall be constructed in accordance with the manufacturer's instructions. Individual rings and cover slabs shall have an approved watertight joint. Under roads and paved areas precast concrete manholes shall be surrounded with 150 mm of Concrete Grade C15/40/C.

Sewer manholes with vertical back-drops shall be constructed to details shown on drawings.

3.24.1 Dimensions of Reinforced Concrete Manholes for Sewerage Works

Reinforced concrete manholes shall conform to the following minimum dimensions as indicated in Table 3-5 above and/or as indicated on drawings and Bill of Quantities.

Table 3-5: Minimum Dimensions of Reinforced Concrete Manholes and Chambers

Depth to Invert (m)	*Minimum Internal Dimensions (mm)*		*Minimum Cover Size (mm)*	
	Rectangular (L x W)	Circular Diameter	Rectangular (L x W)	Circular Diameter
1.5 or less	1200 X 750	1200	600 X 600	600
> 1.5	1200 X 1000	1200	600 X 600	600

3.25 INSPECTION CHAMBERS FOR SEWERAGE WORKS

For sewerage works within building premises, inspection and connecting chambers shall be constructed with the materials and to the dimensions indicated and shown on the Drawings. The channel invert of the inspection and connecting chambers shall conform to the level shown in the Drawings. The rate for inspection and connecting chambers to be entered in the Bill of Quantities shall be all inclusive for the construction of the chambers and shall include for all materials workmanship, handling.

The Contractor may propose to use prefabricated inspection chambers in polyethylene material conforming to MS EN 13598:2010 or BS EN 13598:2010. Such type of prefabricated chamber shall only be used at locations recommended by the manufacturer/supplier as per the latter's specifications as applicable, subject to the approval of Wastewater Management Authority (WMA) and the Engineer. The Contractor shall submit all installation procedures and details of material to be used for underneath and surrounding the proposed prefabricated chamber, for the Engineer's and/or WMA's approval.

Any concrete bedding being used, shall conform to the requirements of Section 5 of the specifications shall be concrete class 15.

3.25.1 Dimension of Inspection Chambers for Sewerage Works

Inspection Chambers for sewerage works shall have the minimum dimensions given in Table 3-6 above.

Table 3-6: Minimum Dimensions of Inspection Chambers

Depth to Invert (m)	*Minimum Internal Dimensions (mm)*		*Minimum Cover Size (mm)*	
	Rectangular (L X W)	Circular Diameter	Rectangular (L X W)	Circular Diameter
0.6 or less	450 X 450	450	450 X 450	450
1.0 or less	600 X 600	600	600 X 600	600

3.26 COVERS FOR REINFORCED CONCRETE MANHOLES AND INSPECTION CHAMBERS

Manhole covers shall be air tight, made of cast iron or ductile iron, and shall comply with the requirements of BS EN 124: 1994 or equivalent and surface boxes shall conform to BS5834: 2011. They shall be of the classes or grades given in Table 3-7 below.

Table 3-7: Class or Grade of Manhole and Inspection Chamber Covers

Location	**Class of Manhole Covers** *(BS EN 124)* *(Min. size 600mmx 600mm)*	**Grade of Surface Boxes** *(BS 5834)* **(Max. size 450mm x 450mm)**
Inspection Chamber within building premises	Class A15 *(no moving traffic on top)* *or* Class B125 *(under car access or carport)*	Grade C *(no moving traffic on top)* *or* Grade B *(under car access or carport)*
On footpaths, not subject to vehicular traffic	Class C250	n/a
On roads, subject to vehicular traffic	Class D400	n/a
Distribution Chambers for Leaching Fields	n/a	Grade C
In fenced-off area around septic tanks	Class C250	Grade A

Before being incorporated in the work, all manhole frames, gratings and covers shall be thoroughly cleaned including the removal of all grease and rust and shall then be coated immediately with an approved bituminous or other compound. The frames of manhole covers shall be set in roads, paths, etc so that the cover shall be flush with the surface of the road or path and elsewhere 300 mm protruding above the surrounding ground. The frames shall be adjusted to the correct level by the use of Class 15 concrete and then set in 1:3 cement mortar.

3.27 FIXING STEP IRONS AND OTHER FITTINGS

All step shall be built-in as the work proceeds and shall be staggered 150 mm apart horizontally and be 300 mm apart vertically. Cutting out completed work for inserting step irons shall not be permitted.

3.28 MINIMUM CLEARANCES BETWEEN SERVICES

The Contractor should ensure that the underground services of the CEB shall conform to the following requirements:

(a) The minimum horizontal clearance between CEB power cables and telecom cables (or any other cables) running parallel shall be 500mm.

(b) The minimum vertical crossing clearance between CEB power cables and telecom cables (or any other cables) shall be 300mm.

(c) Underground pipes for water distribution (or any other services) shall be laid at a minimum horizontal clearance of 500mm from CEB power cables.

Any clash between underground CEB cables and any other services should immediately be reported to the Engineer's Representative.

Section 4

TESTING OF PIPELINES

SECTION 4 - TESTING OF PIPELINES

4.1 SUPPLY OF WATER

The Contractor shall supply water to the Site and for the Works and site testing of all the components of the Works, including the hydraulic testing of the pipeline as and when ordered by the Engineer. The Contractor shall submit plans to the Engineer well in advance of the time for the tests, giving details of the arrangements he proposes for bringing water to the Site where the tests will be performed.

The water used for the tests shall be clean, and the pH corrected if necessary, to produce a reasonably neutral water. The Contractor may purchase potable water from the CWA for the purpose of the tests and shall make all arrangements and shall at all times be responsible for the timely supply of water to the Site. Liability of the CWA as regards the supply of water to the Contractor shall not entitle the latter to any compensation whatsoever.

4.2 EQUIPMENT, LABOUR ETC. FOR TESTS

All fittings required for temporary closing of the openings in the pipework to be tested shall be properly designed for the purpose and shall be adequately strutted to withstand the pressure specified. All apparatus required by the Engineer for measuring and maintaining pressures and levels shall be supplied, fixed and maintained by the Contractor to the approval of the Engineer. All measuring instruments required for the various tests shall have been previously calibrated by an approved laboratory.

The labour required for the testing of any parts of the works shall be supplied by the Contractor who shall be responsible for the said works, injury or damage to persons, animals or property. Any such damage and/or injury will be the sole liability of the Contractor.

4.3 DISPOSAL OF WATER

The Contractor shall make adequate arrangements to ensure that water discharged after the testing of any parts of the works shall not cause damage to any part of the said works, injury or damage to persons, animals or property. Any such damage and/or injury will be the sole liability of the Contractor. The Contractor shall also ascertain that the chlorine content in the water is not objectionable in all respects and likely to cause problem to plantations, animals or humans.

4.4 HYDROSTATIC TESTING OF PRESSURE PIPELINES

4.4.1 Testing Pipework

Pipework shall be subject to preliminary tests and a test on completion, both of which shall be water tests as specified:

A preliminary test shall be made after the pipework to be tested has been laid and jointed and the filling of the excavation, placed to a sufficient depth above the crown of the pipe to prevent movement of the pipe during testing.

The test on completion shall be made on the whole length of the pipeline after the pipeline excavation, for the length under test, has been backfilled.

Pressure gauges of the correct ranges shall be used for recording the test pressures.

Pipelines shall be tested after the Contractor has proved satisfactory performance of the pipes and jointing.

The works shall be considered complete after the satisfactory testing on completion in the presence of the Engineer.

4.4.2 Hydrostatic Test

After the Contractor has ensured that the length of pipeline to be tested is clean inside and free from all foreign matter, the ends shall be sealed off. At all summits a valve for releasing air shall be fitted and at the lowest points, valve connections fitted for the pump and measuring apparatus.

The Contractor shall make adequate arrangements for resisting the thrust on the pipeline stop ends during testing, such as providing temporary concrete blocks, or other arrangements, approved by the Engineer. The Contractor shall submit to the Engineer the dimensions and details of the anchor blocks he proposes to use for approval at least 10 days before the testing of the pipelines starts. The Engineer may modify the anchor block arrangements approved by him in all cases where he considers that modifications are necessary in order to suit localised soils conditions. Buttressing of the pipeline already laid will not be permitted, and all permanent anchors shall be in position before testing starts. Testing against closed sluice valves will not be permitted.

The length of pipeline under test shall be filled slowly as approved by the Engineer, the water shall be metered and the quantity recorded and care taken to expel all air.

After the air has been expelled from the pipeline and all measurements properly recorded, a small capacity high pressure positive displacement pump shall be connected, drawing from a suction tank where the volume change can easily be checked and measured. The positive displacement pump shall be capable of output

control such that the volume of water pumped can be recorded and plotted against the resulting pressure measured at the lowest point of the pipeline under test, the time of all readings being also recorded. Should the plot differ appreciably from the graph expected from the bulk modulus of the water and Young's modulus of the pipe making it evident that there is air in the pipeline, then bleeding of the air shall be carried out and repeated until there is no air in the pipeline.

4.4.3 Hydrostatic Test for HDPE Pipe

All joints must be left opened during testing. The pressure test should be carried out at ambient temperature and should not exceed the rated pressure of the pipe or 1.5 times the maximum static head on the main, whichever is greater.

The selected test pressure applicable to the system is maintained by additional pumping, if necessary, at 1 hour intervals for 3 to 4 consecutive hours. After the 1 hour the decrease in pressure may attain 2.5 to 3.0 bars at the test gauge.

The test procedure can only begin after the pressure in the system stabilities at the pressure (See Figure 4-1).

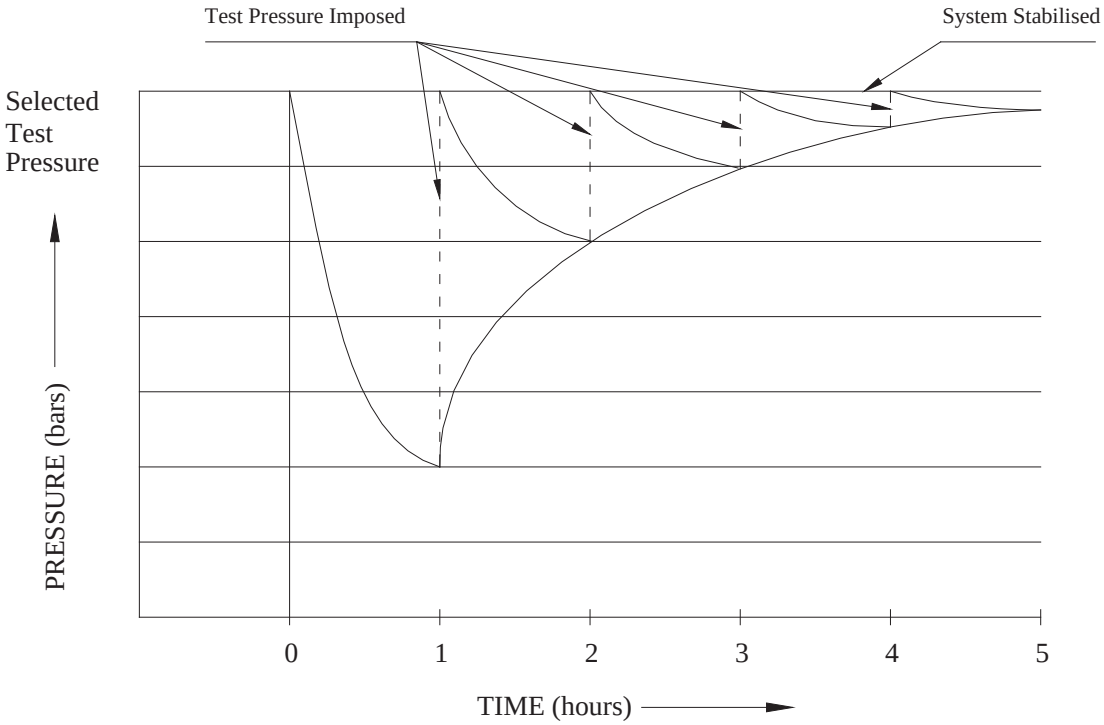


Figure 4-1: Graph showing test pressure stabilization.

The system is deemed to be considered as such if the decrease in pressure for two consecutive readings at one hour interval is equal to or less than 0.2 bars at the test gauge.

4.4.3.1 Type 1 – Pressure Test

This test is suitable for short lengths of small diameter main where there is no residual air in the test section.

The selected test pressure which is applied must be maintained by additional pumping as required for a period of 30 minutes. During this time an inspection should be carried out to identify any obvious leaks.

The pressure should then be reduced rapidly by bleeding water from the system to a nominal pressure of 3 bars at the test gauge. The control valve should be then be closed to isolate the installation.

The pressure gauge readings should then be recorded and plotted at the following intervals:

0 – 10 mins	@ 2 minute	5 readings
10 – 30 mins	@ 5 minute	4 readings
30 – 90 mins	@ 10 minute	6 readings

The resulting graph for a leak-tight system should have a characteristic profile similar to that shown in Figure 4-2.

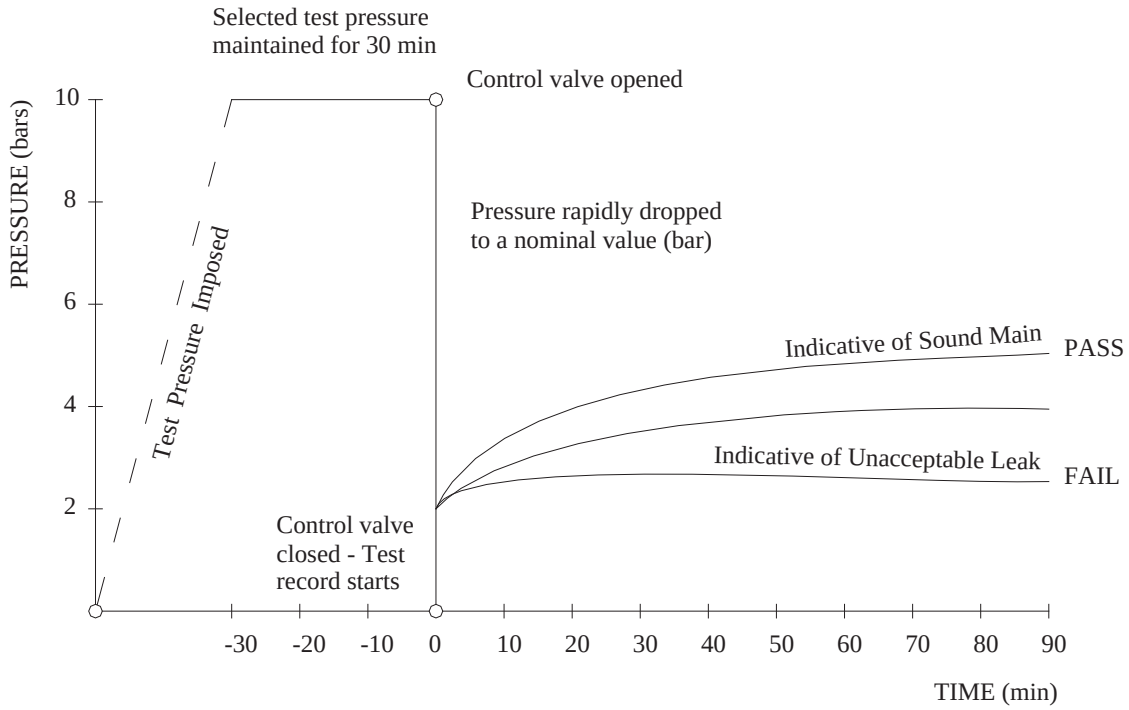


Figure 4-2: Graph indicating a sound and an unsound main.

In a leak free system the gauge pressure is expected to rise from its reduced setting due to polyethylene attempting to contract to its original diameter. The system should then retain this slightly higher pressure.

The degree to which the creep in the material affects the pressure graph and the time for response to reduced pressure will be influenced by:

(a) length of the test section

(b) the diameter of the pipe

(c) the presence of air

(d) the efficiency of the bedding and compaction

Within about a 90 minutes period a good indication will normally be available. If during the period there is a falling away of pressure, this indicates a leak within the system.

Any defects in the installation must be rectified and the test repeated.

4.4.3.2 Type 2 – Pressure Test

This test is for large diameter and long pipelines. The preparation for the test is similar to as described for Type 1 – Pressure Test.

The main should be connected to a calibrated pressure gauge capable of resolving to ± 0.2 bar, or a suitable data logger. Pressure gauges should be read with reference to the levels at which they are positioned.

All air vents should be opened and the installation slowly filled with water from the lowest point. To assist with the expulsion of air, a foam swab may be introduced with care. Once the pipeline is fully charged, the air vents should be closed.

A period should be allowed for the installation to stabilise whilst an initial inspection of all mechanical joints is carried out to ensure they are tight. The test procedure should then begin.

Pressure should be applied to the main by pumping continuously at a sensibly constant rate with respect to volume/time.

The pressure will be expected to decay with time due to the Characteristic Stress relaxation in HDPE. Readings of pressure decay at time intervals should be taken from valve closure. Units of time to be in minutes.

A first reading of pressure P_1 is taken at a decay time of t_1 equal to or greater than

$$\mathbf{t_L \ (i.e.\ t_1 > t_L)}$$

A second reading of pressure P_2 is taken at a decay time t_2 equal to or greater than

$$\mathbf{5t_L \ (i.e.\ t_2 > 5t_L)}$$

N_1 is calculated from the formula:

$$N_1 = \frac{Ln\ P_1 - Ln\ P_2}{Ln\ t_1 - Ln\ t_2}$$

If $N_1 > 0.25$ an unacceptable leak is indicated. Typically N_1 should lie between 0.04 and 0.12.

A third reading of pressure P_3 is taken at a decay time $t_3 > 15t_L$

N_2 is calculated from the formula.

$$N_2 = \frac{Ln\ P_2 - Ln\ P_3}{Ln\ t_3 - Ln\ t_2}$$

If $N_2 > 0.25$ an unacceptable leak is indicated

The ratio $N_1:N_2$ is then determined. If $N_1:N_2 < 0.75$ an unacceptable leak is indicated.

If the test is to be repeated a minimum period equivalent to 5 times the previous test period must be allowed as recovery time.

4.4.4 Completion of Hydrostatic Tests

After the test on completion has been accepted by the Engineer all temporary connections used during testing shall be closed off and securely blanked to the satisfaction of the Engineer, and the pipeline left with water.

After the installation of household connections on mains and/or lateral distribution pipes in a specified zone, the network system in that zone shall again be tested at a test pressure of 600 KPa.

Pipes failures, leaks or any other defects of the household connections shall be located, made good and the pipeline retested by the Contractor all at his own expense to the satisfaction of the Engineer.

4.4.5 Swabbing of Pipelines

Prior to the hydraulic test on completion all pipelines shall be cleaned by the passing through of a foam swab. Swabbing shall be carried out between adjacent swabbing points.

The foam swab shall be in accordance with the recommendations of the British Water Research Association, Technical Inquiry Report TIR 130 of 1996.

The swab shall be of a soft quality and have a diameter equal to the pipe's diameter plus 25 per cent.

4.4.6 Cleaning and Disinfection

After completion of the hydraulic tests and prior to commissioning the pipes shall be carefully and thoroughly cleaned with water.

Flushing with water, as many times as necessary, shall be carried out in order to ensure the complete removal of any material which may have accidentally been left in the pipelines in the course of the works. This repeated flushing should eliminate any taste or smell from the water.

The pipeline shall then be sterilized with chlorine solution or a solution of potassium permanganate at a rate of 30 grams per cubic metre of water, or at a dosage approved by the Engineer.

Filling the pipeline with water, section by section from one-end of the pipe to the other, shall be carried out by successively opening all the delivery valves from the upstream to the downstream end until obtention, according to the disinfection chosen, of either a violet tint provided by the permanganate or a 5 mg/l chlorine content. Immediately after this operation the delivery valve shall be closed.

After a 24 hour contact period, the system shall be completely drained and rinsed with clear water. Test samples shall be taken immediately thereafter by the CWA's laboratory responsible for monitoring the water supply, and the samples shall be analysed. The Contractor shall make the necessary arrangements with the CWA for the collection and testing of samples, and provide the necessary transport.

If the results of the analysis are satisfactory, the system shall be immediately put into service. If the results are unsatisfactory, the cleaning and disinfection operations shall be repeated at the Contractor's expense.

Provisional acceptance of the pipelines shall only take place after successful disinfection.

4.4.7 Testing by CWA

The contactor shall provide all equipment and facilities to the CWA, should the latter decide to carry out any pressure test, other than those specified in the Contract. The Contractor should provide all assistance to the CWA, and the results of those tests shall be accepted by the Contractor as if these tests had been specified in the Contract and carried out by the Engineer.

4.5 TESTING OF DUCTILE IRON PIPELINES

4.5.1 Preparatory Works

Before testing commences, the Contractor shall ensure that all anchor and thrust blocks are completed and that the concrete is completely set or that temporary supports have been installed. Thrusts from temporary pipe ends or branch pipes shall be adequately strutted and the section under test closed off with stop ends, blank flanges or other closure fittings.

The Contractor shall supply all equipment and materials necessary for carrying out the requirements of this Clause.

Pressure gauges used for testing pipelines shall have 300mm dials calibrated in metres head or bars or pounds per square inch. Each gauge shall have been calibrated by an approved testing Organization and the Contractor shall produce a calibration chart and dated test certificate for the Engineer's inspection.

All pipelines shall be cleaned before testing by flushing or by passing through them a swab as appropriate and as approved by the Engineer.

All tests shall imperatively be carried out in the presence of the Engineer or his representative; the Contractor shall give the Engineer 24 hours notice in writing of any pressure tests which he intends to carry out. Tests shall be conducted in accordance with the requirements of this entire clause. Within 24 hours of the completion of any test, the Contractor shall submit two copies of a full record of the test to the Engineer. The record shall be in a form as priorily decided by the Engineer.

4.5.2 Testing Procedure

The Contractor shall provide all water in the appropriate volume and quality, fittings, plugs, stoppers, test pumps, pressure gauges and all necessary labour, tools and materials for the testing of pipelines and pipework. The cost of carrying out all testing is the responsibility of the Contractor and this cost will be deemed to have been included in the Contractor's pricing for the works.

Any section of pipework which fails to pass the tests applied shall have the defects made good by the Contractor and a further test carried out. The cost of all remedial work and re-testing shall be borne by the Contractor.

The Contractor shall inform the Engineer/Project Manager at least 24 hours before a length is ready for an inspection or test.

The length of the section of pipeline to be tested may be determined by the Contractor, by must not exceed 600m and shall have the approval of the Project Manager/Engineer.

Trenches must be kept dry until the pipes have been passed by the Engineer/Project Manager. The main shall be tested with all joints exposed where possible but with sufficient backfilling placed to ensure the stability and safety of the pipeline and after all temporary and permanent concrete thrust blocks and anchors have developed adequate strength to resist the test pressures.

Notwithstanding the passing and approval of any stretch of pipeline, a final test shall be carried out on the complete pipeline inclusive of all fittings.

The pipeline shall be filled with water in such a manner as to prevent shock and the accumulation of air, and kept under observation for leakage at static head for twenty-four hours. If there is no leakage, a final test shall be applied in the presence of the Engineer/Project Manager. The pressure shall be raised slowly by means of a force pump until the test pressure is obtained and this pressure shall be maintained by the addition of further water and the quantity of water required to maintain the test pressure over a period of four hours shall be measured and shall not exceed 0.1litre per day per 1000m of pipe per mm of nominal pipe diameter for each 30metres head of pressure applied.

If the loss exceeds the equivalent of 0.003 litres per millimeter of nominal bore of pipe per kilometer for every head of test pressure measured at the highest point of the pipe run in a period of 24hours, the pipe shall be deemed satisfactory and the Contractor shall search for and repair the leaks and then repeat the test.

The test pressure shall be equivalent to the maximum sustained operating pressure, or the maximum static pressure, plus 5 bars. For pipelines with house connections, a second test shall be carried out at 6 bars after the installation of connections. This test pressure shall be measured by gauge at, or corrected for, the lowest point on the pipeline.

On completion of a satisfactory test, any temporary anchor blocks shall be broken out and stop ends removed and backfilling of the pipeline shall be completed.

4.6 TEST PROCEDURES AND METHODS FOR WATER PIPELINES

Notwithstanding the provisions of Clauses 4.1 to 4.5 above, all testing procedures and methods shall comply with Clause 11 of EN805:2000 "*Water Supply - Requirements for Systems and Components Outside Buildings*".

4.7 TESTING OF SEWERS

4.7.1 General

Pipelines shall be tested when required by the Engineer in lengths between manholes or such shorter lengths as the Engineer may direct or permit. The final test shall be applied in the presence of the Engineer.

Fittings required for temporarily closing the openings in pipeline to be tested shall be properly designed for this purpose and shall be adequately strutted to withstand the pressure specified. The Contractor shall keep a record of all tests in an appropriate book which shall be available for inspection and handed over to the Engineer on demand.

During testing, any length of pipeline which is found to be defective shall immediately be put in a sound and satisfactory condition by repairing any defective part or if necessary by relaying the whole of the defective length and again testing and so on until the test is satisfactory, all at the cost of the Contractor. Any pipe found to be partly or totally cracked after laying shall be replaced with another unless the Engineer should approve the adoption of an alternative method of repair.

If the Engineer should suspect that a pipeline has been damaged during concreting or backfilling or subsequently, he may order the Contractor to retest the suspected length by one of the approved methods. Should the retest indicate that the line is no longer capable of withstanding the prescribed tests, the Contractor shall forthwith search for and repair the damage and re-test the pipeline until satisfactory test is obtained and all costs incurred including those of the retests shall be borne by the Contractor.

Should it be found on completion of any particular section of the work that there is a rate of infiltration into the pipe system in that section in excess of that specified , the Contractor shall at his own expense search for, isolate, repair and retest the defective length or lengths all to the satisfaction of the Engineer.

The Contractor shall at his own expense provide ample expanding stoppers for each diameter of pipe to be laid, together with such upstands tubes, U-tubes, pumps and all other required testing apparatus to the approval of the Engineer.

4.7.2 Water Test for Sewer of 300mm Diameter and Less

Both ends of the pipe run to be tested shall be closed off by expandable plugs or other suitable type of plug. Each plug shall be provided with an entry pipe controlled by a stopcock. The entry pipe at the upper end shall be connected to a source of water and to a standpipe. The pipe run shall be filled with water and allowed to soak for not less than two hours. At the end of this period the system

shall be topped up so that the water level in the standpipe is 1.2m above the soffit of the pipe.

Water in measured amounts shall be added at intervals of 10 minutes to maintain the level in the standpipe. The amount of water lost per 100m of pipe run in 30 minutes shall not be more than 1 litre per hour per metre diameter per metre of pipe run and as tabulated in Table 4-1 below:

Table 4-1: Water Test on Sewer Pipelines

Nominal bore of pipe (mm)	Max. amount of Water lost in 30 mins per 100 of pipe (litres)
110	5.5
160	8.0
200	10.0
250	12.5
300	15.0

Where a pipe run is so steeply graded that the application of a pressure of 1.2m head at the upper end would give rise to a pressure of more than 6.0m at the lower end, then the pipe run shall be tested in stages

4.7.3 Air Test for Sewer of Diameter Greater than 300mm

The ends of the pipe run to be tested shall be closed by means of expandable plugs or other suitable type of plug which is airtight.

One of the plugs shall be provided with an entry pipe controlled by a stopcock. The entry pipe shall be connected to a manually operated air pump provided with a “U” tube manometer capable of reading up to 200mm head of water.

Air shall be pumped into the system until the manometer is registering 100mm head and this pressure shall be maintained for 15 minutes.

The air pressure should not fall by more than 25mm of water during a period of 5 minutes. If the loss of pressure is more than specified, the Contractor shall search for and repair the leak and then repeat the test. In the event that no source of leakage is discovered the Contractor shall carry out water test with such restrictions as the Engineer may instruct. If the pipe run fails this test the Contractor shall search for an repair the leak and then repeat the test.

4.7.4 Water Test for Pressure (Rising) Mains

The length of the section of pipeline to be tested may be determined by the Contractor, but must not exceed 600m and shall have the approval of the Engineer.

Trenches must be kept dry until the pipes have been passed by the Engineer. The mains shall be tested with all joints exposed possible but with sufficient backfilling placed to ensure the stability and safety of the pipeline and after all temporary and permanent concrete thrust blocks and anchors have developed adequate strength to resist the test pressure.

Final tests shall be carried out on the complete pipeline inclusive of all fittings.

The pipeline shall be filled with water in such a manner as to prevent shock and the accumulation of air, and kept under observation for leakage at static head for twenty-four hours. If there is no leakage, a final test shall be applied in the presence of the Engineer. The pressure shall be raised slowly by means of a force pump until the test pressure is obtained and this pressure shall be maintained by the addition of further water and the quantity of water required to maintain the test pressure over a period of four hours shall be measured and shall not exceed 0.1 litres per day per 1000m of pipe per mm of nominal pipe diameter for each 30m head of pressure applied.

The test pressure shall be equivalent to 1.5 litres the maximum sustained operating pressure. This test pressure shall be measured by gauge at, or corrected for, the lowest point on the pipeline.

On completion of a satisfactory test any temporary anchor blocks shall be broken out and stop ends removed and backfilling of the pipeline shall be completed.

4.7.5 Infiltration Test

Where a pipe run is below the level of the water table in the surrounding ground, it shall be tested for infiltration by measuring the amount of water flowing from the lower end. The rate of flow shall not exceed the amount shown in Table 4-1 at sub-section 4.7.1.

4.7.6 Obstruction Test

All pipelines having a nominal diameter of less than 300mm shall be tested for obstruction by drawing through each completed length a mandrel 750mm long and having a diameter of 10m less than the actual internal pipe diameter.

4.7.7 Further Tests, Cleaning and Inspections

When the sewer has withstood satisfactorily the above tests, the concrete haunching or surround, if any, shall be completed and this shall be inspected by the Engineer before any backfilling is placed.

When 300mm of backfilling has been placed above haunched pipes, the backfilling will be inspected before further filling proceeds.

When backfilling has been completed, a further air test will be carried out on all lengths of sewers as before described in the preceeding sub-clauses.

The length of sewer to be tested shall be the length between two adjacent manholes unless otherwise allowed by the Engineer.

Should any portion of the work fail to pass the tests applied to the satisfaction of the Engineer, the fault or faults shall be made good by the Contractor at his own expense according to methods approved by the Engineer and the work shall be tested again. The cost of extra tests shall be borne by the Contractor.

Any sewer inaccurately laid to grade, direction, line, depth or the interior surface of which shows open joints or any irregularities or which is not in alignment must be made good at the Contractor's expense and shall again be inspected and tested when satisfactory.

The Contractor shall be responsible for cleaning al pipework at all times to the satisfactory of the Engineer. A Taking Over Certificate will be not issued until the Engineer is satisfied that all dirt, jointing materials and other extraneous injurious materials have been removed.

The whole fixed pipe systems shall be flushed through with clean potable water for a sufficient duration to ensure all debris, and any other contaminants shall be removed.

4.7.8 Testing and Inspection by WMA

The Contractor shall provide all equipment and facilities to the WMA, should the latter decide to carry out any test, other than those specified in the Contract. The Contractor should provide all assistance to the WMA, and the results of those tests shall be accepted by the Contractor as if these tests had been specified in the Contract and carried out by the Engineer.

4.8 TESTING OF STRUCTURES ON PIPEWORK

Unless approved by the Engineer, all concrete or blockwall chambers and water retaining structures on the pipework which are not tested with the pipework shall be separately tested, in the presence of the Engineer or his representative, for watertightness and infiltration.

Manholes shall be subjected to water leak-proof test as directed by the Engineer. The manholes to be tested shall be filled with water just below the cover level and allowed for absorption of water by the structure for a period of 48 hours. After this period, the water level in the manholes shall be restored to its original level. They shall then be tested and deemed to be watertight and have passed the leak-proof test if after 30 minutes, the drop in water level is not more than 12 mm. Any manholes chambers which fail the test shall be repaired and made watertight at the Contractor's expense and retested to the satisfaction of the Engineer.

Section 5

CONCRETE

SECTION 5 - CONCRETE

5.1 CODE OF PRACTICE FOR CONCRETE WORKS

All workmanship, materials, and tests and performance in connection with the concrete work shall be in conformity with the British Standard BS EN 1992.

Materials shall conform to the requirements of Section 2 of the Specification.

5.2 TESTING

5.2.1 Laboratory Testing of Cement

Tests for Ordinary and Rapid Hardening Portland Cement shall be as given in Table 5.1 below.

Table 5-1: Tests for Cement

Description of Test		*Standard Specification*
(i)	Consistency of Standard Cement Paste	BS EN 196-3
(ii)	Initial and Final Setting	BS EN 196-3
(iii)	Fineness test	BS EN 196-6
(iv)	Soundness Test	BS EN 196-3
(v)	Compressive Strength	BS EN 196-1

5.2.2 Testing of Concrete

Notwithstanding other tests required under this Specification and stated elsewhere, the following laboratory tests shall be carried out by the Contractor, as given in Table 5.2 below:

Table 5-2: Laboratory tests to be carried out by the Contractor.

Description of Test	*Method or Test No.*
Aggregate Crushing Value	BS EN 1097-2
Flakiness	BS EN 933-3
Testing of Sand	BS EN 933-8
Fresh Concrete	BS EN 12350
Hardened Concrete	BS EN 12390

5.2.3 Testing of Steel Bars

The testing for steel bars shall be carried out in compliance with the following British Standards, depending on the type of steel bars and wires:

- BS 4482
- BS 4449
- BS 4483
- BS EN 10029
- BS 5896

5.2.4 Testing by Engineer

The Engineer and his staff shall at all times have free and unrestricted access to the Contractor's laboratory or any other approved laboratory in order to watch and supervise all tests.

5.2.5 Grading of Aggregates

The grading of the aggregate at each stockpile extraction point shall be determined at least once daily. The Contractor shall allow in his rates for the cost of testing of materials and workmanship as described above.

5.3 CONCRETE MIXES

Concrete mixes shall be "design mixes" in accordance with the requirements of BS EN 206 having the characteristics specified in Table 5.3 of these Specifications. Concrete for water retaining or water excluding structure shall comply with the requirements of the relevant parts of BS EN 1992.

Table 5-3: Classes of Concrete

Prefix ' C' stands for Class

Suffix ' A' stands for Severe Conditions

Suffix ' B' stands for Average Conditions

Suffix ' C' stands for Sheltered Conditions

CLASS	*Characteristics Compressive Strength* *N/mm²*	*Maximum Free Water/Cement Ratio*	*Minimum Cement Content* *Kg/m³*	*Maximum Cement Content* *Kg/m³*	*Maximum Aggregate Size* *Mm*
C35/20/A	35	0.55	325	400	20
C25/10/A	25	0.55	325	400	10
C25/20/A	25	0.55	325	400	20
C25/20/B	25	0.55	325	400	20
C25/20/C	25	–	325	400	20
C20/20/B	20	0.55	290	400	20
C20/40/B	20	0.55	260	400	40
C20/40/C	20	–	220	400	40
C15/40/C	15	–	180	400	40
C15/20/C	15	–	180	400	20
C10/40/C	10	–	150	400	40

Notes:

1. *The minimum cement contents shown in the above Table are required in order to confer impermeability and durability. In order to meet the strength requirements in the Specification higher contents may be required.*

2. *The categories applicable to the Permanent Works are based broadly on the factors listed hereunder:*

Sheltered Conditions: fluids other than	*Inland sites, free from airborne pollution. Concrete not subject to frost, extremes of temperature or contact with rain.*
Severe Conditions: corrosive fluids	*Marine sites and sites subject to heavy pollution. Extremes of temperature. Concrete subject to contact with including polluted water, or sulphates. Water retaining structures. Marine structures.*
Average Conditions:	*All circumstances other than those above.*

5.4 WORKABILITY

The workability of the fresh concrete should be such that the concrete is suitable for the conditions of handling and placing so that after compaction it surrounds all reinforcement, tendons and ducts and completely fills the formwork.

Workability should be assessed as per BS 12350 by means of the slump test, compacting factor test or VB consistometer test as appropriate.

5.5 REQUIREMENTS FOR DESIGN MIXES

5.5.1 Target Mean Strength

The concrete mix should be designed to have at least the required minimum cement content and to have a mean strength greater than the required characteristics strength by at least the current margin.

The current margin for each particular type of concrete mix should be determined; it may be taken as having the smaller of the values given by (1) or (2).

1) 1.64 times the standard deviation of cube tests on at least 100 separate batches of concrete of nominally similar proportions of similar materials and produced over a period not exceeding 12 months by the same plant under similar supervision, but not less than 1/6 of the characteristic strength for concrete of Grade 10 or 15, or 3.75 N/mm^2 for concrete Grade 20 or above.

2) 1.64 times the standard deviation of cube tests on at least 40 separate batches of concrete of nominally similar proportions of similar materials and produced over a period exceeding 5 days but not exceeding 6 months by the same plant under similar supervision but not less than 1/3 of the characteristic strength for concrete for Grade 10 or 15 or 7.5 N/mm^2 for concrete Grade 20 or above.

If there is insufficient data to satisfy (1) or (2) above, the margin for the initial mix design should be taken as two-thirds of the characteristic strength for concrete of Grade 10 or 15, or 15 N/mm^2 for concrete Grade 20 or above. This margin should be used as the current margin only until sufficient data are available to satisfy (1) or (2) above.

5.5.2 Evidence of Suitability of Proposed Mix Proportions

Evidence should be submitted to the Engineer for each grade of concrete showing that at the intended workability, the proposed mix proportions and manufacturing method will produce concrete of the required quality.

If adequate data for “target mean strength” is not available, trial mixes should be prepared.

The following information should be provided before any design mix is supplied. Subsequently the Contractor should declare any change in sources of materials and any change in cement content which results in a difference greater than 20 kg/m^3 from the cement content last declared.

Nature and source of each material

Either

(a) Appropriate existing data as evidence of satisfactory previous performance for target mean strength, and current margin and if required workability and water/cement ratio,

or

(b) Full details of tests on trial mixes

(c) For ordinary structural concrete a statement that for initial production the appropriate mix proportions given in Table 5.3 will be used.

Proposed quantities of each quantities per cubic metre of full compacted concrete.

5.5.3 Trial Mixes

At least six weeks before commencing the placing of any concrete in the Works, trial mixes shall be prepared for each class of concrete to be used in the Works.

Three separate batches of concrete should be made using materials likely to be typical of the proposed supply and under full scale production conditions. Sampling and testing should be in accordance with BS EN 12350.

The workability of each of the trial batches should be determined and three cubes made from each batch for test at 28 days. A further three cubes shall be made from each batch for test at an earlier age if required. The trial mix proportions should be approved if the average strength of the nine cubes tested at 28 days exceeds the specified characteristic strength by the current margin minus 3.5 N/mm^2 or if nine tests at an earlier age indicate that it is unlikely to be exceeded by this amount.

To demonstrate that the maximum free water/cement ratio is not exceeded, two batches of concrete shall be made in a laboratory with cement and surface dry aggregate known from past records of the suppliers of the material to be typical. The proposed mix proportions will not be accepted unless both batches have the cement content specified and a free water/cement ratio below the maximum specified in Table 5.3 above.

5.5.4 Additional Trial Mixes

During production the Engineer may require trial mixes to be made before a substantial change is made in the materials or in the proportions of the materials to be used.

5.6 PRODUCTION OF CONCRETE

The Engineer shall be afforded all reasonable opportunity and facility to inspect the materials and the manufacture of concrete and to take any samples or to make any tests.

The quantity of cement, the quantity of fine aggregate and the quantities of the various sizes of coarse aggregate shall be measured by weight.

A separate weighing device shall be provided for weighing the cement. Alternatively, the cement may be measured by using a whole number of bags in each batch.

The amount of water shall be measured, by volume or by weight. Any solid admixtures to be added shall be measured by weight but liquid or paste admixtures may be measured by volume or weight.

The batch weights of aggregate shall be adjusted to allow for a moisture content typical of the aggregates being used.

The accuracy of the measuring equipment shall be within ± 3 % of the quantity of cement, water or total aggregates being measured and within ± 5 % of the quantity of any admixture being used. All measuring equipment shall be maintained in a clean, serviceable condition.

The mixer should comply with the requirements of BS EN 12151 where applicable. The mixing time shall be not less than that used by the manufacturer in assessing the mixer performance.

The water content of each batch of concrete shall be adjusted so as to produce a concrete of the workability required by the trial mixes.

Concrete Mixers shall be completely emptied before receiving the materials for the succeeding batch and shall be kept clean and shall be washed out after stopping work for more than 30 minutes and at the end of each shift. On commencing work with a clean mixer the first batch shall contain only one half of the normal quantity of coarse aggregate for the batch so as to compensate for the fine material and cement which is left adhering to the drum. This batch shall also be mixed for at least one minute longer than the normal time.

The Contractor shall provide standard test weights at least equivalent to the maximum working load used on the most heavily loaded scale and other auxiliary equipment required for checking the satisfactory operation of each scale or other measuring device. Tests shall be made by the Contractor at intervals to be determined by the Engineer but not less than weekly and shall be carried out in his presence and to his approval.

The Contractor shall furnish the Engineer with copies of the complete results of all check tests and shall make such adjustments, repairs or replacements as the Engineer may consider necessary to ensure satisfactory performance before mixing recommences.

Neither volume batching of materials nor hand mixing of concrete shall normally be allowed. They may, however, be permitted at the Engineer's discretion, at isolated points where the total volume of concrete is small. Hand mixing of concrete shall be done on a clean boarded platform. The material shall be turned over no less than three times dry, water shall then be sprayed on through a hose and the materials turned over in a wet condition and worked together until a mixture of uniform consistency is obtained.

For hand mixing concrete, the specified quantities of cement shall be increased by 10 per cent and not more than one half of cubic metre shall be mixed at one time. Any concrete mixed by hand will be paid for at the appropriate rates for the class of concrete inserted in the Bill of Quantities and no claim will be considered in respect of any extra cost of hand mixing by reason of the additional cement or otherwise.

Where volume batching has been approved, gauging of materials shall be done by means of properly designed rectangular gauging boxes with smooth clean edges on top. The boxes shall be properly filled and struck off level by means of a straight edge.

During windy weather, sufficient precautions shall be taken to prevent cement from being blown away during the process of apportioning and mixing in both machine and hand mixed concrete. Precautions shall also be taken to protect the cement and concrete during wet weather.

The Contractor shall be required to submit to the Engineer a daily return of the number of pockets of cement and the quantities of fine and coarse aggregate used, the grade of concrete poured and the location thereof, for each concreting operation, in order that a check may be kept on the ingredients used per cubic metre of each grade of finished concrete.

5.7 CONSISTENCY

The consistency of all concrete shall be determined by means of the slump test in accordance with British Standard Specification BS EN 12350 "*Methods of Testing Concrete*". The Contractor shall provide the necessary number of slump cones and rods as required by the Engineer. The slump cones shall be designed to lift off in a truly vertical plane, this being controlled by guides set on a steel base, the guides being also used to determine the exact amount of slump.

Slump tests shall be made at frequent intervals when concreting is in progress and as ordered by the Engineer. The first consistency tests shall be made immediately concreting is commenced on any section. For the purposes of any test two slump tests shall be taken at a time and the average adopted.

The slump required shall be determined by the Engineer and shall be varied to suit the purpose for which the concrete is required. All concrete shall be mechanically vibrated after deposition within the shuttering. No concrete shall be used with a slump exceeding 100 mm without the approval of the Engineer.

The cost of providing slump apparatus and labour and materials required for taking slump tests shall be included in the rates for concrete in the Bill of Quantities.

5.8 CONTROL OF STRENGTH OF DESIGN MIXES

5.8.1 Adjustment to Mix Proportions

During production, adjustments of mix proportions may be made in order to minimize the variability of strength and to approach more closely to the target mean strength, but the specified limits of minimum cement content and maximum water/cement ratio shall; be maintained. Changes in cement content shall not be made without the written approval of the Engineer. Adjustments to mix proportions shall not be taken to imply any change to the current margin.

5.8.2 Change of Current Margin

A change in the current margin, used for judging compliance with the specified characteristic strength becomes appropriate when the results of a sufficiently large number of tests show that the previously established margin is significantly too large or too small; recalculation of the margin should be carried out in accordance with Sub-clause 5.5.1 but, although a recalculated margin is almost certain to differ numerically from the previous value, the adoption of the recalculated value will not be authorised if the two values differ by

Less than 18 % when based on tests on 40 separate batches; or

Less than 11 % when based on tests on 140 separate batches; or

Less than 5 % when based on tests on 500 separate batches.

On the adoption of a recalculated margin, it becomes the current margin for the judgment of compliance with the specified characteristic strength of concrete produced subsequently to the change.

5.9 COMPLIANCE WITH SPECIFIED REQUIREMENTS

Provided that the Engineer is satisfied that the materials used are in accordance with the Specification and that correct methods of manufacture and practices of handling raw material and manufactured concrete have been used, the compliance of a designed mix for ordinary structural concrete will be judged by the strength of the hardened concrete in comparison with the specified characteristic strength together with the cement content, in comparison with the specified minimum cement content.

All sampling and testing of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard and all sampling and testing of fresh and of hardened concrete shall be carried out in accordance with the provisions of BS EN 12350 and BS EN 12390 respectively.

The characteristic strength of concrete is that 28 days cube strength below which not more than 5 % of the test results fail.

Compliance with the specified characteristic strength will be judged by tests made on cubes at an age of 28 days.

Each cube shall be made from a single batch or pour taken from a randomly selected batch of concrete. The rate of sampling shall be one sample per 10 concrete batches or $10m^3$ whichever is the lesser volume with a minimum of 4 samples (i.e. 4 cubes) from each major concrete pour or important section of concrete. These cubes shall be crushed at 28 days. Additional cubes shall be made and tested at 7 days or earlier as directed by the Engineer. These cubes shall not be used in the statistical analysis for quality control of concrete.

The samples should normally be taken at the point of discharge from the mixer, or, in the case of ready-mixed concrete, at the point of discharge from the delivery vehicle. If concrete is pumped or transported for more than 500 metres sampling should be taken at the point of deposition into the formwork.

The Contractor shall supply to the Engineer within 3 days of manufacture of test cubes, copies of certificate showing reference numbers of the cubes, classes of concrete, types of cement used, the date of manufacture and the locations in the Works in which the relevant concrete was placed.

Compliance with the specified characteristics strength may be assumed if

1) the average strength determined from any group of four consecutive test cubes exceeds the specified characteristics strength by not less than 0.5 times the current margin, and

2) each individual test result is greater than 85 % of the specified characteristic strength.

The current margin should be taken to be two-thirds of the specified characteristic strength for concrete of grade 10 or 15, or 15 N/mm^2 for concrete of grade 20 or above, unless a smaller margin has been established to the satisfaction of the Engineer.

If only one cube result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that cube was taken provided the average strength of the group satisfies the first requirement.

If more than one cube in a group fails to meet the second requirement or if the average strength of any group of four consecutive test cubes fails to meet the first requirement, then all the concrete in all the batches represented by all such cubes shall be deemed not to comply with the strength requirements. For the purposes of this Sub-clause, the batches of concrete represented by a group of four consecutive 28-day test cubes shall include the batches from which samples were taken to make the first and the last cubes in the group of four, together with all the intervening batches.

5.10 CEMENT CONTENT

The cement content of any batch of concrete shall be not less than the specified minimum value minus 5 % of that value, nor more than the specified maximum value plus 5 % of that value.

5.11 WORKABILITY LIMITS

The workability of concrete shall be within the following limits:

Slump:	± 25 mm or ± one third of the required value, whichever is the greater
Compacting Factor:	± 0.03 where the required value is 0.90 or more;
	± 0.04 where the required value is less than 0.90 but more than 0.80;
	± 0.05 where the required value is 0.80 or less
VB:	± 3 seconds or ± one fifth of the required value, whichever is the greater

The water/cement ratio of a batch of concrete should not exceed the specified maximum value by more than 5 % of that value. If a maximum water/cement ratio has been specified, the ability to comply with that requirement, at a suitable level of workability, will have been determined by means of trial mixes. Provided that the constituent materials and mix proportions are not substantially different from those used in the trial mixes, a maximum water/cement ratio will be judged from workability tests.

5.12 NON- COMPLIANCE WITH SPECIFIED REQUIREMENTS

If the specified requirements for concrete have not been fulfilled, the Contractor shall take such remedial action as the Engineer may order and the Contractor shall before proceeding with the placement of further concrete submit in good time to the Engineer his proposals to ensure that the new concrete will comply with the specified requirements.

Where in the opinion of the Engineer the remedial action is unacceptable, the batches of concrete represented by the tests shall be classified as defective work and removed forthwith from the Works and replaced as directed by the Engineer, all at the Contractor's expense.

5.13 RECORDS

Records in a form approved by the Engineer shall be kept by the Contractor of the details of every pour of concrete placed in the Works. These records shall include class of concrete, location of pour, date of pour, temperature, slump, moisture content of aggregates, weights of aggregates, number of batches, tests undertaken and cement parcel number. The Contractor shall supply to the Engineer four copies of these records each week covering the concrete work carried out in the preceding week.

5.14 PREPARATION OF ROCK SURFACES TO RECEIVE CONCRETE

Immediately before concrete is placed on or against a rock surface, the rock shall be given a final cleaning with the use of high pressure air. The foundation shall be properly drained and dewatered so that no water runs over or stands on a surface on which concrete is being placed. If required by the Engineer, drains provided through or beneath concrete for the temporary conveyance of water shall afterwards be completed sealed to the Engineer's approval.

5.15 AUTHORIZATION TO COMMENCE PLACING OF CONCRETE

The Contractor shall give the Engineer at least 24 hours' notice of his intention to place concrete in a particular section of the Works. Before concrete is placed, the Contractor shall apply to the Engineer for approval of the cleaning of rock and/or the

fixing of shuttering, reinforcement, embedded parts and the like, and he shall obtain written permission from the Engineer to proceed with concreting.

5.16 DEPOSITION OF CONCRETE

All concrete work shall as far as is practicable be carried out continuously. The concrete immediately after being mixed and before the initial set has taken place shall be carefully deposited within the formwork so as not to displace the formwork or reinforcement. It shall be carefully transported in watertight containers and deposited into position in regular layers approved by the Engineer, and compacted into place within the formwork and around the reinforcement by means of pokers and other mechanical vibrators. Every care must be taken to prevent the segregation of the coarse material from the finer materials in the concrete, during transit to place of deposit and if, in the opinion of the Engineer, any segregation of materials has taken place, the concrete shall be again turned over and mixed before it is deposited in position. The concrete shall be a plastic mixture capable of being solidly filled within the formwork and between and around the reinforcement, consolidated, thoroughly worked around embedded fixtures and into the corners of the formwork and compacted until it assumes a jelly-like consistency with water just appearing on the surface. Excess of mixing water shall be avoided. The receptacles or chutes used for transport shall be kept clean and washed out after each operation.

The operation of depositing concrete is to be continuous in so far as is practicable until the section authorised by the Engineer is completed to the height shown or required. Where this is impracticable, the required height shall be obtained by depositing concrete in regular layers of an approved thickness well compacted as specified above.

All work shall be completed on the concrete before the initial set commences and care shall be taken not to disturb the concrete before it has set hard. No concrete that has partially hardened or that has been mixed for more than twenty minutes shall be used in the work.

When the deposition of concrete requires to be interrupted, suitable precautions shall be taken to ensure satisfactory joints with concrete deposited earlier. Where delays of more than one hour occur during concreting operations, work shall be suspended until, in the opinion of the Engineer, the concrete has had sufficient time to harden before fresh concrete is deposited thereon.

Concrete generally shall not be deposited from a greater height than 1 m. Should certain sections of the work require the concrete to be deposited from a greater height, it shall be deposited in such a way to avoid segregation of the materials and ensure an unbroken stream of concrete, all to the approval of the Engineer.

5.17 CONSOLIDATION OF CONCRETE

The Contractor shall use mechanical vibration for consolidating all concrete.

The number and type of vibrators to be used shall be the approval of the Engineer. In the case of thin vertical faces, vibrators fastened to the formwork may be required on both faces so as to cover the lift of concrete being deposited. Apart from this, immersion vibrators of approved design to cover each 1.5 m length of concrete shall be available so as to enable the whole layer to be vibrated.

Before vibrating is commenced, the concrete of an approved thickness of layer shall be spread to an approximate level surface.

Special care must be taken to ensure that all formwork is sufficiently substantial to permit this extent of vibrating equipment to be in operation without disturbing the formwork and cause it to bulge or move out of alignment. Special care shall also be taken to prevent leakage of mortar through joints in the formwork during vibration.

Generally the vibration of the concrete shall be continued until the period when the appearance of air bubbles on the surface of the lift of concrete ceases. Care shall be taken not to continue vibration to a point where segregation of the materials may commence and the whole of the operation shall be subject to the approval of the Engineer. Means for the rapid switching off of each or all vibrators shall be provided to prevent an undue amount of vibration.

No vibrators shall be fastened to the reinforcement and care shall be taken that no tubes attached to the immersion vibrators are allowed to come into contact with the reinforcing rods or the internal surface of the shuttering.

The particular purpose of the vibration of concrete is to ensure a densely compacted mass.

All concrete must be worked up against existing faces of concrete as well as against the faces and into the corners of formwork so as to produce a thoroughly consolidated mass by spading and ramming and internal and external vibrating so as to ensure its complete contact and incorporation into the adjacent concrete.

Generally the method of obtaining the most efficient results for the placing, compacting and vibrating of all concrete as well as the number of and disposal of rammers, shovellers and vibrating equipment to be carried out on any particular section of the work and the slump value and water/cement ratio shall be subject to the approval of the Engineer.

After final compacting of any section up to the authorised vertical or horizontal construction joint, care shall be taken that no disturbance to the concrete is caused until the section is completely set.

Any charges which the Contractor considers necessary to cover the cost of mechanically vibrating the concrete shall be included in the rate for the respective items in the Bill of Quantities.

5.18 CONSTRUCTION JOINTS

Whenever concrete is to be bonded to other concrete which has hardened, the surface of contact between the sections shall be deemed a construction joint.

Where construction joints are shown on the Drawings, the Contractor shall form such joints in those positions. The location of joints which the Contractor requires to make for the purpose of construction shall be subject to the agreement of the Engineer and details shall be submitted with the Programme of Works required by Clause 8.3 of the Conditions of Contract. Construction joints shall be in vertical or horizontal planes except in sloping slabs where they shall be normal to the exposed surfaces or elsewhere where the Drawings require a different arrangement.

Construction joints shall be so arranged as to reduce to a minimum the effects of shrinkage in the concrete after placing, and shall be placed in the most advantageous positions with regard to stresses in the structures and the desirability of staggering joints.

Feather edges of concrete at joints shall be avoided and any feather edges which may have formed where reinforcing bars project through a joint shall be cut back until sound concrete has been reached.

The intersections of horizontal or near horizontal joints and exposed faces of concrete shall appear as straight lines produced by use of a guide strip fixed to the formwork at the top of the concrete lift, or by other means acceptable to the Engineer.

Construction joints formed as free surfaces shall not exceed a slope of 20 per cent from the horizontal.

The surface of the fresh concrete in horizontal or near horizontal joints shall be thoroughly cleaned and roughened by means of high pressure water and air jets when the concrete is hard enough to withstand the treatment without the leaching of cement. The surface of vertical or near vertical joints shall be similarly treated if circumstances permit the removal of formwork at a suitable time.

Where concrete has become too hard for the above treatment to be successful, the surface whether formed or free is to be thoroughly scabbled by means of wet sand blasting and then washed with clean water. The indentations produced by scabbling shall be not less than 10 mm deep and shall not extend closer than 40 mm to a finished face.

If instructed by the Engineer, the surface of the concrete shall be thoroughly brushed with a thin layer of mortar composed of 1 part of cement to 2 parts of sand by weight and complying with Clause 2.10 of the Specification immediately prior to the deposition of fresh concrete. The mortar shall be kept just ahead of the fresh concrete being placed and the fresh layer of concrete shall be thoroughly and systematically vibrated to full depth to ensure complete bond with the adjacent layer.

No mortar or concrete may be placed in position on or against a construction joint until the joint has been inspected and passed by the Engineer.

Construction joints in water-retaining structures shall be made as shown on the Drawings and shall be sealed on the water face with an approved sealant. All costs involved in complying with this Clause shall be deemed to be included in the concrete rates for joints not expressly required by the Engineer.

Kickers shall be formed at the junctions of walls and slabs and shall be not less than 150 mm upstand, cast monolithically with the slab.

5.19 EXPANSION AND CONTRACTION JOINTS

Expansion and Contraction joints are discontinuities in concrete designed to allow for thermal or other movements in the concrete.

Expansion joints are formed with a gap between the concrete faces to permit subsequent expansion of the concrete. Contraction joints are formed to permit initial contraction of the concrete and may include provision for subsequent filling.

Expansion and Contraction joints shall be formed in the position and in accordance with the details shown on the Drawings or elsewhere in the Specification.

5.20 WATERSTOPS

All references to waterstops include groutstops.

Waterstops shall be of the material and form shown on the Drawings. No waterstops material shall be brought onto the site until the Contractor has submitted full details of the materials he proposes to use, including samples, and these have been approved by the Engineer. All samples shall be of adequate length for testing.

Waterstops shall be supplied in lengths as long as possible consistent with ease of handling and construction requirements.

In rubber or plastic materials, joints other than butt joints shall be supplied ready-made by the manufacturer. Butt joints shall be made on site in accordance with the

manufacturer's instructions and with equipment supplied for the purpose by the manufacturer.

Waterstop materials shall be stored carefully on site to avoid damage and contamination with oil, grease, or other pollutants. Rubber and plastic waterstops shall be stored in cool, well ventilated places away from direct sunlight.

Rubber and plastic waterstops which are embedded in one side of a joint more than one month before the scheduled date of placing concrete on the other side, shall be protected from the sun.

Waterstops shall be firmly fixed in the formwork so that they cannot be displaced during concrete placing and shall be completely free of all dirt, grease, oil, etc, before placing concrete.

Concrete shall be placed carefully round waterstops so as to avoid distortion or displacement and shall be fully compacted. Where waterstops lie in a horizontal or nearly horizontal plane, the Contractor shall ensure that no voids are left on the underside of the waterstop.

Formwork round waterstops shall be carefully removed to avoid damage. If waterstops suffer any damage which cannot be properly repaired in-situ, the Engineer may require a section of concrete to be removed and the waterstop replaced.

5.21 CURING OF CONCRETE

Concrete shall be protected during the first stage of hardening from the harmful effects of sunshine, drying winds, rain and running water. The protection shall be applied as soon as possible as practicable after completion of placing by one or more of the following methods:

(a) Concrete with the exception of concrete in walls of water-retaining or water-excluding structures shall be covered with a layer of sacking, canvas, hessian, straw mats or similar absorbent material which shall be securely fixed so as to avoid exposure of the concrete surface. This layer shall be kept constantly wet for 7 days.

(b) Concrete shall be covered immediately on removal of shutters with a layer of approved waterproof paper or plastic membrane kept in contact with the concrete for 7 days.

(c) Except in the case of surfaces to which concrete has subsequently to be bonded, the Engineer may approve curing by application of an approved liquid curing membrane suitable for use in tropical climates.

(d) Application shall be made by low pressure spray at a rate of not less than 0.33 litres/m^2 or according to the manufacturer's instructions. On horizontal surfaces, the curing membrane shall be applied immediately after placing the concrete and on vertical surfaces, immediately after removing the formwork.

(e) Formed surfaces may be cured by retaining the formwork in place for the required curing period.

(f) On no account shall concrete on water-retaining or water-excluding structures be sprayed with cold water on removal of shuttering, as steep temperature gradients may be set up in the concrete leading to a tendency to crack. Water used for curing shall be to the standard specified in Section 2.

5.22 WEATHER CONDITIONS

Any concrete produced and/or placed during adverse weather conditions shall be at the Contractor's own risk. The Engineer shall have the power to order the suspension of concrete production and/or placing whenever he considers such conditions prevail. The Contractor shall be deemed to have allowed in his rates in the Bill of Quantities for any delays that may occur due to adverse weather conditions. Any wasted or damaged concrete resulting from the continuation of work in adverse weather conditions shall be classified as defective work.

In hot weather, suitable means shall be provided to ensure that the temperature of the concrete when deposited shall not exceed 32^{o}C. No concreting shall be allowed when the shade temperature exceeds 38^{o}C.

In hot dry weather, suitable means shall be provided to avoid premature stiffening of concrete placed in contact with hot dry surfaces. Where necessary, the surfaces including reinforcement against which concrete is to be placed shall be shielded from the direct rays of the sun and shall be sprayed with water to prevent excessive absorption by the surfaces of water from the fresh concrete.

5.23 TREATMENT AND PROTECTION OF CAST CONCRETE

No treatment or making good, other than that required for curing shall be applied to the concrete faces until they have been inspected by the Engineer. The Contractor shall submit to the Engineer his method of making good any defects and shall only proceed if the Engineer's approval is received.

The Contractor shall ensure that the completed concrete work is adequately protected from damage and discolouration at all times during construction.

As soon as concrete has set sufficiently to prevent surface damage and before it is dry, the top surface of the concrete shall be covered with PVC sheeting on which is placed a 75 mm layer of dry sand. This protective layer will prevent loss of heat and moisture and shall be maintained for ten days.

5.24 FORMWORK FOR CONCRETE

All formwork with supporting falsework, struts and stagings, etc. shall be of suitable quality, and of substantial strength with ample scantlings as will ensure that the formwork remains rigid without any springing or distortion throughout the placing, ramming, compacting and setting of the concrete, and the design of the formwork shall be such as will permit its being struck and removed for re-use without injury to the concrete, all to the Engineer's approval. No formwork fixings or supports, etc. will be allowed to be incorporated in the finished concrete without the approval of the Engineer.

Form clamps, tie bolts and anchors shall be used to fasten forms. The use of wire ties to hold forms in position during placing of concrete will not be permitted. Tie bolts and clamps shall be positive in action and of sufficient strength and number to prevent spreading or springing of the forms. They shall be of such a type that no metal part shall be left within the specified concrete cover. For water retaining sections, methods of fixing the forms which result in holes through the concrete section when the formwork is removed shall not be used, and wall ties shall be fitted with water baffles.

The cavities shall be filled with grout or mortar and the surface left sound, smooth, even and uniform in colour. All forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

All joints in formwork shall be of such a design as to ensure there is no loss of fine materials or cement during the placing or consolidation of the concrete.

Where reinforcement passes through the end frames of formwork, care shall be taken to ensure close fitting joints against the steel rods so as to avoid loss of cement during consolidation of the concrete.

All formwork shall, unless otherwise shown on the Drawings, be provided with 25 x 25 mm angle fillets so as to form splays on external angles.

The formwork shall be cleaned out prior to concreting and the bottoms thoroughly freed from sawdust, shavings, rust, dirt, mud or other debris, all to the Engineer's approval. After concreting, the exposed surfaces of the formwork shall be cleaned of all adhering concrete before depositing fresh concrete.

To prevent concrete adhering to the formwork, the surface against which the concrete is to be deposited shall receive a thin coat of an approved formwork oil. Care shall be taken to keep the steel reinforcement free from any such coating material. The prices for formwork shall include for this coating.

Formwork must be used for all slopes exceeding 15^{o} to the horizontal, to enable the concrete to be properly rammed.

5.25 BLINDING FOR FOUNDATIONS

Blinding concrete Grade C15/20/C, 75 mm thick or as otherwise shown on drawings, shall be laid on all excavated surfaces prior to the placing of any structural concrete. Prior to blinding, these surfaces shall be compacted in accordance with Specification Clause 3.4 and no blinding shall be placed before the ground has been approved by the Engineer. Vertical surfaces of foundations, etc, shall be formed with formwork.

5.26 FINISHES ON FREE SURFACES

Horizontal or nearly horizontal surfaces which are not cast against formwork shall be finished to the class shown on the Drawings and defined hereunder.

U1 Finish

All surfaces on which no higher class of finish is called for on the Drawings or instructed by the Engineer shall be given a U1 finish.

The concrete shall be leveled and screeded to produce a uniform plain or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.

U2 Finish

This is a floated finish for roof or floor slabs and other surfaces where a hard troweled surface is not required.

The surface shall first be treated as a Class U1 finish and after the concrete has hardened sufficiently, it shall be floated by hand or machine sufficient only to produce a uniform surface free from screed marks.

U3 Finish

This is hard troweled surface for use where weather resistance or appearance is important, or which is subject to high velocity water flow.

The surface shall be floated as for a U2 finish but to the tolerances stated in Table 5.4 below. When the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, it shall be steel-troweled under firm pressure to produce a dense, smooth uniform surface free from trowel marks.

Table 5-4: Surface Tolerances

Class of Finish	*Tolerance in mm (see notes)*		
	A	B	C
U1	Not applicable	10	+20 or –10
U2	Nil	10	+20 or –10
U3	Nil	5	+12.5 or –7.5

Notes:

(i) *Col. A is the maximum allowable value of any sudden change of level in the surface.*

(ii) Col. B is the maximum allowable value of any gradual irregularity of the surface, as indicated by the gap between the surface and a 3m long straight edge or correctly shaped template placed on the surface.

(iii) Col. C is the maximum allowable value of the difference in level or position between a straight edge or correctly shaped template placed on the surface and the specified level or position of that surface.

5.27 SURFACE FINISHES

5.27.1 Classes of Finish

The surface finish to be achieved on formed concrete surface shall be as shown on the Drawings and defined hereunder.

Classes F1 Finish

This finish is for surfaces against which backfill or further concrete will be placed. Formwork may be sawn boards, sheet metal or any other suitable material which will prevent the loss of the material from the concrete being placed.

Classes F2 Finish

This finish is for surfaces which are permanently exposed to view but where the highest standard of finish is not required. Forms to provide a Class F2 finish shall be faced with wrought thickness tongued and grooved boards with square edges arranged in a uniform pattern and close jointed or with suitable sheet material. The thickness of boards or sheets shall be such that there shall be no visible deflection under the pressure exerted by the concrete placed against them. Joints between boards or panels shall be horizontal and vertical unless otherwise directed. This finish

shall be such as to require no general filling of surface pitting, but fins, surface discolouration and other minor defects shall be remedied by methods agreed by the Engineer.

5.27.2 Curved Surfaces

For curved surfaces where F2 finish is called for, the formwork face shall be built up of splines cut to make a tight surface, which shall then be dressed to produce the required finish.

Alternatively, single curvature surfaces may be faced with plastic or plywood linings attached to the backing with adhesive or with escutcheon pins driven flush. Linings shall not bulge, wrinkle or otherwise deform when subjected to temperature and moisture changes.

5.27.3 Tolerances

All parts of formed concrete surfaces shall be in position shown on the Drawings within the tolerances set out in Table 5.5 below.

In cases where the Drawings call out for tolerances other than those given in Table 5.5 below, the drawings shall rule.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to produce a satisfactory straight or curved line. When the Engineer has approved the alignment, the Contractor shall fix the units so that there is no possibility of further movement.

Table 5-5: Tolerances

Classes of Finish	*Tolerances in mm (see Note)*		
	A	B	C
F1	10	10	+ 25 to –10
F2	5	10	+ or -15

Note: *The tolerances A, B and C given in the table above are defined as follows:*

A *is an abrupt irregularity in the surface due to misaligned formwork or defects in the face of the formwork.*

B *is gradual deviation from a plane surface as indicated by a straightedge 3 m long. In the case of curved surfaces the straightedge shall be replaced by a correctly shaped template.*

C *is the amount by which the whole or part of a concrete face is displaced from the correct position shown on the Drawings.*

5.28 REMEDIAL WORK TO DEFECTIVE SURFACES

If on stripping any formwork, the concrete surface is found to be defective in any way, the Contractor shall make no attempt to remedy such defects prior to the Engineer's inspection and the receipt of any instructions which the Engineer may give.

Defective surface shall not be made good by plastering.

Areas of honeycombing which the Engineer agrees may be repaired shall be cut back to sound concrete or to 75 mm whichever is the greater distance. The cavity wall shall have sides at right angles to the face of the concrete. After cleaning out with water and compressed air, a thin layer of cement grout shall be brushed onto the concrete surfaces in the cavity and it shall then be filled immediately with concrete of the same class as the main body but with aggregate larger than 20 mm nominal size removed. A form shall be used against the cavity, provided with a lip to enable concrete to be placed. The form shall be filled to a point above the top edge of the cavity.

After seven days the lip of concrete shall be broken off and the surface ground smooth.

Defects other than those mentioned above shall be dealt with as instructed by the Engineer.

5.29 REMOVAL OF FORMWORK

The removal of formwork after the concrete has set shall be carefully effected without shock or disturbance and in such a manner as will not injure the concrete. No formwork shall be removed before the concrete has set sufficiently to withstand safely any stresses to which the structure may then be subjected.

Unless otherwise approved by the Engineer, the minimum periods which shall elapse between completion of the concreting operations and the striking of the formwork for various parts of the structures shall be as given in the Table 5.6 below based on normal cement, but this shall not relieve the Contractor from this obligation to delay removal of the formwork until the concrete has set sufficiently hard and the Contractor shall be held responsible for and make good at his own cost all injury and damage arising from premature striking of the formwork. A small portion of the framework shall be removed to ensure that the concrete has set sufficiently hard before the whole area of the framework is removed.

Table 5-6: Minimum Periods for Striking of Formwork

Type of Formwork	*Minimum Period before Striking (assuming minimum surface temperature of concrete 16 ^{o}C)*
Vertical formwork to columns, walls and large beams	3 days
Soffit formwork to slabs	4 days
Props to slabs	11 days
Soffit to formwork to beams	8 days
Props to beams	15 days

5.30 SPECIAL METHOD OF WORKING

Should the Contractor propose to use special methods of working not included in this Specification, such as pumping concrete or using vacuum moulds, he shall obtain the Engineer's approval before commencing work and comply with any subsequent specification made by the Engineer for this special method of working.

5.31 LOADING OF STRUCTURES

No concrete structure shall be loaded until the concrete is at least 21 days old, and only then with the approval of the Engineer, and subject to such conditions as he may lay down.

5.32 MEASUREMENT OF FORMWORK AND CONCRETE

Formwork, where measured separately from the concrete items, will only be measured when it is used and the Engineer considers it necessary to use, and the measurement will be strictly limited to the superficial area of formwork actually in contact with the finished faces of concrete. No measurement will be allowed for formwork to construction joints, either vertical or horizontal, or to such other temporary joints as may be necessary.

The Contractor shall include in the rates for formwork, the cost of all timber steel plates and sections, bolts, nails, straps, clamps and all other fixings, all cutting and waste and the cost of all labour and materials in making, erecting and removing the formwork and for all preliminary and other work required to construct the concrete to the forms and dimensions shown on the Drawings or as directed by the Engineer. In the case of precast work where the items for concrete include cost of framework, then the rates for such items shall include all the above costs.

In the case of formwork for suspended beams, and slabs, etc, the price to be entered by the Contractor in the Bill of Quantities shall include the cost of any special steel or timber centering that may be necessary to support the load of “green” concrete across the full span.

The measurement for all concrete shall, unless otherwise specified, be taken as the net cubical contents of the concrete actually used in the work completed in accordance with the Contract. No reduction shall be taken for the concrete displaced by steel reinforcing rods.

The rates for concrete shall include for forming perfect facework of whatever shape or size and for construction of all temporary joints and preparation of temporarily exposed faces, as well as for provision and consolidation of the concrete, building in of all objects and every other expense or labour that may be specified or be necessary to complete the work in accordance with the Contract.

5.33 REINFORCEMENT FOR CONCRETE

The steel reinforcement for concrete shall consist of mild steel plain round bars and high yield deformed bars complying with the requirements of the British Standard BS 4449 –“ Steel reinforcement of concrete”. All reinforcement shall be cut to the exact length and, made truly straight or bent to the exact shape as indicated on the Drawing and shall be within the dimensional tolerances given in BS 8666: 2005. The Contractor shall prepare and submit in duplicate to the Project Manager bar bending schedules for approval before reinforcements are fixed in the permanent work. All bending of bars shall be done by the application of a slow steady pressure.

All reinforcement, after it is bent and immediately before it is placed in the permanent work, shall be well cleaned and made perfectly free from dirt, scale, loose rust, paint, oil, limewash or any other coating.

All steel reinforcement shall be fabricated to the forms and dimensions and fixed exactly in the positions shown on the Drawings. Special care shall be taken that the overall length of bars with multiple bends is accurate and that after bending and fixing in position the bars remain in place without any warp or twist.

The bars shall be firmly bound together with No.16 gauge soft annealed wire at intersection of bars to ensure that the meshwork or bars will retain its designed form, and the meshwork shall be so temporarily supported as to retain its correct position in the moulds during the process of depositing and consolidating the concrete. The ends of all such binding wire shall be turned into the body of the concrete and not allowed to project towards the surface of the concrete.

During concreting, a competent steel placer shall be in attendance on the work to adjust and correct the position of the reinforcement immediately prior to the placing of the concrete.

Spacers shall be used to maintain cover to steel and shall be made from dense cement mortar unless other materials are approved by the Engineer. Spacers shall not be used on water retaining faces.

Where steel fabric reinforcement is used for concrete work, the fabric shall comply with the requirements of the British Standard BS 4483, unless otherwise directed by the Engineer.

Before concreting, all reinforcement shall be carefully cleaned of all set or partially set concrete which may have been deposited thereon during the placing of a previous lift of concrete.

The rates for the steel reinforcement shall include for supplying, delivering, handling, cleaning, cutting, bending, wiring, welding, placing, supporting and every expense necessary to complete the work as shown on the Drawings or as may be ordered by the Engineer. The tying wire is not measured and the concrete displaced by steel bars is not deducted. The bar bending schedules shall be checked by the Contractor who will be responsible for their accuracy.

The Contractor shall be paid for the net theoretical or calculated weight of the steel reinforcement actually used in the Works in accordance with the Drawings or as may be instructed by the Engineer, and no allowance will be made for rolling margin or otherwise.

Steel fabric reinforcement shall be measured and paid for on the basis of the net area covered and the Contractor shall allow in this rate for the fabric for all laps specified.

The concrete cover to reinforcement shall be equal to or greater than the cover shown on the Drawings. The Contractor shall measure the cover to all reinforcement with a calibrated cover meter as soon as the formwork has been stripped and submit the record of this survey to the Project Manager as soon as practical. In situation where cover meters show cover less than specified, the work shall be properly re-executed at the Contractor's own cost.

5.34 JOINTING MATERIALS

1) Resin Bonded Cork as filler in gaps shall be manufactured by Expandite or similar approved. It shall not extrude when compressed and shall return to not less than 80 per cent of its original thickness after compression.

2) Waterproof Building Paper shall be polythene sheeting of 375 micron thickness minimum

3) Contraction and Expansion joints shall be sealed with an approved make of joint sealer of type and dimensions as shown on the Drawings.

Bitumen-rubber joint sealing compounds shall be pourable conforming to type A as specified in BS EN 14188:2004 “Specifications for hot *applied fillers and sealants*” and shall be an approved solvent type gun grade applied by suitable gun for vertical joints.

Polysulphide joint sealing compounds shall be two part conforming to BS EN 1S0 11600:2003+A1:2011

5.35 CLEANING AND DISINFECTION

(a) General

Before being tested or put into service all building, tanks and other units, constructed under this Contract, shall be thoroughly cleansed so as to remove all dirt, grit and rubbish. Any tanks, etc, that will contain treated potable water shall be disinfected.

(b) Disinfection

The inside faces of tanks, etc, shall be washed with clean water and when completely clean, the tank shall be filled to a depth of 300 mm with clear water having a chlorine residual of not less than 20 mg/litre. All inside faces shall then be scrubbed with this water using stiff brushes. Workmen carrying out this operation shall wear clean rubber boots, which have been disinfected. Strict precautions shall be enforced to ensure that hygienic conditions prevail throughout the disinfection operations. After disinfection no area shall be touched without the prior permission of the Engineer. Particular attention shall be paid to the provision of adequate safety precautions for personnel involved throughout the disinfection operation.

5.36 TESTING OF WATER RETAINING STRUCTURES

All concrete structures designed to retain water shall be tested by the Contractor after completion for water-tightness. Such testing will not be allowed to begin until the structure has been fully completed and all concrete has reached its specified strength. The Contractor shall make preparations to begin as soon as possible after each main structure has been completed.

After cleaning to the satisfaction of the Engineer, the structure shall be filled at an approximately uniform rate of increase of water level of not more than 1m in 24 hours to the intended top water level. The water shall be allowed to stand in the structure for a period of 7 days after which time the level shall be recorded and further measurements made at intervals of 24 hours for 7 days. The structure may be deemed to be water-tight if the total drop in surface level does not exceed 12 mm in 7 days, taking into account the losses due to evaporation.

If the total loss is greater than 12mm, the Contractor shall at once investigate the cause, and shall determine the points of leakage, the water level being lowered in stages as required. The Contractor shall carry out any further remedial work necessary to stop such leakage in a manner directed by the Engineer; the structure shall subsequently be recleaned and testing repeated.

If the structure does not satisfy the conditions of the test, and the daily drop in water level is decreasing, the period of test may be extended for a further 7 days and if the specified limit is then not exceeded, the structure may be considered as satisfactory.

The structures will not be accepted by the Employer until they have been ascertained to be in a perfectly useable and water-tight condition to the complete satisfaction of the Engineer.

No claim for extra payment to the Contractor shall be allowed if for any reason the Engineer is unable to allow filling or emptying to be carried out at the time requested by the Contractor.

The Contractor shall provide all water, pumps, measuring instrument and all necessary labour, tools and materials for the testing of structures. The cost of carrying out testing is the responsibility of the Contractor and this cost will be deemed to have been included by the Contractor in these prices for the structure.

5.37 PRECAST CONCRETE

5.37.1 Precast Members

Precast concrete members, kerbs, channels, cover slabs, paving slabs, etc., shall generally comply with the requirements of British Standard BS EN 1339:2003- "Concrete Paving Flags Requirements and test methods"

The Contractor shall set up an adequately covered precasting yard of suitable dimensions, capable of handling all the precast concrete works to be procured under the contract and shall provide a suitably qualified engineer for the supervision of the pre-casting concrete works. The Contractor shall provide full details and drawings showing his proposals for the precast yard, and the method of producing the precast concrete for the Engineer's approval.

5.37.2 Concrete Mixes

Concrete mixes for the precast members shall be proposed by the Contractor for approval by the Engineer before any production of precast concrete is commenced at the precast yard. Specimens shall be manufactured and tested as directed by the Engineer before the batch production is commenced.

5.37.3 Formwork

The precast units shall each be cast complete in one operation, on suitable and appropriately designed platforms and moulds, all to the satisfaction of the Engineer. Before casting is commenced, the Contractor shall submit for the approval of the Engineer fully detailed drawings showing the proposed layout of casting beds, together with the details of the method of assembling and dismantling of the moulds. In cases where the finished thickness of the concrete is small, and compaction by internal or surface vibration is considered to be difficult, the mould may be constructed so that external vibration of the shutter will satisfactorily compact the concrete, or alternatively vibrating tables may be used. The soffit shutter shall be adequately supported to prevent any settlement which might cause cracking of the concrete.

Provision shall be made to hold firmly and maintain in position all projecting reinforcement, bolts, screwed sockets, etc., so that they are correctly located in the completed unit or member being cast.

5.37.4 Weather Protection and Curing

The precast units shall at all times be cast under suitable shelter to provide complete protection from the sun, rain and drying winds. They shall remain under cover and protected against direct sunlight for at least four days or until the units are strong enough to be lifted from the casting beds, whichever is the longer period. During this period, all exposed concrete shall be protected and cured as described in these Specifications. Thereafter, the units shall be transferred to a storage area or be erected in their final position, as the case may be, with the utmost handling care to prevent damage or hair-cracking.

5.37.5 Surface Finishes

The methods used for compacting the concrete must be such that pinholes or airholes on the surface shall not be visible at all times. Upon removal of the formwork, any units having a concrete face with rough, uneven, honeycombed or imperfect finish shall be rejected by the Engineer and shall forthwith be removed from the precast yard. Where remedial work is allowed to be effected by the Engineer, irregularities shall be eliminated by grinding, or where an area shows airholes, these shall be filled and thoroughly rubbed over to leave the desired surface. Unsightly encrustations and stains shall be removed from all exposed surfaces.

5.37.6 Lifting and Handling Units

No items shall be lifted from the casting beds unless and until they have gained sufficient strength to avoid damage or cracking through lifting, handling, erection or stacking. Notwithstanding any guidance given by the Engineer on the concrete

strength necessary to prevent damage, the Contractor shall be solely and entirely responsible for any damage or cracking resulting from any mishandling. Any precast items damaged or cracked will be rejected by the Engineer, and shall be forthwith disposed of, to the approval of the Engineer, at the Contractor's expense.

Before casting, the Contractor shall submit to the Engineer, for his approval, full details of the proposed method of hoisting precast units including the location of proposed lifting points. The Contractor shall be responsible for the design and provision of extra reinforcement that may be required to facilitate the safe and proper handling of the precast units. The Contractor's price for precast units should include for such extra reinforcement.

The edges of precast units shall be protected by fenders of timber or other approved material during the lifting, handling and erection stages. Alternatively, the edges of the precast units may be slightly chamfered, if so ordered by the Engineer.

5.37.7 Stacking of Precast Units

During stacking, the precast members shall be firmly supported at such bearing positions that will ensure that the stresses induced in them are always less than the permissible design stresses.

Ample space shall be provided for the storage and stacking of the units. No movement of workers and/or machine will be allowed on stacked members. They shall at all times be prevented from coming into contact with soil, dirt, grease, ropes, cables, pieces of timber etc. likely to cause stains, patches and discolorations to the manufactured precast units.

5.38 PRE-MIXED CONCRETE

Pre-mixed or ready-mixed concrete as specified in BS EN 206-1 and BS 8500-2, prepared off the Site i.e. at a pre-mixed concrete manufacturing yard may be used only with the agreement of the Engineer and shall comply with all the relevant specifications. Mixing at a central plant shall conform to the requirements for mixing at the site. The supplier of the ready-mixed concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the required rate.

The concrete shall be transported in purposely-designed mixer trucks. The concrete shall be placed and compacted in its final position within one (1) hour of the introduction of cement to aggregates unless a longer time is agreed by the Engineer depending on the retarding-agent used. The time of such introduction shall be recorded on the Delivery Note together with the weight of the constituents of each mix. When truck mixed concrete is used, water shall be added under controlled supervision either at the site or at the central batching plant as agreed by the Engineer but in no circumstances shall water be added in transit. Unless otherwise agreed by the Engineer, truck mixer units and their mixing and discharge

performance shall comply with the requirements of BS EN 12151. Mixing shall continue for the number and rate of revolutions recommended in accordance with BS EN 12151.

Each mixer, agitator and truck shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of volume of the mixed concrete, and the speed of the rotation of mixing drum or blades.

Notwithstanding the above provisions, before the use of any ready-mixed concrete is allowed, the Contractor shall submit to the Engineer full details regarding the batching plant, distance to be covered, type and number of mixer trucks, quality control procedures etc.

The placing of ready-mixed concrete by pumping will be permitted only if authorized by the Engineer. The Contractor shall submit full information on the design mix for the Engineer's approval. The equipment shall be so arranged that no vibration will occur that might damage freshly placed concrete. Full details of the concrete pump shall also be provided.

Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the Work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is obtained. When pumping has been completed, the concrete remaining in the pumping hose or pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or segregation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned. The placing of concrete by pumping shall not entitle the Contractor for any extra payment. This method shall be deemed to be included in the prices in the Bill of Quantities or elsewhere.

5.39 METAL PARAPETS

5.39.1 General

Proprietory vehicle parapets shall be of a design acceptable to the Engineer. Metal parapets shall be provided with the name, trade mark or other means of identification of the proprietory parapet system, group designation and type or mark number, for the due approval of the Engineer.

5.39.2 Welding

In the case of steel parapets, welding shall comply with the requirements of the relevant Standard Specifications.

In the case of aluminium and aluminium alloy parapets, welding shall comply with the requirements of either BS EN 1011-4:2000

5.39.3 Inspection and Testing of Welding

When directed by the Engineer and before fabrication is commenced, welding procedure trials shall be carried out using representative samples of materials to be used in the work.

A penetrant dye or other non-destructive method of testing agreed with the Engineer shall be used to examine the welds selected by the Engineer. The Contractor shall thereafter produce all the relevant certificates.

5.39.4 Erection of Parapets

During erection of parapets, they shall be securely held in their correct position until all connections and fastenings are complete and the post fixings have gained sufficient strength to withstand the design holding-down moment. The assessment of the strength of the post fixing shall be subject to the Engineer's approval. After erection, the finished parapets shall be true to line throughout their entire lengths.

Section 6

ROADWORKS

SECTION 6 - ROADWORKS

Note: *This Section should be read in conjunction with Section 7 "Catchment and Road Drainage".*

6.1 ROADWORKS – GENERAL

The work specified under this section shall include all works preparatory to the construction of pavement and related work of any nature necessary for due and satisfactory construction, completion and maintenance of said works to the intent and meaning of the Drawings and the orders that may be issued by the Engineer from time to time. The works shall comprise necessary site clearance, platforming involving cut and fill as indicated on drawings, provision for construction of road-side drains, excavation to the required formation level and compaction of subgrade, providing and laying and compaction of sub-base, laying of bituminous concrete courses, kerbs, and other related works etc. in areas as shown on drawing complete in all respects in conformity with the Specification, Drawings and the instructions of the Engineer. The work shall also include regular clearance of rubbish, clearing up and leaving perfect on completion of all permanent works.

All works performed shall conform to the lines, grades, cross-sections, levels and dimensions shown on the Drawings and/or as directed by the Engineer.

6.2 SEQUENCE OF OPERATIONS

The Contractor shall submit the sequence of operations which he proposes to follow to the Engineer through a "*Method Statement*" and shall obtain the Engineer's approval to such proposal prior to commencing work, and shall adhere to the agreed sequence after any modification (if any) proposed by the Engineer. The Contractor shall not thereafter modify the sequence of operations without the approval of the Engineer.

6.3 ENGINEER'S APPROVAL OF METHODS AND PLANTS

The Contractor shall not commence any individual item of work until he has obtained the Engineer's approval in writing of the plant and methods that he proposes to employ for each and every operation.

The foregoing provisions shall not prevent the Engineer from requiring the Contractor to vary his plant and/or methods at any time during the execution of the works, should the Engineer consider this essential for carrying out the Contract. The Contractor shall not vary plant and/or methods which have been approved by the Engineer, without previously obtaining the Engineer's approval of such variation.

6.4 SETTING OUT THE WORK

The Contractor shall set out the work in accordance with the Drawings and as directed by the Engineer, and shall secure the Engineer's approval of the setting out

before proceeding with the construction. The Contractor shall, without any extra charge, provide all necessary instruments, appliances, surveying personnel and labour, and any material, which the Engineer may require for checking the setting out or for any relevant work to be done. If, in the opinion of the Engineer, any modification is necessary, the Engineer will issue detailed instructions to the Contractor for such modifications and the Contractor shall revise the setting out for further approval at no extra cost.

6.5 PREVENTION OF DAMAGE TO PARTIALLY COMPLETED PAVEMENT

The Contractor shall ensure that the passage of vehicles or plant over partially completed works shall not cause any rutting or other damage or disturbance to the partially completed pavement. There shall be no storage or stockpiling of material on top of partially completed pavement. Any damage to partially completed pavement resulting from any cause shall be made good by the Contractor as directed by the Engineer at no extra cost.

Adequate measures shall be taken by the Contractor at all times during the construction period to duly and satisfactorily protect the works against rain by providing adequate drainage of all exposed surface. No placing of any road layer shall be permitted unless the receiving surface is dry.

6.6 CONTROL OF HORIZONTAL ALIGNMENT

The edges and finished levels of the paving main road, parking areas, and lateral road, as constructed shall be correct within a tolerance of ±10 mm.

6.7 LEVELS AND CROSS-SECTIONS

The levels as shown on the Drawings or as directed by the Engineer shall be the surface finished levels after the application of the top most course, unless otherwise provided for. The levels on the surface of each pavement course shall not vary from those calculated with reference to the levels and profiles shown on the Drawings or as directed by the Engineer.

The typical cross-sections shown on Drawings shall be applied on cross-sections levelled and to be approved by the Engineer.

The theoretical camber which has been shown at 2.5% may vary between 1.5 and 3%. Nevertheless, along the road alignment and for the same cross-section, the camber on each half of the carriageway shall not differ by more than 0.5%.

The nominal thickness specified on typical cross-sections and on plan and longitudinal profiles are deemed to be the minimal thickness of the different materials to be placed.

6.8 SIEVE DESIGNATIONS

The sieve designations referred to in the specifications correspond to Square Hole Perforated Plate and Woven Wire Cloth test sieves specified in BS 410. Sieves of other standards equivalent to BS sieves may be used after approval of the Engineer.

6.9 QUALITY CONTROL

6.9.1 General

The materials and works shall be subjected to quality control tests. The tests shall be performed by the Contractor at his own cost in accordance with the test methods mentioned and/or as directed by the Engineer. The Contractor shall have staff experienced in performing the various tests. The testing frequencies set forth in the specifications are the desirable minimum and the Engineer shall have the full authority to carry out tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications. Where specific procedure of testing is not indicated, the same shall be carried out as per the prevalent accepted engineering practice as directed by the Engineer. The Engineer may direct the Contractor to perform any test not mentioned in the Specification as he may deem necessary to fulfill the requirements of the works.

The Contractor shall supply the Engineer with two copies of the results of each test as soon as possible after completion of the test. Such results shall be presented on standard forms approved by the Engineer.

Particular attention shall be given to the compaction and rolling of various pavement courses at the corners and the edges. Where the rollers cannot reach and compact the corners and the edges, suitable approved method shall be used for the purpose, as directed by the Engineer.

6.9.2 Proof Rolling Sections

Before commencing any pavement work, the Contractor shall carry out compaction trials by establishing proof rolling sections. The purposes of these trials are to determine the proper compaction plant to be used (including number of rollers, wheel load, inflation pressure of tyres, rolling patterns, speed of rollers, distance between the asphalt paver and the compaction plants), the number of passes, the thickness of loose material for each layer, the temperature for spreading in order to achieve the required thickness of compacted material, the required density and a minimum value for the deflection under a 8.2 tonne axle load.

The Contractor shall submit to the Engineer for approval a method statement for carrying out these compaction trials, duly supported by any necessary laboratory and in-situ tests. These trials and tests shall be completed and approved before any paving work is allowed to start. However, any approval by the Engineer shall not relieve the Contractor of any of his duties, responsibilities and obligations under the Contract.

The Contractor's attention is drawn that proof rolling inclusive of all tests and trials will not be paid separately. The Contractor should therefore allow for the costs associated with the proof rolling sections in other priced items in the Bill of Quantities.

6.10 TESTING AND TESTING METHODS

6.10.1 General

The methods of preparation of samples and of testing materials and works shall conform to the latest edition (including amendments) of the Standards mentioned in sub-section 6.10.7 below or equivalent methods approved by the Engineer.

The Contractor shall carry out as deemed necessary on the Site, tests for selection and control of materials and workmanship in accordance with the Technical Specifications and/or as instructed by the Engineer. Such instructions shall in no way relieve the Contractor from his responsibility to ensure that all materials and workmanship are in accordance with the Contract.

All tests to be performed shall be in accordance with Standard Specifications of the B.S, LCPC, AASHTO and ASTM as specified in these Technical Specifications.

Whenever the facilities of the Contractor's laboratory are inadequate to carry out control tests on materials or workmanship, such tests shall be carried out at the Contractor's expense by an approved Testing Authority (for e.g Material Testing Laboratory of M.P.I) or any other laboratory which shall be indicated by the Engineer and the Contractor shall be fully responsible for the lead time associated with the testing and the corresponding delay in the overall works.

All samples and records shall be properly kept by the Contractor till the end of the Defects Notification Period or as may be directed by the Engineer. Such records shall be kept and labelled in an orderly fashion to the Engineer's approval. The results of all tests shall be entered on standard forms to be provided by the Contractor and which shall be submitted to the Engineer immediately after completion of the tests. No material shall be incorporated in the Works until the results of all relevant tests have been duly approved by the Engineer. Rejected materials shall be immediately removed from the site.

6.10.2 Additional and Independent Tests

In addition to the standard tests required under the various sections of these Specifications, the Engineer shall have power to order additional and independent tests of all materials as he deems necessary. Such tests shall be carried out by some person appointed by him at such place or laboratory as he may determine. The results of such tests shall be conclusive and the Contractor shall have no right of appeal against such tests.

6.10.3 Witnessing of Tests on Manufactured Products by Engineer

The Engineer reserves the right to send representatives/inspectors to witness factory tests of products being manufactured by the Contractor for the purpose of the works, following which the Engineer shall either approve or reject such products. Notwithstanding the above, the Contractor shall invariably obtain from the manufacturer/s of the said products certificates of test and manufacturing details as evidence that the products have been tested in accordance with the requirements of the relevant clauses of these Specifications. The Engineer may forthwith request for tests on site if, in his opinion, such tests are necessary. The Contractor shall proceed forthwith with such tests, all at his own cost.

6.10.4 Tests on Site (Field Tests)

At any time during the contract that the engineer requires tests on site to be carried out, the Contractor shall proceed forthwith with such tests. The Contractor shall carry out such tests in the presence of the Engineer if the particular case demands it and/or shall carry such tests by independent testing agencies or laboratories.

Field tests shall be carried out over and above the specified laboratory tests and shall act as monitoring and control tests during all the time of the construction. These tests are described below:

(i) Moisture Content

The moisture content in the field shall be tested as requested by the Engineer either in accordance with the relevant BS given in Sub-section 6.10.1 above, or alternatively by the use of a Speedy Moisture Tester. In case the SMT is used, the Contractor shall ensure its re-calibration for each individual different type of material being subjected to testing, with a view to ensuring its accuracy at all times.

(ii) In-Situ Dry Density

This test can be carried out by any of the four (4) methods listed below subject to the proposals of the Contractor being approved by the Engineer:

- Sand-cone method
- Rubber-balloon method
- Nuclear density
- Moisture method

(iii) Deflection under Typical 8.2 Tonne Axle Load

This test shall be carried out using the Benkleman Beam Method at offsets of 2.5m from the proposed road centre line at intervals of 25 metres along the stretches of road construction, at different stages of construction such as sub-grade cut and fill, embankments, compaction layers and finished road levels.

(iv) Plate Load Test

Plate Load Test is a field test for determining the ultimate bearing capacity of soil and the likely settlement under a given load. The Plate Load Test basically consists of loading a steel plate placed at the foundation level and recording the settlements corresponding to each load increment. The test load is gradually increased till the plate starts to sink at a rapid rate. The total value of load on the plate in such a stage divided by the area of the steel plate gives the value of the ultimate bearing capacity of soil. The ultimate bearing capacity of soil is divided by suitable factor of safety (which varies from 2 to 3) to arrive at the value of safe bearing capacity of soil.

6.10.5 Location of Materials

The Contractor shall locate and identify all naturally occurring materials to be incorporated in the works, and shall request for approval of such locations from the Engineer.

For this purpose, the Contractor shall dig up trial pits as necessary and carry out tests as appropriate to furnish the Engineer with all the required data for the purpose of approval of such materials.

6.10.6 Method of Sampling of Materials

Sampling of materials to be tested pursuant to Sub-clause 6.10.5 above shall be carried out in accordance with the standard methods listed in Table 6.1 below. In cases where such standard methods are either not specified or are not available, the method of sampling shall be as directed by the Engineer.

Sampling from trial pits shall follow the methodology given below:

Trial pits if and when dug by hand shall be of dimensions 1.2 x 1.2 m. Alternatively, the trial pits shall be dug by mechanical means if so agreed with the Engineer.

Samples shall not be taken from the excavated material volume of the trial pit. Samples shall be taken from each of the side faces of the dug pit at different depths, carefully mixed to achieve a representative mix from which the sample shall then be taken.

6.10.7 Standards for Testing of Materials

The methods of preparation of samples and of testing materials and works shall conform to the latest edition (including amendments) of the Standards mentioned in Table 6.1 below or equivalent methods approved by the Engineer.

Table 6-1: Testing of materials according to standards

Test	**Test Method in accordance with**
Determination of:	
Aggregate Grading of Asphaltic Concrete	BS 598
Aggregate Impact Value	BS EN 1097-2
Binder content of Asphaltic Concrete	BS 598
Bulk Density	BS EN 1097-3
California Bearing Ratio (CBR)	BS 1377-4
Compaction Test 1	BS 1377-4
Distillation (Residue) of Bitumen	AASHTO/T78 (T59)
Dry Density of Compacted Material	BS 1377-4
Ductility Test of Bitumen	AASHTO/T51
Flakiness Index of Aggregates	BS EN 933-3
Flash Point of Bitumen	AASHTO/T48/T79
Grading of Aggregates	BS EN 12620
Liquid Limit	BS 1377-2
Los Angeles Abrasion Value of Aggregate	BS EN 1097-8
Maximum Dry Density	BS 1377-4
Moisture Content	BS 1377-2
Optimum Moisture Content	BS 1377-2
Particle Size Distribution	BS 1377-2
Penetration Test of Bitumen	AASHTO/T49
Plastic Limit	BS 1377-2
Plasticity Index	BS 1377-2
Sampling of Bituminous Material	AASHTO/T40/T41
Sand Equivalent Test	AASHTO/T176
Sieve Analysis	BS 812-103
Sodium Sulphate Soundness	ASTM C88-56T
Softening Paint of Bitumen	AASHTO/T53
Solubility Test of Bitumen	AASHTO/T44
Specific Gravity	BS 812
Viscosity of Bitumen	AASHTO T201/T59
Water absorption of Aggregates	BS EN 1097-6

6.11 PREPARATORY WORKS

6.11.1 Setting Out

The limits of the earthwork as per Drawing shall be marked by fixing stout wooden pegs (at least 100 mm dia 500 mm long) at 15 m intervals or closer if desired by the Engineer.

The pegs shall be fixed at about 0.5 m beyond the actual limits of the fill and painted in a distinct colour.

6.11.2 Preparation of Existing Ground

The existing ground within the limits of the Permanent Works shall be cleared of all rubbish and other deleterious materials. Necessary cut and fill shall be carried out where required, as per Drawings.

6.11.3 Excavation of Existing Road Pavement Structure

Excavation of existing road pavement structure, when arising due to the need for breaking-up existing road pavements of whatever type and nature, widening of existing carriageway or shoulder, adjusting level of existing road etc. shall consist in excavation of bituminous material from the pavement to such a depth as shown on the Drawings or as directed by the Engineer.

The works shall include, but not limited to:

- Scarifying, loosening and digging any bituminous material from the existing road structure.
- Clearance and demolition of existing concrete flush kerbs, dry stone kerbs, island kerbs and concrete slabs as the case may be.
- Loading, carting away and disposal of all materials in spoil tips, temporary stockpiles or in subgrade of new pavement if and when approved by the Engineer.
- Shaping and compaction of the bottom of the excavation to 95% B.S Heavy or as directed by the Engineer.

6.11.4 Borrow Pits

The Contractor shall provide all necessary information to the Engineer or his Representative pertaining to the borrow pits he intends to utilize for the importation of materials for the purpose of constructing the works.

Such data shall include, but not be limited to:

- The location of the proposed borrow-pit
- The thickness of topsoil or suitable material to be removed
- The depth of suitable material to be excavated
- The type or types of material to be obtained from the borrow-pit and imported to site of work.
- The areas for stockpiling of topsoil to be re-used to cover the borrow-pit
- Access details to and from the proposed borrow-pit.
- Proposals for reinstating the borrow pit.

The Contractor's attention is drawn to the fact that the approval of the borrow pit area by the Engineer shall not relieve him of his obligations to ensure that all the materials used as fill fully satisfy these specifications.

The Contractor's attention is specifically drawn to the fact that under no circumstances shall the use of explosives or explosive materials be allowed either for excavation at the borrow-pit areas or within the work areas.

6.11.5 Preparation of Embankment

The contractor shall ensure that all other preparatory works have been attended before he starts with the construction of embankments.

The Contractor shall first carry out the stripping of the top soil, and in the event that the underlying ground formation is observed to be unsuitable by the Engineer or his Representative, the Contractor shall excavate to such depths as required to reach satisfactory sub-surface layer and shall dispose of the material to *approved spoil tips*.

The Contractor shall thereafter carry out all works necessary to properly and adequately drain the natural ground prior to forming of the embankment. Should any subsequent embankment filling be adversely affected through lack of such drainage, even if such drainage would have been approved by the Engineer, the Contractor shall remove and replace it at his own expense.

Prior to placing fill material in embankments, the Contractor shall compact the top 300 mm of the ground in accordance with Clause 6.12 below.

Before commencing any embankment construction, the Contractor shall submit to the Engineer for approval proposals for the establishment of proof rolling sections, including the procedures for the associated compaction trials supported if necessary by laboratory and in-situ tests. The purposes of these trials are to determine for each main type of materials to be used in the embankment construction, the type and nature of compaction plant and equipment to be used, the number of passes which will be required and the optimum thickness of loose material for each layer in order

to achieve the required degree of compaction and a minimum value for the deflection under a 8.2 tonne axle load, as per sub-clause 6.10.4 (iii) above.

6.12 PREPARATION OF SUBGRADE

For the purpose of these specifications, the subgrade is defined as follows:

It shall be the surface on which the sub-base (or base if no sub-base is required) is placed.

The existing ground level along the alignment of the road and paving area shall be reduced to the formation level i.e. sub-base bottom level by controlled excavation.

Moisture content of the loose material shall be adjusted by sprinkling water so that at the time of compaction it remains within the range specified hereunder. After water has been added, the materials shall be processed by mechanical or other approved means if so directed by the Engineer until the same is uniformly wet.

Immediately thereafter, the subgrade shall be levelled and compacted with 8 to 10 tonnes smooth wheeled rollers or other approved plant. Rolling shall commence at the lower levels and progress from the lower to the upper level parallel to the centre line of the pavement. Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. The subgrade shall be compacted to not less than 95 % of the maximum dry density determined by BS 1377. Field Density shall be determined by either sand replacement method (BS 1377) or with a Nucleo-Gammadensometer type Troxler or any equivalent.

The subgrade on completion of compaction shall be well closed, free from movement under compaction plant and from compaction planes, ridges, cracks or loose material.

Any subgrade area which in the opinion of the Engineer is inadequately compacted or is unsuitable, shall be recompacted or replaced as directed by the Engineer. Any irregularities or depression which develop in the surface of the subgrade during compaction shall be corrected by loosening the materials up to 150 mm depth at the places affected and adding, removing or replacing material and recompacting as specified, so that the surface is smooth and uniform. Any erosion that may develop in the surface of the subgrade shall be made good by the Contractor at his own expense. In dry weather dust shall not be permitted to form on the surface of subgrade.

No portion of the subgrade shall be covered up until it has been inspected and approved by the Engineer.

The area of the subgrade which has been inspected by the Engineer shall be protected against damage, drying out and cracking and shall be kept well drained at all times. Any damage resulting from any cause shall be repaired at the Contractor's

expense as directed by the Engineer. Storage or stockpiling of plant or materials on the finished subgrade shall not be permitted.

The finished subgrade shall be properly shaped and compacted to a smooth surface within a range of –2cm to +2cm at any point. When measured with a 3-metre straight edge, deflections shall not exceed 2cm.

If for two consecutive working days, more than 10% of the measurements do not comply with the above-specified tolerances, the Work shall be stopped in order to examine the working methods and the equipment being used; any equipment which, in the opinion of the Engineer, is not producing the necessary workmanship shall be forthwith replaced by the Contractor at no extra cost.

The deflections measured under 8.2 tonne axle load shall not exceed the maximum values determined during the proof rolling exercise.

6.12.1 Tests

The works of subgrade shall satisfy the test requirements given in Table 6.2 below:

Table 6-2: Test requirements on subgrade.

Description of Test	*Requirement*	*Frequency of Testing*
(a) CBR Test on a set of 3 specimens compacted to 90% of MD (BS 1377-4)	7%	As stated by the Engineer on site.
(b) Moisture Content at the time of compaction	1% above to 2% below optimum moisture content.	As stated by the Engineer on site.
(c) Density of Compacted layer.	As stated	As stated by the Engineer on site.

The visits for the purpose of carrying out these tests, if not separately provided for in the Bill of Quantities, shall be deemed to be included in the roadworks rates.

6.12.2 Drainage Layer

Where a drainage layer is required to be placed on the subgrade, it shall be placed as shown on the typical cross-sections if such appears or alternatively where directed by the Engineer. The drainage layer materials shall be spread with a grader and compacted with a vibrating roller or heavy self-propelled tyred roller. Depending of the type of the materials, the method of compaction shall be determined following the results of the proof rolling sections. Drainage layers in shoulders or as backfilling of masonry or drainage structures shall be hand-placed and compacted with hand-propelled vibrating roller.

6.13 CONSTRUCTION OF SUB-BASE AND BASE

6.13.1 Materials

The sub-base material shall be crushed stone and/or crusher run 0/31.5 mm for the First Layer and Crusher Run 0/20 mm for the Second Layer. The materials shall comply with Clause 2.17 of Section 2 of these technical specifications.

The crushed materials shall be reasonably cubical and regular in shape. They shall be hard, strong, durable and shall not contain unduly flaky or elongated pieces, dirt or other objectionable matter.

6.13.2 Construction Operations

The graded material shall be laid by a mechanical grader of a type approved by the Engineer and water shall be added to achieve specified moisture content. Care shall be taken to avoid segregation. If segregation occurs, re-mixing shall be carried out again by a method to be proposed by the Contractor and approved by the Engineer. Deposition of the material shall be in continuous uniform layers of the approved thickness, width, shaping and surface tolerances.

The moisture content of the material shall be the optimum ±1.0 % as determined in accordance with the Vibrating Hammer Method Test 14 of BS 1377. The Contractor shall control the moisture content of the material before and during compaction. Where it is necessary to add water to adjust the moisture content, such addition shall be by an approved mechanical sprinkler; the mixing shall be to the full thickness/depth of the loose material.

Top of subgrade over which the granular sub-base is to be laid shall be free from dust and other extraneous material. The materials shall be spread uniformly using a grader or any other plant approved by the Engineer in such quantities to produce the required compacted thickness.

Compaction shall be carried out by 8-10 tonne rollers or an approved vibrator roller of equivalent capacity. Rolling shall take place in longitudinal direction. Rolling shall commence at the lower levels and progress from the lower to the upper level parallel to the center line of the pavement, overlapping on successive passes by at least one half of the width of the rear wheel. The compaction of the crusher run layer shall be carried out only after the construction of the edge concrete kerbs provided for retaining the material.

Compaction shall be continued till the aggregates are thoroughly keyed. Each layer shall be compacted by not less than 10 passes of the roller to achieve the required density. The thickness of the construction layer shall be checked regularly during the compaction to ensure that the tolerances are within the accepted limits as laid down in sub-section 6.13.4 below.

On completion of the sub-base no further work shall proceed until the Contractor has received, in writing, the approval of the Engineer for the layer. In the event that such approval is not granted because of defective work, the Contractor shall, upon so

instructed by the Engineer, dig out all loose and segregated materials over the required area and make good and re-compact all at his expense.

6.13.3 Tests

The materials and works of sub-base shall satisfy the test requirements as stipulated in Table 6.3 below:

Table 6-3: Test Requirement on Sub-Base and Base

Description of Test	*Requirement*	*Frequency of Testing*
(a) Los Angeles Abrasion Value	50 % maximum	As stated by the Engineer on site.
or Aggregate Impact Value	40 % maximum	As stated by the Engineer on site.
(b) Flakiness Index Aggregates	20 % maximum	As stated by the Engineer on site.
(c) Grading of Aggregates	As stated	As stated by the Engineer on site.
(d) Dry Density of Compacted Sub-Base Layer	95 % of the maximum dry density determined by the test method BS 1377-4	As stated by the Engineer on site.
(e) Dry Density of compacted of Base Layer.	Same as above but 98 %	As stated by the Engineer on site.
(f) Moisture Content during compaction	± 2% if O.M.C	As stated by the Engineer on site.

6.13.4 Tolerances

The finished surfaces of crushed stone sub-base and base shall not show any deformation from the required cross-sections exceeding 20mm when measured with a 3-metre long straight edge.

If the deformation is greater than these tolerances, the Contractor shall at his own expense scarify, reshape, add water as necessary, and compact such areas.

If for two consecutive working days more than 10% of the measurements do not comply with the above-specified tolerances, the work shall be stopped in order to

examine the working methods and the equipment being used; any equipment which, in the opinion of the Engineer, is not producing the necessary workmanship shall be forthwith replaced by the Contractor at no extra cost.

The deflections measured under 8.2 tonne axle load shall not exceed the maximum values determined during the proof rolling exercise.

6.13.5 Shoulder Construction

The construction of shoulders and pedestrian walkways and cycle tracks shall in all respects be similar to that of sub-base and base courses, except for compaction requirements which shall be fixed to 95% B.S. Heavy Compaction. Where crushed stone/crusher run base (and sub-base) is provided, construction and especially compaction of shoulder layers shall be carried out at the same time as the corresponding works on the road pavement. Where bituminous base-course and wearing-course are provided, the laying and first compaction of shoulder material shall be made before the construction on the bituminous courses.

6.14 PRIME COAT

The work shall consist of application of a coat of liquid asphalt prime coat on previously constructed base surface in accordance with the Specification and as directed by the Engineer. The finished receiving surface (base surface) shall have been prepared true to line, grade and cross-section within the tolerances specified by Sub-clause 6.13.4

6.14.1 Material

Medium curing cut-back asphalt shall consist of an asphaltic base fluxed with suitable petroleum distillates. The product shall be free of water, shall show no separation prior to use and shall conform to all the requirements of MC-30 in accordance with ASTM or an equivalent grade subject to the approval to the Engineer, all as per the specifications of Clause 2.20 of Section 2 "*Materials and Workmanship*".

The quantity shall be 1.0 kg per square metre area of base surface, and shall be applied by a pressure distributor.

6.14.2 Construction Operations

Immediately before the spreading of the liquid bitumen, the Base surface shall be thoroughly swept and scraped cleaned of dust, mud, clay, cohesionless materials and other extraneous materials, with mechanical rotating brooms or other approved equipment accompanied by handsweeping. The base surface shall be dry.

The bitumen shall be sprayed uniformly over the dry surface of base preferably using mechanical sprayers. (pressure distributors) whose nozzles shall have been checked prior to spraying. At the time of spraying, the temperature of the liquid bitumen shall be within the limits appropriate to the grade of bitumen used.

The primed surfaces shall be allowed to cure for not less than 24 hours (till it is cured), and no further work shall be done over the primed surface during that period.

The rate and number of applications shall be such that the priming material penetrates at least 15mm into the base course and dries to a uniform matt surface in 24 hours.

The area to be primed shall extend to the whole width of the base course, including shoulder to be covered by the wearing course, as the case may be.

During spraying of the prime coat, all elements such as culvert head walls, kerbs and the like which are liable to be disfigured by splashing of bitumen shall be protected and any such feature which is accidentally marred by bitumen shall be cleaned off with a suitable solvent or made good.

Any areas insufficiently covered by the pressure distributor shall be resprayed by spray lance to the satisfaction of the Engineer, all at the Contractor's own cost.

In the event that the prime coat has not completely penetrated into the base, the excess should be blotted with sand or single sized aggregate 4/6.

If under exceptional circumstances, traffic is to be allowed on the primed surface, the prime coat shall be covered with sand or single sized aggregate 4/6 at the rate of 6 litre/m^2 as a measure of protection, at no extra cost.

6.15 BITUMINOUS CONCRETE BASE COURSE AND WEARING COURSE

The work shall consist of constructing the asphaltic concrete base course and the asphaltic concrete wearing course, to the compacted thickness specified in the relevant Drawings. The minimum thickness of asphaltic concrete shall be 50 mm or as indicated on drawings.

6.15.1 Materials

The binder shall be straight run bitumen of 60-70 penetration grade complying with ASTM specification.

The coarse aggregates shall consist of crushed stone, crushed gravel or other stones. clean, strong, durable of fairly cubical shape, free of disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity.

The fine aggregates shall be the fraction passing 2.36 mm sieve and retained on 75 micron sieve, consisting of crusher run screenings, natural sand or mixture of both. These shall be clean, hard, durable, uncoated, dry and free from any injurious, soft or flaky pieces and organic or deleterious substances.

The filler shall be an inert material, the whole of which passes 600 micron sieve, at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be stone dust, cement, hydrated lime, fly ash or other non-plastic mineral matter approved by the Engineer.

The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to the grading specified in Table 6.4 below:

Table 6-4: Grading specifications.

Sieve	*% by weight passing*
13.2 mm	100
10 mm	70 – 50
5 mm	50 – 70
2.36 mm	35 – 50
600 micron	18 – 29
300 micron	13 – 23
150 micron	8 – 16
75 micron	4 – 10

6.15.2 Mix Design

The Contractor shall carry out trial mixes to determine the job mix formulae (grading of aggregates, proportions of bitumen and aggregates) at least one month before production of bituminous mixes are started for site placing, in order to check the reliability of the PAC production plant and to optimise mix designs.

In the case where the Contractor is not the owner of a pre-mixed asphaltic concrete plant, he shall still be responsible for his compliance with the specifications of this clause, and shall obtain all relevant data and information from his proposed supplier of bituminous concrete.

The Contractor shall submit for the approval of the Engineer full details of his proposed aggregates grading and bitumen content together with details of the mix design and results of tests carried with various bitumen contents both below and above the proposed bituminous content. Specimens at each bitumen content shall be made in triplicate.

The approved laboratory design mix shall be confirmed by full-scale plant trials using the ranges of bitumen contents used as per the previous paragraph. Thereafter the approved plant trial mix shall be termed the "*Job Standard Mix*" (JSM). Thereafter,

the Contractor shall under no circumstances modify the PAC plant setting without the written permission of the Engineer.

The actual mixes for the site placing, termed for the purposes of these specifications as "*Working Mix (WM)*" shall be at all times within the tolerances specified below, failing which the WM's will be rejected by the Engineer.

- Bitumen: 5% of the specified weight of bitumen
- Filler: 1.5% by weight of total mix
- Aggregate retained on 5.00mm B.S. Sieve: 7% by weight of total mix
- Aggregate passing 5.00mm B.S. Sieve but retained on 75 micron B.S. Sieve: 5% by weight of total mix.
- Site frequency checking of WM: 2 days on 2No. extractions
- No. of samples for Marshall Test: 6No.

6.15.3 Construction Operations

Asphaltic concrete shall be laid on clean surface and free of dust and other foreign matter.

A prime coat complying with this Specification shall be applied over the sub-base before laying asphaltic concrete.

A tack coat complying with this Specification shall be applied over the asphaltic concrete base course at least one half hour before laying of the wearing course, and only so far in advance as directed by the Engineer.

Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant may either be of batch type or continuous type, having co-ordinated set of essential units such as dryer for heating the aggregates, device for grading and batch-feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder. A paddle mixer for intimate mixing of the correct quantity of filler is also a necessary auxiliary.

The aggregates shall be thoroughly dry and fed into the mixer at a temperature of 155^0C – 163^0C. Binder shall then be added at a temperature of 150^0C – 175^0C. Provided also that at no time shall the difference in temperature between the aggregates and binder exceed 14 ^{o}C. Mixing shall continue until a homogenous mixture is obtained in which all particles of the aggregates are coated uniformly and on discharge the temperature of the mixed materials shall be 150 ^{o}C – 165 ^{o}C.

The mixture shall be transported from the mixing plant to the laying position as rapidly as possible in clean vehicles and shall be protected by covering and insulation against contamination by foreign matter or against loss of temperature.

Oiling or dusting of the interior of the vehicles to facilitate discharge is permissible but the amount of soap solution, thin lubricating oil or dust must be kept to a minimum.

The bituminous concrete shall not be laid when the receiving surface is wet or when it is raining or when the receiving surface contains water pools. The bituminous concrete shall be placed in one layer either for the base course or wearing course.

The mix shall be spread by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to specified grade, lines and cross sections. The paver shall be capable of laying to a width of 4 metres.

The screed unit shall be adjusted before laying is started in order to produce a compacted layer with the required thickness as shown on the Drawings or as directed by the Engineer. During laying, the screed unit shall be blocked, i.e. no adjustment of the thickness during laying using the so-called floating action of the screed unit shall be allowed.

The mixed material shall be supplied continuously to the machine and laid as soon as possible after delivery.

The speed of the paver shall be adjusted with the production rate of the PAC plant; and the transport frequency shall be so planned and arranged so that the paving operation is maintained as continuously as possible during the work.

The temperature of the mix at the time of laying shall be in the range of 135^0C – 163^0C. Mixes which have lower temperatures as measured in the receiving hopper of the paver, shall be rejected and the bituminous concrete so rejected shall outright be removed from the site.

Longitudinal joints and edges shall be constructed true to the delineating lines parallel to the centre line of the road. All longitudinal joints shall be offset by at least 150 mm from those in lower course while transverse joints shall be offset by at least 500mm. All joints shall be cut vertical to the full thickness of the previously laid mix and the exposed vertical surface painted with hot bitumen before placing fresh material.

When the asphalt layers are laid in half widths, the longitudinal joints between them shall be treated similarly to the transverse joints.

Cold joints shall be neatly cut away in straight lines except where they have been compacted to the required rate by means of a special equipment (lateral wheel). They shall then be painted with hot bitumen or emulsion. The Contractor shall so organize his work so as not to leave any exposed longitudinal joints at the end of any day's work.

Before opening to traffic, any new layer shall be linked up with the existing one by means of a chamfered edge with a slope not exceeding 8%. Before resuming the paving of the layer, this chamfered edge shall be cut away.

Immediately after the spreading by the paver, the asphaltic concrete shall be thoroughly compacted by rolling with a set of rollers. The initial rolling shall be with 10 – 12 tonne three wheel roller and the surface finished by final rolling with suitable pneumatic rollers. The rollers shall be capable of reversing without backlash. The wheels of the roller shall be kept moist to prevent the mix from adhering to them but in no case shall fuel lubricating oil be used for this propose. The speed of the roller shall be such as to avoid undue displacement of the mix and in any case not more than 5 km per hour. The roller operators shall be fully-trained and experienced persons.

Rolling shall commence longitudinally at the lower level and progress from the lower to the upper level parallel to the centre line of the pavement. The roller shall proceed on the fresh materials with rear or fixed wheel leading so as to minimize the pushing of the mix and each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. Rolling shall be continued till the density achieved is at least 95 % of that of the laboratory Marshall specimen and all roller marks are eliminated. The minimum rolling temperature shall be 100 ^{o}C. Rolling shall not be prolonged till racks appear. Rollers shall not remain stationery on freshly compacted surfaces, so as not to create any deformations.

Densities measured by "Troxler" apparatus shall be compared with those measured on drilled core-samples. It for two (2) consecutive working days, more than 10% of the measurements do not comply with these requirements, the works should be stopped in order to examine and improve the methods of placing and the equipment being used; remedial measures shall immediately be proposed by the Contractor for the Engineer's approval.

Deflection measurements shall be carried out for bituminous concrete courses in compliance with Sub-clause 6.13.4.

The following tolerances shall apply:

- When measured with 3 metre-long straight edge, deflection shall not be greater than 8 mm for base course and 5mm for wearing course.
- The thickness of each layer shall be checked on the sample taken for control of compaction. The tolerances shall be within the range –10% to +20% of the thickness defined on the Drawings or as directed by the Engineer.
- If for two (2) consecutive working days, more than 10% of the measurements do not comply with these requirements, the work shall be stopped in order to examine and improve the methods of work and equipment being used; if necessary any defective equipment shall be immediately replaced by the Contractor.

When the bituminous concrete is spread in areas which are not accessible to rollers, compaction shall be carried out by hot hand compactors, at temperatures between 115-130^{o}C.

Traffic may be allowed soon after completion of the final rolling when the mix has cooled down to the surrounding temperature, subject to the approval of the Engineer.

6.15.4 Tests

The materials and works of asphaltic concrete shall satisfy the test requirements specified in Table 6.5 below:

Table 6-5: Test Requirement for Material and Works of Asphaltic Concrete.

Description of Test	*Requirement*	*Frequency of Testing*
(a) Quality of binder	As stated	As required
(b) Aggregate Impact Value	30 % maximum	One test per 50 –100 m^3 of aggregate
or Los Angeles Abrasion Value	30 % maximum	ditto
(c) Flakiness Index	25 % maximum	ditto
(d) Stripping value of aggregates	25 % maximum	ditto
(e) Water absorption of aggregates	1 % maximum	ditto
(f) Loss in Sodium Sulphate Soundness Test	12 % maximum after 5 cycles	ditto
(g) Mix grading	As per job mix formulae	One set of tests on individual constituents and mixed aggregates from the dryer for each 100 tonnes of mix subject to a minimum of two sets per plant per day
(h) Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	As specified	At regular close intervals.
(i) Stability of mix	As specified	For each 100 tonnes of mix produced, a set of six (6) Marshal specimens to be prepared and tested for stability, flow value, density and void content, subject to a minimum of two sets being tested per plant per day.
(j) Binder content and graduation in the mix	As per job mix formulae	One test for each 100 tonnes of mix subject to a minimum of two tests per day per plant.
(k) Rate of spread of mixed material	To fit the asphat plant production schedule to ensure continuous operation.	Regular control through checks on the weight of mixed material and layer thickness.
(l) Density of compacted layer	As specified	One test per 500 m^2.

6.15.5 Pre-mixed Asphaltic Concrete (PAC) Plant

While it is recognized that the PAC plants in Mauritius differ from owner to owner, yet for the purposes of these specifications, certain requirements in respect of the PAC plant have been specified, especially with regards to the control of the JSM.

The nominal capacity of the asphalt plant shall be within the range of 50-80 tonnes per hour on the basis of a 3% moisture content of aggregates.

A written commitment is required from the Contractor and/or the owner of the PAC plant that there shall always be sufficiently large stockpiles of all required sizes of aggregates at all times to ensure satisfactory supply to the site as and when required.

The PAC plant shall either of the batch type or the continuous type, with the following features:

(i) Sufficient capacity of the storage tank to ensure reliably supply with due allowance for delays in delivery.

(ii) The appropriate type of aggregate storage bins and their protection from contamination.

(iii) Control devices such as gauges, thermometers, mechanical/electrical/luminous/ resonant/control switches and alarms, timers, dryer for heating of aggregates, device for grading and batching – feed by weight or volume of the required quantities of aggregates, binder heating and control unit for the metering of the correct quantity of binder, paddle mixer for thorough mixing of the correct quality of filler etc.

(iv) Quality control with respect to specified tolerances to the JSM.

(v) Operation and maintenance system, working condition, skill of operating staff and labour force.

(vi) Tests available.

6.16 TACK COAT

The work shall consist of application of a coat of low viscosity liquid bituminous material to Asphaltic Concrete Base Course surface as preparation to laying of wearing course.

6.16.1 Material

Liquid asphalt for tack coat shall be rapid curing type cut back grade RC-250 conforming to ASTM or emulsified asphalt (SS-1) as directed by the Engineer. The quantity shall be 5 kg per 10 m^2 area.

6.16.2 Construction Operations

Immediately before the spreading of the liquid bitumen, the surface shall be thoroughly swept and scraped clean of dust, mud, clods of clay, cohesionless materials and other extraneous materials, with rotating brooms or other approved equipment accompanied by handsweeping. The surface to be treated shall be dry.

Bitumen shall be heated to the temperature appropriate to the grade of the bitumen used and as approved by the Engineer. The bitumen shall be sprayed uniformly at the rate specified at Sub-clause 6.13.1 above, preferably by pressure sprayers.

The tack coat shall be applied just ahead of the oncoming Asphaltic Concrete wearing course.

6.17 ROAD MARKINGS

6.17.1 General

Markings in road shall be accurately set out laid in accordance the requirements and standards of the Ministry of Public Infrastructure, Land Transport & Shipping, the Traffic Management and Road Safety Unit and/or as directed the Engineer.

6.17.2 Materials

Marking paint shall be of approved sprayable road markings reflectorised thermoplastic paint, complying in all respects with the values laid down in the BS Specifications for Hot applied thermoplastic road marking materials BS EN 1871 and BS EN 1824.

- The reflectorised thermoplastic paint to be used for road markings shall comply with the following requirements:

- The AGGREGATE shall consist of a mixture of light coloured silica sand and crushed calcite.
- The PIGMENT shall be titanium dioxide complying with BS EN ISO591-1 type A (Anatase) or type B (Rutile).
- The EXTENDER shall be whiting (calcium Carbonate) complying with BS 1795.
- The BINDER shall be synthetic hydrocarbon resin, plasticised with mineral oil.
- The BALLOTINI incorporated shall be made from soda glass all of which passes a 1.70 minimum sieve, and not more than 10 % passes a 425 micron sieve. Not less than 80 % shall be transparent, reasonably spherical and free from flaws.

6.17.3 Composition

The constituents shall comply with the Table 6.6 below:

Table 6-6: Composition of Road Marking Constituents.

Constituent	*Min %*	*Max %*
Binder	18	22
Pigment	10	–
Pigment and Extender	18	22
Ballotini	10	–

A further 10 % of ballotini shall be normally surface applied by pressure application.

6.17.4 Grading of Total Solids

On analysis, the grading of the combined aggregate, pigment extender and ballotini, shall comply with Table 6.7 below:

Table 6-7: Grading of Total Solids.

Sieve	*% by weight passing*
2.80 mm	100
600 micron	75 – 95

6.17.5 Containers

Material shall be supplied in plastic bags, each containing 25 kg net.

Marking: Each bag shall be clearly marked as follows:

(a) Manufacturer's name & place

(b) Batch Number

(c) Date of Manufacture

(d) BS EN 1871 and BS EN 1824

(e) Binder - Synthetic Hydrocarbon Resin

(f) Maximum safe heating temperature – 240°C.

6.17.6 Reflectorisation

If specified by the Engineer, ballotini dispensed onto the surface of the marking shall be made of soda glass and should conform to the grading indicated in Table 6.8 below:

Table 6-8: Grading of Ballotini.

Sieve	*% by weight passing*
1.70 mm	100
600 micron	85 – 100
425 micron	45 –100
300 micron	10 – 45
212 micron	0 – 20
75 micron	0 – 5

Not less than 80 % by mass shall be transparent, reasonably spherical and free from flaws.

The material shall comply with the accepted results of tests for Softening Point, Luminance, Flow Resistance, Heat Stability, Skid Resistance, High Temperature Softening etc. as laid down in the BS Codes.

Paint shall only be applied at a covering rate recommended by the manufacturer and approved by the Engineer. The paint film shall have a minimum thickness of 0.4 mm. Paint work for lines shall be applied mechanically.

Markings shall be free from raggedness at their edges and shall be uniform and free from streaks.

6.17.7 Painting Operations

The Contractor shall set out the markings and obtain the Engineer's and TMRSU's approval before commencing painting.

The setting out of lines and symbols shall be made by the Contractor according to Typical Drawings. For junctions and roundabouts, the contractor shall submit to the Engineer for approval relevant working drawings at least fifteen (15) days before the start of works on site.

Prior to application, the road surface shall be thoroughly cleaned of dust, dirt and all loose material strictly as per BS EN 1824 . Painting on wet surface will not be allowed by the Engineer or his Representative under any circumstances.

The application of paint shall preferably be done by a purposely-made machine. All applications shall strictly adhere to these specifications.

The spraying rate for cold paint will vary with the roughness of the surface but shall be such as to give continuous coverage. Immediately after application of the cold paint, ballotinis shall be spread on top.

The minimum dry film thickness and the rate of ballotinis shall be in accordance with the manufacturer's instructions or as specified in Sub-clauses 6.13.2 to 6.17.6 above. The guarantee period of all road-marking products shall be at least twelve months.

Warning signs shall be erected when painting is in progress and traffic shall not be allowed to pass over wet paint. Any painting disfigured by traffic, or any painting not to the satisfaction of the Engineer, shall be wiped out and repainted at the Contractor's expense.

6.17.8 Road Studs

The materials have been specified at Sub-clause 2.22.2 at Section 2 of these Specifications, "*Materials and Workmanship*".

Road Studs shall be fixed in accordance with BS EN 1463 and the manufacturer's instructions for use, according to the paint centerline pattern.

The different colours of road studs to be installed shall be in accordance with the requirements of the relevant Authorities such as the RDA and TMRSU, or the DC as the case may be.

6.18 TRAFFIC SIGNS AND OTHER FEATURES

6.18.1 Signs and Posts

All traffic signs shall be of Diamond Grade and shall comply with GN 154 of 1990 and BS EN 12899 -"*Fixed , Vertical road traffic signs*". Height or diameters of signs are given on typical Drawing. The Engineer shall specify locations of traffic signs.

Note: *All dimensions of road signs and their respective locations shall be approved by TMRSU before any permanent or temporary fixing on site.*

The sign plates shall be manufactured from Aluminum alloy sheets of minimum 11 gauge i.e. 3mm thickness. The sign plates shall moreover be stiffened by means of 15mm flanges on all edges. Materials for fixing such as brackets, sockets, bolts and nuts caps, screens, clips, nuts and wasters shall be to the Engineer's approval. Brass or copper shall not be used if they are to be in contact with Aluminium.

All posts shall receive one coat of rust protective primer before being erected and fixed in foundations. Rust inhibitive paints shall comply with BS 2523: Lead Based Priming Paints.

When the sign has been assembled, the complete sign including the post, shall receive one coat of rust protective primer as specified followed by two coats of grey paint of an approved manufacture.

The foundation of sign posts shall be Class 25 concrete, with a minimum volume of 0.25 m^3 and/or as given in the relevant drawings. The post shall be surrounded at sides and bottom by a minimum of 150 mm of concrete. The top of the foundation shall be set to the design level with an allowable tolerance of 2 cm.

The reflective sheeting used on road signs shall consist of spherical lens elements embedded within a transparent plastic having a smooth, flat outer surface with a protected pre-coated adhesive which shall be pressure sensitive for manual application or tack free heat activated for mechanical vacuum-heat application.

The reflective sheeting shall be sufficiently flexible so as to permit application over and conformance to a moderate embossed surface. It shall show no damage when bent 90^o over a 50 mm diameter mandrill.

The sheeting shall be solvent resistant so as to be capable of withstanding cleaning with petrol, diesel, fuel, mineral spirits, turpentine and methanol.

The sheet shall show no cracking or reduction in reflectorisation after being subjected to the dropping of a 25 mm diameter steel ball from a height of 2 metres onto its surface.

The contractor shall ensure that the adhesive he proposes to use shall permit the reflective sheeting to adhere securely within 48 hours after application at temperature of up to 95^0C.

The reflective material shall be weather-resistant and following cleaning shall show no definite fading, darkening, cracking, blistering or peeling and not less than 75% of the specified wet or dry minimum brightness values when exposed to accelerated weathering for 2 years, in accordance with an approved testing procedure.

6.18.2 Guard Rails

Guard rails complying with BS 6779, shall be installed as shown on the relevant Drawings or as directed by the Engineer. The guard-rail holding posts shall be spaced at an interval of about 4 metres, and they shall be plumbed. The top of the post shall be set to the design level within an allowable tolerance of 2cm.

6.18.3 Pedestrian Hand-Rails

Pedestrian hand-rails complying with BS 7818, shall be provided as shown on the relevant drawings. Individual hand-rail sections shall take into account the horizontal and vertical alignment of the ground where the hand-railing is to be located; provision should be made for changes in direction of the hand-railing at road junctions.

Support posts for the hand-rail sections shall be fixed in the ground as shown on the Drawings.

6.18.4 Bollards and Milestones

Milestones and bollards shall be of the precast type, manufactured with Class 25 concrete to the dimensions shown in the Drawings or as directed by the Engineer and shall in all respects comply with the requirements of Clause 5.37 entitled " *Precast Concrete*" at Section 5. They shall be embedded in Class 15 concrete.

Bollards shall be painted and milestones lettered and painted as directed by the Engineer.

6.18.5 Traffic Signal Equipment

Should any traffic signal equipment be required to be supplied and installed under the contract, it shall be as per the specifications of the Traffic Management and Road Safety Unit.

6.19 ROADS KERBS

The work shall comprise of laying smooth formed finished precast units of kerbs in a cement concrete bedding as shown in the drawing. Kerbs shall be laid to the alignment and levels shown in the Drawings and/or as directed by the Engineer.

6.19.1 Precast Kerb Units

The precast concrete kerbs shall be cast and installed in accordance with specifications of precast concrete work. The kerbs shall be as per details shown in the Drawings. They shall be laid and embedded in a layer of mortar of minimum thickness 10mm on a Class 15 concrete foundation and backed by Class 15 concrete. All precast kerbs shall be butt jointed and all joints shall be mortared. For radii of 12 metres or less, kerbs of appropriate radii shall be used.

6.19.2 Bedding and Haunching

Concrete of Class 15 shall be used as bedding and haunching of the kerbs. The concrete shall be laid, after necessary earthwork (cleaning, trimming and compaction), to the dimensions and as directed by the Engineer.

6.19.3 Laying

Precast kerbs shall be laid over the bedding with cement, sand mortar of 1:4 proportions over the cement concrete bedding as shown in the Drawings and as per the direction of the Engineer. Joints of kerbs shall be neatly pointed with cement mortar (1:4) without spilling over of mortar in the adjacent members. Any unit of kerbs deviating more than 3mm in 3 metres from line and level shall be considered as being unacceptable, and shall be made good by removing and replacing.

6.19.4 Laying Kerbs at Curves

Where kerbs are to be laid on curves, the Contractor shall cast in-situ kerbs for full length of curves of small radii and between the gaps of precast kerbs laid along the curves of greater radii as and where approved by the Engineer.

6.19.5 In-Situ Kerbs

Kerbs placed in-situ shall be provided with regular sides, edges, arises and chamfers, and finished to a surface free from blowholes, and shall be impervious. The top of the kerbs shall be regular and in line without one protruding over the other.

The horizontal alignment shall not deviate from that shown on the Drawings by more than 3mm in 3 metres.

Concrete used for in-situ kerbs shall comply with the relevant clauses of Section 5 "*Concrete*" of these Specifications and shall be Class 30.

The exposed surfaces of kerbs shall be cured by treating with an approved aluminized curing compound immediately after laying. Other methods of curing may also be proposed by the Contractor for approval by the Engineer.

In-situ kerbs shall remain firmly secure on the surface on which they are laid and shall be cast at least one week prior to the laying of the layer they are to contain. They shall be cut and moulded whilst green to form expansion and contraction joints. The joints shall then be filled.

6.20 PLACING OF TOP SOIL, GRASSING AND LANDSCAPING

After completion of bituminous surfacing or as instructed by the Engineer/ Landscaping Architect, the verges, central median areas, green spaces and the slopes of cuttings and embankments shall be planted with indigenous grass suitable for this particular use with the plant springs of grass being placed at approximately 15cm centres and any other plants as per the landscaping plans.

Topsoil shall be obtained from material resulting from site clearance or from spoil tips or from natural ground in close proximity to the works. It shall be lightly compacted, to offer a smooth surface to the grass planting as per the requirements of the Engineer/ Landscaping Architect. Planting shall preferably be carried out at the beginning of a rainy season, but where this is not possible, the grass and other plants shall be watered at regular intervals. Any dried grass area of plants shall be replanted by the Contractor at no extra cost.

Landscaping shall be made by means of loose boulders, decorative bushes and trees, all as directed by the Engineer/ Landscaping Architect or his representative. The bushes and trees shall be supplied and planted by specialists sub-contractors, approved by the Engineer/ Landscaping Architect or his representative.

6.21 ADDITIONAL SPECIFICATIONS AND CONDITIONS APPLICABLE TO RDA CLASSIFIED ROADS

Over and above the requirements of the preceding Clauses pertaining to Road Works, the Contractor shall pay special attention and shall abide strictly to the additional specifications and conditions of RDA, which shall become applicable to works being carried out within and along RDA classified roads.

6.22 ADDITIONAL SPECIFICATIONS AND CONDITIONS APPLICABLE TO ROADS AND STREETS UNDER THE JURISDICTION OF DISTRICT OR MUNICIPAL COUNCIL

Over and above the requirements of the preceding Clauses pertaining to Road Works, the Contractor shall pay special attention and shall abide strictly to the additional specifications and conditions of the District or Municipal Council, which shall become applicable to works being carried out within and along roads falling under the jurisdiction of the District or Municipal.

6.23 ROAD LIGHTING

Note:

(i) In this Section, where not specifically indicated the word "Contractor" shall likewise mean the "electrical sub-contractor" and vice versa.

The Contractor's electrical sub-contractor shall be duly named by the Contractor in the latter's tender submission.

6.23.1 Scope of Work

The scope of road lighting works to be carried out under this Contract shall include the design, manufacture, works tests, supply, delivery to site, erection, cabling and connections, including earthing, testing and commissioning of the following components forming the complete Road Lighting System:

- Lighting Columns,
- Cabling Works (to be read in conjunction Section 8)
- Luminaires,
- Electrical Distribution Panels
- Control Equipment
- Complete with all accessories.

The cabling from the nearest CEB power source to the lighting control cabinets, voltage controllers/regulators and final connections to the lighting bulbs on the lamp-posts shall also be carried out under this Contract.

The Contractor will also be responsible for the construction and installation of all necessary civil works associated with the road lighting system, for which relevant items in the Bill of Quantities have been provided for pricing by the Contractor.

The Contractor is advised to have recourse to an electrical sub-contractor for the design, importation, installation, construction and commissioning of the road lighting system being described and specified in this Section.

6.23.2 Design Parameters

The Contractor and/or his electrical subcontractor shall check the designs of the Road Lighting System described above based on the characteristics of the light bulbs to be supplied, and generally to achieve a uniform illumination. Point by point light levels should be calculated by using an internationally recognized computer software (ex. Dialux) and submitted by the Contractor. The lighting levels must conform to the requirements of EN 13201-2 Class ME3a and the design shall meet lighting characteristics as per Table 6.9 below, if and where applicable.

Table 6-9: Lighting Characteristics

Maintained Average Illuminance L (cd/m^2)	*Overall Uniformity Ratio U_o*	*Longitudinal Uniformity Ratio U_L*
1.0	> 0.4	> 0.7

6.23.3 Electrical Installation Design, Standard and Statutory Provisions

The bidder shall check the complete design of the Road Lighting System described above based on the characteristics of the light bulbs to be supplied, and generally to achieve a uniform illumination. In this respect computer based calculations on point by point light levels shall be submitted by the Contractor.

The applicable standards to which the road electrical system shall be designed shall be , but not limited to, according to the list of standards given below:

(i) The latest edition of the Mauritian Code of Practice MS63:1995

(ii) The latest edition of the Institution of Electrical Engineers Wiring Regulations

(iii) The latest edition of the relevant British Standards regarding Requirements for the Electrical installations and Codes of Practice

(iv) The latest edition of the relevant International Electrotechnical Commission publication

(v) The relevant statutory provisions and requirements of the Government of Mauritius

(vi) The latest relevant applicable European Standards

(vii) The standards and specifications of the Central Electricity Board

Note: *Any discrepancy or conflicting items or statements between the foregoing applicable standards shall be immediately brought to the attention of the Engineer for review, and appropriate instructions will then be issued by him to the bidder*.

Moreover, the installation shall be carried out in accordance with the Institution of Electrical Engineers Regulations for the Electrical Equipment of Buildings and relevant British Standards or I.E.C. Codes of Practice and shall also comply where applicable with such provisions, rules, regulations and standards practice of the Central Electricity Board (CEB) or any other statutory regulations which are in force at the time of tendering.

The Contractor shall submit shop drawings duly signed and approved by a Registered Electrical Engineer; prior to placing of order the Registered Electrical Engineer shall obtain the statutory approval of the CEB. It will be the Contractor's responsibility to obtain all the necessary approvals and clearances from the relevant statutory bodies such as the Central Electricity Board or District/ Municipal Council, for the approval of the design drawings and the actual works at completion.

6.23.4 Voltage

The incoming supply will be provided by the CEB at 400/230 volt, 4-wire 50Hz with the neutral solidly earthed. The Contractor or his Electrical sub-contractor shall liaise with the CEB for ascertaining the supply characteristics and the supply points of the CEB. The contractor or his electrical sub-contractor shall carry out all the necessary connection and cablings between the CEB power points to the power points of the project building and/or infrastructure. No claim whatsoever will be entertained from the Contractor with regards to the above obligation on the Contractor's part.

Note: *For the electrical works associated with the road lighting refer to Section 8 " Electrical works".*

6.23.5 Materials and Workmanship

Wherever any particular manufacturing or supply firm, proprietary article, trade name or manufacturer's catalogue number is specified, such documentation shall be construed as an indication of the class and quality of materials, performance and workmanship required. The Contractor shall be at liberty to obtain such goods and/or services from any other supply source provided the workmanship is of acceptable quality and subject to the Engineer's approval in writing before ordering or manufacture is commenced. Three copies of all orders for items of plant, equipment and materials placed with suppliers shall be provided for the Engineer at the time of placing the order.

The whole of the equipment supplied shall be of the best modern design and a high class durable finish suitable for installation in tropical climates and particularly in Mauritius. The Contractor shall be responsible for ensuring that the components of each system are mutually compatible and integrated to form fully efficient systems complying with the drawings, the present Specifications and the statutory regulations in force. No claim whatsoever will be entertained in respect of the above.

All materials and equipment used shall be to the satisfaction of the Engineer and shall be of a high standard, robust, dust and moisture proof, and vandal proof and shall be designed and manufactured and fixed in accordance with the requirements of Sub-clause 6.23.3. The Contractor shall ensure a high quality of work using the best available materials.

All materials and equipment required for the Contract shall be supplied through a local agent who shall also ensure the availability of spare parts for a period of at least three (3) years. All relevant information concerning the source of local supply shall be furnished by the Contractor at the tender stage, together with the relevant certificates and undertakings.

All articles and materials specified to conform to International Electrotechnical Commission Recommendations and British Standards shall be indelibly marked and stamped with the Standards number specified and other details required by the regulations. Where such marking is proved to be impracticable, the relevant advice/delivery notes shall include the Standard number with which they are to comply.

The Contractor shall be required to maintain a competent electrical supervising Registered Engineer throughout the whole time the electrical installations are progressing on site. The Contractor shall seek the approval of the Engineer prior to the appointment of the electrical engineer and shall have the authority to withdraw this approval at any time. His CV should be submitted for approval at least fifteen (15) days before the installation works start on site.

On account of the accident hazards associated with electrical works, no person shall be allowed to execute any type of work which is normally carried out by a skilled tradesman unless he has been proved to be thoroughly experienced and proficient in the trade concerned. The Engineer shall have the option to require any tradesman to demonstrate such experience and proficiency to his satisfaction, prior to his being accepted to work on the site.

All notices, signs, labels and use instructions to be displayed on the manufactured goods and products in accordance with the drawings or the Specifications including all maintenance and operating instructions on plant and equipment shall be exclusively in English. In the event that any other language should also be used in conjunction with the English language, the Contractor shall do the necessary without any additional cost.

6.23.6 Tender Drawings

The Contractor or his electrical sub-contractor shall not modify or alter in any way the Tender Drawings, and he shall adhere to the dimensions given on these drawings, as far as is practically possible. However, the Contractor shall submit other alternative proposals as a Separate Memorandum accompanying his tender with any adjustment in price. Such alternatives shall be duly considered by the Engineer and/or Client/Employer who shall thereafter obtain any further technical clarifications or additional information from the contractor.

Civil works drawings are included in the Drawings Register to give information of layouts and general areas where street lighting is provided.

The following documents shall be submitted with the contractor's bid to enable his capability to be assessed:

(i) The proposed road lighting layout showing the locations and final quantities of poles on site, complete with design calculations where applicable.

(ii) Past experience of the firm. Over the last five (5) years for similar works – indicating name, location, Client, time of execution and costs of projects undertaken.

(iii) Design Calculations certifying that that the proposed poles are designed to withstand cyclonic conditions of 300Km/hr

(iv) All relevant technical literature of electrical accessories, poles, lamps, cables, electrical distribution panels etc in the form of brochures, photographs etc, including their country of origin.

(v) C.V of the staff proposed to be deployed to the electrical installation works, specially the supervising engineer and the foremen.

(vi) Any Separate Memorandum for any alternative proposal. In this respect, please note that alternative proposals will only be considered if the conforming bid is found to be in order.

(vii) Clear indications of the schedule of delivery of all materials and the site installation periods.

6.23.7 Working Drawings

The Contractor or his electrical sub-contractor shall submit general arrangement of lighting poles and detailed drawings of all equipment and manufactured items. These drawings shall show dimensions and design sizes of all equipment, columns and fittings (inclusive of luminaires).

Towards this end, the Contractor or his electrical sub-contractor shall supply to the Engineer at least twenty-one (21) days before start of works on site, three copies of all drawings, including associated electrical cabling diagrams for comment and approval by the Engineer.

The acceptance by the Engineer of any such drawings shall not relieve the Contractor or his electrical sub-contractor of his obligations under the Contract; the Engineer shall at no time be liable for any mistake of the manufacturer's deficiencies, and any shortcomings and departure from the Specifications.

The Engineer reserves the right to effect amendments and/or additions to the details of the working drawings as may be deemed necessary, at any time during the contract, if such amendments/additions are deemed to improve the overall installation system.

The Contractor or his electrical sub-contractor shall be responsible to obtain the necessary approval of the electrical cabling diagrams from the CEB or District/ Municipal Council as the case may be before works start on site. No such works will be allowed to start without the written approval from the CEB or District/ Municipal Council. The Contractor or his electrical sub-contractor shall duly allow for this lead time in his Programme of Works, and no additional contract time will be allowed for any delay arising therefrom.

6.23.8 As-Built Drawings and Operation and Maintenance Manuals

As soon as the works are complete and all tests have been satisfactorily carried out, the Contractor or electrical sub-contractor shall submit to the Engineer within fifteen (15) days of completion of works three sets of electrical record drawings, showing the works as finally installed.

Similarly three (3No) sets of Operation and Maintenance Manuals shall be provided by the Contractor or his additional sub-contractor within a period of three (3) weeks after completion of works.

6.23.9 Inspections and Tests at Manufacturer's Premises

The Engineer, or his duly authorised representative, shall have access to the Contractor's or electrical sub-contractor's or the manufacturer's premises to inspect and examine the materials and workmanship of the lighting system and equipment during their manufacture. The Contractor or his electrical sub-contractor shall be responsible for the supply to the Engineer of all necessary authorizations. Such inspection, examination or testing, if made, shall not relieve the Contractor from any of his obligations under the Contract.

All works, materials or equipment, when rejected shall be corrected or replaced as the case may be at the Contractor's expense, and to the satisfaction of the Engineer.

6.23.10 Testing and Commissioning on Site

Upon completion of the site installation or part of the site installation, the Contractor or his electrical sub-contractor shall carry out the testing and commissioning of the entire lighting system, equipment and integral systems, in stages if so required, to ensure that it is in proper working order and capable of performing all its functions, in accordance with the Specifications and Regulations to the satisfaction of the Engineer. The commissioning tests shall include 24-hour per day burn test of three (3) days duration. Any item of equipment or plant or apparatus damaged during commissioning shall be replaced by the Contractor at his own expense and the lighting system, equipment or system concerned shall be re-tested and commissioned. No instruction or action of the Engineer shall relieve the Contractor of this obligation.

The Contractor or his electrical sub-contractor shall provide the necessary power supply or generator, skilled labour, supervision, apparatus, and instruments required for commissioning and testing of the system.

The following tests shall be carried out on all electrical installation as per the IEE Wiring Regulations, prior to energizing the street lighting network in the following sequence: -

a) Continuity of protective conductors, main and supplementary bonding;

b) Continuity of final circuit conductors;

c) Insultation resistance;

d) Site applied insulation;

e) Protection by separation of circuits;

f) Polarity;

g) Earth electrode resistance.

The following tests shall be carried out after the street lighting network has been energized and polarity re-checked: -

a) Prospective fault current;

b) Earth fault loop impedance;

c) Residual current operating devices.

After successful completion of such commissioning, the Contractor shall furnish to the Engineer six (6) copies of certificates of all tests performed and accepted, signed by the Contractor, or an authorised person acting on his behalf, as prescribed in the appropriate Regulations and Specifications. If any part of the lighting system or equipment fails to pass the specified tests, further tests shall be repeated, until successful testing. Acceptance shall not in any way relieve the Contractor of his responsibility for the performance of the plant or equipment after erection as a complete working system in all respects.

The Contractor's attention or that of his electrical sub-contractor is drawn that such testing and commissioning shall be carried out in the presence of the CEB and/or District/Municipal Council; the testing and commissioning shall then be approved in writing by the CEB and/or District/Municipal Council. For this purpose, the Contractor should do the necessary liaison with the relevant Authorities to ensure the witnessing of the testing and commissioning by the representatives of these Authorities. The acceptance will be deemed to be complete only after receipt of such approval/clearance from the CEB and/or District/Municipal Council.

6.23.11 Guarantee and/or Defects Liability

The Contractor's attention is drawn to the fact that the main contract does not make provision for staged taking-over of the works. However, certain sections or components of the works will inevitably have to be commissioned and operated prior to the contract completion date; such components include the road-lighting systems. Due allowance should therefore be made by the Contractor for running costs and maintenance costs of these sections and components for the length of time from the commissioning stage to the end of the contract period. Such costs shall be allowed by the Contractor and spread over the bill items; no extra payment will be made. In case the road-lighting component is sub-contracted, the sub-contractor shall liaise with the main contractor to assess his programme of works in order to determine the magnitude of this running and maintenance cost liability. Furthermore, the full responsibility for the security of those works shall remain with the main Contractor with regards to any theft, vandal and accident damage, up to the time of taking-over of the main contract.

The Contractor shall guarantee all work (including lamp, lamp posts and ballasts) for a period of twelve (12) months after the issue of the Taking-Over Certificate by the Engineer. In the event of a defect arising within this period, which in the opinion of

the Engineer is due to faulty workmanship or materials, the Contractor shall, at his own expense, make good such defects where instructed to do so by the Engineer.

The repairs shall be carried out within forty-eight (48) hours of demand from the Engineer or the Client. The Contractor shall provide the required spare parts to replace the faulty part at his own expense, for the whole duration of the Defects Notification Period.

In this process the electrical sub-contractor and the Contractor shall liaise with each other as the case may require.

6.23.12 Spare Parts and Routine Maintenance

(i) Spare Parts

The Contractor shall submit a list of recommended spare parts covering a period of three (3) years for all the lighting system supplied under this Contract.

This list shall be priced individually as indicated in the Bill of Quantities. The Employer shall not be obliged to purchase all the recommended spares. Only those spares which the Engineer deems to be necessary shall be supplied by the Contractor and paid for after written instructions are given by the Engineer. This priced list of spare parts will not be accounted for in the tender evaluation, if so judged necessary by the Engineer.

(ii) Routine Maintenance

The contractor or his electrical sub-contractor shall insert in the appropriate Bill item a cost for routine inspection and maintenance of the entire lighting system installed through this contract. This cost shall be paid as a monthly lump sum and shall stay fixed for a period of three (3) years following the taking-over of the Works.

The Bill item has been indicated to be Provisional. It shall therefore be utilised only under instruction from the Engineer and may become payable by the Contractor directly to the relevant Statutory Authority, with the associated "*on-cost*" to the Contractor.

6.23.13 Road Lighting Columns

The road lighting columns shall be of the octagonal tapered type and be manufactured from only one piece of sheet steel of appropriate thickness. The columns and single and twin brackets shall have a high quality hot-dipped galvanised finish with the zinc coating being at least 550 g/m^2, and giving protection both inside and outside the columns.

Note: *The Contractor (or his electrical sub-contractor) may provide alternative for the road lighting columns, after conforming with the specified ones. Appropriate costs shall also be supplied.*

The galvanising process shall comply with the relevant British Standard, namely BS EN ISO 1461 or the equivalent Mauritius Standard, if any.An original certificate from the manufacturer with regards to the galvanization of the columns shall be submitted by the Contractor upon request by the Engineer.

The columns shall comply with BS 5649 and BS EN 40, with single or double outreach shall be a nominal height of six (6) metres or other heights as specified elsewhere. Columns will be generally located at a minimum interval of 20 metres except where otherwise specified in the tender documents. Alternatively, columns may also generally be located at the boundaries of the plot of land (or at a maximum distance of 2 metres from the said boundaries) while respecting any minimum interval which may be imposed by any statutory Authority including the CEB. All columns shall be provided with a flanged base plate surface mounted on a concrete column base using galvanised anchored bolts. The minimum dimension of the column at the base shall be 250mm.

An access opening/inspection door complete with a cover plate shall be situated at a 2.0m height along the column or as approved by the Authorities. However, the inspection door shall be on the lee side of the column after installation and erection.

The columns and brackets shall be capable of supporting single or twin side entry luminaires with integral control gear; the poles complete with lanterns shall be designed so as to be capable of withstanding a wind velocity and cyclonic gusts of 83.33m/s (300 km/hr). A written guarantee shall be submitted while tendering, or upon request by the Engineer; same shall be certified by the poles' manufacturer at the time of order. The Contractor or his electrical sub-contractor shall provide detailed calculations to show the wind withstand capacity of the poles and lanterns.

The single and twin brackets shall be securely fixed to the column to prevent rotation. The brackets shall give a maximum outreach to the centre of Lantern not exceeding 1.5 m and shall give a Lantern inclination of 5 to 15 degrees above the horizontal, all in accordance with the manufacturer's recommendation in order to achieve the best illumination and uniformity and intensity as a function of the area to be covered by the illumination.

Hot-dipped galvanized anchor bolts and nuts (with two nuts per bolt) shall be supplied and installed in previously cast foundation; the Contractor shall undertake the foundation works. The electrical sub-contractor will be required to place anchor bolts in box outs in these foundations and concrete the bolts into the foundation, all under the supervision of the Contractor.

For identification and maintenance purposes, all masts and columns shall be numbered in figures 70mm high using black figures on a white background minimum 30mm all round the number on an aluminium plate. The numbering shall be proposed by the Contractor and approved by the Engineer.

The concrete foundation shall be constructed by the main contractor with a box out for insertion and final concreting of anchor bolts. After the pole has been plumbed, all the space below the base and bolts shall be grouted with cement mortar. PVC sleeves 80mm diameter or bigger as indicated by the Engineer or on drawings, and

large radius bends shall be embedded into the stub for the cable entrance into column.

6.23.14 Road lighting Luminaires

The luminaires shall be minimum IP 66, IK 08 and be of Class II and shall comply to BS EN 60598-2-22 or IEC 598 - 2-3 No.2.

The luminaires shall be of the totally enclosed type of robust construction, weatherproof and dust proof, manufactured from aluminium alloy or polycarbonate and tempered glass as appropriate. Reflectors shall be of the wide-beam version (ext.) and be in highly reflective anodized aluminium.

The luminaires shall be of neat appearance presenting minimum windage area, designed for side entry mounting. The spigot mounting shall incorporate a locking device to prevent rotation or displacement under the wind conditions specified in Sub-section 6.21.13 above.

All luminaires shall be supplied with factory mounted LED drivers with one step auto dimming for additional energy savings (up to 50%), similar to Philips Lumistep or equivalent.

The Contractor or his electrical sub-contractor shall, one month before the ordering of the luminaries, supply to the Engineer all the relevant technical specifications for approval.

6.23.15 LED Lamps

Lamps shall be similar or equivalent to Philips LEDGINE 2.0 with optimized spacing and efficiency up to 95 lm/W. The LED lamps shall have an average rated life of 80,000 hrs with 70% lumen maintenance.

6.23.16 Fused Cut-out Units

A totally enclosed insulated 5/6 amp SP & N MCB (Type C, 4.5 KA) shall be provided in the base compartment of each 6-metre single arm column and two 5/6 amp SP + N MCB for twin arm 6-metre columns to BS EN 60947-3.

A totally enclosed insulated 4A SP + N MCB (Type C, 4.5KA) shall be provided in the base compartment of each single arm column and two 4A SP + N MCB for twin arm 6-metre columns to BS EN 60947-3.

The Contractor shall provide all internal column wiring between luminaire control gear and fused cut out with three-core 1.5mm² flexible cable or such cable size to maintain an acceptable voltage drop as per Contractor's Design.

The column earth conductor shall be efficiently bonded to the armouring of the incoming cable and to the common earthing cable. All wiring connections with columns shall be made inside the column and not underground.

6.23.17 Road Lighting Cables and Wires

The contractor is referred to Section 8 - "*Electrical Works*" which provides specifications in respect of:

- Site lighting cables and wires
- Earthing
- Electrical controls
- Control cabinet and equipment
- Transformer/regulator and control equipment

6.23.18 Street Lighting Bollards

Street lighting bollards where specified shall be provided with LED lamp 4000K rated. The luminaires shall be minimum IP66. The bollards shall be manufactured from die-cast aluminium and shall be 800mm to 1200mm high.

The contractor shall provide all technical details and samples for approval by the Engineer's Representative and the Client prior to placing any order.

6.24 INTERACTION BETWEEN MAIN CONTRACTOR AND ELECTRICAL SUB-CONTRACTOR

6.24.1 Trenching and Backfilling of Trenches

The trenching and backfilling operations shall be carried out by the main contractor.

However, immediately after appointment, the electrical sub-contractor shall start liaison with the main contractor to obtain all necessary information in the form of drawings to locate services and positioning of road lighting fixtures and programme of works to determine when the electrical sub-contractor will intervene for his tasks.

In this respect, the electrical sub-contractor shall send his representative to attend the site meetings with the Client/Employer, the Engineer and the main contractor.

6.24.2 Concrete Bases for Lighting Poles

The foundation shall be designed by the Contractor and submitted to the Engineer, to comply with the structure requirements due to a wind load of 300 km/h, for installation in both fill and cut areas . The construction and casting of concrete bases for the lighting poles, ducts, up-stands etc. shall be carried out by the main contractor.

However, the electrical sub-contractor shall liaise with the main contractor as to the sequence of events for the road lighting cable laying, ducts and passage holes to be left in the concrete bases, their required number etc.

6.24.3 Construction of Service Cable Pillars

The service cable pillars (SCP) shall be constructed by the main contractor.

The electrical sub-contractor shall, however, be responsible for liaison with the main contractor for the provision of the necessary openings (locations, dimensions, sizes etc) and connection points inside the SCP's.

6.24.4 PVC Pipes

All ductings in the form of PVC pipes shall be provided by the main contractor, who shall also be responsible for the laying thereof as per drawings, inclusive of placing of galvanized or nylon draw wires. For these tasks, he will liaise at all times with the Electrical sub-contractor.

Note: *PVC pipes for street lighting shall be of the yellow high pressure type and to the appropriate BS.*

6.24.5 Warning Tapes Between Columns

The electrical contractor shall liaise with the main contractor to ensure that the necessary warning tapes are provided in the trenches between columns.

6.24.6 Fixing of Anchor Bolts for Columns

The electrical sub-contractor shall supply the necessary anchor bolts for the fixing of the road lighting columns.

However, these bolts shall be remitted by him to the main contractor for fixing into the concrete column bases while they are being cast by the latter. The electrical sub-contractor shall liaise accordingly at the main contractor.

6.24.7 Street Lighting Distribution Boards

The construction and workmanship of the switchboard from both a technical and aesthetic point of view must be of a very high standard. Water tightness and treatment of metallic envelopes against corrosion shall be a prime consideration.

Switchboards sides are to be clad with 2mm sheet steel, folded, dished, allowing increased IP protection by gasketing. Dimensions shall be standard and construction modular. The switchboards shall be from reputable international suppliers.

All switchboards and control cabinets enclosures and any other enclosures shall be to IP66 and be complete with key and lock. Upon completion of works, the tenderer shall submit 3 sets of the door keys of each enclosure. All metal enclosure doors shall be solidly earthed.

The Contractor or his sub-contractor shall submit fully detailed drawings of the switchboard and main electrical distribution for approval by the Engineer before

order. All ratings of switchgears must be given in the main electrical distribution drawing.

The DB shall be labelled properly using suitable accessories provided by the Supplier. All switchgears shall be from a reputable manufacturer such as Schneider Electric, Hager, Legrand or ABB. They shall be designed for fixed installation.

The Contractor must ensure that the breaking capacities of the switchgears proposed do match with the requirements of the installations. All Distribution Boards shall be supplied with a minimum of 20 percent spare capacity.

The concrete sheds for housing the electrical distribution boards will be erected by the main contractor, fitted to the outside wall of the transformer rooms.

However, the electrical sub-contractor shall liaise with the main contractor to ensure that all bolting, connection points, opening, ductings are provided where necessary.

The purpose of the concrete sheds will be to protect the electrical distribution boards and the equipment from vandalism.

6.25 REMEASUREMENT

All cable lengths and quantities of other items of work included in the road lighting system will be remeasured on site during and/or after the excavation of the works, and paid for as per actual.

6.26 DISCREPANCIES

Should the bidder detect any discrepancy between any section of the bid document, he shall immediately notify the Engineer (Scene-Ries Consult Ltd). After examining such discrepancy, an Addendum to Bid will be duly issued for which the bidder will be required to send an Acknowledgement Receipt.

No such representation will be considered after the bid submission.

6.27 LIAISON WITH MAIN WORKS CONTRACTOR

The Electrical sub-contractor shall, at all times during the whole contract period and the defects notification period of 12 months after completion of the contract, liaise with the main contractor to ensure that the entire road lighting system is and remains in good working order.

Any making good or repair work or maintenance work shall be carried out timeously after notification to this effect by the Employer/Engineer or CEB or any other statutory body.

6.28 BIDDING DOCUMENT OF MAIN WORKS CONTRACT

The electrical sub-contractor is hereby informed that he will work as a sub-contractor to the main contractor who will be appointed for the whole of the works.

Section 7

CATCHMENT AND ROAD DRAINAGE

SECTION 7 - CATCHMENT AND ROAD DRAINAGE

Note: *This Section should be read in conjunction with Section 6 "Roadwork".*

7.1 GENERAL

Section 7 of these Specifications governs the construction of the following catchment and road drainage works:

- Drains (including absorption drains, and including road-side drains)
- Absorption pits
- Pipe culverts
- Gullies and manholes
- Retaining walls, paving slabs
- Masonry works (including retaining walls, stone facing, rainwater downspout etc)
- Riprap
- Concrete channels

7.2 DRAINAGE EXCAVATION AND BACKFILLING

The Contractor shall excavate all catchment, roadside drainage systems, including absorption pits where applicable, to the lines, levels, gradients and dimensions shown on the Drawings or as directed by the Engineer. Excavation for drainage systems shall be carried out in accordance with the requirements of the Section 3 of these Technical Specifications, entitled "*Earthworks and Pipelaying*" and as per BS 6031:2009 – Code Practice for Earthworks.

The excavations of trenches and pits shall be of adequate and sufficient dimensions to enable the proper compaction of the bottom of the trench, the placing of the bedding material, the laying and placing of concrete thrust blocks and the proper backfilling and ramming operations to be carried out. The bottom of such excavations shall be compacted to 95% B.S Heavy.

Where rock is encountered at the formation level of the trench, it shall be cut to a depth of 200 mm below the formation level and replaced with sand, granular material or other material to the approval of the Engineer.

Trenches shall be kept free from water until any concrete works shall have sufficiently set; the Contractor shall construct any temporary drains for the purpose of keeping the trenches dry.

Where seepage of water occurs in trenches or pits, bedding and backfilling shall be carried out using sand, granular material or crushed stones or other suitable material as directed by the Engineer.

Should excavations be executed to greater depths or widths than necessary through the incidence of boulders or other causes, the Contractor shall backfill and make good to his own cost, with approved materials thoroughly compacted, to the correct line, level and dimensions and to the approval of the Engineer.

The material excavated for drainage channels shall be, if suitable, set aside for use as backfill; if found unsuitable or in excess, the excavated material shall be carted away to spoil tips.

Material for backfilling shall be deposited in layers not exceeding 150 mm of loose material, compacted with power rammers, the moisture content of the material being adjusted to facilitate thorough compaction. The density of each compacted layer shall not be less than 95% of B.S Heavy.

7.3 TIMBERING AND SHORING OF EXCAVATIONS

The sides of excavations in trenches and pits shall, where required, be timbered and shored to the satisfaction of the Engineer. The Contractor shall remain liable for any damage or injury to his workers and the public arising from his failure to provide timbering and shoring in any part of the works, irrespective of whether the Engineer

has approved this stretch of the excavations or not. He shall in the same way be liable for premature removal of any shoring or timbering.

Where directed by the Engineer, the timbering and shoring shall be left in excavations and measured and paid for except if, in the Engineer's opinion, the necessity for leaving the shoring and timbering in the trenches has been the result of carelessness or neglect on the part of the Contractor.

7.4 REINFORCED CONCRETE DRAINS

The concrete drains and/or channels shall either be pre-cast or cast in-situ. The workmanship shall be in strict accordance to “Section 5 – Concrete” of the Specifications. Blinding shall be of Class 15 concrete and the base slab and the walls shall be of Class 25 concrete or as shown on drawings.

The concrete drains shall be constructed to the cross-section as shown on the drawings or as directed by the Engineer and the invert shall be finished smooth to a steady longitudinal gradient of not less than 0.5% and the fall shall in all cases be towards a culvert or any other outlets shown on the drainage layout. The walls shall be of off-shutter quality finish with the construction joints rubbed down to a smooth finish. The top edge of the walls shall be carefully finished smooth and level so that the precast covers do not rock at opening positions on the covering slab. Expansion joints filled with an approved bituminous compound shall be formed every 20 metres.

7.5 SLIP-FORMED SLOT DRAINS

The slip-formed slot drains shall also be used if, specified and/or, shown on the drawings pertaining to drainage works. The slot drain may be cast in-situ separately or can incorporate the roadside kerb adjacent to the slot on top of the drain. The slot-drain slipform paver machine can be fitted with a custom mould to accommodate the inserts needed to produce this drain *plus* kerb arrangement.

The maximum width of the slot shall be 40mm and removable gratings shall be provided at 10m intervals along the linear drainage channel. The internal bore diameter of the drain shall be 400mm, 500mm or 600mm as shown on drawings.

The contractor shall ensure that the formation level for the casting of the slip-formed drain is well compacted and approved by the Engineer prior to any casting. Furthermore, he shall ensure that sufficient working space has been provided to accommodate the slipform paver machine and that no damages are caused to other services already laid underground. Any such damage should be re-instated to its original state by the contractor without additional payment and/or time.

Being given that the construction of the slip-formed slot drain is of a specialized nature, the main contractor shall either carry out the work himself or entrust the work to a sub-contractor experienced in the construction of slot drains. In such a case, the main contractor shall submit the name of the sub-contractor who shall carry out this work, together with all necessary technical documentation regarding experience and capability, materials and construction methodology for approval.

7.6 CONCRETE PIPE CULVERTS

Excavation for pipe culverts should be carried out as per Sections 7.2 and 7.3 above. Trenches for pipe culverts shall be excavated such that the pipes can be properly laid to lines, levels and gradients, jointed, inspected and tested. The width of the trenched from the bottom of the formation level of the trench to the crown of the pipe shall be at least 150mm and/or as per drawings and, shall in all cases be adequate to permit the handling and the correct jointing of the pipes when laid in trench.

The upstream and downstream joints with the rest of the drain, whether of blockwork, masonry or concrete, shall be correctly constructed, with either mass concrete or reinforced concrete, properly rendered if so required by the Engineer, all as per drawing or as instructed on site by the Engineer. Such joints, and any necessary associated box-outs shall not be itemized separately in the Bill of Quantities, but shall be deemed to be allowed in other rates.

The methodology used for the placing of the pipes, the joints to be used, as well as the tools being employed shall be to the approval of the Engineer. A properly fitted plug shall be placed inside the openings at the end of each pipe already laid and shall be removed only when the next pipe is being laid or on completion of the pipeline or

culvert. Care should be taken to clean the inside of the pipes before any pipe culverts are put in place. Any damaged or cracked pipe shall not be used.

Trenches for pipe culverts shall be excavated up to the formation level such that the minimum thickness of the granular bedding as shown in the drawings can be laid below the invert levels of the pipes. This granular bedding shall be placed and thoroughly compacted carefully under the haunchings, on both sides and up to 300mm above the crown of the pipe culverts. It should be ensured that bedding material is in intimate contact with the pipe. The remainder of the trench shall be backfilled with approved materials and in layers as shown on the typical trench sections.

If instead of granular bedding, concrete bedding and surround is specified on the drawings, no backfilling shall commence prior to 7 days after the concrete bedding and surround were placed.

The pipe culverts shall be reinforced precast concrete type and/or to the approval of the Engineer. Jointed pipes shall be tested by an appropriate method or as directed by the Engineer.

7.7 CONCRETE BOX CULVERTS

Excavation for concrete box culverts should be carried out as per Sections 7.2, 7.3 and 7.6 above. All reinforcement, concrete and formworks shall be as per “Section 5 – Concrete” of the Specifications.

The base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed.

Before concrete is placed in the sidewalls, the culvert footings shall be thoroughly cleaned of all shavings, sticks, sawdust, or other extraneous material and the surface carefully chipped and roughened.

The concrete in the walls shall be placed and allowed to set before the top slab is placed.

Each wing wall shall be constructed monolithically. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

7.8 GULLIES AND MANHOLES

Gullies and manholes shall be built to the lines, levels, dimensions and details given on the drawings. The bottom of the excavation shall be blinded with Class 15 concrete. The base slab and the walls shall be built with Class 25 concrete. The internal surfaces shall be of off-shutter finish with the construction joints rubbed

down to produce a uniform and smooth surface. The top edge of the wall shall be carefully finished smooth and level to accommodate the precast cover slabs without any undue rocking movement.

7.9 MASONRY WORKS

If and where applicable, the stones for masonry works shall be in accordance with the requirements of Clause 2.19 of Section 2 of these Specifications entitled "*Materials and Workmanship*".

The masonry shall be laid to line and in courses roughly levelled up. The bottom courses shall be composed of large selected stones and all courses shall be laid with bearing beds parallel to the natural beds of the material.

Each stone shall be cleaned and thoroughly saturated with water before being put in place and the receiving bed shall be clean and well wetted. All stones shall be well bedded in freshly placed mortar.

Wherever possible, the face joints shall be properly pointed before the mortar becomes set. Joints which cannot be so pointed shall be prepared for pointing by racking them out to a depth of 50 mm before the mortar has set.

Vertical joints in each course shall be placed out of line relative to those of adjoining courses by at least 150 mm. In no circumstances shall a vertical joint be so located as to occur directly above or below another one.

In case any stone is moved or the joint broken, the stone shall be taken up, the mortar joint thoroughly cleaned, and the stone reset in fresh mortar.

Joints not pointed at the time the stone is laid shall be thoroughly wetted with clean water and filled with mortar. The mortar shall be well driven into the joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done and in hot or dry weather the pointed masonry shall be protected from the sun and kept wet for a period of at least four (4) days after completion. After the pointing is completed and the mortar has set, the wall shall be thoroughly cleaned and left in a neat condition.

7.10 RIPRAP

The stones for riprap shall be as specified in Clause 2.19 Section 2 of these Specifications entitled "*Materials and Workmanship*". They shall be laid with closed joints from the bottom of the slope of the embankment or existing ground, in an upward direction, with the larger stones being laid at the bottom.

7.11 RAINWATER DOWNSPOUTS

The stones for rainwater downspouts shall be as specified in Clause 2.19 of Section 2 of these Specifications entitled "*Materials and Workmanship*". They shall be laid and bedded in Class 15 concrete to the lines, levels and dimensions given in drawings.

7.12 INLET AND OUTLET STRUCTURES

Inlet and outlet structures shall comprise of wing walls, head walls, in-situ reinforced concrete aprons all in accordance with the Drawings.

The Contractor may, if he wishes, propose alternative methods of construction, in which case he shall submit full design calculations and drawings for the Engineer's approval.

Section 8

ELECTRICAL WORKS FOR SITE INFRASTRUCTURE

SECTION 8 - ELECTRICAL WORKS FOR SITE INFRASTRUCTURE

8.1 GENERAL

This section of the specifications pertains essentially to the electrical aspects of the infrastructure works required to be carried out within the project site.

The ducts for the underground CEB cables shall comply with the requirements of BS EN 61386-24 2010 or MS IEC 61386-24 – *"CONDUIT SYSTEMS FOR CABLE MANAGEMENT – Part 24: Particular requirement – Conduit systems buried underground "* and as given in the following sub-sections.

Pipes shall be used as ducts for underground power cables. The material from which the pipe is produced shall consist of unplasticised Polyvinyl Chloride (uPVC) to which may be added those additives that are needed to facilitate the manufacture of sound durable pipes of good surface finish, mechanical strength and opacity. They shall be rectilinear, having a smooth surface and free from visible defects.

Each pipe shall have an integrated solvent-weld socket at one end and a chamfered spigot at the other end to allow easy assembly of the duct. The axis of the pipes and that of the socket shall be practically on the same alignment.

8.1.1 Colour

The pipes shall be of yellow colour, or to any specific colour required by the Central Electricity Board (CEB), with whom the Contractor shall accordingly liaise.

8.1.2 Marking

The outside surface of the pipe shall be permanently marked along one of its length, using a highly visible colour, as follows:

- Manufacturer's name and/or identification mark
- Product identification mark
- Dimensions in mm
- Code "L" or "N"
- Code "250", "450" or "750"
- Date of manufacture

The marking should be legible and must be reproduced along the pipe at regular interval, preferably one (1) metre but, no longer than 3m.

A specimen of this marking shall be submitted for approval to the Engineer before the beginning of manufacture.

8.1.3 Dimension of Pipes

The dimensions of the pipes to be used for the electrical works shall be 63mm, 80mm, 110mm and 160mm as specified on drawings. The allowable variances in the pipe dimensions shall be strictly as per Clause 8 and Table 101 of BS EN 61386-24 2010.

8.1.4 Mechanical Characteristics

The pipes being used for buried underground electrical conduit system, shall be resistant to shocks and the various constraints to which they may be subjected. These pipes or ducts shall be rated "**N**" – normal for resistance to impact and "**450**" for resistance to compression.

Thus, the pipes when tested as per Clause 10.2 of BS EN 61386-24 2010, shall not have a deflection of more than 5 percent (%) when subjected to a compression force of 450N and After the test, there shall be no crack allowing the ingress of light or water between the inside and the outside.

On the other hand, there should be neither sign of disintegration nor shall there be any crack allowing the ingress of light or water when subjected to an impact test as per Clause 10.3 of BS EN 61386-24 2010.

8.1.5 Quality Control by the Manufacturer and Factory Acceptance

The manufacturer shall guarantee a permanent quality control during the manufacturing process by implementation of Quality Assurance System (preferably according to ISO 9002) and shall exercise a permanent control at all stages of the production such as:

- Control of raw material.
- "*In process*", on-line quality testing and quality.
- Quality control of finished pipes at the end of the production to ensure traceability of pipes manufactured.

The result of the various controls shall be recorded in a register to be put at the disposal of the Engineer, upon his request.

This quality control takes place in the factory upon the manufacturer's notice that pipes have been manufactured.

The manufacturer shall carry out all the controls and tests required. The Engineer may also depute his representatives to attend/carry out some of the tests whenever he finds it necessary and the contractor shall provide all necessary assistance at no extra cost.

The Engineer shall have free access to the site of manufacture and the place of storage of materials. Moreover, the manufacturer shall make available free of charge the required personnel, instruments, and all testing equipment that shall be required.

All samples of raw materials and pipes necessary for the tests (particularly destructive tests) shall be provided by the Contractor at no extra cost.

The tests shall be performed by taking samples. When a refusal is pronounced, the manufacturer shall immediately remedy the defects noticed. The batch(es) which have been refused shall be scrapped and removed from site. The manufacturer shall destroy or erase the marking on the pipes in the presence of the Engineer's representative.

8.1.6 Storage of Pipes

During storage, the pipes shall be piled up taking all necessary precautions so as to avoid their deformation or deterioration.

For this purpose, the height of the piles shall be such that the pipes may not undergo any permanent deformation and that it allows taking of samples wherever decided by the Engineer. The pipes should be protected from direct sunlight when stored in the open for a long period of time.

8.2 MINIMUM CLEARANCES BETWEEN SERVICES

The Contractor shall ensure that the underground services shall conform to the following requirements:

(a) The minimum horizontal clearance between electrical power cables and telecom cables (or any other cables) running parallel shall be 500mm.

(b) The minimum vertical crossing clearance between electrical power cables and telecom cables (or any other cables) shall be 300mm.

(c) Underground pipes for water distribution (or any other services) shall be laid at a minimum horizontal clearance of 500mm from electrical power cables.

Any clash between underground electrical cables and any other services should immediately be reported to the Engineer’s Representative.

8.3 ELECTRICAL WORKS ASSOCIATED WITH ROAD LIGHTING

8.3.1 Road Lighting Cables and Wires

Subject to final measurement and adjustment, all cables and wires shall be installed, connected up complete, tested and commissioned in accordance with the drawings and Specification. All cables shall be equal sized copper conductors PYC or XLPE insulated and sheathed with steel wire armouring to BS 5467.

Due consideration shall be given to the ambient temperature; the Contractor shall ensure that the materials supplied by him are suitable to withstand the ambient conditions.

(i) Laying of Cables and Wires

The final routing of all cables shall be approved by the Engineer prior to installation.

(ii) Cable Lengths

The cables shall run in the longest practical lengths without joints. No joints shall be allowed between columns or between columns and control cabinet.

The radius of the bends shall be not less than twelve (12) times the overall cable diameter unless otherwise stated. Cables shall loop in / loop out of all columns and cabinets.

(iii) Cables laid direct in ducts

The cables running underground entering feeder pillars or passing beneath the structures shall be laid in high pressure type PVC pipes with minimum diameter of 100 mm and coloured orange. After cables have been drawn through these ducts, a vermin-proof plug shall be provided and fitted by the electrical sub- contractor at each end, and finally sealed with an epoxy resin compound.

The PVC pipes shall be laid at a depth of 800 mm and provided with a bedding and selected-fill cover thickness of at least 100 mm of fine sand or rocksand or as specified on the drawings.

All along their alignment, the underground cables shall be indicated by a plastic warning tape above the cables/pipes after the trenches have been partially backfilled; the tapes shall be laid at 300 mm below surface level. The tape shall be manufactured from high grade polythene 150 mm wide and at least 0.3mm thick, coloured yellow with the words "*Electric Cable*" printed along its whole length to BS EN12613: 2009.

A sample of the high pressure type PVC pipe and plastic warning tape shall be submitted upon request by the Engineer prior to start of works on site.

(iv) Liaison with CEB for Supply and Connection Points

The Contractor or his electrical sub-contractor shall liaise with the CEB for the latter to indicate the potential connection points.

In this respect, the Contractor shall undertake all necessary liaison and arrangements with the CEB. The Contractor shall also carry out all necessary liaison with the MPI for any road crossing which may be required.

Over and above, the Contractor shall undertake all necessary arrangements with the other organisations e.g. the District/ Municipal Council, and Police Department if any off-site work is required.

The Contractor will be held responsible for any damage to underground services caused during or as a consequence of excavation or erection. In the event of such damages, the Contractor shall be responsible for the necessary repairs at his own cost, and also and specially for the immediate notification to the respective Authority in charge of or being the owner of the underground service.

8.3.2 Earthing

The whole of the installation covered by these Specification shall be efficiently bonded back to the Feeder Pillars through the metal sheathing of cables and earth wires all in accordance with the I. E.E. Regulations, British Code of Practice and Mauritian Code of Practice if applicable as well as CEB Regulations. All prices shall be inclusive of the cost of this bonding/ earthing.

The Contractor's attention is drawn that the armouring of the underground cables shall not be used as the sole means of bonding / earthing.

Accordingly, an earth conductor (colour green of appropriate size and according to IEE regulations) shall be provided with each underground cable for bonding / earthing purposes in addition to the armouring.

All earthing installations including sizes of earth wires and bonding shall be in accordance with IEE 364-5-54 and/or the relevant BS. The earthing continuity of each metal sheathed cable shall be maintained by efficient bonding between the cable sheath, the gland and the metal case of switchgear or other metal - clad accessory or appliance at which the cable terminates.

All wires and cables shall be protected against mechanical stresses and corrosion. All joints between wires and earthing metalwork shall be mechanically sound before soldering. The earth stud or terminal of the column shall be bonded to the armouring of the incoming cable and earth conductor in an approved method, and shall be subject to the Engineer's approval.

The armouring of the circuit cabling and earth conductor shall be used to earth each section of the installation back to the feeder pillar earth bar. A copper clad steel type earth electrode shall be provided next to each column.

The frame and earth of feeder pillar and column shall be connected to its adjacent electrode to ensure that the earth loop impedance is in accordance with the I.E.E. Regulations, and/or the relevant BS.

The minimum size of the earthing rods shall be 1.5 to 2 m long and of 20 mm diameter. A rate shall be given for extra 2 m lengths if required. Connection from each feeder pillar frame and earth bar shall be by means of single core stranded copper cable in green PVC as per IEE Regulations and/or the relevant BS.

The Contractor shall be responsible for taking necessary earth readings and providing a satisfactory earth to meet the IEE wiring Regulations or Mauritian Code of Practice requirements and/or the relevant BS; the earthing resistance shall however not exceed 5 ohms. The Contractor shall be responsible for the carrying out of all the associated tests, for which costs are deemed to have been included in his rates.

All final circuits shall be protected by the use of ELCB (300 mA) of the type "*Bloc differentiel*" + DP MCB. Note that ELCB of the type "*Disjoncteur differentiel*" will not be accepted as an equivalent.

8.3.3 Electrical Controls

A light sensitive Switch/Photocell shall be connected to the electrical supply cable feeding the streetlights. These switches shall be of appropriate ratings and shall be contactor-operated and shall be securely fixed on the poles as necessary. The photocell shall be capable of being adjusted over a range of 5 to 25 Lux. The photocell shall be mounted with weatherproof enclosure to IP 65 which shall be securely fixed on the poles as necessary at a height of about 5.0m or as indicated by the Engineer; they shall comply to BS 5972.

8.3.4 Control Cabinet and Equipment

All control equipment/control cabinet/dimming equipment shall be enclosed within reinforced concrete chambers of appropriate dimensions and of appropriate design.

These chambers shall be constructed/provided complete with base and chamber for cable access, be of heavy-duty type and fitted with hot-dipped galvanised door of appropriate size and non-corrosive hinges. The chamber's door shall be solidly earthed.

All control cabinet enclosures and any other enclosures shall be to IP 65 and be complete with key and lock.

Upon completion of works, the Contractor shall submit three (3) copies of the door keys of each enclosure and of the chamber's door.

- The Contractor shall submit with his Tender the following additional details:
- The type of equipment (transformer regulator protective device) he is proposing together with all relevant technical details.
- The enclosure
- The reinforced concrete chamber.

8.3.5 Transformer/Regulator and Control Equipment

Voltage regulation will be through equipment by which the voltage along the line at the point at which the equipment is fitted is stepped up to 230V, irrespective of the input voltage at that point.

The stepping up of the voltage shall be by means of a transformer of appropriate rating but this shall also incorporate a voltage regulator by means of which the output voltage is kept at 230 V for any input voltage.

The Contractor's attention is drawn that:

(i) The input voltage to the equipment may be expected to be as low as 215V +/- 5V when all the streetlights are on (lighting) but this value may also be higher in the event that some of the lights may be burnt.

(ii) The whole of the equipment shall be protected against over voltage by means of protective device which shall be of the automatic reset type.

(iii) The enclosure shall be solidly earthed and the earth resistance shall not be more than four (4) ohms.

The voltage regulation equipment is only required over long runs of cables where the voltage drop may alter the proper functioning of those lights located at the far end of the supply cable.

It is therefore recommended that such an equipment be installed along the supply cable at that point where the voltage is as low as 210 V provided that the ballast / discharge lamp proposed may still operate at 210 V.

It shall therefore be the responsibility of the Contractor or his electrical sub-contractor to make all necessary voltage drop calculation, (copy of which shall be submitted to the Engineer for approval) in order to ascertain the use or not of the voltage regulation equipment.

All ancilliary control equipment, main switch cut-outs, fuse units, ELCB for all circuits links and copper bus-bars shall be supplied and fitted in the control cabinet. The switching unit of the photo-electric cell will also be fitted in this enclosure which shall

be designed accordingly. Circuit details and labelling shall be by means of indelible markings; a cable diagram with permanent ink and shrink plastic covered shall be provided in the control cabinet.

8.4 TECHNICAL SPECIFICATION OF LOW VOLTAGE CABLES

Note:

(i) In this Section, the word "Contractor" shall likewise mean the "cable sub-contractor" and vice versa.

(ii) The Contractor's supplier of Low Voltage (LV) shall be duly named by the Contractor in the latter's tender submission.

(iii) The electrical sub-contractor (for road lighting works – see sub-clause 6.21 of Section 6 "Roadworks" and the cable Sub-contractor may be only one company or firm.

8.4.1 Description

Four-core 1000 volt grade, 95mm² XLPE Aluminium Cable and four-core 1000 volt grade, 240mm^2 XLPE aluminium cable.

The cable, designated as 4 x 95 mm², 1000 V and 4 x 240mm^2, 1000V, shall be used underground on a three-phase system of 600/100 volts.

8.4.2 Characteristics of the Cable

Rated voltage	:	on 3- phase system of 600/1000 volts
Type	:	Four-core armoured
Conductor	:	Stranded Aluminium
Cross-section	:	95 mm² and 240 mm^2
Insulation	:	XLPE
Inner sheath	:	PVC
Armouring	:	Galvanised steel wire or tape
Outer sheath	:	PVC
Core Identification	:	Colour or number

8.4.3 Standards

The Low Voltage cables shall conform to IEC 60502-1, to the relevant BS and to MSB Specifications.

8.4.4 Test Report/Certificate

Type Test Reports to IEC 60502-1 shall be submitted from a recognized and Independent Authority.

All LV cables shall has a conformance certificate from the MSB. The supply of the LV cables shall also conform with MSB Standard

8.4.5 Other Documents to be Submitted

The other documents which shall be submitted together with, and forming part of, the bid are listed below:

(a) Evidence of the manufacturer's experience in the manufacture of the item.

(b) Export/ Orders for the last five years.

(c) Company Profile including plant and machinery and other associated facilities.

(d) Past experience of the firm over the last 5 years for similar works – indicating name, location, Client, time of execution and costs of projects undertaken.

(e) All relevant technical literature of the LV cables materials including their country of origin.

(f) C.V of the staff proposed to be deployed to the electrical installation works, specially the supervising engineer.

(g) Any Separate Memorandum for any alternative proposal. In this respect, please note that alternative proposals will only be considered if the conforming bid is found to be in order.

8.4.6 Guaranteed Particulars

The Contractor shall supply all relevant data where applicable by filling in the Schedule of Guaranteed Particulars given in Table 8.1 below:

Table 8.1: Guaranteed Particulars

S.No	Description	Unit	Item 1	Item 2	Item 3
1	Normal working or design voltage of cable	volt			
2	Type of cable (single core armoured or three core armoured)				
3	Insulation material				
4	Sectional area of conductor	mm^2			
5	Diameter of conductor	mm			
6	No. of wires in each conductor				
7	Diameter of each wire	mm			
9	Diameter over XLPE insulation	mm			
9(a)	Is insulation semi-conductive screen of the free strippable type?	Yes/No			
10	Minimum thickness of PVC sheath	mm			
11	Diameter over PVC sheath – (a) Minimum	mm			
	(b) Maximum	mm			
12	Number and diameter of galvanised armoured wires/tapes	No/mm			
13	Type of protective covering				
14	Nominal external diameter of completed cable	mm			
15	Nominal weight per metre of completed cable	kg			
16	Minimum radius of bend around which cable can be laid	m			
17	Manufacturing drums lengths (a) Normal				
	(b) Maximum	m			
18	Maximum d.c. resistance of conductor per 1000 m of cable at 20°C	ohm			
19	Maximum a.c. resistance of conductor per 1 000 m of cable at 20°C	ohm			
20	Equivalent star reactance per 1 000 m of cable at 50 Hz	ohm			
21	Maximum equivalent star capacitance per 1000 m of cable	mfd			
22	Maximum charging current per conductor per 1000 m of cable at normal voltage and frequency	A/km			
23	Maximum continuous current carrying capacity per conductor when laid :-				
	(a) Direct in ground	amp			
	(b) In ducts	amp			
	(c) In air	amp			

S.No	Description	Unit	Item 1	Item 2	Item 3
24	Maximum conductor temperature :-				
	(a) Laid direct in ground	^{o}C			
	(b) Drawn into pipes or ducts	^{o}C			
	(c) Installed in air	^{o}C			
25	Tan § at maximum conductor temperature in normal operation plus 5^0 C up to 10^0 C maximum	$x\ 10^{-4}$			
26	Insulation resistance at operating temperature	MΩ/km			
27	Heating cycle test plus partial discharge test	pC			
28	Impulse withstand voltage	kV			
29	Power frequency voltage withstand after impulse voltage test	kV			

A schedule of Guaranteed Particulars as per Table 8.1 above shall be filled, where applicable, and signed by the cable manufacturer. The attention of the contractor or his cable sub-contractor is drawn to the fact that he should imperatively seek and obtain the approval of the Engineer before placing of any order for the said materials

Name of Bidder(s): _____

Signature of authorised signatory: _____

Name of authorised signatory: _____

Position of authorised signatory: _____

Date: _____

Company Seal (Mandatory) _____

8.4.7 Inspection of Cables

(i) Overseas Cables

The Contractor's attention or that of his cable sub-contractor is drawn to the fact that for cables manufactured overseas, inspection thereon is absolutely needed prior to shipment. Such an inspection shall be done by an independent Inspecting Agency. For your information, the CEB hires the services of the following Inspecting Agent for its overseas orders:

Inspecting Agent: Crown Agents
St. Nicholas House
St. Nicholas Road – Sutton
Surrey SM1 1EL
United Kingdom
Tel No: 44 20 8643 3311
Fax No: 44 20 8770 9101

(ii) Local Cables

If the cable is manufactured locally, the manufacturer shall produce copies of factory test reports on the manufactured cable, showing that the cable as made, meets the applicable specifications.

In this respect, it shall be the sole responsibility of the Contractor or his cable sub-contractor to carry out all necessary liaison with CEB if the need arises, undertake visits to the manufacturer if required, and finally obtain the Engineer's approval.

8.5 SPECIFICATIONS FOR LAYING OF LV CABLES

8.5.1 Scope of Work

The scope of works to be carried out under this Contract shall include the manufacture, works tests, supply, delivery to site of LV cables, followed by laying of the said LV cables either in trenches or in pipe sleeves/ducts, including connection earthing, testing and commissioning of the entire LV network as required.

The connection of the LV network to the nearest CEB power source shall also be included in the scope of works under this Contract.

The contractor shall be responsible for the civil works associated with the LV network namely, excavation of trenches and laying of uPVC pipes acting as sleeves or ducts.

Note: *Notwithstanding the above, the cable sub-contractor or supplier shall at all times liaise with the main contractor during the construction of the civil works associated with the LV network to ensure that all necessary precautions are taken and all provisions adhered to for a good quality end product.*

8.5.2 General

LV Cables shall be generally laid direct in ground; however, there are places where they will need to be drawn through uPVC pipes – which therefore would have been provided and laid by the main Contractor.

8.5.3 Cable pulling

Where applicable, cables shall normally be pulled into place along rollers placed at intervals not exceeding 1.0m along the bottom of the trench.

The bending radii of the cables shall be minimum 12 (twelve) times the diameter of the cable oversheath. This specification shall be strictly adhered to. The cable should be bent as little as possible preferably always in the same plane to avoid twisting of the cable.

Unless with the consent of the Engineer, there should be no "*figure eighting*" of cables.

Pulling ropes shall be attached to the free end of cables by means of an approved "*pulling eye*" which shall be solidly fixed (sweated) on to cables cores and sheath or by means of a cable stocking to the approval of the Engineer.

Mechanical pulling of cable shall be permitted provided that the pull is applied gradually and provided that the mechanism has an automatic slipping clutch set to limit the pull to a maximum of 1500kg. To ensure this, a tension meter shall be used to check/monitor the pulling tension.

8.5.4 Cable Pulling into Existing Cable Pipes

The Contractor or his cable sub-contractor shall clean out the internal surfaces of the pipes before pulling cables into the existing cable pipes. The pulling speed should not exceed 10 metres per minute, and shall be strictly as per the Engineer's instruction during the operations.

8.5.5 Testing of Cable

The Contractor or his electrical sub-contractor shall test the insulation of the cables before and after pulling. It shall be the sole responsibility of the Contractor or his cable sub-contractor to carry out the necessary liaison with the Engineer to ensure his presence at the required time. No cables shall be laid (pulled) unless the Engineer's representative has priorily approved the insulation tests in question.

8.5.6 Cutting and Sealing of Cable

The work which entails cutting the cable, capping the cable end by heat-shrinkable materials followed by PVC taping, shall be carried out exclusively by authorized personnel.

In this respect, the cable Contractor shall carry out the necessary liaison with the main contractor and shall be solely and fully responsible accordingly. No claim to that effect shall be entertained.

8.5.7 Sealing-Off of Cable Entry

All cable entries into a joint pit or into a sub-station shall be properly sealed off by the Contractor or his cable sub-contractor immediately upon completion of laying of the cable.

8.5.8 Sealing-off of Pipe sleeves

In the case where the uPVC pipes acting as sleeves have been laid by the main Contractor without any cable being laid through by the Cable Contractor or where cable laying could not be completed by the cable Contractor on the same day, the cable entries shall be properly sealed by the main Contractor to prevent ingress of water. Rapid hardening cement or similar or water sealing compound shall be used when required or where directed by the Engineer.

8.5.9 As-Built Drawings

As soon as the works are complete and all tests have been satisfactory carried out, the Cable Contractor shall submit to the Engineer within fifteen days (15) of completion of works three sets of electrical record drawings, showing the works as finally installed.

8.5.10 Inspections and Tests at Manufacturer's Premises

The Engineer, or his duly authorized representative, shall have access to the Cable Contractor's or the manufacturer’s premises to inspect and examine the materials and workmanship used for the manufacture of the LV cables. The Contractor or his cable sub-contractor shall be responsible for the supply to the Engineer of all necessary authorizations. Such inspection, examination or testing, if made, shall not relieve the Cable Contractor from any of his obligations under the Contract.

All works, materials or equipment, if and when rejected shall be corrected or replaced as the case may be at the Contractor's expense, and to the satisfaction of the Engineer.

8.5.11 Testing and Commissioning on Site

Upon completion of the site installation or part of the site installation, the Contractor or his cable sub-contractor shall carry out the testing and commissioning of the entire LV cable network, in stages if so required, to ensure that it is in proper working order and capable of performing all its functions, in accordance with the Specifications and Regulations to the satisfaction of the Engineer. Any item of material, equipment or plant or apparatus damaged during commissioning shall be replaced by the Cable Contractor at his own expense and the LV network system shall be re-tested and commissioned. No instruction or action of the Engineer shall relieve the Cable Contractor of this obligation.

The Contractor or his cable sub-contractor shall provide the necessary power supply or generator, skilled labour, supervision, apparatus, and instruments required for commissioning and testing of the LV system. After successful completion of such commissioning, the Cable Contractor shall furnish to the Engineer six (6) copies of certificates of all tests performed and accepted, signed by the Cable Contractor, or an authorized person acting on his behalf. If any part of the LV network fails to pass the specified tests, further tests shall be repeated, until successful testing.

Acceptance shall not in any way relieve the Cable Contractor of his responsibility for the performance of the LV network after installation as a complete working system in all respects.

The Contractor's attention or his cable sub-contractor's attention is drawn that such testing and commissioning shall be carried out in the presence of the Engineer; the testing and commissioning shall then be approved in writing by the Engineer. The acceptance will be deemed to be complete only after receipt of such approval/clearance from the Engineer.

8.5.12 Guarantee and/or Defects Liability

The Contractor's attention or his cable sub-contractor's attention is drawn to the fact that the main contract does not make provision for staged taking-over of the works. However, it may be that certain sections or components of the works shall have to be commissioned and operated prior to the contract completion date; the Cable Contractor shall liaise with the main contractor to assess his programme of works in order to determine the best possible liaison and interaction. Notwithstanding the above, the full responsibility for the security of those works shall remain with the main Contractor with regards to any theft, vandal and accident damage, up to the time of taking-over of the main contract.

The Cable Contractor shall guarantee all work for a period of twelve (12) months after the issue of the taking-over certificate by the Engineer for the whole for the works under the contract. In the event of a defect arising within this period, which in the opinion of the Engineer is due to faulty workmanship on the part of the Cable Contractor, or materials supplied by his manufacturer/supplier, the Cable Contractor

shall, at his own expense, make good such defects where instructed to do so by the Engineer.

The repairs shall be carried out within forty-eight (48) hours of demand from the Engineer or Client. The Cable Contractor shall provide any required spare parts to replace the faulty part at his own expense, for the whole duration of the Defects Notification Period.

In this process, the Contractor and his cable sub-contractor shall maintain constant liaison between them as the case may require.

8.5.13 Interaction Electrical Sub-Contractor / Main Contractor

(i) Trenching and Backfilling of Trenches

The trenching and backfilling operations shall be carried out by the main contractor.

However, immediately after appointment, the Cable sub-contractor or the electrical sub-contractor shall start liaison with the main contractor to obtain all necessary information in the form of drawings (to locate services and positioning of LV network fixtures) and programme of works (to determine when the cable sub-contractor will intervene for his tasks).

In this respect, the cable sub-Contractor shall send his representative to attend the site meetings with the Employer, the Engineer and the main contractor.

(ii) uPVC Pipes

All ductings in the form of uPVC pipes will be provided by the main contractor, who shall also be responsible for the laying thereof as per drawings, inclusive of placing of draw wires, where required.

For these tasks, he will liaise at all times with the Cable Contractor.

(iii) Warning Tapes

The cable sub-contractor shall liaise with the main civil works contractor to ensure that the necessary warning tapes are provided in the trenches where required.

8.5.14 Remeasurement

All cable lengths and quantities of other items of work included in the LV network will be remeasured on site during and/or after the excavation of the works, and paid for as per actually measured quantities.

8.5.15 Discrepancies

Should the bidder detect any discrepancy between any section of the bid document, he shall immediately notify the Engineer (Scene-Ries Consult Ltd). After examining such discrepancy, an Addendum to Bid will be duly issued for which the bidder will be required to send an Acknowledgement Receipt.

No representation invoking any discrepancy or conflicting issues will be considered after the bid submission.

8.5.16 Liaison between Contractor and Cable Sub-Contractor

The Cable sub-Contactor shall, at all times during the whole contract period and the Defects Notification Period of 12 months after completion of the contract, liaise with the main civil works contractor to ensure that the entire LV network system is and remains in good working order.

Any making good or repair work or maintenance work shall be carried out timeously after notification to this effect by the Employer or the Engineer.

8.5.17 Bidding Document

The Contractor is hereby informed that he will have to hire the services of a sub-contractor who will be appointed for the LV cable works, all as per above listed requirements and specifications, and to the approval of the Employer and the Engineer.

Section 9

SAFETY, HEALTH AND ENVIRONMENT

SECTION 9 - SAFETY, HEALTH AND ENVIRONMENT

9.1 STATUTORY REQUIREMENTS

The Tenderer/Contractor shall pay due attention to the following Occupational Safety and Health provisions.

(i) OSHA – Occupational Safety and Health Act No. 28 of 2005

(ii) EPA – Environment Protection Act No. 19 of 2002

(iii) Any other legal standards, General Notice, Code of Practice pertaining to Safety, Health and Environmental issues.

(iv) Any other relevant document such as Contractor's own safety, health and environmental policy.

9.2 CONTRACTOR'S PLEDGE

The Contractor shall provide commitment to achieve/complete this project in attaching the greatest importance to the prevention of any form of loss, in particular to the safety, health and welfare of his employees, the employees of the Employer as well as other relevant stakeholders etc.....as far as reasonably practicable. The Safety, Health and Environment (SHE) Plan shall provide the necessary guidance, equipment and safe working system for each and every employee and stakeholder and to allow him to carry out his work in the safest manner.

9.3 SAFETY ORGANIZATIONAL STRUCTURE

The Contractor shall appoint a Health and Safety Officer (HSO), duly registered with the Ministry of Labour and Industrial Relations, who shall have the duty to implement and enforce SHE issues. The name and CV of such Health and Safety Officer shall be communicated to the Engineer at the on-set of the contract.

The Site Managers and other supervisory staff will have the duty to assist the HSO in their daily duties in terms of Safety, Health and Environment.

The HSO shall be based full time on site and shall have the duty to carry out regular inspections and report unsafe situations and recommend remedial measures to relevant persons, including the supervising engineer.

Over and above the HSO, the Contractor shall have at least three (3) of his staff who have followed or attended a First Aid training course and will act as first aiders and who shall be made accountable for specific SHE tasks.

For the Contractor's staff working at the site, Safety Committee members will be elected by their fellow colleagues and will sit on the SHE committee which shall be

duly constituted by the Contractor. Evidence of such Safety Committee shall be produced to the Engineer at the start of the contract.

All workers, including sub-contractors will be required to go through a Site Induction prior to any activity on site.

9.4 SITE SECURITY MANAGEMENT

At the start of the contract, the Contractor shall erect all necessary boundary fence which will also act as fencing/hoarding for the site, for security purposes.

Established security personnel shall be recruited for controlling entry points during and after working hours. Such personnel may be the contractor's own watchmen or employees of registered security firms.

Visitors shall be requested to report to site offices before entering the site, and no access will be authorized to those having no business on site.

The names of site contact persons and emergency telephone numbers shall be affixed at the following locations; Site Offices, Store, workers welfare facilities, entrance gate, mess room etc.

The Contractor shall take all necessary precautions to avoid occurrence of thefts. Sub-contractors will be required to provide safe storage for plant and materials to ensure a proper and efficient site security management.

The Contractor shall ensure that an internal route will be made available for vehicles and/or delivery trucks, which shall respect a 10km/hr speed limitation within the site premises.

9.5 SAFETY RULES AND REGULATIONS

All workers of the main contractor or his sub-contractors shall undergo a '*Safety Induction*' prior to any activity on site which will encompass the site work specifications/requirement, rules and regulations, all as per existing regulations in force.

9.6 PERSONAL PROTECTIVE EQUIPMENT

The Contractor shall provide personal protective equipment (PPE) to all his employees who shall carry and wear their PPE as per the Occupational Safety and Health Act and Government Notice no.146 of 2012 at all times whilst on site.

The Contractor shall ensure that visitors and/or Employer's representatives wear hard hats where necessary.

Notwithstanding the above, depending on the nature of works/activities prevailing at the site of work, other protective equipment shall be provided by the Contractor and worn by all his employees or those of his sub-contractors.

It shall be the duty of all the contractor's supervisors to enforce safety rules with regards to the wearing of personal protective equipment.

The Site Manager / Contract Manager and the HSO shall ensure that sufficient quantity of personal protection equipment is available in the contractor's site store at all times.

9.7 FIRST AID

The Contractor's attention is drawn to the provisions for trained/qualified first aiders which shall be made available as well as First Aid posts. The names of **three** (3) first aiders and First Aid posts shall be affixed at visible locations, and submitted to the Engineer before the start of works on site.

9.8 INJURY AT WORK

In the event of an accident, workers shall be requested to contact First Aiders present at the site to receive treatment and the latter shall immediately assess the severity of the injury.

If, in the opinion of the First Aider, further medical treatment is needed, the injured workman shall be immediately transported to the nearest medical institution / hospital as the case may be.

Accident/injury cases shall strictly follow the applicable Accident Procedure in force within existing prevailing regulations.

9.9 FIRE SAFETY

Fire extinguishers will be provided at fire risk areas as per the following specifications:

Area	**Type**
Store(s)	Dry Powder
Kitchen (if applicable)	Dry Powder
Offices	Carbon Dioxide

Flammable liquids and chemical products which can spontaneously ignite shall be segregated and stored in specific well ventilated areas.

It will be strictly forbidden to burn rubbish, waste etc.....on site.

9.10 GOOD HOUSEKEEPING

Every foreman shall be responsible to keep his work area/section in clean and tidy conditions at all times, to the approval of the Engineer.

A central dumping area shall be made available to avoid accumulation of construction rubble on site and disposal of construction and demolition wastes shall take place on a regular basis.

A separate dumping area shall be identified and demarcated especially for concrete waste so as to avoid accumulation of waste concrete which can also result in tripping hazard.

Materials such as scaffold items shall be properly stacked in a specific demarcated fenced area. A scaffold clerk shall be appointed who shall have the duty, apart from controlling the in an outs of scaffold items, to ensure that scaffold items are properly stacked and not left trailing on the ground floor where it could cause tripping hazards.

Sub-contractors shall be instructed by the main contractor to ensure that materials waste is properly disposed from work areas to the central dumping area on a regular basis, and preferably at the end of the day's works.

It shall be a general condition to all workers on site to ensure site tidiness. Offenders shall be subjected to sanctions in the form of warning. After several such warnings, the Engineer shall have the power to order such members of personnel out of the site.

Scaffolding shall be properly designed and all lateral bracing shall be provided to avoid any collapse which could be injurious to the workers.

9.11 SHE AGREEMENT

As per OSHA 2005, all sub-contractors shall be regarded as "*employer"* themselves and must abide to all current legislation in addition to the main contractor's Site Rules and Regulations.

Prior to any activity on site, a SHE Contract Agreement shall be filled in and duly signed by both parties i.e. main contractor and sub-contractor, copy of which shall be remitted to the supervising engineer.

Sub-contractors found violating safety rules shall be subject to sanctions which can lead to termination of their contract as stipulated in the SHE Agreement. The Engineer shall be notified in writing of such events.

9.12 ENFORCEMENT

The safety committee and its members and/or any responsible person will decide on remedial, corrective measures and if need be upon punitive/penalties action on non-compliance to SHE issues on the part of any personnel or labour force present at the site.

All responsible persons on the contract's staff shall have the duty to implement and enforce safety procedures on site and may be ordered to leave the site if they do not comply with the rules.

A Non-Compliance Form (NCR) following site safety inspections shall be issued by the Safety and Health Officer, and counter-signed by the Site Senior Staff on any SHE non-compliance.

Serious and/or obvious SHE non-compliance on known SHE rules and regulations shall lead to disciplinary actions and may lead to termination of employment.

9.13 SCAFFOLDINGS AND WORKS AT HEIGHT

9.13.1 Potential Hazards

The Contractor's attention is drawn to the potential hazards associated with scaffolding, such as:

(i) Improper Scaffold

(ii) Workers falling from scaffold

(iii) Leading edges not properly fenced by solid barriers.

9.14 ERECTION AND DISMANTLING

Erection, alteration, dismantling of scaffold shall be carried out under the supervision of a competent and duly authorized person. Every scaffold structure shall be erected on a firm surface capable of supporting the weight of any load placed on it. The use of *concrete blocks and/or any other light/soft materials* to support scaffolding shall be strictly forbidden.

Bracing/ties shall be used where and when necessary to stiffen the scaffolding and to prevent any sideways/lateral movement/sway - which may lead to collapse and human / bodily injury

Working platforms shall fully boarded, and no gaps shall be allowed in between. Scaffold working platforms more than 2 metres high shall be fitted with handrails. Scaffold structures shall be fitted with safe means of access and aggress.

Scaffoldings shall be inspected by the contractor's supervisory staff on a regular basis and specially by an appointed Scaffold Safety Inspector who will record his findings as per a scaffold register as stipulated in the standard SHE Procedure.

9.14.1 Potential Risks

The Contractor's attention is drawn to the potential risks such as:

(i) Fall of persons

(ii) Falling objects

To eliminate such risks, every scaffold structure more than 2 metres high shall be fitted with handrails so as to prevent workers from falling. The gap between the scaffold/working platform and the building structure shall be as small as possible and not exceed 300mm when working in a sitting position. No gaps in between boards shall be allowed.

Where scaffoldings cannot be used, safety devices such as safety harnesses, belts etc shall be strictly enforced. Leading edges, voids etc. shall be fenced/covered by appropriate and solid barriers and fixed covers to avoid any worker or material from falling through.

9.15 EXCAVATIONS

9.15.1 Potential Hazards

The contractor's attention is drawn to the potential hazards associated with excavations such as:

(i) Collapse of sides

(ii) People falling in

(iii) Vehicles falling in

(iv) Materials falling on people working in the excavation

9.15.2 Prevention of Collapse of Excavation

All excavations/trenches shall be verified by a competent person before commencement of work so as to determine the risks of collapse. Excavation material shall be stored at a reasonable distance away from excavation edges to prevent excessive load on the excavation walls. Movement of earthmoving vehicles excavation, bobcats dumpers etc near excavation edges shall be avoided at all times, specially when people are working in the trenches.

Depending on the type of soil, the sides of the excavation / trench shall be secured by adequate sloping shoring, sheeting or other effective means wherever practicable.

9.15.3 Prevention of workers and vehicles from falling into excavations

All deep excavations/trenches in all areas but specially in busy work areas shall be fenced by solid barriers.

In addition to barriers, warning tapes shall be provided to indicate the presence of excavations. Such warning tapes shall be of bright colour and fluorescent.

Timber baulks shall be installed alongside the excavation(s) to prevent vehicles from overrunning the edge. Means of access and egress shall be provided for workers in all types of excavations and in all types of trenches. Excavation outside the site perimeter shall be fenced by solid materials/barriers. All excavations shall be fenced by solid materials and warning beacon lights if they are situated within pubic areas.

9.15.4 Trenches/Excavation left open

Pre-planning with all parties concerned shall be carried out by the contract manager so as to avoid excavations/trenches for services etc.....to be left open for long periods of time.

Excavations shall be inspected on a regular basis by an appointed Excavation Safety Inspector who will record his findings as per an excavation register stipulated in the standard SHE Procedure.

9.16 VEHICULAR TRAFFIC

9.16.1 Potential Hazards

The Contractor's attention is drawn to potential hazards associated with vehicular traffic, such as;

(i) Accidents – workers on site and property damage
(ii) Overrunning into excavation and trenches
(iii) Lifting loads

9.16.2 Construction Vehicles

Routes shall be clearly demarcated for trucks and construction vehicles. All trucks shall carry their helper who shall give proper indications/signals to the driver to avoid any entanglement with structures, items of plant, scaffoldings etc. All truck owners shall ensure that their vehicles are always in good condition.

Timber baulks shall be installed alongside excavations to prevent vehicles from overrunning the edge.

Construction vehicles i.e. mobile cranes, lorry-mounted cranes, ,lifting machines etc...must provide load test certificates and be in compliance with all current legislation regarding insurance, driver's licence etc. The Contractor shall be responsible for ensuring that such test certificates are valid at all times, and shall be produced to the Engineer on demand.

Road signs such as "*Reduce Speed", "Speed Limit" "Narrow Roads*" etc shall be provided where necessary.

Speed limitation sign (10km/hr) shall be posted at the entrance to the site of work.

"*Hard Core*" surfacing as and when required shall be placed to help and/or ease ongoing vehicular traffic especially where muddy conditions exist within the site.

9.17 ELECTRICAL SAFETY

9.17.1 Main Hazard

The Contractor's attention is drawn to the hazards associated with electrical wiring such as:

(i) Contact with energized circuits

(ii) Fire

9.17.2 Safety Measures to be taken at the Site

Electrical installations shall be checked/verified by the electrical sub-contractor. All permanent electrical installation "cables" shall be as far as possible buried.

All temporary cables shall as far as possible be in an aerial manner so as to avoid frayed/damaged cables.

An appointed Electrical Safety Inspector shall carry out on a daily basis a routine check and replace any broken plugs, sockets and any other part, element of an electrical component which can lead to electrocution. All findings shall be recorded in the contractor's site diary.

Appropriate trip devices, breakers etc will be provided to all electrical installations being used by the contractor or sub-contractor for the purpose of delivering his works at the site.

A general inspection of all electrical tools, extension leads etc. shall be carried out on regular basis to assess the state of the equipment for repairs, replacement or to be removed from site. The Contractor shall appoint the relevant and competent person to be in charge of this activity.

9.18 WORKING OUTSIDE NORMAL HOURS

Appropriate and sufficient lighting shall be provided whenever and wherever necessary. Provision for standby vehicles in the event of emergency will be made available.

The Contractor's senior site responsible person(s) shall be the only one(s) to decide upon the workforce to work overnight so as to restrict confusion from overcrowding etc...

No work activities where visibility can be a serious threat shall be undertaken after daylight unless under strict supervision and/or appropriate measures are made available for such works by the authorized person from the Contractor's personnel.

9.19 ENVIRONMENTAL ISSUES

9.19.1 Site Activities

All activities shall be carried out in such a way as to avoid any infringement and/or degradation of the environment, particular any surrounding or adjacent population centre.

For the purpose of plant and equipment servicing, a demarcated area shall be identified so as to avoid any hydrocarbon spills etc...to infiltrate through the soil

Whenever and wherever required, a wetting system shall be implemented to attenuate dust emission and propagation e.g. in time of high winds.

No burning of waste and/or any materials etc.....shall be allowed on site. Litter bins shall be provided at different locations on site.

9.19.2 Dust

As and when required, wetting shall be carried out so as to attenuate dust concentration, and/or dust generation which could cause complaints from the employees or the nearby residents.

9.19.3 Good Housekeeping

All foremen shall be responsible to keep their respective work areas clean and tidy. A central dumping area shall be provided for regular disposal from site. Demarcated laydown / storage areas shall be made available for materials/scaffold items. Waste bins shall be provided at conspicuous locations on the site. All to the Engineer's approval.

9.20 NOISE ABATEMENT

Nuisance caused by noise shall be kept to a minimum with consideration given to the use of the quietest plant available (for example - electric dewatering pumps). All pneumatic breakers shall be fitted with mufflers.

Plant shall not be operated during the night, on Sundays and on Public Holidays, except with the prior approval of the Engineer's Representative and relevant Authorities. This provision shall not be applicable in the case of dewatering of excavation during the normal course of the works. In these circumstances, minimum inconvenience shall be caused to the public.

9.21 ENVIRONMENTAL MITIGATION MEASURES

The contractor shall pay special attention to the following prediction of environmental impacts and their mitigation measures, as elaborated in the table below:

Environmental Parameter	Potential Negative Impact	Mitigation Measure
Air Quality	Creation of public nuisance through generation of dust and exhaust fumes during construction	• water sprinkling at least two times daily • cover stock piles of excavated material • maintain roads clear of mud and dirt from the site • routine maintenance of construction vehicles • switch off vehicles when not in use • routing of vehicles away from major residential areas as much as possible • covering of vehicles transporting loose/dusty • materials
Noise	Impact on residential Properties, and their residents as NSR's	• restrict work to daylight hours and Monday to • Saturday only • use of properly- tuned engines, proper mountings and muffling of equipment • use of equipment fitted with silencers • place noisy operations away from residences • switch off equipment when not in use • routing of vehicles far from residential/ noise sensitive area • use of hydraulic equipment • provide noise protection to workers (ear muffs)

Environmental Parameter	Potential Negative Impact	Mitigation Measure
Water Quality	i) River crossings ii) Waste Disposal	• waste handling and disposal procedures to be clearly defined • prohibit unauthorised dumping of waste • proper disposal of storm water with high turbidity resulting from silting etc. • good site management practices
Land	Waste Disposal and Visual impacts	• same as above • continuous removal of excavated materials to temporary sites for sorting, recycling and storing for backfill • construction work to be undertaken in segments • after completion of works, area shall be returned to near original condition
Traffic	i) Impact on residents along roads and streets. ii) Traffic congestion. iii) Vehicle Emissions.	• endeavour to carry out work during daylight hours as far as possible • proper planning and co-ordination of traffic diversions, • limit length of open trenches • inform public in advance of diversions • night time work in areas of high traffic to be undertaken, where practical, but with all nuisance-free measures • designate routes which minimise disturbance to residential areas • Liaison with TMSRU, RDA, MCBBRH • Routine maintenance of vehicles • switch off vehicles when not in use • route vehicles away from major residential areas

Environmental Parameter	Potential Negative Impact	Mitigation Measure
Socio-Economic	i) Noise ii) Traffic iii) Access to Properties iv) Damage to properties	• same as in noise above • proper access to properties shall be provided at all times including parking facilities where vehicle access is interrupted. • suitable construction practices to avoid damage • adequate insurance cover to the taken by contractor • adequate compensation or repairs
Health and Safety	i) Workers Safety ii) Public Safety	• good site management practices • trenches to be protected to prevent cave-in protective clothing to workers • noise- protection equipment to workers on heavy machineries. • boards indicating construction activity shall be displayed • dewatering of trenches safe access to properties • proper site supervision • adequate barriers at work places • immediate backfilling of trenches after completion
Other Impacts	Interference with existing utility services, sewers, existing water mains, telecommunication and electrical cables	• strict coordination with Utilities technical officer before and during execution of works • trial holes to be carried out well in advance to determine location of existing services • proper co-ordination with all concerned parties • care in construction works to protect works and sewers, telecommunication and electricity cables

9.22 ENVIRONMENTAL MONITORING PLAN

At the on-set of the contract, the contractor shall prepare and submit for the Engineer's approval an Environmental Monitoring Plan (EMP) taking into account all the environmental measures enumerated at Clause 9.21 above, and all the conditions of the EiA Licence enclosed at Annex 9A.

Annex 9-A

EIA LICENCE

Republic of Mauritius

LIST OF CONDITIONS FOR PROPOSED PARCELLING OUT OF LAND ABOVE FIVE HECTARES WITHIN AUREA LIVING HARMONY RESIDENTIAL DEVELOPMENT AT COTE D'OR BY SIT Property Development Ltd (SPDL) [ENV-ESDD-EIA-2020-2]

1. The EIA Licence is valid for the parcelling out of a plot of land of 83,932.9m2 bearing 4 sites, namely S7, S8, S9 and S10 into 95 residential, 1 children playing area, 4 green spaces, 2 TX plots for transformer and other associated amenities within the Aurea Living Harmony at Cote D'Or.

2. All necessary permits and clearances from the relevant authorities, shall be obtained and all the conditions attached therewith shall be scrupulously observed. A copy of all the permits/clearances obtained shall be submitted to the Director of Environment.

3. The development shall be undertaken as per the mitigating measures stated in the EIA report and the additional information submitted, unless as otherwise advised herein.

4. The Department of Environment shall be informed in writing of the date of commencement of works on site for monitoring purposes.

5. In accordance with Section 18(2)(l) of the Environment Protection Act 2002 (as amended), the proponent shall submit to the Director of Environment, an Environmental Monitoring Plan (EMP) for approval prior to start of works on site. No infrastructural works shall start prior to the approval of the EMP. The proponent shall thereafter submit monitoring reports as per the EMP approval.

6. The Department of Environment shall be informed in writing, within one month of the date of completion of all works on site, with copy of the final morcellement layout plan, for monitoring purposes.

7. The project shall comply fully with all the provisions as stipulated in Section 25 (Part I) and Section 26(Part I) of the Rivers and Canals Act.

8. The development shall comply with the provisions of the Forests & Reserves Act. The lots which borders the affluent Terre Rouge namely lot E1, E11, E12, E13, E14 and E15 shall respect the reserve 3m and no development shall be allowed within. The lots which borders the River Terre Rouge namely lot E1, E2, E3 and E4 shall respect the reserve 16m and no development shall be allowed within. The lots C36 and C37 which adjoin the left bank of Rivulet Francoise shall respect a setback of 8m and no development shall be allowed within.

9. Street lighting shall be provided to the satisfaction of the Municipal Council of Vacoas-Phoenix.

10. No waste of any type shall be discharged in any rivers, canals, watercourses, waterbody or ground surface

11. The proponent shall submit a report on the quality of water of River Terre Rouge upstream and downstream and Feeder Terre Rouge prior to construction phase and thereafter on a monthly basis to the Water Resources Unit and the Scientific Services of the Central Water Authority for monitoring purposes. The proponent shall ensure that there shall be no alteration in the quality of water due to any activity undertaken during the construction and operational phases.

12. The proponent shall ensure that residents do not have access to the River for any water activities mentioned in the Rivers and Canals Act 1863 unless authorisation be granted by the Supreme Court. A copy of approval for usage of water from river, feeder and rivulet shall be submitted to the Water Resources Unit and the Central Water Authority.

13. The pipe laying works shall be initiated according to Central Water Authority's specification.

14. The detailed design calculation and hydraulic sizing of the proposed infrastructure for drain shall be submitted to Land Drainage Authority and Municipal Council of Vacoas –Phoenix for assessment. The covers of the proposed drains and all the drain crossings shall be coupled with heavy duty metal gratings at regular 5m c/c intervals to allow for the ease of maintenance and to effectively capture the surface run off. All perpendicular and acute drain connections as proposed in the drainage network shall be realigned so as to prevent any hydraulic jump or backflow of water. Appropriate infrastructural measures shall be taken to prevent silt and debris from being discharged into the drainage network. The following details shall be submitted to Land Drainage Authority at the Building and Land Use Permit Stage:

a. The hydraulic calculations for the feeder to River Terre Rouge, River Terre Rouge and Rivulet Francois.
b. Connection points of the drainage infrastructure,
c. Cross sections of drainage infrastructures with the drain invert and the road finish level.

15. An official handing over of the works including the submission of the detailed As-Made drawings including layouts, cross sections and longitudinal sections shall be made to enable a proper maintenance of the drainage infrastructure by the Land Drainage Authority.

16. Wastewater flows shall be conveyed to existing sewers provided for SIT Aurea Morcellement. An internal sewer reticulation shall be provided for plots S7 to S10 to connect all lots to existing sewers provided for Morcellement ref:M /15524. All costs related to the sewerage infrastructure shall be borne by the promoter. The promoter shall submit for approval by the Wastewater Management Authority, the detailed design of the wastewater networks required to connect all lots S7 to S10 to the existing sewers constructed for M/15524. The detailed design shall be in accordance with BS EN 752 and shall be carried out and signed by a civil engineer registered with the Council of Registered Professional Engineers of Mauritius. The submission shall include the following:

a. material specifications for the works;
b. detailed design drawings showing dimensions and steel reinforcement of proposed manholes, inspection chambers and drain crossings;
c. layout of proposed internal and outfall sewers, showing the position of inspection chambers, manholes, fittings and sewer alignment from the proposed lots to existing sewers
d. longitudinal sections of the proposed internal and outfall sewers;
e. drawings showing details of connection of the internal sewers to the existing sewers.
f. the detail design of wastewater networks shall as far as possible cater for connection of all proposed lots to the existing sewers.
g. the exact distance between the proposed sewer manholes and river, feeder and rivulet shall be indicated in a well-defined plan.

17. During construction phase, excavated materials and boulders shall be re-used as backfill materials. Inert construction and demolition wastes (e.g., bricks, concrete) shall be used as backfill material or disposed in dedicated bays at La Chaumiere Civic Amenity Centre. Non-inert construction and demolition wastes (e.g., wood, paper, plastic, steel) shall be segregated and sent in dedicated bays at La Chaumiere Civic Amenity Centre. Recyclable solid wastes generated during operational phase be collected separately and sent to registered recyclers. Contaminated recyclable solid wastes, if any, be disposed at the nearest transfer station. Non-recyclable solid wastes shall be collected and disposed at the Mare Chicose Landfill. Green and biodegradable wastes be composted.

18. All equipment to be used on site, during the construction period, shall be regularly serviced and maintained in good working condition to avoid excessive noise emanation.

19. All electric motors such as pumps, compressors, generators, transformers and other noise generating equipment shall be housed in noise attenuating structures so that noise generated therefrom shall be within permissible limits as per Environment Protection (Environmental Standards for Noise) Regulations 1997.

20. Necessary measures shall be taken during site preparation and infrastructural works, so as not to cause any nuisance by way of noise, vibration, dust, odour or otherwise to the public and surrounding environment. The site of works shall be properly protected by hoardings, during the construction phase, to avoid any nuisance therefrom.

21. Necessary measures shall be taken to notify the public of the contact details of person responsible for environmental issues by way of notices/signboards at the project site near to existing residential development. A proper line of communication (including provision of contact details of person responsible for environmental issues) shall be established with the inhabitants of the locality to ensure effective monitoring and prompt actions by the proponent to address any grievances and environmental nuisances in terms of noise, dust and mud entrainment, among others.

22. The green space and children’s playgrounds shall be developed with amenities to the satisfaction of the Municipal Council of Vacoas-Phoenix, prior to handing over of same to the Council. The site/green spaces shall be properly embellished and landscaped with native and non-invasive plants to enhance the aesthetic value. The maintenance of infrastructure with regards to drains, road, road reserve, street lighting and green space shall be maintained regularly by a Syndic.

23. The proponent shall keep the individual lots clean and tidy and shall be responsible for the upkeep of the lots up to the sale. The proponent shall submit to the Municipal Council of Vacoas-Phoenix with copy to this Ministry, the name, address and contact details of the owner of the respective lots after the sale thereof, for environmental monitoring purposes.

24. The eventual owners of the lots shall thereafter properly maintain the acquired lots until the time of any development thereon.

25. Conditions 19, 23 and 24 shall be included in the Title Deed of each owner for all residential lots and any Deeds in Succession. Conditions No. 7, 8 and 10 shall additionally be included in the Title Deed of each owner and any Deeds in Succession of lots E1, E2, E3, E4, E11, E12, E13, E14 and E15.

26. In case of any environmental pollution or nuisance arising from this development, this Ministry in consultation with other concerned authorities may impose additional conditions, which shall be strictly observed, and will take necessary actions in accordance with the provisions of the Environment Protection Act 2002 (as amended). The additional conditions shall be strictly observed and implemented by the proponent.

27. Any proposed deviation shall be subject to an application to the Director of Environment. No deviation or part thereof shall be executed prior to the determination of the application by the Director.

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Section 10

ARCHITECTURAL WORKS

SECTION 10 - ARCHITECTURAL WORKS

Note: *These architectural works specifications should be read in conjunction with the other parts of the specifications enclosed in the other sections. They would apply for any buildings and structures being constructed as part of the infrastructure works.*

10.1 WORKED FINISHES TO IN-SITU CONCRETE

All finishing operations shall be carried out at optimum times in relation to the setting and hardening of the concrete. The Contractor shall not wet surface of concrete to assist surface working nor sprinkle cement on to finished surface of cast in-situ concrete.

A wood float shall be used so as to give a uniform slightly coarse texture which shall be free from ridges and steps.

Freshly-cast concrete shall be floated to an even surface with no ridges or steps, after which curing shall immediately commence as specified.

The concrete surface shall be successively hand or power trowelled/floated at intervals, applying sufficient pressure to close the surface, to give a uniform smooth finish free from towel marks and other blemishes. A surface hardener/sealer shall be applied in accordance with the manufacturer's recommendations, to be approved by the Engineer's architect. Then the specified curing shall be resumed without delay.

The Contractor shall complete a sample area of the finished work of size 4m2, in advance of the remainder, in an approved location, and shall obtain approval of appearance before proceeding.

10.2 BLOCKWORK

10.2.1 Concrete blocks

Concrete blocks shall comply with BS EN 771-3 for strength, drying, shrinkage, moisture movement, curing and mix. Blocks shall be obtained from an approved source and shall be good, hard, well cured and pressed and of a regular size and dimensions.

The Contractor shall supply a certificate from the supplier for each consignment of concrete blocks received to the effect that the blocks meet the required specifications. Concrete blocks shall be cured for not less than 28 days before they are used in the works.

All internal and external blockwork shall be 150mm thick hollow blockwork, unless otherwise specified.

All blockwork below plinth level shall be solid blockwork unless otherwise specified. All retaining walls to basements shall be to Structural Engineer's drawings, specifications and details.

All blockwork and reinforced concrete below ground level shall be waterproofed all in accordance with the Structural Engineer's drawings, specifications and details.

All dividing blockwork walls requiring sound insulation shall be laid with the opening in the concrete block facing up and filled with concrete. Blockwork shall be reinforced to Structural Engineer's details if required.

Where walling is to be finished fairfaced, the blocks shall be selected free from defects. Joints shall be raked out as works proceed and pointed with a neat flush joint.

Air blocks in the form of Claustra blocks of size 150mm x 150mm x 150mm shall be supplied and fixed wall panels as indicated on drawings, the purpose of which shall be to allow air to circulate inside the building.

10.2.2 Cement

Cement used for making mortar and blocks shall be ordinary Portland cement to comply with BS EN 197.

10.2.3 Sand

Sand used for making mortar and blocks shall be washed coral sand or approved alternative and comply with the relevant BS standard

The sand used shall be clean, well graded and hard. It shall be free from organic or other deleterious matter, stone, salt and dust and shall be sieved and washed if so directed by the Architect/Engineer.

10.2.4 Water

Water shall be clean, fresh and pure water from the water-supply pipes and shall be kept free from any impurities.

Water shall be tested in accordance with BS EN 1008 if so instructed by the Architect/Engineer.

10.2.5 Joint Fillers

Expansion joints compressible filler shall be to BS EN 14188 or approved equivalent and used in accordance with their written instructions.

10.2.6 Mastic Pointing

Pointing mastic shall be polysulphide mastic and used in accordance with their written instructions.

10.2.7 Storage of Materials

All materials shall be stored in accordance with the recommendations in CP 121 and the manufacturer's written recommendations.

10.2.8 Mixing Platforms

All mortar shall be mixed on a level, non-absorbent and close jointed timber or steel platform. Platforms shall be kept clean and old mortar removed before any new batch of mortar is prepared for mixing. All materials shall be measured in approved and tested gauge boxes.

The Contractor shall not use any of the slab cast in the Project as a mixing platform.

10.2.9 Mortar

Cement mortar shall, unless otherwise specified, be composed of cement and sand (1:3). The specified mix proportions shall be measured by volume using dry sand in proper gauge boxes and bulking shall be allowed for if the sand is damp.

Mortar shall be made and used in accordance with CP 121. The cement and sand shall be mixed dry on a platform until the mix is uniform in colour and then water added gradually through a fine rose and the mixture turned over until the ingredients are thoroughly incorporated and brought to a proper consistency. Only sufficient water shall be used to obtain a workable mix.

Cement mortar shall be mixed in small quantities and must be used within thirty minutes of mixing and no partially or wholly set mortar shall be reused or remixed.

10.2.10 Setting Out

All walls, partitions, projections, openings, etc., shall be carefully set out in accordance with the drawings, checked up with any reinforced concrete work and overall dimensions. The Architect's/Engineer's attention shall be drawn to any discrepancies or if any doubts occur in the setting out before proceeding.

10.2.11 Workmanship Generally

Blocks which are mis-shaped or which have broken arises or are chipped, cracked or otherwise damaged shall not be used.

Workmanship shall be in accordance with CP 212 and unless otherwise specified all blockwork shall be built in stretcher bond.

Blocks shall be well and fully soaked before being laid and the top of the walling where left off shall be well wetted before recommencing block laying the next day.

All courses shall be kept level and in line, and all wall faces, angles and features shall be accurately plumb and true to the lines and true in vertical plane.

Walls shall be set out carefully to ensure satisfactory junctions and joints with adjoining or built-in elements and components. All perpends and angles shall be plumbed, and jambs and reveals properly formed.

Proper setting-out rods shall be provided and all work shall be set out for course, opening, heights etc., to the widths, depths and heights indicated on the drawings and as directed by the Architect/Engineer.

10.2.12 Bonding

Bonding shall be in accordance with CP 121.

All walls shall be constructed with all materials fully bonded or tied together, and joints filled, to ensure compliance with design requirements for stability, strength and fire resistance.

All walls shall be built entirely solid in blocks, without voids, with alternative courses of walls at all angles and intersections carried through the full thickness of the adjoining wall and shall be properly bonded and secured at such intersections.

All walls of 200mm thickness or less shall be built in single thickness of block.

10.2.13 Jointing and Pointing

Jointing and pointing shall be in accordance with CP 121.

Blocks shall be well-buttered with mortar and shall be solidly bedded and jointed at each and every course throughout the width of each course in cement mortar as described with beds and joints not more than 12mm or less than 10mm thick, all flushed up and grouted solid as work proceeds.

Wall shall be built in such a manner that no vertical joint in any one course shall be within 110mm of a similar joint in the courses immediately above or below.

Walls which are to receive rendering shall have joints raked out as work proceeds in order to produce the necessary keying for plaster.

10.2.14 Staging

All walls shall be properly protected while mortar is setting and all walls throughout the work shall be carried out to not more than 1.0 metre higher at any one time than any other part of the wall being built.

All putlog holes shall not be less than one course deep and shall be carefully filled with a block cut to fit the size of the hole with beds and joints filled in solid with mortar and well tamped in after scaffolding is removed.

10.2.15 Curing

Walls shall be kept thoroughly wet for at least three days or for such longer period of time as the Architect/Engineer may direct. Walls exposed to the sun shall be protected with a sacking which shall be kept wet.

10.2.16 Sample Blockwork Panels

The Contractor shall allow for constructing two sample blockwork panels approximately 2sq m each 150mm thick for checking by the Architect/Engineer for approval. When approved, sample panels shall form the standard to be maintained throughout the contract. The Contractor shall ensure that the sample panels are located in such a position that they are kept in place throughout the construction period.

The sample area and the foundation thereof shall be removed when instructed and the surface of the ground shall be made good.

10.2.17 Cutting

All rough cutting, raking cutting, curved cutting or cutting to special architectural profiles shall be executed true to the lines and neatly in accordance with the drawings or as directed by the Architect/Engineer.

10.2.18 Building-in

Cramps, gratings, air blocks, dowels, etc., shall be built in cement mortar.

10.2.19 Building-in, Bedding and Pointing

Steel door and window frames and the like shall be built as the work proceeds and shall be set up in positions for building in and securely strutted to prevent distortion whilst the walls are being built.

Pressed-steel door frames shall be grouted in solid at back with concrete as specified as the work proceeds.

Where steel windows or pressed-steel door frames are built against concrete, they shall be plugged and screwed on dove-tailed hardwood blocks or proprietory fixings cast into concrete walls, beams, columns etc.

All doors, windows and similar frames shall be bedded and carefully pointed all round and made perfectly watertight in cement mortar as described.

Where doors, windows and similar frames are specified to be bedded and pointed with mastic compound, they shall be pointed all round externally and/or internally with an approved waterproof compound of such composition that it will not stain surrounding surfaces, and that it will adhere tenaciously, will remain plastic without sagging or running, will be capable of accommodating any normal movement of the joint sealed and in the case of steel receiving paint without "bleeding". The pointing material shall be forced into the joints, which shall have previously been prepared to receive same, by means of a pressure gun or by other suitable method, all in accordance with the manufacturer's instructions.

10.2.20 Chases and Holes

All chases, recesses, projections, etc., cut or formed for electrical conduits, switch boxes, distribution boards, etc., shall be formed as and where shown on drawings and details.

Pockets and holes for pipes shall be formed or neatly cut as required and properly made good thereafter. The positions of all chases and holes shall be agreed with the Structural Engineer.

All chases, recesses, projections, holes, etc., shall be cut or formed neatly and to true lines and levels using suitable power tools to prevent any damage to the blockwork.

10.2.21 Protection

The whole of the blockwork shall be kept clean and protected as the work proceeds.

10.2.22 Measurement and Rates

The Contractor shall allow in his rates for walling for all plumbing angles, rough cutting whether straight, raking or splay and waste, split courses necessary for bond, bonding at angles, intersections and junctions of walling of different thickness, forming solid tops under beams and soffits of slabs, forming any split course and cutting and fitting around ends of cills and lintels or other members, cutting and pinning ends of structural timbers, steel sections, forming all door, window or other openings including forming reveals to same and for all cutting and waste to walling in short lengths to mullions or jambs of openings.

10.3 STONEWALLER

10.3.1 Stones

All stone for walls shall be approved local fieldstone of blue or yellow basalt stone carefully selected for size, strength, colour and texture. Stones shall be sound and hard throughout, free from any defects.

Stones shall be mixed evenly throughout the work to avoid any inconsistencies in pattern or variation in colour or texture.

10.3.2 Cement

Cement used for making mortar shall be ordinary Portland cement to comply with BS EN 197.

10.3.3 Sand

Sand used for making mortar shall be washed coral sand or approved alternative and comply with the relevant British/European Standard.

The sand used shall be clean, well graded and hard. It shall be free from organic or other deleterious matter, stone, salt and dust, and shall be sieved and washed if so directed by the Architect/Engineer.

10.3.4 Water

Water shall be clean, fresh and pure water from the water-supply pipes and shall be kept free from any impurities.

Water shall be tested in accordance with BS EN 1008 if so instructed by the Architect/Engineer.

10.3.5 Storage of materials

All materials shall be stored in accordance with the recommendations in CP 121 and the manufacturer's written recommendations.

10.3.6 Mixing Platforms

All mortar shall be mixed on a level, non-absorbent and close jointed timber or steel platform. Platforms shall be kept clean and old mortar removed before any new batch of mortar is prepared for mixing. All materials shall be measured in approved and tested gauge boxes.

10.3.7 Mortar

Cement mortar shall unless otherwise specified, be composed of cement and sand (1:3). The specified mix proportions shall be measured by volume using dry sand in proper gauge boxes and bulking shall be allowed for if the sand is damp.

Mortar shall be made and used in accordance with CP 121. The cement and sand shall be mixed dry on a platform until the mix is uniform in colour and then water added gradually through a fine rose and the mixture turned over until the ingredients are thoroughly incorporated and brought to a proper consistency. Only sufficient water shall be used to obtain a workable mix.

Cement mortar shall be mixed in small quantities and shall be used within one hour of mixing and no partially or wholly set mortar shall be reused or remixed.

10.3.8 Workmanship

Walls shall be built to the thickness shown on the drawings and the stones shall be bonded solid for the full width and all voids filled in solid with cement mortar as described. Excessive gaps between adjacent stones shall be filled in neatly with smaller stones as the wall is built. All stones shall be “as found” and laiduncoursed. Mortar joints shall be raked to a depth of 25mm from the face of the wall to give a dry stone wall appearance or flush pointed as described.

All vertical faces, returns and reveals of stone walls shall be dressed to true lines and levels.

Stones shall be soaked before being laid and the top of any walling where left-off shall be well wetted before recommencing the stone laying.

All wall faces, angles and features shall be accurately plumb and true to the lines and true in vertical plane.

Walls shall be set out carefully to ensure satisfactory functions and joints with adjoining or built-in elements and components. All perpends and angles shall be plumbed, and jambs and reveals properly formed.

Proper setting-out rods shall be provided and all work shall be set out for course, opening, heights etc., to the widths, depths and heights indicated on the drawings and as directed by the Architect/Engineer.

10.3.9 Bonding

All walls shall be constructed with all materials fully bonded or tied together, and joints filled, to ensure compliance with design requirements for stability and strength.

10.3.10 Staging

All walls shall be properly protected while mortar is setting and all walls throughout the work shall be carried up evenly, no part being allowed to be carried out up more than 1.0 metre higher than any other part of the wall being built at any time during the construction.

All putlog holes shall not be less than one course deep and shall be carefully filled with a stone cut to fit the size of the hole with beds and joints filled in solid with mortar and well tamped in after the scaffolding is removed.

10.3.11 Sample Stonework Panels

The Contractor shall allow for constructing two sample stonework panels approximately 2 sq m each 450mm thick; when approved, such sample panels shall form the standard to be maintained throughout the contract. The Contractor shall ensure that the sample panels are located in such a position that they are kept in place throughout the construction period.

10.3.12 Cutting

All rough cutting, raking cutting, curved cutting or cutting to special architectural profiles shall be executed true to the liens and neatly in accordance with the drawings or as directed.

10.3.13 Copings

Copings to top of stone walls shall be dressed on all exposed faces.

10.3.14 Protection

The stone wall shall be properly protected from mortar droppings, etc., and kept clean and neat as the work proceeds and the whole of the stonework shall be wire-brushed and cleaned down to the satisfaction of the Architect/Engineer on completion. Should the Contractor be unable to clean the wall from mortar droppings etc., to the satisfaction of the Architect/Engineer, he will be required to re-execute the work to the extent which the Architect/Engineer may deem necessary at no extra cost.

10.3.15 Measurement and Rates

The Contractor shall allow in his rates for walling for all plumbing angles, rough cutting whether straight, raking or splay and waste, split courses necessary for bond, bonding at angles, intersections and junctions of walling of different thickness, forming solid tops under beams and soffits of slabs, forming any split course and cutting and fitting around ends of cills and lintels or other members, cutting and pinning ends of structural timbers, steel sections, forming all door, window or other

openings including forming reveals to same and for all cutting and waste to walling to short lengths to mullions or jambs of openings.

Rates for stonewalling shall include for all dressing to external angles.

10.4 ROOFING

10.4.1 Thatch Roofs

The minimum thickness of the face work, measured above the face of the batten, at right angles to the pitch, shall not be less than 400mm. Valleys shall be rounded off to give a minimum depth of 500mm over the valley centre.

The Contractor shall ensure an even density of thatch over the roof surface.

The thatch shall be fixed under tension at all times and shall not slip.

All areas of the roof will be securely protected by galvanised wire netting or approved equivalent. Netting shall conform closely to the roof shape and be fixed in such a way that it can be easily removed in the event of fire.

10.4.2 Timber Shingles

Timber shingles shall be applied on solid decking or open spaced sheathing, with the necessary spacing, depending on the length of shingle used.

Shingles shall be doubled at all eaves to form a starter course. Butts of shingles in the first course on roofs shall project as specified from the edge of roof eaves to insure proper spill. Shingles shall be butted together at the side edges as they are installed.

All hips and ridges shall be fixed with screws or nails long enough to penetrate into sheathing. Capping shall be of copper.

Shingles extending into a valley shall be sawed to the proper mitre. The Contractor shall not break joints into valley nor lay shingles with grain parallel with the centreline of valleys. All valleys shall be installed with shingles lapping the valley flashing not less than 200mm on each side. Flashing shall be of copper.

Nails shall be driven flush and in such a manner so that the nail head does not crush the wood. Spacing for nailing on each shingle shall be respected throughout the job. Nail shall be stainless steel or hot-dip galvanized, as approved by Architect/Engineer.

All shingles shall be fixed using a marking line as a straight edge to line up rows of shingles.

Prior to starting work, the contractor shall examine all roof decks on which work is to be applied for defects in materials and workmanship which may be detrimental to the proper installation or long-term performance of the shingles.

The shingle roof shall resist the worst cyclonic conditions with gusts of up to 300km/hr.

The timber used for shingle shall be resistant to decay and termites and fungus attack. In case the timber does not comply with such characteristics in its natural state, the Contractor shall propose additional treatment on shingles to attain the required resistance; such treatment shall be approved by Architect/Engineer prior to the start of work.

10.4.3 Pre-Painted Aluminium Sheeting

Pre-painted aluminium sheeting shall be supplied by approved Manufacturer and laid only by approved Specialist Firm.

All pre-painted aluminium sheeting coverings shall be executed to the entire satisfaction of the Architect/Engineer and in accordance with the following applicable BS, AA (Aluminium Association) and EN Documents & Specifications: BS EN 485, BS EN 515, BS EN 573 and

Pre-painted aluminium sheeting shall be available in profiles IBR and corrugated.

The product shall be resistant to atmospheric/chemical attack (corrosion resistance); it shall be protected by a thin self-heating film of oxide and be of high reflectivity to heat, light and radio wave.

The minimum thickness for pre-painted aluminium sheeting shall be as per the manufacturer's technical data sheet and shall be supplied readily formed by a variety of processes as per Manufacturer's Specifications. The ductility of sheeting shall allow the product to be easily folded, pressed, rolled, extruded, forged and diecast.

Colours and design for pre-painted aluminium sheeting shall be approved by the Architect.

10.4.4 Measurement and Rates

To Contractor's attention is drawn that eaves, ridges, skirtings, fascias, aprons, roof lights, ventilators, soaker collars, hip, special roofing pieces or sheets shall be deemed to be included in the item for coverings and linings, unless otherwise specified.

10.5 WOODWORK

10.5.1 Definitions

The term "(f)"qualifying an expression of size means that the work shall be finished to the sizes given.

The term "Ex" qualifying an expression of size means that the work shall be executed out of nominal sizes given.

The term "Plugging" shall mean the provision and fixing of hardwood or approved proprietory plugs, or, at the contractor's option fixing by other approved mechanical means to any background e.g. blockwork, concrete, etc.

10.5.2 Source and Quality of Timber

All timber shall be obtained from an approved source of supply and shall be in compliance with the specified requirements.

All timber shall be suitable for the purpose for which it is intended and shall be well and thoroughly seasoned, sound, free from sap, shakes, large, loose or dead knots, cracks, decay, live insect attacks or other defects.

Timbers shall be straight and true and any warped or twisted timbers shall be rejected. Timbers are to be sawn die square and shall hold the full sizes specified. All timbers shall be in one piece.

No timbers, whether permanent or temporary, which are or show evidence of being, or have been, infected with borer or any other insects, pests are to be permitted on site, and such timbers are to be removed and replaced.

10.5.3 Certificate of Treatment

The Contractor shall submit a certificate of treatment against termite, pests, etc. at source, and this certificate shall be to the satisfaction of the Architect/Engineer

10.5.4 Anti-Termite Paint

All timber faces which are earmarked to be placed in direct contact with plaster, concrete or blockwork shall be treated with an approved anti-termite paint, in addition to the specified treatment of the wood, prior to placing in the required position, all to the approval of the Architect/Engineer.

10.5.5 Preservative Treatment

Where described as treated, timber shall be pressure impregnated with an approved preservative to a dry salt retention of 5.3 kg of preservative per cubic metre of timber. Timber to be treated shall be machined down to its final dimensions before treatment.

Pressure impregnation shall be carried out in accordance with the preservative manufacturer's recommendations and the recommendations of BS 8417 and BS EN 1995.

After pressure impregnation, the timber shall be dried to the moisture content specified hereinafter. All surfaces of timber which are cut or machined after impregnation shall be treated with preservative as recommended by the manufacturer of the preservative used for the impregnation.

Any metal used to fix or fix to timber which has been treated with preservative shall be compatible with the preservative or shall be treated so as not to corrode under any conditions.

Similarly, all adhesives used to fix or fix to timber which has been treated with preservative shall be compatible with the preservatives in accordance with the recommendations of the adhesive and preservative manufacturer's recommendations.

10.5.6 Back of Frames and Linings

The Contractor shall allow for treating all backs of frames and linings in contact with walling or concrete with an approved preservative, which shall be to the satisfaction of the Architect/Engineer.

10.5.7 Timber for Carpentry

All timber for carpentry shall be as specified and of first grade best quality and treated, to the approval of the Architect/Engineer.

All carpentry shall be executed with workmanship of the best quality and be accurately set out and in strict accordance with the Drawings. Constructional carpentry shall be framed together in the best and strongest manner and secured with all the necessary straps, bolts and other ironwork. All plates and similar items shall be in long lengths, properly halved at joints, etc., all according to the best practice and to approval. The provision of all brads, nails, screws, plates or other fixings shall be as directed and approved by the Architect/Engineer.

10.5.8 Timber for Joinery

All timber for joinery shall be as specified and of first grade, best quality and selected, to the approval of the Architect/Engineer.

All exposed woodwork, unless otherwise specified, shall be wrot. All wrot surfaces shall be finished clean, smooth and free from tool marks. For each wrot face 1.5mm and 3mm will be allowed off specified sizes for hard and soft woods respectively except where specified as " (f) " or "(f sizes)" in which case the timbers must hold the full size specified.

10.5.9 Wrought Timber for Joinery

The quality of timber shall be in accordance with BS EN 942. Timber to receive a clear finish shall comply with the requirements specified therein. Timber to receive a paint finish shall comply with the requirements specified therein. Timber grounds and other concealed framing shall comply with the requirements for "concealed or semi-concealed surfaces".

10.5.10 Hardwood Veneers

Hardwood veneers shall be as stated, and shall be to the approval of the Architect/Engineer.

10.5.11 Plywood

Plywood shall comply with BS 1088 Grade 2, veneer WBP bonding. Marine plywood shall be as specified, and shall meet the approval of the Architect/Engineer.

10.5.12 Moisture Content

All timber for joinery shall be kiln dried to moisture content which shall not be less than 10% nor exceed 12%.

The Contractor shall ascertain the particular moisture content for doors and other joinery items in respect of their location in the finished building before placing orders. The specified moisture content shall be maintained during the execution of the works.

10.5.13 Workmanship

The quality of workmanship shall be at least equal to the applicable recommendation in BS EN 942.

All joinery shall be scribed to fit perfectly in position and unless otherwise described, all joinery shall be slightly rounded on all exposed arises.

When fixed in position, doors and all other joinery work shall remain free from shrinkage, swelling, twisting, splitting, warping or any other defect which will detract from satisfactory performance or appearance.

10.5.14 Nailing

Use of nails shall be minimised in woodwork and shall be solely at the discretion of the Architect/Engineer.

All nails when allowed to be used shall be of the best quality and of gauge, length and strength suitable for the particular work for which they are used. Nails shall be long enough to enter the second timber by at least one-half their entire length, before punching. Only galvanised nails complying with BS 1202 shall be used in joinery work.

10.5.15 Screwing

All timber shall be fixed with brass screws or pins. Screws shall comply with BS 1210 or equivalent as appropriate. Brass screws or pins shall be of the best quality and of gauge, length and strength suitable for the particular work for which they are used. Screws shall be long enough to enter the second timber by at least one-half their entire length. All screw heads shall be countersunk below the timber surface and pelleted. All work shall be secret fixed wherever possible, and shall obtain the final approval of the Architect/Engineer.

10.5.16 Pelleting and Stopping

Colour and grain match pellets not less than 6mm thick, cut from matching timber only shall be used and shall be finished off flush with face. The exposed face of the pellets shall be perfectly circular and fit in neatly. Stopping to timber shall match the timber in colour and appearance so as to be indistinguishable from the surrounding woodwork.

10.5.17 Fixing of Joinery

All joinery works shall be executed in accordance with the Architect's drawings and not from measurements at the building. It shall be the responsibility of the Contractor to ensure that the surrounding or enclosing carcass where joinery works are to be fixed in or inserted in the required positions should be built accurately to the dimensions shown and true to the lines and levels so that all joinery works to be fixed in or inserted in the required position fit in accurately and neatly in the surrounding or enclosing carcass, all to the approval of the Architect/Engineer.

It shall be the responsibility of the Contractor to ensure that the necessary fixings are incorporated in the carcass or surrounding; alternatively, the Contractor shall construct such grounds as are required to provide a suitable base and fixing for the joinery works.

Joinery works shall not be fixed in position until after all floor, wall and ceiling surfaces have been formed or constructed and the building enclosed.

10.5.18 Joinery

All joinery manufacture shall be put in hand immediately after the order has been given to commence work or upon receipt of details. Joinery must be stacked in an approved manner in a dry place and shall not be wedged or glued until just before fixing in the building. Should the joints of any joiner's work open or give, or any shrinkage take place before payment of the final certificate, such defective work shall be taken down, refitted and redecorated or new joinery put in its place at the Contractor's expense.

Unless otherwise specified, all joinery shall be purpose made and worked to detail drawings and shall be constructed in accordance with approved best standard practice, morticed and tenoned, dowelled, dovetailed, tongued, grooved, glued, pinned, screwed, etc., as is best suited for the particular part. All morticed and tenoned joints shall be pinned with hardwood pins in addition to wedging and gluing. Single lengths of skirtings, rails, architraves and such items of joinery shall be used wherever possible in preference to lengths made up of shorter pieces. Heading joints will not be permitted except where unavoidable. Such heading joints shall be splayed and made invisible. Where there are joints in joinery which are to be finished for waxing or oiling, then the ends shall be matched for grain.

All exposed screw-heads shall be covered with wood pellets finished flush.

The whole of the joinery works shall be properly protected as directed by the Architect/Engineer and kept clean and neat during the course of the works; should any joinery works be damaged or disturbed, same shall be made good to the satisfaction of the Architect/Engineer all at the Contractors' expense.

10.5.19 Defective Work

All timber during manufacture, delivery, storage, fixing and thereafter to practical completion shall be maintained to conditions of temperature and humidity suitable for specified moisture content of the timber components.

Any work with defects such as shrinkage, warping, etc., appearing before the expiration of the Defects Notification Period for this Contract shall be removed, refitted and redecorated or replaced by new joinery; any other work disturbed in consequence thereof shall also be made good, all at the Contractor's expense, and to the Architect/Engineer's approval.

10.5.20 Doors

(a) Framed Doors

All framed doors shall have continuous stiles, properly morticed for rails, ledges, braces, etc., as detailed, and all these members shall be properly tenoned to fit neatly and tightly into the mortices and shall be securely glued and dowelled in position, the whole frame being held in a metal clamp during dowelling. Where doors are lined with tongued and grooved boarding, the stiles and heads shall be rebated, grooved and V-joined for the boarding, which shall be properly cramped up, secret bradded and twice screwed at intersections with ledges and bottom rail with galvanised countersunk screws.

(b) Framed, Ledged and Braced Doors

Unless otherwise described, all "framed and ledged" doors and "frame, ledged and braced" doors shall have the ledges and braces chamfered and shall be filled in with grooved, tongued and V-joined boarding on both sides in narrow widths, shall be rebated on the outer edges and shall be fixed in grooves in stiles and top rail, flush one side and twice countersunk screwed at each intersection with ledges and braces. The inner edges of framing and abutting edges of boarding shall be chamfered to form a V-joint. All edges of boarding and framing and back of ledges and braces shall be primed before assembling.

(c) Solid, Semi-solid and Hollow-Core Doors

Solid, semi-solid and hollow-core doors shall be of approved manufacture, of the best quality material and workmanship and shall comply with the requirements of BS 459 Part 2, unless otherwise specified.

Flush doors shall be properly jointed together with the rails dovetailed to the stiles and faced both sides with 3mm thick plywood to BS 1088; all wedges shall be lipped with 8mm thick hardwood, unless otherwise specified.

Fire check flush doors shall comply with the requirements of BS 459 Part 3, with the approved fire retardant infill, to the approval of the Architect/Engineer.

Soundproofing and waterproofing fittings shall be as per requirement to meet the desired soundproofing and waterproofing levels, as specified and/or to the approval of the Architect/Engineer.

(d) Concealed Edges to Doors

Doors described as "with one edge concealed" shall have an edge strip of material similar to the veneer tongued or glued to one edge of each door. Doors "with all edges concealed" shall have similar edge strips tongued or glued to all edges of each door or leaf.

(e) Hanging Doors

Allowance shall be made by the Contractor in his rates for hanging and fitting all doors to steel or wood frames.

10.5.21 Panelled Work

All panelled or veneered woodwork, whether stained, varnished or painted, etc., shall be of timber carefully selected for uniformity of grain and colour and all to the approval of the Architect/Engineer.

10.5.22 Glazed Timber Doors

Doors shall be of specified frames, transoms, and mullions, all divided to Architect's details/design and complete with quadrant beading to detail.

Glazing shall be as specified and to the approval of the Architect/Engineer.

10.5.23 External Openings

All external timber openings shall have weather drips as per details and shall be properly siliconed to jambs/cills and head prior to fixing beadings/architrave.

10.5.24 Priming

The surfaces of all joinery work shall be prepared and primed to receive a paint finish prior to delivery to the site and shall thereafter receive a second paint finish on site.

Preparing and priming shall be in accordance with the specification therefor in "Painting and Decorating" hereinafter. Open-grained surfaces shall be filled and rubbed down to give a smooth even surface suitable for the subsequent site applied finish.

10.5.25 Ironmongery

All ironmongery shall be either of the make and to the exact specification described or of an approved make and design giving similar action. In the latter case, actual samples shall be submitted to the Architect for approval and comparison with the goods specified. All ironmongery shall be fixed with screws to match.

All locks shall be stampered with distinctive consecutive numbers and the keys shall be tagged and referenced to the doors which they operate and handed over to the

Client/Employer in the presence of the Architect on completion. All locks supplied with three keys. All locks shall be different from each other so that the key of any one lock will not open any other lock. All locks shall be determined according to the master keying system.

The Contractor shall be responsible for ordering correct "hands" of ironmongery and supplying accurate site dimensions for kicking plates and similar items where required.

10.5.26 Measurement and Rates

All timbers shall be measured the net length and no allowance has been made for joints in the lengths whether lapped, spliced, halved or carved. All work shall be understood to be fixed, including all waste, labour, nails, spikes, brads, screws, pins, etc., laps dovetailing, mitres, jointing and gluing all of which shall be allowed for in the rates quoted by the Contractor. In addition, prices shall also include for selecting and keeping clean from staining, polishing where so described, cutting and fitting around obstructions, notches, rounded corners, sinking and the like, short lengths ends, returned ends, angles and mitres, holes and countersunk holes for bolts, pipes, tubes, bars, cables, conduits and the like, all plugging and screwing to any background. Unless otherwise stated, all joinery work shall be taken as planted on i.e. fixing with nails, pins or screws as may be required.

The Contractor shall also allow in his rates for all fixings and grounds to which joinery is fixed and for hanging and fitting of doors to steel or wooden frames.

Rates shall include for fixing to softwood, hardwood or pressed metal door frames and for all screws, etc., of corresponding metal or colour. All ironmongery, locks, etc., shall be oiled eased after fixing and as may be required. Rates shall include for protecting from damage, removing ironmongery for decorations and subsequent refixing and cleaning off on completion.

The rates for continuous hinges, curtain tracks, water bars, channels and other similar items of linear measurement shall be deemed to include for cutting to lengths, and for allowing any wastage resulting therefrom.

10.6 METAL WORK

10.6.1 Steel

(i) Mild steel shall be of an approved manufacture and comply with BS EN 10025.

(ii) Stainless steel shall comply with BS EN 10268 or BS EN 10312.

10.6.2 Bolts

Bolts, nuts and screws shall be of the sizes shown and with hexagonal heads and nuts and washers where required. All bolt holes shall be true and opposite. Bolts and nuts shall comply with BS 1769 as appropriate.

10.6.3 Rivets

All rivet heads shall be countersunk at all bearings, joints and wherever necessary.

10.6.4 Galvanising

Metalwork to be galvanised shall comply with BS EN ISO 1461.

All hot-dipped galvanising shall be executed in accordance with BS 990. Where this is impractical because of tolerances on screw threads, the finish shall be electro-galvanised to BS 7371.

The latter process shall be used for making good any damage to hot dipped galvanising if so directed by the Architect/Engineer, and to their approval.

10.6.5 Metalwork on Delivery to Site

All metalwork shall be delivered to the site quite clean and free from rust, pitting or any corrosion.

Such deliveries will be duly checked by the Architect/Engineer and any detected rust, pitting or corrosion will cause the metalwork to be rejected; it shall then be remedied to the approval of the Architect/Engineer, all at the Contractor's expenses.

10.6.6 Steel Windows

All steel windows shall be from galvanised sections or hot dipped galvanised after manufacture. A sample window shall be submitted to the Architects for approval before any order is placed. All sectional frames, casements and glazing bars shall be free from flaws and other imperfections.

All steel windows and doors and frames shall be constructed in FX6 and FX8 section with tee glazing bars as specified.

All top, bottom and side-hung opening casements, unless otherwise described or shown on the drawings, shall be hung on stout steel pivot hinges with gunmetal centres.

All top hung opening fanlights and casements, unless otherwise described or shown on the drawings, shall be fitted with brass peg stays with pegs arranged to lock window when closed.

All side-hung casements, unless otherwise described, or shown on the drawings, shall be fitted with brass handles and pivot with night ventilating notches to engage with striking plate and adjustable brass sliding stay.

All horizontal and vertical pivot hung sashes shall be fitted with approved bronze friction centres capable of adjustment and fitted with brass fastening, unless otherwise described or shown on the drawings.

10.6.7 Steel Doors

Steel doors with frame and sash frame shall be as described and specified. Kicking plates and other solid metal beads shall be screwed on. Locks and furniture shall be as described and shall have three keys. Each leaf of doors shall be fitted with two 150mm brass square pattern tower bolts.

All large doors and windows shall be provided with temporary braces of stiffeners to prevent coupling screws or sections being strained during transit, hoisting and handling. After doors and windows are built in and prior to glazing, each door and window shall be carefully tested and adjusted to ensure that opening sections are in perfect working order and, making good contact, are watertight and that glazing bars are perfectly aligned.

10.6.8 Louvres

Louvres shall be in galvanised steel or anodised aluminium with an anodising of not less than 20 microns and shall be obtained from an approved supplier. A sample louver shall be submitted to the Architect/Engineer for approval before any order is placed.

Louvres shall be complete with fixing screws, plugs, weather strips at heads and sills and all necessary fixing accessories. Composite openings of 1000mm high and above shall be provided with aluminium mullions 6mm x 50mm as per the manufacturer's recommendations and shall be fixed by means of retaining brackets with 4 screws on each head and cill and bolted to the louver channels.

Louvres shall be glazed with either 152 mm x 6mm clear float glass louver blades with two long edges bevelled and polished.

The whole of the louvres shall be fixed in accordance with the manufacturer's instructions, and to the approval of the Architect/Engineer.

10.6.9 Pressed Steel Door Frames

Pressed steel door frames shall be of 1.6mm (for once rebated frames) and 1.2mm (for twice rebated frames) close annealed and hydraulically flattened galvanised steel sheets, pressed to shape, mitred and welded at angles and provided with six approved steel lugs (three to each jamb) with ends split and flanged for building into walls. Frames described as suitable for fixed or opening fanlights shall have transoms of similar steel with welded seams at edges and ends tenoned into and welded to frames. Frames shall be fitted with solid plates or bracing bars across their bottom edges.

Unless otherwise stated, each frame shall be fitted as described with approved heavy steel butts welded on. Each frame to doors fitted with a mortice lock shall be slotted for bolt, correctly positioned and shall have a mortice cap welded on at the back of the perforation. All necessary drilling for sundry ironmongery such as fanlight openers, bolt sockets, etc., should be executed by the steel frame manufacturers at the works and the Contractor shall undertake to supply the correct information to the manufacturer to ensure that this is done. All frames shall be fitted with a pair of anti-slam buffers.

Fixings for set-screws shall have a solid welded-on plate at the back in all cases. All steel frames shall be thoroughly cleaned free from rust, scale, etc., and shall be primed prior of delivery to the site.

10.6.10 Roller Shutters

Roller shutters shall be in galvanised mild steel plates of 18 S.W.G. sheets or slatted aluminium panels, whichever applicable, and shall be obtained from an approved manufacturer.

Shutters shall be complete with guides, channels manual gear, gearbox caning, lock and cyclone bars as appropriate.

Roller shutters shall be designed, manufactured and fixed to withstand the worst cyclonic conditions with wind speeds/gusts of 300km/hr; and a written guarantee to this effect shall be provided by the manufacturer together with any supporting evidence and samples before any order is placed.

10.6.11 Aluminium Openings

Aluminium screens, doors and windows shall be obtained from an approved manufacturer. Anodising shall not be less than 20 microns and all aluminium shall be anodised and shall be finished with a polyester powder coat finish of an approved colour with a minimum thickness of 60 microns, to the approval of the Architect/Engineer. Powder coated finish shall be to BS 6496 with a guarantee of 10 years.

Aluminium openings shall be complete with all glass and ironmongery as specified. Brass screws shall be used unless otherwise specified.

The contractor shall be responsible for the design of all the aluminium openings and submit the necessary design calculations to the Engineer for approval.

Shop drawings and sample of sections, ironmongery and slatted panels shall be produced for approval prior to placing order for manufacture.

All aluminium openings shall be properly siliconed to RC jambs, heads and cills prior to fixing architraves and beadings. A maximum gap of 5mm will be considered as acceptable.

All joints are to be made weathertight with neoprene rubber gaskets, etc, as recommended by specialist. The aluminium openings shall be properly silicone to RC jambs, heads and cills and shall be able to withstand water pressure test as witnessed and approved by Architect.

Approved door stopper and door holder shall be provided for each aluminium door, unless otherwise specified. Detail of threshold to external doors shall be approved by Architect/Engineer. Doors/windows should be fitted with all necessary approved ironmongery, handles, aluminium or stainless hinges and/or friction hinges to both sides of openings etc, bolts and screws shall be of stainless steel grade 316 and should be properly fixed within concrete and/or blockwork and/or timber subframe.

Information pertaining to specific trade (e.g. Distribution Board Panel) shall be to respective Consultant's specifications.

The whole screen shall be designed, manufactured and fixed to withstand the worst cyclonic conditions and wind speeds and gusts of 280km/hr; a written guarantee to this effect shall be provided by the manufacturer together with any supporting evidence and samples before any order is placed.

10.6.12 Composite Items of Metalwork

The fabrication, assembly and erection of all composite items of metalwork shall be executed in accordance with the Architect drawings.

Metalwork which are bent or distorted during loading, transporting, off loading or in storage will be rejected by the Architect/Engineer.

All composite items of metalwork shall be hot dipped galvanised after manufacture as described.

10.6.13 Fixing and Erection

All metalwork including doors and windows shall be inspected for damage on arrival at the site and any damage to hot dipped galvanising or paint shall be made good subject to approval from Architect/Engineer.

All seating and surrounds shall be checked for line, level and bolt setting before commencement of fixing. Errors which cannot be accommodated without distortion shall be brought to the attention of the Architect/Engineer. Drifting or burning of holes will not be permitted.

10.6.14 Freedom from Surface Defects

All welded fillet or butt joints shall be ground smooth and shall be free from porosity, cavities and entrapped slag before hot-dipped galvanising.

Welds which are to be hot-dipped galvanised shall be neatly formed and the surfaces shall be acceptably free from cracks in the welds or heat affected zone, from overlap, undercuts, porosity, entrapped slag and spatter in or associated with the welds. The welds shall seal completely the edges of all overlapping or contacting surfaces.

The profile of the weld shall be uniform, of approximately equal leg length, and free from overlap at the toes of the weld. Unless otherwise specified, the surfaces shall be either flat or slightly convex in the case of fillet welds and with a reinforcement of not more than 3mm in the case of butt welds. The weld face shall be uniform in appearance throughout its length.

10.6.15 Temporary Bracing of Metalwork

The Contractor shall be responsible for whatever temporary bracing is necessary. Upon completion of the Works, all temporary bracing, brackets, cleats and the like shall be removed and all surfaces made good or painted as specified.

10.6.16 uPVC Openings

All uPVC doors and windows shall be obtained from an approved Manufacturer/Supplier, complete with all fittings and fixtures to the satisfaction of the Architect/Engineer and in accordance with the following BS documents: BS 7412, BS ISO 9000-2, and BS EN 12608 for white uPVC.

All uPVC doors and windows shall be resistant to weather, termite and be fire retardant. uPVC profiles shall be multi-chambered for maximum sound proofing and thermal insulation.

The chambers shall be reinforced by approved material such as electro-galvanised steel or aluminium and shall run through the entire profile length. The unit shall be designed such that water drainage does not pass through the reinforced chambers.

The corners of the frame shall be fusion-welded for greater joint strength. The complete system shall be free from sharp edges and blur.

All uPVC doors and windows shall be designed for optional double glazing. Thickness of glass shall be approved by the Architect/Engineer and shall comply with BS 6206. The profiles shall be able to incorporate glass of varying thickness, from 4 mm in single glazing to a 24 mm unit for a double glazing.

All uPVC openings shall be properly siliconed to RC jambs, heads and cills prior to fixing architraves and beadings. A maximum gap of 5 mm shall be considered acceptable.

All uPVC windows shall be provided with weather shield in all openable sashes of each system, ensuring dust and noise proofing.

All hardware fixtures shall be approved and shall be resistant to or protected against atmospheric corrosion.

10.7 FINISHINGS

10.7.1 Standard of Finishings

The whole of the plasterwork shall be executed to the entire satisfaction of the Architect and in accordance with the following applicable BS and CP documents:

BS EN 13914 for external rendered finished.

BS 5385 for wall tiling and the backings thereto.

CP 202 for tile flooring and slab flooring and beds thereto.

CP 203 for sheet and tile flooring and beds thereto.

CP 204 for in-situ floor finishes and beds thereto.

All materials and accessories used in connection with finishing shall comply with the above requirements of the full applicable documents.

Any work rejected by the Architect/Engineer shall be re-executed by the Contractor at his own expense.

10.7.2 Cement

Cement shall be ordinary Portland cement or equivalent as described.

10.7.3 Sand

Sand used shall be washed coral sand or approved alternative of fine grains screened through a 1.6 mm mesh sieve and shall have three washings.

In case coral sand is used, it shall have three washings in lieu of two for internal work.

10.7.4 Water

Water shall be clean, fresh and pure water from the water supply pipes and shall be kept free from any impurities.

Water shall be tested in accordance with BS 3148 if so instructed by the Architect/Engineer.

10.7.5 Storage of Materials

All materials shall be stored in accordance with the recommendations ofCP 121 and the Manufacturer's written recommendations.

10.7.6 Mixing Platforms

All render or screed shall be mixed on a level, non-absorbent and close jointed timber or steel platform. Platforms shall be kept clean and old mortar removed before any new batch of mortar is prepared for mixing. All materials shall be measured in approved and tested gauge boxes.

10.7.7 Render of Screed

Render or screed shall, unless otherwise specified, be composed of cement and sand (1:3). The specified mix proportions shall be measured by volume using dry sand in proper gauge boxes and bulking shall be allowed for if the sand is damp.

Render or screed shall be made and used in accordance with CP 121. The cement and sand shall be mixed dry on a platform until the mix is uniform in colour and then water added gradually through a fine rose and the mixture turned over until the ingredients are thoroughly incorporated and brought to a proper consistency. Only sufficient water shall be used to obtain a workable mix.

Cement render or screed shall be mixed in small quantities and must be used within one hour of mixing and no partially or wholly set render or screed shall be remixed for use.

10.7.8 Preparation of Surfaces

All surfaces of concrete receiving rendering or similar finishing shall be scrabbled or well hacked to form a good key immediately after the formwork is removed. The hacked surfaces shall be wire-brushed and well wetted and slushed over with cement slurry (1:2) to form a good key for the finish. The slushing shall be allowed to set hard before any finish is applied.

Concrete floors and roofs receiving screeds shall be hacked or scrabbled to form a good key, washed thoroughly cleaned with a wire brushed and thoroughly wetted and a coat of neat cement slurry (1:1) applied before any screeding is commenced.

No traffic shall pass over nor shall any building operations take place on the prepared surface without proper covering and protection.

All walls shall be well wetted with a hose before rendering is commenced.

10.7.9 Thickness of Rendering

All external surfaces shall be rendered in two coats. The first coat shall be applied with wooden float to an even thickness 10 mm. As soon as the first coat starts to set, it shall be closely combed to a depth of 3 mm to 5 mm and kept damp for at least two days after which time the second coat shall be applied to an even thickness of 10 mm.

All internal surfaces shall be rendered in a single coat to an even thickness of 13 mm.

All rendered surfaces shall be kept damp for at least two days after the final coat has been applied.

In no case should rendering be used to correct bad workmanship. Excessive trowelling up to a smooth surface shall be avoided and adequate protection from the sun and damping down shall be given as specified for the first coat. Day to day breaks shall be made to coincide with Architectural breaks in order to avoid unsightly junctions/joints and particular attention shall be given to this matter by careful planning of the work on site by the Contractor.

Rendering exceeding 20 mm shall be secured using wire mesh which shall be fixed to the receiving structure with brass screws.

Moulds weathering, projecting or sunk banks, cores and other special architectural features shall be executed in accordance with the drawings to a true finish and shall include for any dubbing out.

Internal angles shall be coved to a radius of not more than 25mm.

Vertical and horizontal arris shall be formed to beams, columns, openings and the like and shall be pencil rounded. Particular care shall be taken to ensure that the rendering is strong and sound at the external corners.

10.7.10 Cement and Sand Rendering

Cement and sand rendering on walls shall be one coat composed of 3 parts of sand and 1 part of cement, all by volume, and mixed as described.

The surfaces of the internal rendering shall be steel trowelled to a smooth, even and true finish, unless otherwise specified.

External rendering shall be finished to a true even surface with a wood float and to a sponge textured finish, unless otherwise specified.

Rendering shall be returned into reveals, soffits of openings, margins and sunken banks and the like and all angles shall be true and straight with salient angles rounded.

All rendered surfaces shall be free from blemish. All cracks, blisters and other defects shall be cut out and made good and the whole left perfect at completion.

All rendered surfaces shall be kept damp and moist for at least two days after the final coat has been applied.

10.7.11 Expansion Joints in Rendering

At the intersection of block walls with concrete walls, columns and beams and at straight joints between temporary and permanent block walls, expansion joints shall be provided and formed in the render (all types) as per the following instructions:

(a) Coincident with the junctions of the walls with the concrete and coincident with the above mentioned straight joints form a cut through the full thickness of the rendering coat with a steel trowel.

(b) Form a similar cut through the setting coat or finishing coat of render finished with a neat edge to give a thin straight cut in the plaster.

(c) Where concrete beam or column sides and block walls are to be finished with a flush coating of plaster, the two are not to be plastered in the first coat simultaneously, but shall be covered separately so that the exact position of the junction between the two bases are properly located and the expansion/contraction joint is made in the correct position.

(d) Where no joint is allowed between concrete and blockwork expanded metal lathing shall be fixed above junctions prior to rendering.

10.7.12 Tyrolean Rendering

Tyrolean rendering shall be in two coats consisting of a 12mm backing coat of render of one part cement to four parts of sand trowelled up to an even and true surface followed by a Tyrolean finishing coat of cement and sand of a suitable mix applied evenly with a special spraying machine to fine grain and built up in three coats to a total thickness of 8mm, all as directed and to the approval of the Architect/Engineer.

Floated tyrolean rendering where specified shall consist of tyrolean rendering as described above, but finished neatly to an even and true surface with a steel float.

All grooves, flush bands around openings, joints or returns to reveals, soffits of openings, margins, and sunken bands and the like shall be formed as directed by the Architect.

10.7.13 Ceiling Finish

(i) Cement and sand rendering.

Cement and sand (1:3) rendering to concrete ceilings shall be as described in the above clauses.

Tyrolean rendering concrete ceilings and beams shall be as described above and finished to a fine grain tyrolean render.

(ii) Plaster Finish

Lightweight retarded semi-hydrate gypsum plaster to internal concrete ceilings shall be as described in the above clauses to thickness required as per the Manufacturer's Specification.

The Contractor shall apply corner beads to level all external corners and reveals before plastering. For a smooth finish stand, the Contractor shall apply a tight skim coat finish with a rubber float and steel trowel for polishing the surface.

(iii) Off-Shutter Finish

Only well-cleaned plywood shall be used for soffit shuttering to enable an off-shutter finish to be of an acceptable quality. Joints shall be minimised and in any case made good as necessary.

(iv) Suspended Gypsum Board Ceiling.

Gypsum board plastered suspended ceiling work shall be executed to the entire satisfaction of the Architect/Engineer and in accordance with the Standard Clauses for Suspended Ceiling Systems Specifications. All materials and accessories used in

connection with finishing shall comply with the above requirements of the above-listed documents and the above clauses.

Suspension components will consist of a number of different items which when combined/joined or used in conjunction with each other will create an effective suspension system.

Typical standard/approved components used as the sub-grid and suspension systems in the ceiling framing, gypsum plastered board, galvanised corner beads, screws, adhesive tape for reinforcing jointing, joint filler with tape edge, PVC joint used where expansion joints are required, etc... shall be as described in the relevant clauses of these Specifications, and in Sub-clause 10.7.13 (ii) above.

(v) PVC False Ceiling.

The PVC panels shall be double-wall, rigid, tongue and groove interlock design. If used externally, the panels shall be weather resistant. The false ceiling shall be supported on a grid system of battens with centres not exceeding 600mm.

10.7.14 Screed to Floor and Roof

Screed to floors, treads of steps, thresholds and similar horizontal surfaces, unless otherwise specified, shall not be less than 25mm thick composed of 3 parts of sand and 1 part of cement, all by volume, and mixed as described in the relevant sub-clauses and shall be trowelled to a true, level and smooth surface to final finish or suitable to receive the final finish of tiles or similar finishing.

Screed to stair risers, sides of kerbs and other associated vertical surfaces, unless otherwise specified, shall not be less than 13mm.

Exposed salient angles shall be neatly rounded to approximately 20mm radius, unless otherwise specified.

Screed to roofs and gutters shall be laid to the thickness, falls, and crossfalls as shown on the drawings. All screeds shall be kept moist and damp until hardening and curing is completed as directed by the Architect/Engineer.

Any screeding to receive tiles or similar finishing shall be laid in good time to allow it to be perfectly dry when the finishing is laid.

10.7.15 Rocksand Screed

Rocksand screed shall comprise 1 part of cement to 3 parts of washed rocksand of an approved grain, all by volume, and mixed as described in the relevant sub-clauses and shall be trowelled up to a true, level and smooth surface to final finish or as preparation for further finish whilst unset.

10.7.16 Composite Screed and Tile Finish

Tiles shall be laid on cement and sand bed to pattern as described in the following sub-clauses, and then rocksand screed shall be laid as described in the relevant sub-clauses in between the tile pattern to a true, level and flush surface.

10.7.17 Tinted Screed Finish

Tinted screed to floors, treads of steps, thresholds and similar horizontal surfaces, shall not be less than 25 mm thick composed of 3 parts of sand and 1 part of cement mixed with special pigment inorganic colorant for all by volume, and mixed as described in the relevant sub-clauses and shall be trowelled to a true, level and smooth surface to final finish.

Tinted screed to stair risers, sides of kerbs and other associated vertical surfaces, unless otherwise specified, shall not be less than 13 mm. Exposed salient angles shall be neatly rounded to approximately 20mm radius, unless otherwise specified.

For waterproofing and protection of tinted screeded surface floors, where required the contractor shall apply two separate coats to saturation of a special acrylic sealer, all in accordance with the Manufacturer's Specification.

10.7.18 Brushed Rocksand Screed

Rocksand screed shall be laid as described in the relevant sub-clauses of these specifications and whilst the surface is unset it shall be finished by lightly wire-brushing to the surface to expose fine aggregate with smooth plain borders or tile patterns as directed by the Architect/Engineer.

10.7.19 Bush-Hammered Finish

Rocksand screed shall be laid as described in the relevant sub-clauses and finished with a light bush-hammered finish as directed by the Architect/Engineer with plain margins, banks, grooves and the like, as per sample approved by the Architect/Engineer.

10.7.20 Terrazzo Work

(i) Cement.

Cement shall be Portland cement as described in the relevant sub-clauses of these specifications

(ii) Aggregates.

(a) Aggregates for undercoat for floors shall be of one part Portland cement to two parts of washed coral sand and one part crushed quartzite, all of which shall pass a 10mm mesh and shallbe free of dust and to approval.

(b) Sand for undercoat for walls shall be hard, clean washed coral sand graded from fine to coarse and to approval.

(c) Aggregate for finishing coat of terrazzo shall be marble chippings – granular not flaky – of the kind and colours specified. This aggregate shall be graded from coarse to fine.

(d) All aggregates shall be free from organic or other deleterious matter and samples of the marble aggregate shall be submitted for approval and the aggregate used shall comply with the approved sample or samples.

(e) Mixes: Cement and aggregates shall be proportioned by volume.

(iii) Terrazzo

a) General

All terrazzo work shall be executed by artisans specialising in such work and approved by the Architect/Engineer. Samples of the finished terrazzo work (floors, stairs, walls, etc.) shall be prepared for approval and thereafter all terrazzo work shall be equal to the approved samples and in compliance with the specification. Such samples shall be not less than 600 mm x 300 mm or, in the case of steps, not less than 400 mm in length and shall include the undercoat.

b) Terrazzo Floors

Terrazzo floors or pavings unless otherwise specified shall be constructed and laid as follows:

The concrete surface is shall thoroughly cleaned, wire-brushed and well sprayed with water.

The undercoat shall be of one part cement to three parts of fine aggregate brought to a true and even, but rough, level or face not less than 15 mm below the finished surface of the terrazzo floor and not less than 25 mm thick.

On this undercoat shall be laid the terrazzo finishing coat not less than 15 mm thick, divided into panels, as shown on drawings, with approved brass or white metal strips having approved “keyed” web, embedded into the undercoat and left projecting to suit finishing coat.

The terrazzo finishing coat, except where otherwise specified, shall be of waterproof cement (white or coloured) and marble chippings, in the required and approved proportions and shallbe mixed dry. After this dry mixing, water shall be added to make a paste. The finished surface shall show approximately 85 % of marble.

The finishing coat shall be uniform in composition and appearance over the whole surface and throughout its entire thickness.

c) Brushed Terrazzo

Brushed terrazzo shall be as described in the above sub-clauses but when the surface is sufficiently hard shall to be brushed with clean water and a hard brush to removal all surplus cement. All finished surfaces of in-situ brushed terrazzo shall match the finished surfaces of precast works.

d) Polished Terrazzo

Where polishing is specified, this is to be executed with a fine abrasive stone.

e) Precast Terrazzo

All precast terrazzo blocks shall be made and supplied by an approved manufacturer and such manufacturer shall be skilled and experienced in this class of work. He shall be duly approved by the Architect/Engineer.

The Contractor shall submit samples of precast terrazzo for approval. Such sample blocks shall consist of the core and the facings (the facings on one side and on edge).

The final sample or samples as approved, shall be lodged with the Architect/Engineer and thereafter all precast terrazzo blocks supplied for the works shall be equal to the approved sample or samples.

All precast terrazzo blocks shall be made in accordance with the drawings and details and shall be cast with joggles, housings, frogs, slots, mortices, grooves, rebated joints, throatings, weatherings, etc., as shown on the drawings or as required.

All bottom edges and return bottom edges of sill blocks shall be splayed for damp course. No beds or joints shall exceed 5mm in thickness. The Contractor, when making the blocks, shall check all figured dimensions given on the drawings; before work is put in hand all dimensions shall be verified from the drawings. The Contractor will be held solely responsible for ascertaining the exact sizes of all blocks and slabs.

Full setting-out drawings shall be prepared where necessary and shall be submitted for approval before the moulds are made. The Contractor shall indicate, before signing of the Contract, if he is not satisfied with the thickness of slabs detailed and

method of fixing and after having the matter resolved, by the Architect/Engineer shall take full responsibility for twisting and other defects of slabs.

The blocks shall be finished perfectly straight and true and shall be accurately profiled in accordance with details provided

Stones shall be clean, sharp, machine-crushed granite, free from dust, salt, clay or other deleterious matter and shall be graded for concrete work and shall be of a fine texture for finished work. Flat spalls or elongated pieces and crusher screenings shall be rejected.

The blocks (core and finishing) shall be adequate in crushing strength, durability and density and free from any tendency to absorb water or moisture and shall be free from flaking, crazing and any all other defects.

(1) Core.

The core shall consist of one part by volume of cement, two parts by volume of sand and four parts by volume of 10mm stone chippings. The whole shall be distributed uniformly to not more than 15 mm from the finished surface and shall be deposited into the moulds in a wet state (not dry pressed) while facing is still wet.

(2) Facing.

All precast terrazzo blocks are to be properly cured and matured. The blocks, after casting, are shall be cured under continuous moist conditions, but shall not be exposed to free air for at least 10 days after casting.

The “facing” of the blocks shall be 15mm to 20mm thick and the core and facing shall be such that they will form together one consolidated integral mass.

The facing shall be of one part by volume of Portland cement, tinted to approval, to two parts by volume of marble chips 3mm gauge. The marble and colour shall be duly approved by the Architect/Engineer. No colouring matter shall be used unless approved by the Architect/Engineer; such colouring matter shall be used to the extent as shall be decided by the Architect/Engineer,. The colouring matter shall be mixed dry with the cement and to be uniform throughout the whole thickness of the facing. The facing mixture shall be poured into the moulds in a wet state (not dry pressed) and thoroughly worked up against finished faces and finished clean from the mould with all arises clean and sharp.

The finish of the exposed surfaces shall be kept wet by spraying at regular intervals. All exposed surfaces of blocks shall be of even colour, free from blemishes, cracks or other imperfections. All exposed faces externally shall be highly polished with a fine abrasive machine.

All precast terrazzo blocks shall be properly cured and matured. The blocks, after casting, shall be cured under continuous moist conditions, but shall not to be exposed to free air for at least 10 days after casting.

The making of the blocks shall therefore, conform to a time schedule prepared by the Contractor so that the blocks will be available in a properly matured condition when they are required to be built in. Internal corners of blocks shall be splayed and thickened at weak spots where shown on drawings.

The Contractor shall provide storage space where the blocks can remain under suitable and proper conditions, without risk of being discoloured or damaged.

Provision shall be made for hoisting and handling the blocks so that they will not be damaged.

All blocks shall be solidly bedded, grouted and jointed in (1:2) cement mortar. Cement mortar shall be mixed in small batches as no mortar that has once commenced to set shall be used. Platforms shall be well cleaned before mixing each batch.

The joints shall to be raked out as the work proceeds and pointed with slightly ruled-in half round joints with 3:1 tinted cement mortar to the approval of the Architect/Engineer.

All precast terrazzo blocks shall be kept clean during process of handling, building-in and pointing.

The Contractor shall allow for covering up and protecting all work from damage and stains and cleaning off with soft soap and hot water immediately before occupation and finally treating with an approved colour fixing emulsion, all to the satisfaction of the Architect/Engineer.

All damaged blocks shall be removed and replaced at the Contractor's expense.

(3) Non-Slip Surfaces.

Where so specified, terrazzo pavings, etc., shall be thoroughly sprinkled with fine abrasive material of a colour to match the terrazzo in the proportion of 1.22 kg of abrasive material to each square metre of paving, well rolled into the aggregate immediately after the water is extracted.

(4) Damage.

All terrazzo work shall be protected against damage or discolouration until the building is handed over. Should any terrazzo work be damaged during the process of the work it shall be replaced to the satisfaction of the Architect/Engineer.

10.7.21 Tiling

Screed floors to receive tiles shall be laid as specified below:

(i) Floor Tiles with Cement Mortar slurry

Floor tiles shall be laid with a thin contact layer of cement mortar slurry composed of one part cement to 1-2 parts of sand, grain size 0 –1 mm, by volume and mixed as described below to provide a true, level and neat surface.

All tiles shall be well soaked in water for at least 24 hours before fixing and thoroughly cleaned off and protected after fixing.

Concrete, cement plaster, stone, bricks and blocks shall be firm and clean, free of loose material, mould oil, grease, organic growth and any surface moisture. Organic growth shall be removed and the spores killed with an effective fungicide such as household bleaching solution.

Tiles shall be firmly bedded into the cement mortar slurry by using a rubber mallet before surface drying has occurred and any excess adhesive shall be removed from the joint.

(ii) Floor Tiles with Adhesive

Floor tiles shall be laid with grey cement-based top quality tile adhesive supplied in a powder form; it shall be mixed with clean water on site, and the slurry shall be used to provide a true, level and neat surface as specified by the Manufacturer, all to the approval of the Architect/Engineer.

Concrete, cement plaster, stone, bricks and blocks shall be firm and clean, free of loose material, mould oil, grease, organic growth and any surface moisture. Organic growth shall be removed and the spores killed with an effective fungicide such as household bleaching solution.

For spreading tiles adhesive on floors, it is recommended that a notched trowel 10 x 10 mm tooth gap at 6 mm intervals be used to a minimum bedded thickness of 6 mm.

Tiles shall be firmly bedded into wet adhesive by using a rubber mallet before surface drying has occurred and excess adhesive shall be removed from joint.

A minimum joint width of 3mm shall be used for floor. No butt joint tiles shall be allowed.

(iii) Wall Tiles with Adhesive or Mortar

Wall tiles shall be fixed to a plaster backing with an approved adhesive or fixed direct to walls in (1:3) cement mortar with horizontal and vertical joints continuous.

Tiles shall be laid to patterns and profiles with continuous joints. It is recommended that a notched trowel, minimum 6 x 6 mm tooth gap at 6 mm intervals be used for spreading tiles adhesive on walls to a minimum bedded thickness of 3 mm.

Tiles shall be firmly bedded into wet adhesive by using a rubber mallet before surface drying has occurred and excess adhesive shall be removed from joint.

A minimum joint width of 1.5mm shall be used for floor. No butt joint tiles shall be allowed.

Where rounded angles are not available, corner edges shall be mitred for the full length of the tile. The whole of the ceramic floor and wall tiling shall be cleaned using cleaning materials and methods as recommended by the Manufacturer of the materials being cleaned and the applicable Code of Practice. In the absence of such recommendations only suitable cleaning materials and methods in accordance with the cleaning material Manufacturer's recommendations shall be used.

(iv) Grout

Floor and wall tiles shall be point jointed with a pigmented cement base non-shrink grout impermeable to water. Grout shall be in paste or powder form; it shall be mixed with clean water on site as specified by the Manufacturer.

Surface preparation shall be firm and clean, free of loose material, mould oil, grease and organic growth. If organic growth is present, it must be removed by using an effective fungicide such as household bleaching solution.

Tiles shall be firmly secured in place. Joint width for wall tiles shall be minimum 1,5 mm and 3 mm for floor tiles.

The grout shall be generously applied to the surface and worked into the joints with a sponge-faced float, ensuring that joints are completely filled. The excess of grout shall be wiped away from the joints, and not left to harden.

When grout is used in permanent wet areas i.e. showers, bathroom, swimming pool, etc... 60 % of the water used in the mix shall be replaced by a plasticiser as per the Manufacturer's Specification, to the approval of the Architect/Engineer.

For areas where the floors and walls may be subjected to acid spillage, the grout shall be replaced by a special epoxy tile grout as per the Manufacturer's Specification, as per the Architect/Engineer

The Contractor shall propose colours available to the Architect/Engineer and obtain written approval after which all work shall conform to the respective approved samples.

10.7.22 Timber Floor

The selection of wood shall conform to the durability, wear resistance and finishes, which shall be protected from wear, dirt, oxidation and moisture.

Timber free from defects shall be used.

The contractor shall submit sample of the timber he proposes to use, with full Technical Data Sheets, along with details of proposed adhesive, for approval by the Architect/Engineer before start of any work. The data shall include information confirming the use of the material in the local climatic conditions and specific site conditions of the project. Material safety data sheets for adhesives, finishes and other materials which may be considered hazardous because of toxicity, flammability or reactivity shall also be provided by the manufacturer.

Material shall be delivered to the building site in original, unopened packages, bundles or containers. Materials shall be protected against dampness during transportation/shipment and after delivery. Materials shall be stored, and covered in a well-ventilated building, where the material will not be exposed to extreme changes of temperature and humidity. The packages shall be isolated off the ground. Materials shall not be stored in the building under construction until all wet-applied building materials are dry.

Since climatic conditions vary due to geographical location, correct temperature and humidity ranges for the project area shall be checked with the flooring manufacturer and local installer.

Moisture content in timber shall not be less than 9% and more than 12%. The Contractor shall submit a certificate of kiln-drying, to the Architect/Engineer for approval

Timber flooring work shall be scheduled after completion of any other work which would raise the moisture content of the flooring or damage the finished surface of the flooring.

The flooring shall match the colour and pattern of the sample selected and shall be approved by the Architect/Engineer before installation.

The receiving floor shall be made clean, dry and free from organic growth, oil, grease and protected from surface moisture by appropriate grading and drainage. Organic growth shall be removed and the spores killed with an effective fungicide such as household bleaching solution.

The Contractor shall ensure proper contact of timber flooring units when laid on floor in order to prevent from slits all over the floor plane.

If timber flooring is installed on sleepers, according to International Building Code (IBC), the concealed sleeper spaces shall be fire-blocked or filled with an approved non-combustible material such that there shall be no open spaces under the flooring that exceeds 9.3 sqm.

Hardwood floors that are not glued to the sub-floor must always be installed over plastic foam sheeting or a thermal acoustic board so as to prevent them from knocking against a hard sub-floor. If it is necessary to install sound proofing, the floor should be installed on a sound-absorbing surface that meets the appropriate requirement level.

Strips composing each block shall be fastened together tightly in a manner that will maintain the integrity of the block. Each block shall have a standard flooring tongue or corresponding matching groove on each of the four edges, so arranged that the block can be laid as per the selected pattern. The thickness of the blocks shall not be less than 19mm.

The adhesive used shall be water-proof and as recommended by the flooring manufacturer, to the approval of the Architect/Engineer.

Expansion spaces shall be provided at walls and partitions. Expansion space shall be of size as recommended by the flooring manufacturer. Pre-moulded cork strips shall be of installed in expansion spaces and shall be the same depth as the flooring and of width in accordance with the flooring manufacturer's directions.

10.7.23 Laminated Floor

For a laminated floor glueless installation system, a full technical data sheet showing category of use, abrasion resistance, impact test and resistance, scratch resistance, indicative dimension, weight/m2, etc… shall be submitted for approval to the Architect/Engineer.

The structure shall be composed of an overlay to decorative laminate, with an aqua-resist swell-reduced HDF-E1 coreboard and aqua-edge impregnation to finish with a special backing.

The Contractor shall produce an Engineering/Laboratory Test Technical Sheet for residential, commercial and public application where specified and shall be subjected to the Architect/Engineer approval.

Surface preparation shall be firm and clean, free of loose material, mould oil, grease and organic growth. If organic growth is present, it must be removed by using an effective fungicide such as household bleaching solution.

The double joint feature glueless installation system shall provide a safe and reliable floating installation with all accessories. The clic - connect system can be laid horizontally.

A flooring-felt underlay, if specified, for reducing level of noise is recommended for all suspended slab to reduce the effects of echo across the flooring surface.

Cleaning of the flooring shall be done as per Manufacturer's Specification.

A certificate of warranty from the date of completion of works shall be delivered by the Manufacturer as from the practical completion date of the work.

10.7.24 Bamboo Floor

For a bamboo floor click or milled tongue and grooved to edges system, a full Technical Publication Data Sheet showing category of use, abrasion resistance, impact test and resistance, anti-scratch resistance, indicative dimension, weight/m2, etc... shall be submitted to the Architect/Engineer for approval.

The structure of the bamboo board shall be composed of a minimum thickness of 15 mm with an overlay and backing surface and shall receive UV-cured acrylic Urethane w/aluminium oxide in base coats and anti-scratch top coats in low satin gloss treatment.

The Contractor shall produce an Engineering/Laboratory Test Technical Sheet for residential application.

Surface preparation shall be firm and clean, free of loose material, mould oil, grease and organic growth. If organic growth is present, it must be removed by using an effective fungicide such as household bleaching solution.

The click or milled tongue and grooved to edges system shall provide a safe and reliable floating installation. No naildown installation shall be used. A flooring-felt underlay, if specified, for reducing level of noise is recommended for all suspended slab to reduce the effects of echo across the flooring surface.

Cleaning of the flooring shall be done as per the Manufacturer's Specification.

A certificate of warranty for pre-installation guarantee, structural guarantee, rescreening/refinishing warranty and finish guarantee shall be delivered by the Manufacturer as from the practical completion date of work.

10.7.25 Carpet Floor

The carpet floor shall be installed according to the code of practice for the installation of textile floor coverings. A full Technical Specifications Data Sheet showing category of use to recommended areas, fibre type and mass, fire index, electrostatic propensity, static control, indicative dimension, weight/m2, etc… shall be submitted to the Architect/Engineer for approval.

Surface sub-floor preparation shall be firm, sound, level, hard, dry and clean, free of loose material, mould oil, grease and organic growth. If organic growth is present, it shall be removed by using an effective fungicide such as household bleaching solution.

Cleaning of the flooring shall be done as per the Manufacturer's Specification.

A certificate of warranty for ten years from practical completion date of work shall be delivered by the Manufacturer, and shall be to the satisfaction of the Engineer/Architect.

10.7.26 Vinyl Floor

Vinyl flooring shall be supplied by an approved Manufacturer and laid only by an approved Specialist firm.

All resilient vinyl flooring ranges shall be executed to the entire satisfaction of the Architect/Engineer and in accordance with BS 1711 & 5750 and BS EN ISO 10581.

Vinyl flooring shall be heavy duty homogeneous PVC base top wear reinforced by a layer of fibreglass on a PVC foam base. No signs of breaking, cracking or failure shall be visible when tested to BS EN ISO 10581.

The product shall be sustainable for the anticipated life of the product, allowing for foreseeable action such as general wear and tear and regular maintenance.

The minimum thickness for vinyl flooring shall be 2.5 mm and shall be supplied and laid as per the Manufacturer's Specifications and shall conform to BS 8203 with approved adhesive.

All seam joints shall be welded with PVC flooring rods for a continuous finish and of the same colour to match the PVC flooring.

The vinyl flooring shall be asbestos free, scratch proof, slip resistant, fire resistant, stain- proof and chemical-resistant to normal cleaning detergents.

All flooring base shall be levelled evenly and free from particles and moisture to the Manufacturer's Requirement prior to the laying of the vinyl flooring.

Colour and design for vinyl flooring shall be approved by the Architect/Engineer.

10.7.27 Samples

The Contractor shall prepare samples of all finishing as directed by the Architect/Engineer until the quality, texture and finish required is obtained and approved by the Architect/Engineer after which all work shall conform to the respective approved samples.

10.7.28 Dry Wall Partitioning

Dry-wall partitioning work shall be executed to the entire satisfaction of the Architect/Engineer and in accordance with the technical data sheet for plastering specifications.

All materials and accessories used in connection with finishing shall comply with the above requirements of the above application documents.

Galvanised studs used as the vertical members in the framing for drywall systems, galvanised corner beads, adhesive tape for reinforcing jointing, screws, dry-wall joint filler with tape edge, PVC joint used where expansion joints are required, etc… shall be as described in the relevant sub-clauses of these specifications.

10.7.29 Measurement and Rates

Rates for plastering and screeds shall include for the preparation of all surfaces as described in the relevant sub-clauses, in accordance with all temporary rules and grounds, forming all internal and external angles, fair edges, finishing against frames, windows, dishing to outlets, around pipes, holder bats, etc., narrow widths, small quantities any extra thickness or dubbing out consequent upon the concrete not being finished to true levels, curling, protection and cleaning.

Rates for tiling shall include for narrow widths, small quantities, all cutting and waste, forming internal and external angles, bedding and pointing as described (backings measured separately) and cleaning down on completion.

10.8 GLAZING

10.8.1 Glazing Standard

All glass shall comply with BS 952 and shall be of the best quality of its respective kind, free from specks, bubbles, air holes, scratches, distortions and other surface imperfections and shall be of uniform thickness. The clear glass shall be polished plate glass of uniform thickness.

The Contractor shall provide safety glass – laminated or tempered – as indicated by the Architect/Engineer.

Where any bath enclosure or shower cubicle is constructed of glass such glass shall be safety glass.

10.8.2 Putty

Putty shall be the best quality glazier's putty and shall be obtainable from a supplier duly approved by the Architect/Engineer. Putty for metal shall be approved metal putty specially manufactured for that purpose. Putty for wood shall be approved wood putty specially manufactured for that purpose.

10.8.3 Fixing of Glazing

Glass must be cut accurately in one piece in panes to suit all glazed openings, with sufficient clearance to prevent cracking by expansion. All puttied glass shall be pressed tightly and bedded into a sufficiency of putty, thoroughly back-puttied and held firmly. The finished surface of putty shall be true in line and level and shall be neatly cut in against the glass.

Glass blades for louvred openings shall be 6mm thick of selected glazing quality Grade 'A' to BS 952. The two exposed edges of the blade shall be flat smooth-polished with no sharp arris.

Putty shall be neatly finished with smooth surfaces, sharp mitres, etc. All sashes, whether wood or metal, shall be primed with an approved metal or wood primer prior to fitting and glazing. All glass to metal openings shall be fitted with approved glazing clips. Glass shall be springed in at wood sashes if puttied. Putty for glazing in hardwood shall be tinted or stained to match the wood.

10.8.4 Breakages and Cleaning

Should any glass be cracked, broken or scratched prior to handing over the building, the same shall be replaced by the Contractor at his own expense.

At completion all glass shall be thoroughly cleaned both sides and such clearing shall fetch the Architect's/Engineer Approval.

10.8.5 Workmanship

All glass shall be carefully cut to the required sizes so that all panes of figured or textured glass are uniform in appearance.

Glazing shall be carried out in accordance with the requirements of CP 152. Only putty and/or other glazing compounds recommended in CP 152 as being suitable for

the particular material to be glazed shall be used. All glazing shall be weather tight on completion.

10.8.6 Mirrors

Mirrors shall be fixed in accordance with the stipulations of CP 152.

10.8.7 Measurement and Rates

All rates for glazing shall include for all necessary labour in raking cutting, curved cutting and polished and bevelled edges.

10.9 PAINTING AND DECORATING

10.9.1 Standards for Painting Materials

All materials for and used in connection with Painting and Decorating shall comply with the requirements in CP 231.

All paint, oil stains, varnish, linseed oil, knotting, driers, distempers, etc., shall be of the best quality and of an approved brand and manufacture.

All materials shall be used in strict accordance with the manufacturer's instructions and otherwise in accordance with the best standard practice.

Only primers and sealers recommended and supplied by the paint manufacturer for the particular surface and particular type of paint shall be used. Only undercoats as recommended by the paint manufacturer for the particular finishing coat shall be used.

If necessary, paints, etc., shall be strained free from shins and similar impurities immediately before application.

Priming coats shall be applied over the whole surface and well brushed in to obtain the maximum penetration.

All materials shall be delivered to the job in their original sealed containers with the manufacturer's name and description of contents thereon.

Paint shall not be diluted excepting accordance with the manufacturer's instructions and no adulteration will be allowed.

10.9.2 Colours of Paints

Samples of the final colours required shall be submitted for approval by the Architect/Engineer before putting the work in hand and the work shall then be finished to the colour or colours approved. Each coat of paint shall be a distinctive colour working up to the finished colour as approved.

10.9.3 Stripping, Cleaning and Filling Materials

All stripping, cleaning and filling materials including knotting, stopping and fungicide solutions shall be:

(i) suitable for the intended purpose.

(ii) in accordance with the written recommendations of the manufacturer of the material/s in question.

(iii) compatible with the subsequent covering.

Knotting shall comply with the stipulations of BS 1336.

10.9.4 Stopping and Filling

Stopping and filling for surfaces to receive a clear finish shall be tinted to match the colour of the surface.

Stopping and filling shall be finished off flush with and to match the texture and appearance of the surface being filled.

10.9.5 Workmanship

Workmanship shall comply with the recommendations of CP 231.

External painting shall not be undertaken during rainy, damp or other adverse weather or where such weather is reasonably to be expected within the next 24 hours.

Before any internal painter's work is commenced, all floors shall be swept clean and all dirt and rubbish removed. The rooms shall be free from dust and such dust-free conditions shall be maintained throughout the progress of the work. No sweeping or dusting shall be done whilst the painting is in progress.

The nature of all surfaces to be painted shall be carefully inspected by the Contractor who must satisfy himself that the surfaces are in a perfect state to take the paintwork specified.

All loose material, mortar and render droppings, rust, oil, grease and any other deleterious and extraneous matter shall be removed so as to leave all surfaces perfectly clean, free from dust, dirt, grease, blotches before painting and decorating. Any irregularities, cracks, holes, open grain and the like shall be filled and surfaces to be decorated shall be cleaned and prepared in accordance with:

(i) the recommendations in CP 231 and any other applicable BS and CP documents

(ii) the written recommendations of the manufacturer of the paint or other decoration to be applied

(iii) the best building practice

All surfaces shall be left clean, dry and level so as to ensure adhesion of the covering and its specified finished appearance.

The Contractor shall remove any efflorescence and shall ensure that such efflorescence has ceased before commencing decoration; he shall treat mould infected surfaces with fungicide solution as directed by the Architect/Engineer or as specified in the other sub-clauses of these specifications.

Unless otherwise directed, the last coat of paint or finishing shall be done when all other works in the Contract have been completed and the premises have been made free from all rubbish and dirt. On completion all painters' work shall be touched up where necessary and any defects made good.

10.9.6 Application of Paint

Paint shall be applied by brush unless otherwise described or instructed.

Each coat of paint shall be of even thickness.

The Contractor shall prime and seal immediately after cleaning and preparing the surfaces. He shall allow each priming/sealing and undercoat to become dry and shall lightly rub down with fine abrasive paper to a smooth even surface prior to applying succeeding coats of paint.

The Contractor shall ensure that surfaces which have been primed prior to delivery to the site have been properly prepared and that the primer is of a suitable type, firmly adhering and in good condition. Priming coats shall be touched up as necessary on joinery primed prior to delivery to the site and cleaned and prepared so as to be suitable to receive subsequent decoration. Any surfaces of such joinery which are cut after delivery to the site shall be prepared and primed.

Painting adjacent to glazing with putty shall be extended across the putty and on to the glass up to the sight line. All painting shall be cut in neatly and cleanly to line.

The finished paintwork shall be smooth and even coloured, free from brush marks, sags, runs, dust, hair or other extraneous material adhering thereto and any other defects and shall be all to the entire satisfaction of the Architect/Engineer.

10.9.7 Treatment of Surfaces Before Painting

(i) Rendered Surfaces

Rendering shall be ensured to be perfectly set and thoroughly dry before painting starts, The onus shall be on the Contractor to satisfy himself that rendered surfaces are in a fit condition to receive decoration before commencing the works. Surfaces shall be brushed down, sanded smooth and cleaned down. All defects shall be patched and made good and given an extra coat of primer or sealer.

Hair cracks and other blemishes on rendered surfaces shall be painted and shall be filled with an approved filler and any imperfections made good.

(ii) Wood Surface

All wood timber built-in or in contact with walling and concrete shall be treated with two coats of an approved type of wood preservative before application of any paint, all to the satisfaction of the Architect/Engineer.

All woodwork must be thoroughly prepared, sandpapered and rubbed down to a smooth, even finish before painting or staining or varnishing and thereafter each successive coat of paint stain or varnish shall be rubbed down to a smooth face before the next coat is applied. Knots shall be cleaned off and coated with an approved knotting. Stopping is shall tinted as required to match oiled or stained woodwork. Screw holes etc., shall be cleaned out, pellated or stopped with an approved filler or stopping as directed by the Architect/Engineer.

(iii) Ironwork and Steel Surfaces

Iron and steel surfaces shall be scraped and all rust, scale dirt, grease, etc., removed by scrapers or wire brushers before painting.

(iv) Galvanised Surfaces

Galvanised steel surfaces shall be treated with “Galvanised iron cleaner 13700” or other approved solution in strict accordance with the manufacturer’s instructions and thereafter thoroughly washed down with clean water and the surface allowed to dry before painting.

(v) Copper Pipes

Copper pipes shall be rubbed down with coarse emery, cleaned with a solution of one part acetone to two parts of benzene and left to dry before painting.

10.9.8 Polyurethane Varnish

Polyurethane varnish shall be brushed on, using material as it comes from the can. Before application and between coats, any nibs, raised fibres or sharp edges shall be rubbed down with fine dry abrasive paper and dusted off.

The polyurethane varnish shall be applied in four coats, the first two coats to be gloss finish rubbed down and the following two coats to be matt finish.

10.9.9 Cleaning and Protection

All painter's work shall be protected as necessary including the provision of caution signs as necessary and the whole of the work shall be left clean and perfect all to the entire satisfaction of the Architect/Engineer.

10.9.10 Measurement and Rates

The preparation and pre-treatment of surfaces as described in the preceeding sub-clauses herein shall be carried out in addition to the number of coats of paint hereafter specified; all rates shall include for such proper pre-treatment.. Rates shall also include for any required protection of paint work, providing the necessary caution signs and leaving all work clean and perfect.

10.10 WATERPROOFING

10.10.1 Double-Layer Waterproofing Membrane to Roof

The whole of the double-layer waterproofing works shall be carried out by a Specialist firm approved by the Architect/Engineer. The work shall be executed strictly in accordance with the Manufacturer's instructions and shall carry an irrevocable **Ten** year guarantee with the guarantee conditions as approved by the Architect/Engineer and in accordance with the relevant and applicable BS Standards.

The guarantee shall be deposited with the Architect Engineer at the end of the Defects liability Period. The waterproofing treatment shall be applied over all expansion joints, parapets, upstands, flashings, and dressed into all rainwater heads and outlets as per the Manufacturer's Specifications, and to the approval of the Architect/Engineer

All surfaces to be waterproofed shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the waterproofing installation.

All the surfaces shall be cleaned and prepared as required by the Contractor at his own expense.

Before any waterproofing treatment is applied, the waterproofing contractor will have to sign a handing over certificate notifying his acceptance regarding the proper fall to slope of the screed towards rain water outlets.

10.10.2 Single-Layer Waterproofing Membrane to Roof

The whole of the single-layer waterproofing works shall be carried out by a Specialist firm approved by the Architect/Engineer. The work shall be executed strictly in accordance with the Manufacturer's instructions and the relevant and applicable BS Standards.

The waterproofing treatment shall be applied over all joints, parapets, upstands, flashings, and dressed into all rainwater heads and outlets as per the Manufacturer's Specifications.

All surfaces to be waterproofed shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the waterproofing installation.

All the surfaces shall be cleaned and prepared as required by the Contractor at his own expense.

Before any waterproofing treatment is applied, the waterproofing contractor will be required to sign a handing over certificate notifying his acceptance regarding the proper fall to slope of the screed towards rain water outlets.

10.10.3 Rubberised Bitumen Emulsion Waterproofer

Special rubberised bitumen emulsion waterproofing system shall be executed to all reinforced concrete sloped roof before laying and fixing of roof tiles, shingles and metal sheeting as per the Manufacturer's Specification and in accordance with the relevant and applicable BS Standards.

The product applied by the Specialist firm must be approved by the Architect/Engineer.

All surfaces to be treated shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the waterproofing membrane installation.

All the surfaces shall be cleaned and prepared as required by the Contractor at his own expense.

The waterproofing contractor will have to sign a handing over certificate notifying his acceptance regarding the proper fall to slope of the screed towards waste sumps and verticality of walls.

10.10.4 Bituminous Roofing Felt.

Bituminous roofing felt with micro-porosity characteristic system shall be laid to slope any timber structure roof as per the Manufacturer's Specification and in accordance with the relevant and applicable BS Standards.

The product applied and fixed by Specialist firm must be approved by the Architect/Engineer in writing.

All timber boarding surfaces to be treated shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the roofing felt installation.

10.10.5 Walkable Waterproofing System

Special waterproofing protected walkable system shall be laid on existing double layer waterproofing installation as per the Manufacturer's Specification and in accordance with the relevant and applicable BS Standards Which shall be supplied by the contractor

The product applied and fixed by Specialist firm must be approved by the Architect/Engineer.

All surfaces to be treated shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the waterproofing walkable installation.

All the surfaces shall be cleaned and prepared as required by the Contractor at his own expense.

10.10.6 Waterproof barrier.

Special flexible cementitious waterproof membrane composed of two-component element shall be executed to all permanent wet areas (floors and walls) as described i.e. showers, bathrooms, etc... as per the Manufacturer's Specification and in accordance with the following BS standards :

BS 6920: for effect on water quality.

BS 1881: for water penetration test.

The product applied by the Specialist firm must be approved by the Architect/Engineer. The work shall be executed strictly in accordance with the Manufacturer's instructions and shall carry an irrevocable ten year guarantee with the guarantee conditions as approved by the Architect Engineer. The guarantee shall be deposited with the Architect Engineer at the end of the Defects Liability Period.

The waterproofing barrier treatment shall be applied over floors and walls to wet areas, and dressed into all waste sumps disposal as per the Manufacturer's Specifications.

All surfaces to be waterproof shall be inspected by the Specialist who must satisfy himself that the surfaces are in a perfect state to take the waterproofing membrane installation.

All the surfaces shall be cleaned and prepared as required by the Contractor at his own expense.

Before waterproofing treatment is applied, the waterproofing contractor will have to sign a handing over certificate notifying his acceptance regarding the proper fall to slope of the screed towards waste sumps and verticality of walls.

10.10.7 Damp-Proof Course

Damp-proof course shall be 2-ply felt of approved manufacture and laid on a 25mm thick bed of cement mortar (1:3 mix) on walls.

The damp-proof courses shall extend across the full thickness of walls, partitions and beams in one width and to be overlapped 150mm at all jointings and corners.

Section 11

TELECOMMUNICATION SERVICES

SECTION 11 - TELECOMMUNICATION SERVICES

11.1 GENERAL

This section of the specifications pertains essentially to the telecommunication aspects of the infrastructure works required to be carried out within the project site.

The ducts for the underground Telecommunication cables shall comply with the requirements of BS EN 61386-24 2010 or MS IEC 61386-24 – *"CONDUIT SYSTEMS FOR CABLE MANAGEMENT – Part 24: Particular requirement – Conduit systems buried underground "* and as given in the following sub-sections.

Pipes shall be used as ducts for underground telecommunication cables. The material from which the pipe is produced shall consist of unplasticised Polyvinyl Chloride (uPVC) to which may be added those additives that are needed to facilitate the manufacture of sound durable pipes of good surface finish, mechanical strength and opacity. They shall be rectilinear, having a smooth surface and free from visible defects.

Each pipe shall have an integrated solvent-weld socket at one end and a chamfered spigot at the other end to allow easy assembly of the duct. The axis of the pipes and that of the socket shall be practically on the same alignment.

11.1.1 Colour

The pipes shall be of **white** colour, or to any specific colour required by the Mauritius Telecom (MT), with whom the Contractor shall accordingly liaise.

11.1.2 Marking

The outside surface of the pipe shall be permanently marked along one of its generatrices, using a highly visible colour, as follows:

- Manufacturer's name and/or identification mark
- Product identification mark
- Dimensions in mm
- Code "L" or "N"
- Code "250", "450" or "750"
- Date of manufacture

The marking should be legible and must be reproduced along the pipe at regular interval, preferably one (1) metre but, no longer than 3m.

A specimen of this marking shall be submitted for approval to the Engineer before the beginning of manufacture.

11.1.3 Dimension of Pipes

The dimensions of the pipes to be used for the telecommunication works shall be 45mm, 60mm, 80mm and 110mm as specified on drawings. The allowable variances in the pipe dimensions shall be strictly as per Clause 8 and Table 101 of BS EN 61386-24 2010.

11.1.4 Mechanical Characteristics

The pipes being used for buried underground telecommunication conduit system, shall be resistant to shocks and the various constraints to which they may be subjected. These pipes or ducts shall be rated "**N**" – normal for resistance to impact and "**450**" for resistance to compression.

Thus, the pipes when tested as per Clause 10.2 of BS EN 61386-24 2010, shall not have a deflection of more than 5 percent (%) when subjected to a compression force of 450N and After the test, there shall be no crack allowing the ingress of light or water between the inside and the outside.

On the other hand, there should be neither sign of disintegration nor shall there be any crack allowing the ingress of light or water when subjected to an impact test as per Clause 10.3 of BS EN 61386-24 2010.

11.1.5 Quality Control by the Manufacturer and Factory Acceptance

The manufacturer shall guarantee a permanent quality control during the manufacturing process by implementation of Quality Assurance System (preferably according to ISO 9002) and shall exercise a permanent control at all stages of the production such as:

- Control of raw material.
- "*In process*", on-line quality testing and quality.
- Quality control of finished pipes at the end of the production to ensure traceability of pipes manufactured.

The result of the various controls shall be recorded in a register to be put at the disposal of the Engineer, upon his request.

This quality control takes place in the factory upon the manufacturer's notice that pipes have been manufactured.

The manufacturer shall carry out all the controls and tests required. The Engineer may also depute his representatives to attend/carry out some of the tests whenever he finds it necessary and the contractor shall provide all necessary assistance at no extra cost.

The Engineer shall have free access to the site of manufacture and the place of storage of materials. Moreover, the manufacturer shall make available free of charge the required personnel, instruments, and all testing equipment that shall be required.

All samples of raw materials and pipes necessary for the tests (particularly destructive tests) shall be provided by the Contractor at no extra cost.

The tests shall be performed by taking samples. When a refusal is pronounced, the manufacturer shall immediately remedy the defects noticed. The batch(es) which have been refused shall be scrapped and removed from site. The manufacturer shall destroy or erase the marking on the pipes in the presence of the Engineer's representative.

11.1.6 Storage of Pipes

During storage, the pipes shall be piled up taking all necessary precautions so as to avoid their deformation or deterioration.

For this purpose, the height of the piles shall be such that the pipes may not undergo any permanent deformation and that it allows taking of samples wherever decided by the Engineer. The pipes should be protected from direct sunlight when stored in the open for a long period of time.

11.2 DUCT NEST CONSTRUCTION

11.2.1 Staking

The contractor shall carry out staking of the works in plan in conformity with the project. He shall set out a number of points along the duct route which when joined by means of a line will give the axis of excavations, each point being either a metal or timber pole or simply marked clearly with an appropriate paint.

11.2.2 Setting-out

The setting out shall be accurate in all respects and clearly indicated to allow use of sight rails and the like at any time during the execution of the works, as required by the Engineer. The setting-out shall be checked and approved by the Engineer; however, approval shall not relieve the Contractor of his obligations to ensure correctness of the setting-out for which he shall be solely responsible.

The contractor shall take appropriate precautions to maintain the setting out, to re-establish their position or to replace them if need be either at their original location or at other points, if required by the Engineer, for the proper checking of the works.

11.3 TRIAL EXCAVATION/PILOT HOLE

Prior to the start of the excavation of trenches, the Contractor shall carry out Pilot/Trial Hole at every 50 metres or less for the localization of exact positions of underground services/obstruction, and for purposes of carrying out soil tests if so required by the Engineer.

11.4 POSITION OF TRENCH

Trenches shall be excavated along roadway, footway or off-road as required by the site constraints, and/or as shown on Drawings or as directed by the Engineer.

The contractor shall mark up the position and size of the trench with paint or any alternative means provided by himself.

Any work done contrary to MAURITIUS TELECOM Specification will be rejected and will have to be rectified at the Contractor's own charge.

The contractor shall ensure that the trench is located at a minimum horizontal clearance of 500mm from any existing water pipe or electric cables.

11.5 USE OF MECHANICAL EXCAVATORS

Mechanical excavators can be utilized provided that the trench is not wider than it should be. Any overbreak due to the use of excavators exceeding the theoretical trench widths specified in the relevant sections of those Specifications shall be to the Contractor's account.

11.6 SHAPE, QUALITY AND SIZE OF THE TRENCH

The trench shall be straight [except where otherwise specified or required, e.g. bends]. The walls shall be perpendicular to the stone-free and levelled trench bottom.

The trench dimension will vary depending on the location of the works, the size of the duct nest, etc. As and when directed by MAURITIUS TELECOM'S representative or the Engineer's representative, the contractor shall provide trenches of different dimensions, e.g. when working in the vicinity of other services, where minimum clearances are required. The theoretical trench widths shall be as given in the Drawings in respect of each type of duct nest.

The backfill over the top most PVC pipe in the duct nest shall be 800 mm. The regular backfill shall not contain stones more than 100mm nominal size.

The width of the trench shall not be greater than necessary for the execution of the works. Any over-excavation arising from any reason and source shall be to the Contractor's account.

11.7 BACKFILLING

The portion of the trench over the works (duct nest) shall be filled up with selected material through a sieve 5 mm square and conforming to the specifications for fill material given in the relevant parts of these Specifications.

The fill material shall be placed in layers not exceeding 150 mm and thoroughly compacted using a suitable trench compactor or vibrating roller. The Contractor should ensure that no damage is caused to the ducts during compaction.

The backfill shall be humidified, if necessary, prior to compaction, to obtain the compaction value required by the relevant Authorities concerned.

Compaction tests should be carried out at intervals of 250 metres on the sub-grade, or as directed by the Engineer under the relevant sections of these Specifications.

11.8 CONSTRUCTION OF THE DUCT NEST

The duct shall be either embedded in sand free from stones, encased in concrete or a combination of both, as the case may be, as directed by the Engineer or his representative, and/or as shown on drawings.

11.9 EMBEDDING OF PVC DUCT IN SAND

PVC ducts shall be glued, jointed and laid over minimum 50 mm sand bedding (or other material approved by the Engineer) provided on the trench bottom.

100 mm sand (on other approved material) cover shall be provided over the topmost duct and a minimum 70 mm sand (on other approved material) cover shall be provided on the sides.

The contractor shall make use of appropriate steel or wooden stakes to maintain the stability of the duct module and the appropriate wooden benches to join the pipes throughout the installation stage.

Sand (on other approved material) used shall be granulated, size varying between 0.15 mm and 5 mm.

Concrete anchor blocks shall be constructed by the contractor at distances along the duct route that shall not be less than 50 metres.

A hole shall be excavated in advance at places where anchor blocks are to be constructed so as not to damage the pipe during construction.

11.10 ENCASEMENT OF PVC DUCTS IN CONCRETE

The two basic methods for concrete surround, which shall be employed by the Contractor for telecommunication works are specified below:

(i) The standard encasement method or Type A, as described below.

(ii) The layer-by-layer method or Type C, as described below.

11.10.1 Type A

A 50 mm concrete bedding shall be laid on the trench bottom. The PVC pipes shall be glued, jointed and installed over the concrete bedding. A cover of 100 mm concrete over the topmost duct, and a 70 mm concrete of the sides shall be provided.

11.10.2 Type C

The same construction method shall apply, with the difference that a 30 mm gap provided by separators, shall be allowed between the pipes. The gap shall be filled up with easy flow concrete or cement mortar. Duct entries in manholes shall be constructed in type C over the last 1.5 metres to 3.0 metres, as directed by the Engineer.

11.11 LAYING OF PIPES ABOVE CONCRETE EMBEDMENT BLOCK

When PVC pipes are to be laid above the concrete embedment block, they shall be surrounded in a fine sand (or other approved material) bedding over the whole width of excavation such that there is a minimum of 50 mm layer below the generatrix of the lower pipe and 100 above the generatrix of the upper pipe.

11.12 GLUEING COMPOUND

Mauritius Telecom shall approve the glueing compound provided by the contractor. Glueing and coupling of ducts shall be done with care over specially constructed wooden benches.

11.13 CONCRETE MIX

The concrete mix shall be 350Kg cement for 0.4m^3 rocksand and 0.8m^3 coarse aggregate. Granulated washed rock sand, size varying between 0.08 to 5 mm, and coarse aggregate of size ranging from 6 mm to 12 mm should be used.

11.14 PRESENCE OF OTHER SERVICES IN THE GROUND

During the construction of a new duct route the Contractor shall

(i) Take extreme care not to damage existing services of Mauritius Telecom and services pertaining to other authorities

(ii) Provide adequate protection to any services, monuments and structures.

(iii) Maintain the stability of any services and structures.

The services that are encountered during excavation of trenches are usually telephone cables and pipes, water pipes, power cable and sewerage pipes.

Lateral clearances of 500 mm and vertical clearances of 300 mm shall be maintained between the edge of the topmost telephone PVC duct and power cable or water pipe, except where otherwise specified. Installation of the duct directly on top of existing water pipes and/or power cables shall not be permitted except for crossings, under instruction from the Engineer.

PVC ducts shall be laid at a minimum depth of 150 mm below the base of any water drain or gutter, where the case arises, and/or as directed by the Engineer.

The drain or gutter shall then be repaired, and reinstated to its original condition.

11.15 WARNING TAPES

Warning tapes of green colour in the form of grids or plastic tapes shall be laid across and along the whole width and length of the excavations with sufficient overlapping between each element. The warning tape shall be generally laid over the first layer of backfill. Under no circumstances shall it be laid less than 200 mm above the embedded works and less than 100 mm below the surface.

Warning tapes shall be supplied by the contractor himself and approved by the Engineer and/or MAURITIUS TELECOM.

The width of the warning tape should be chosen so that it overlaps the duct nest width by at least 50 mm.

11.16 MANHOLE CONSTRUCTION

11.16.1 Standard Jointing Boxes and Manholes

The jointing boxes and manholes to be constructed shall conform to the standard drawings.

The standard jointing boxes to be constructed on roadway are K1C,K2C,K3C L1C,L2C,L3C,L4C,P1C,P2C

The standard jointing boxes on footway are L1T, L2T, L3T, L4T, L5T, L6T.

11.16.2 Construction Operations

The construction of the joint box and manhole comprises the following operations:

(a) The digging of pilot holes/trial pits to determine the proper location of the works.

(b) The excavation of the required trench.

(c) The construction of the joint box or manhole as per the standard drawing.

(d) The leading-in of the ducts in the manhole with the duct nest terminating in Type C formation.

(e) The backfilling with selected fill material, including ramming at every 150mm on the manhole sides and ceiling.

This operation, however, shall be carried out after the curing period, and at the time of permanent reinstatement.

11.16.3 Shuttering

Subject to compliance with the drawings as regards dimensions, the contractor shall be free to adopt any arrangement he may think fit for the make-up of the shuttering.

The shuttering shall be of such dimensions, and so constructed so as to remain unyielding to weight and vibration during the concrete casting.

11.16.4 Removal of Shuttering and Curing Period

The minimum period before the removal of shuttering for manholes shall be five (5) days.

The curing period shall be twenty-one (21) days during which the joint box and manhole should be fenced and isolated from the traffic.

11.16.5 Fittings

(a) Anchor Irons shall be fitted and secured to the steel reinforcement, and cast in concrete during the placing of concrete itself.

(b) Bearers and Supports, and steps or ladder can be fixed after the striking off of shuttering.

(c) Weakly-sealed fittings shall be removed and refitted so as to be up to standard, when so directed by the Engineer.

(d) Sump cover shall be installed as specified.

11.16.6 Reinforcement for Manholes

(a) The manhole shall be reinforced as per the specified structural design indicated on the drawings.

(b) Any alternative design contemplated by the Contractor shall be carried out by a Professional Structural Engineer, and shall be approved by the Ministry of Public Infrastructure and/or MAURITIUS TELECOM, and/or the Engineer.

The steel reinforcement to be embedded in concrete shall be free from mud, oil, rust, grease, paint, etc.

11.16.7 Manhole Covers and Frames

Manhole covers and frames shall be of the heavy-duty type, the medium-duty type and the light-duty type depending on their locations within the works. They shall be as shown on drawings and/or as indicated by the Engineer.

11.17 CABINET INSTALLATION

Base for cabinet and duct entry in manhole shall be in conformity to the relevant working drawing.

Provision shall be made in the formwork when such work is required.

Curing time for cabinet support shall be seven (7) days.

Mauritius Telecom's representative in conjunction with the Engineer's representative shall indicate the exact siting of the cabinet.

The contractor shall provide earthing of the cabinet structure. including the supply and installation of earth mat/rod and earth lead

11.18 RAISING OF MANHOLES

At the location of the manhole, the road shall be cut square locally leaving a clearance of about 200 mm to 250 mm on each side of the exposed manhole cover.

The existing concrete shall be cut out to a depth of at least 100mm below the existing reinforcement without damaging the existing reinforcement, the frame carefully removed, the surface hacked, cleaned and washed.

Additional 8 mm or 10 mm reinforcement bars (to match the existing reinforcement bars) shall be tied or welded to the existing reinforcement, as directed by the Engineer.

Epoxy 344 concrete bonding agent shall be applied thirty (30) minutes before concreting.

The concrete mix shall be 350kg cement per m^3 of concrete for 0.4m^3 rock sand and 0.8m^3 course aggregate.

The concrete shall be placed against properly dimensioned formwork, and shall be placed up to the top of the frame which the level with the new road surface.

The top of the concrete shall be furnished smooth with a steel trowel.

Curing of the concrete shall be done with hessian kept continuously wet starting from 4 hours up to 72 hours after concreting. The new concrete shall be protected from vehicular traffic for 72 hours after concreting.

All works shall be carried out in strict accordance with the specifications and/or in the presence of Mauritius Telecom representative.

A temporary roof made of timber shall be constructed over the existing cables in the manhole, before cutting of existing concrete starts, to protect them from accidental damage.

The manholes shall be properly fenced with reflective barriers and beacon lights provided at night. Other safety measures and warning sign boards as prescribed by the relevant Authorities and/or the Engineer. On completion of works, the manhole shall be cleaned completely.

11.19 REPAIRS AND REPLACEMENT OF MANHOLE FRAMES AND COVERS

The same specifications as for raising of manhole frame and covers shall apply except that in this case no additional reinforcement bars will be required.

11.20 BRICKWORK

(a) The concrete used during construction shall be 350 Kg cement per m^3 of concrete for 0.4 m^3 rocksand, and 0.8m^3 coarse aggregate.

(b) The concrete on the floor shall be allowed to set at least twelve (12) hours before starting the laying of bricks.

(c) The cement mortar used for joints, and for cement rendering shall be 400 Kg cement per m^3 rocksand, size varying between 0.08 mm to 2 mm.

11.21 DIGGING OF HOLES AND ERECTION OF POLES (IF AND WHERE APPLICABLE)

The installation works for the telecommunication works shall generally be underground. However, if the necessity arises, the MT can instruct for the use of poles.

In such an event, the Contractor shall act as per the following.

11.21.1 Type, Dimension of Pole and Dimension of Holes

The standard wooden poles are 7 m and 8 m. The holes to be dug shall be of the following dimensions:

POLE	7 m	8 m
DIAMETER	0.50 m	0.50 m
DEPTH	1.40	1.50 m

11.21.2 Pole Erection

The pole shall be erected in the hole so dug with appropriate tools, crowbar (barramine) and spoon. There is no objection to the use of a Vehicular Pole Erection Unit, provided all its technical characteristics shall have been furnished to the Engineer, who shall approve or otherwise

The pole shall be held upright and rigidly stable by means of sharp edged stones (Blue Basalt) around the leg of the pole for about a third of the depth of the hole, and rammed in tightly by means of hand rammers. The same operation shall be repeated on the upper third of the pole, round stones and earth being used in the middle layer, and tightly rammed.

For underground network distribution, PVC 45 mm diameter 90° bend should be terminated on the pole.

11.21.3 Siting and Inspection of Hole

(i) The contractor will site the pole and will provide the landmark, in the presence of Mauritius Telecom's representative, and/or the Engineer.

(ii) The contractor will in no circumstances modify the siting without the prior approval of Mauritius Telecom's representative and/or the Engineer's representative.

(iii) Mauritius Telecom's representative and/or the Engineer's Representative will inspect the hole before the pole is erected.

11.21.4 Cutting of Pole

The contractor shall in no circumstances cut the pole.

11.21.5 Protection of the Hole

The hole shall be completely isolated from the public by means of rods and tapes and proper barricading until the pole is erected properly.

11.22 REINSTATEMENT OF ROAD SURFACE (ASPHALT) AND STRUCTURES

11.22.1 Temporary Reinstatement

(a) If and where applicable, and if so directed by the Engineer, the Contractor shall provide a temporary reinstatement immediately after backfilling. Such works shall be carried out within utmost care so as not to cause inconvenience to vehicles and pedestrian traffic until the final reinstatement.

(b) The road surface should be reinstated according to the specifications in force in the area or on the road where excavation works are done, and should generally be reinstated to its original condition.

11.22.2 Scheduling, Quality and Guarantee of Reinstatement Works

Interim restoration or reinstatement works, whether on pavement or roadway will have to be carried out immediately following backfilling and ramming operation and should satisfy the specifications of the Authorities concerned.

Final reinstatement of any asphalt, concrete or masonry stone surface shall be carried out within fifteen (15) days following backfilling and interim restoration. Backfilled trenches not permanently asphalted or tarred shall not exceed a maximum length of one (1) km. In circumstances requiring **URGENT** asphalting or tarring, the Contractor shall execute works **IMMEDIATELY** upon request from MAURITIUS TELECOM, and/or the Engineer's representative.

Repair or reinstatement of bridge, drain, culvert, concrete or any stone structure shall be carried out a maximum of twelve (12) hours following backfilling of trenches.

The time lag and the maximum length of untarred trenches above may be reduced or increased to satisfy the requirements of the Authority concerned, subject to the approval of the MT and the Engineer.

The project on any site of work shall be considered as having been completed only after permanent reinstatement has been effected to the satisfaction of the Authority concerned.

Any subsidence following the initial reinstatement work, shall be rectified and made good by the contractor, before the final acceptance can be considered.

11.22.3 Interim Restoration

Prior to the final reinstatement, asphalt, concrete or masonry stone surfaces, footways and roadways shall be restored to suitable condition to enable normal motorist or pedestrian flow.

The interim restoration shall be executed immediately following backfilling and in the manner specified so that the affected portion is neither a source of inconvenience nor danger to the motorist or pedestrian.

The interim restoration of roadways should be carried out in the manner specified by the Ministry of Public Infrastructure, and/or the Engineer.

11.22.4 Reinstatement of Pavement in Masonry

The trench shall be well compacted by a mechanical rammer as defined in backfilling of trenches.

Concrete mix, 350 kg cement per m^3 concrete, for 0.4 m^3 of washed granular sand, (or rock sand) and 0.8 m^3 coarse aggregate shall be laid on trench surface up to 100 mm.

The masonry stones shall be laid in the concrete in such a way that they are level with the existing surface.

The joints shall be filled up with concrete mortar 400Kg cement per m^3 of sand, and finished flush with the masonry stone pavement.

11.22.5 Reinstatement of Gutter or Drain in Masonry

(a) The same operations as the reinstatement of pavement shall be carried out.

(b) The thickness of the concrete laid on the trench bottom shall be however be 150mm.

(c) The reinstatement stone works shall match the existing gutter regarding shape and gradient.

11.22.6 Reinstatement of Pavement in Concrete

(a) The trench shall be well compacted by means of a Mechanical Rammer.

(b) Hardcore filling shall be handpicked to an average thickness of 70 mm on the trench top.

(c) The hardcore filling shall be blinded with 32 mm (1¼") blue basalt aggregate.

(d) 100 m thick concrete 350 kg m^3 concrete for 0.4 m^3 of washed granular sand (or rock sand), and 0.8 m^3 coarse aggregate shall be laid on the prepared base and made anti-skid with a float.

(e) When required, the surface should be rendered anti-skid with required pattern to restore it to its original condition.

11.22.7 Reinstatement of Gutter or Drain in Concrete

(a) The same operations as the reinstatement of concrete shall be carried out.

(b) The thickness of the concrete shall however be 150 mm.

(c) The bottom shall be rendered with cement mortar 400 Kg cement for 1 m^3 of rock sand and should match existing shape or slope.

11.23 SAFETY AND HYGIENE ON SITE

The contractor shall carry out the works in conformity with the existing legislation in force.

11.24 DUCT TEST

The Contractor shall inform the MT of the date he proposes to perform duct tests. He shall carry out the tests with the help of appropriate mandrel or rings which must travel freely in the laid pipes. He shall prepare test sheets in three (3) copies, one of which shall be handed over to the Mauritius Telecom, and a second one to the Engineer.

All the tests should be carried out in the presence of Mauritius Telecom.

Section 12

PLATFORMING/ ENGINEERING FILL

SECTION 12 - PLATFORMING/ ENGINEERING FILL

12.1 MASS DIAGRAM

The Contractor shall prepare a mass diagram showing in as much details as the Engineer may consider necessary the programmed movement of the earth for measurement purposes. The programme for earthworks shall be submitted for the approval of the Engineer before the commencement of the works. Such approval shall not be deemed to relieve the Contractor of any of his responsibilities under the Contract. The contractor shall before preparing his earthworks programme, carry out such soil testing as necessary to determine the suitability of materials for use in the works.

12.2 SITE CLEARANCE

Clearing site shall consist of clearing the ground of bushes, hedges, shrubs, sugarcane plantations, loose boulders, piles of boulders and other objectionable material excluding soil and rock. It shall include disposal by carting to tip.

12.3 REMOVAL OF TOPSOIL AND ROOTS

The whole area of the site shall be cleared completely of all stumps, roots, grass and vegetable soil irrespective of depth. The Contractor may assume an average depth of 200mm of topsoil will require to be moved in this operation. After removal of top soil and roots, the site shall be graded.

Selected topsoil shall be stockpiled on site and retained for use in verges and side slopes where indicated on the drawings or as directed by the Engineer.

The remainder shall either be carted away to tip or shall be neatly spread, leveled and finished off as directed by the Engineer.

12.4 SETTING OUT

Before starting excavation the Contractor shall carry out the necessary setting out with temporary markers and permanent markers at suitable intervals to facilitate easy checking of the excavation.

Permanent benchmarks shall be established in suitable positions and agreed with the Engineer. These should be maintained so long as they are needed to check the work.

12.5 DRAINAGE OF WORKS

All cuttings, platforms and borrow pits shall be kept free of standing water and drained during the whole of the construction should water accumulate on any part of the earthwork either during construction or after construction until the end of the maintenance period, giving rise to soaking or eroding conditions in the earthworks, the Engineer may order the Contractor to remove and replace at the Contractor's expense any material which has been so affected.

All drains shall be maintained throughout the Contract in proper working order.

Well in advance of commencing earthmoving operations over swampy or waterlogged areas, the Contractor shall cut drains and ditches and carry out any other works as are necessary to assist in draining the ground.

The Contractor must allow in his rates for drainage of the earthworks satisfactorily at all stages during the construction and arrange his methods and order of working accordingly. No work above the subgrade shall be executed until the subgrade has been inspected and approved by the Engineer.

12.6 EXCAVATION

Excavation shall be completed to the lines and level shown in the drawings. Excess excavation below the levels shown on the drawings shall not be allowed. Excess excavation shall not be paid for and the Contractor shall at his own expense reinstate and make good with approved material thoroughly compacted to a density not less than 95% B.S heavy maximum dry density to the level shown on drawing.

12.7 GROUND AND SEA WATER

The Contractor shall keep dry by pumping or other approved means all excavations and trenches for as long as directed by the Engineer.

Dewatering of excavations will not be paid for as an extra.

12.8 EXCAVATED MATERIALS

All excavated material shall either be used for fill or stockpiled for future use (if approved by the Engineer) or disposed of (spoil) if in the opinion of the Engineer it is unsuitable for incorporation in the works.

12.9 GROUND TO BE INSPECTED BEFORE FILLING

Before any fill is commenced the Engineer shall inspect the area. The Contractor shall inform the Engineer of either soft spots or underground seepage encountered. The Engineer shall order and give details of any subsoil drainage where required.

The subgrade shall be cleaned of all foreign matter and any potholes, loose materials, ruts, corrugations, depressions or other defects which have appeared in the subgrade layer due to improper drainage, traffic or any other cause shall be corrected and if directed by the Engineer, the Contractor shall scarify, grade and recompact the subgrade to line and level all at this own expense.

12.10 MATERIALS FOR ENGINEERING FILL

It is expected that in general materials that have been removed from wet areas are suitable and are to be used as fill material, depending on the test carried out.

Two types of materials shall be considered.

1) Material for construction of main body of platforms which shall have a plasticity index of not more than 30% and contain boulders not greater than 150mm maximum dimension.

2) Selected materials for the construction of the top 30cm of the platforms or for filling areas from where unsuitable material has been removed.

   (a) the plasticity index shall not be more than 25%

   (b) the maximum size of boulders not greater than 150mm

   (c) CBR value after 4 days soaking at 95% B.S. Heavy M.D.D shall be not less than 10%. The CBR specimen shall be prepared at B.S. Heavy OMC + 2%.

   (d) Swelling not more than 1%.

12.11 PREPARATION OF THE FORMATION

The preparation of the formation shall not commence until all subgrade drainage has been completed and side drains or channels are capable of removing water from the immediate vicinity of the formation.

Preparation shall proceed as set out below: -

(a) Formations on Soil

After removal of all mud and slurry, duct and deleterious material and any protective layer, the moisture content of the soil extending to 150mm below the formation shall be adjusted to within minus one and plus two per cent of the optimum moisture content as determined by BS1377. If the soil is too dry, water shall be added by sprinklers and mixed in by rotary cultivators. Soil which is too wet may be dried by aerating with rotary cultivators if the weather conditions are suitable. Alternatively, the soil extending to 150mm below formation may be removed and replaced by acceptable material. The formation shall then be rolled with at least four passes of a smooth wheeled roller having a load of between 4.4 and 6.0 tonnes per metre width of roll or by an equivalent pneumatic tyred roller. The rolling shall continue until the dry density of the soil over a depth of 150mm below formation is at least 95 percent of the maximum dry density as determined in BS1377 using heavy (4.5 kg) rammer or such greater density as may be shown on the drawings or specified elsewhere.

Trimming and regulation shall then be carried out to bring the formation to the correct level and grade and finally, the formation shall be re-rolled with a smooth wheeled roller having a load of not less than 2.5 tonnes per metres width of roll.

(b) Formations on Bedrock

After reaching bedrock in cut areas, a minimum of 200mm of approved fill shall be provided on the bedrock, wetted and compacted as specified above.

12.12 SITE TRIALS

Full scale site laying and compaction trials shall be carried out on all materials proposed for the Permanent Works using the Constructional Plant and methods proposed by the Contractor for constructing the Permanent Works. The Contractor shall submit his proposals to the Engineer at least seven days in advance of the Site Trials. The Site Trials shall be carried out in accordance with the requirements specified for each of materials

Each trial area shall be at least 200 square metres and shall be laid to the specified depth for the material. It may be constructed as part of the Permanent Works provided it complies with the Specification. Any areas which do not comply shall be removed.

The Site Trials shall be carried out to confirm the suitability of the proposed compaction equipment to compact the material to the specified density and to confirm compliance with the other specified requirements of the completed course.

At least ten sets of tests shall be made on each 200 square metres of trial area to confirm compliance with the requirements set out in these specifications. Not less than nine out of ten sets of results shall comply.

When a Site Trial of a particular material has been accepted as satisfactory by the Engineer, the particulars shall constitute the accepted material and shall comprise the following information to be submitted to the Engineer:

(a) The composition and grading of the material
(b) The moisture content of the material at the time of laying and compaction
(c) The type and size of compaction, mixing and laying equipment, the number of passes, the rolling speed.
(d) The target density.
(e) The maximum density.
(f) The maximum compacted thickness of layer.
(g) Any other relevant information.

The above details for a material as proposed by the Contractor and accepted by the Engineer shall be used for all such material laid in the Permanent Works. It shall not be altered without the written consent of the Engineer and such alterations shall be confirmed by further Site Trials unless the Engineer does not require further details.

When determining the maximum dry density in accordance with BS1377 as specified in Clause 1.17 for granular materials containing more than five percent of material retained on a 20mm BS sieve, the results shall be corrected as follows :

Maximum dry density = $(P_p \times D_p) + P_t \times D_t)$.

Where P_p is the fraction by weight of the material passing the 20 mm sieve expressed as a decimal.
Where D_p is the maximum dry density of the material passing the 20 mm sieve expressed as a decimal.
Where P_t is the fraction by weight of material retained on the 20 mm sieve expressed as a decimal.
Where D_t is the effective specific gravity of the material retained on the 20 mm sieve determined in accordance with BS 1377.

12.13 FILLING AND COMPACTION OF PLATFORMS

Materials for constructing the platforms shall be of approved fill material obtained from the excavations, cuttings and approved stockpiles or borrow pits. Platforms shall be constructed in layers parallel to the final grade. The compacted thickness of layers of fill materials shall not exceed 300mm and shall not be less than 100mm. Rockfill may be used in the bottom layers of the platforms and each layer should not exceed 600mm in thickness. The maximum particle size in a layer of fill shall not have any linear dimensions greater than 150mm for normal fill material and 400mm for rockfill.

The top of platform shall consist of normal material and not rock. Where rock has been placed below this layer, the Contractor shall blind each layer of the rock with approved fine material to prevent later downwards percolation of fine particles from the upper layers and the whole layer then compacted by an approved method. More fine materials shall be added and the layer again compacted until the voids are then completely filled.

All fills shall be compacted to a density of 95% BS Heavy Compaction at +1% to -2.5% of optimum moisture content for the full design width and depth. In addition, the top 300mm of fill shall be compacted to 95% BS Heavy Compaction at +1% to -2% of optimum moisture content for the full design width.

In tipping and forming the platforms the Contractor shall make allowance in the height and width of these for consolidation and shrinkage. On completion of the Contract, the dimensions of the platforms shall be to the profile shown on the drawings and the necessary allowance being made for the surface finish. No sand slurry, mud, peat, organic, soft or otherwise unsuitable material, shall be placed in platforming works.

12.14 MEASUREMENT OF EARTHWORKS

Prior to construction of any earthwork or excavation the levels of the existing ground shall be agreed between the Contractor and the Engineer. If the Contractor fails to take the requisite level, then the ground levels shown on drawings or determined by the Engineer shall be taken as correct.

All excavation for earthworks for cuttings and platforms will be measured as the net volume in m^3 of the compacted embankments as measured off the cross-section drawings, called “Fill”, and the net volume of the spoil heaps measured from ground levels before spoiling and ground levels after spoiling, called “Spoil”.

If a cutting is over excavated, then the volume of overcut measured in cut when compared to the standard cross section, shall be deducted from the volume of spoil as measured.

12.15 COMPACTION STANDARDS

The terms used for compaction shall be ascribed to them the meaning given in British Standards B.S.1377, Part 1, General.

The standard of compaction used throughout the work shall be the British Standards test as described in B.S.1377, Part 4. Wherever the text of the specification the expression “X% B.S. Compaction” is used, it shall mean a standard of compaction such that the dry density of the compacted material is X% of the maximum dry density ascertained from the aforementioned British Standard Compaction Test.

FREQUENCY OF TESTS

Test	Moisture Content	Specific Gravity	Sieve Analysis	Atterberg Limits	Proctor	C.B.R	Plate Load Test
Fill	1/500 m^3	1/1000 m^3	4	2	1/1000 m^3	2	15

Notwithstanding the above provision, the Engineer shall be empowered to alter the number, type or nature of such tests, as may in his opinion, be necessary for the proper execution of the work. The Engineer shall be at liberty to increase the frequency of the tests and report tests, which in his opinion are unsatisfactory.

Dynamic Probe Super Heavy Test "DPSH"

- 30 no.
- Test reaching refusal at depth less than 1.5 m shall be rejected.

Plate Load Tests

- 20 no.

12.16 COMPACTION OF PLATFORMS

The Contractor shall prepare platforms for the plots and areas which shall accommodate the buildings, housing units and the commercial buildings. The respective clauses above pertaining to the method of backfilling where required shall be strictly adhered to, and the specified compaction tests shall be duly carried out, and the test results regularly produced and submitted to the Engineer.

If any tests should fail the specified norms and standards, the Contractor shall re-compact the appropriate layers of backfilling until the tests are conclusive. The Contractor will not be permitted to start the next layer of backfiling until and unless the previous one has been conclusive. No additional payment will be made in respect of such compaction or re-compaction.

SECTION 13 - LANDSCAPING WORKS

Note: *The Specifications in this Section should be read in conjunction with the other parts enclosed in any of the other Sections. Any apparent discrepancies should be immediately notified to the Engineer's Representative, and/or the Landscape Architect.*

13.1 PRELIMINARIES

If and when a nominated sub-contractor is employed by the Client for the landscaping works, the main Contractor shall allow for liaising, meeting and programming with the nominated sub-contractor, for ensuring that all the conditions of contract and all the other relevant parts of the specifications governing landscaping works would be fully complied with. The nominated sub-contractor shall be responsible for cleaning all planting areas of existing vegetation, except where otherwise specified, and all debris and foreign materials considered a hindrance to the planting operations.

All cleared materials shall be disposed away from site in a manner in accordance with the governing specifications.

13.2 EARTHWORKS

Notwithstanding the other parts of the specifications dealing with earthworks, the nominated sub-contractor, shall carry out the following:

- Carry out in-situ tests on soils from stockpiles.
- Obtain a fertiliser application recommendation.
- From on-site topsoil stockpiles, place and spread topsoil as specified.
- Import, spread and dig in bagasse and manure mixture as specified.
- Undertake micro shape berms and embankments as instructed by the Landscape Architect.
- Grade final levels in planting areas, to ensure rolling landscape with even running levels to tie into in-situ conditions such as road kerbing, tree bases, footpaths and buildings.
- Import and apply fertilisers as specified to plants
- Import and spread mulch layer to finished bed areas
- Import topsoil with added fertilisers, as per the Engineer's or Landscape Architect's instructions.

13.3 PLANTING

Notwithstanding the other parts of the specifications dealing with planting, the nominated sub-contractor, shall carry out the following:

- Install trees according to sizes as specified in appropriate tree holes with compost and fertiliser to specifications.

- Supply and install Palm tree transplants, and plant the said trees as per the Planting Plan.
- Install planting material, splits, 4kg, 10kg shrubs and groundcovers in appropriate planting holes with compost and fertiliser to specifications.
- Supply and install double and single tree staking units to specifications, and to Engineer's or Landscape Architect's instructions.

The appointed nominated sub-contractor shall provide the following minimum depth of in-ground soil mix for:

- Mature plant trees - minimum 1000mm depth
- Tree planting pits - minimum 600mm depth
- Shrub-planting beds - minimum 400mm depth
- Ground cover beds - minimum 300mm depth
- Turfed areas - minimum 150mm depth

13.4 WATERING OF TREES, PLANTS AND TURF

The nominated sub-contractor shall be responsible at all times for the irrigation/watering of the newly-planted trees, plants and turf. In this respect, he shall provide for all ways and means of irrigation/watering the landscaped areas, such as bowsers fitted with pumps and pumping manifold, the water hose, the necessary man-power for the whole duration of the contract and during the Defects Notification Period.

These irrigation/watering arrangements shall be deemed to be included in the nominated sub-contractor's rates for landscaping items in the dedicated Bill of Quantities which he would have purchased.

No separate payment whatsoever will be entertained and effected to the nominated sub-contractor.

The Landscape nominated sub-contractor shall be responsible for the watering and maintenance of all plant material before and after planting. Any losses due to lack of water or neglect will be the responsibility of the landscape nominated sub-contractor.

13.5 MAINTENANCE AND NURTURE

The nominated sub-contractor shall attend to all necessary nurture and maintenance of the landscaped areas, including trees, plants and turf as from the day the specified trees, plants and turf are planted up to the issue of the Taking-Over Certificate for the whole contract and thereafter for the whole Defects Notification Period of 12 months.

13.6 CONSTRUCTION OF LANDSCAPED AREAS

Notwithstanding the other parts of the specifications dealing with construction of the landscaped areas, the nominated sub-contractor shall carry out the following:

- Supply from on-site stockpiles and install boulders (0.7m – 2m dia) to be arranged in groups within the landscaped areas and used as low retaining walls at the Green Spaces No 12 and 15, as directed by the Engineer.
- Supply and install Sand at Green Space No 6 as directed by the Engineer.
- Supply and install crushed coral on well-compacted soil surface over the roundabout on the main distributor road, as directed by the Engineer.

13.7 PLANT NURSERY

The nominated sub-contractor or his sub-contractor shall provide for the installation and setting-up of a Plant Nursery on the site as soon as he mobilises on the site. The location and position of the plant nursery shall priorily be agreed with the Engineer and/or the Landscape Architect.

The installation, setting-up, maintenance, nurturing of the plant nursery shall be deemed to be fully included in the rates given by the nominated sub-contractor in his dedicated Bill of Quantities. No separate payment shall be entertained and effected.

Transplanting from the plant nursery to the respective landscaped areas shall be undertaken as soon as planting materials are ready and such transplanting shall be agreed with the Engineer and/or the Landscape Architect.

13.8 PROVISION OF UTILITY AND HYGIENE SERVICES

Notwithstanding the other relevant parts of the specifications governing the provisions of utility and hygiene services to be provided by the main contractor to his employees and or his other sub-contractor on site, the main contractor shall be responsible for the provision of suitable and clean toilet facilities at all times to the nominated sub-contractor.

The landscape nominated sub-contractor shall make his own arrangements with the main contractor and vice versa, regarding the supply of power and water for the personnel as well as maintenance and nurturing of the trees, plants and turf.

13.9 SOIL PREPARATION

Notwithstanding the other parts of the specifications dealing with soil preparation, the nominated sub-contractor shall carry out the following:

13.9.1 Topsoil

(a) Allow for transport and installation of 300mm topsoil to all landscape areas.

(b) Allow for topsoil to all planting pits as described in the bill of quantities for the landscaping works, and/or the specifications

13.9.2 Compost

(a) Ensure that only bagasse and manure mixture is used, unless new sources are found by the landscape nominated sub-contractor, and are proposed to the Engineer/Landscape Architect, for which due approval shall be obtained.

(b) Ensure that bagasse and manure mixture are dug to a minimum depth of 350 mm for bed areas and 100 mm for lawn areas.

13.9.3 Fertilizers and Additives

(a) Ensure that the landscape nominated sub-contractor should allow for fertilizers per tree, shrub and ground covers.

13.9.4 Final Finishing

(a) The nominated sub-Contractor shall satisfy himself that the levels of the ground shown on the drawings are correct and bring to the notice of the Landscaping Architect/Engineer any discrepancies before landscape operations are commenced. The drawings shall be deemed to be correct if no such notice is given to the Landscaping Architect/Engineer. For this purpose the nominated sub-contractor shall liaise with the main contractor.

(b) Filled areas, surfaces of excavations, slopes of embankments and cuttings and reinstated surfaces of ground shall be trimmed to a correct profile and, where directed to the nominated sub-contractor by the Landscaping Architect/ Engineer, shall be covered with a layer of topsoil spread lightly and consolidated to a uniform thickness. The soil shall be free from all debris, rubble, concrete, stones etc above 40mm nominal size and shall be clear of weeds. The surface shall be scarified before spreading topsoil.

(c) Ensure that topsoil in all bed areas is clean and he shall allow for removing of all stones larger than 200 mm diameter and any alien materials, perennial weeds, roots and other plan matter, broken bricks, concrete and the like.

(d) Ensure that fine grading of the top 150 mm shall be carried out to ensure a true and specified level and slope to avoid dishing or other depressions where water may collect. The use of a heavy roller to roll out humps in bed areas will not be permitted and any other area that becomes unduly compacted during landscape operations shall be loosened by forking and harrowing by the Landscape nominated sub-Contractor.

(e) Ensure that the final level of bed/lawn areas shall be level with all kerb/paved areas to allow for shrinkage and/or settlement or in relation to surrounding levels.

13.9.5 Surface Drainage

(a) Ensure that all areas should drain evenly across the site, away from buildings.

(b) Ensure that the surface run-off shall flow into a general surface drainage pattern.

13.10 PLANTING

13.10.1 Plant Guarantee

All plant material shall be guaranteed by the landscape nominated sub-contractor for the duration of the contract period up and until the issue of a Final Approval Certificate by the Engineer or the Landscape Architect. Dead or dying plants shall be replaced immediately during the contract period at the nominated sub-contractor's expense. At the end of the Defects Notification Period, all dead or dying plants shall be replaced at the nominated sub-contractor's expense. The plant guarantee will cover all plants specified by the Landscape Architect. If the landscape nominated sub-contractor has any objection to any of the plants specified, he shall state his concerns through a letter of qualification when submitting his tender; if no letter or qualification is submitted, it will be construed that the nominated sub-contractor has no objections to the plant material specified and no plants will be exempt from the guarantee.

The landscape nominated sub-contractor must assure himself that the plant material in the designated nursery is acceptable in quality and species to provide the required guarantee after planting.

13.10.2 Scope of Works

Under this sub-section, work shall consist of the following and shall be performed by a nominated sub-contractor, under the responsibility of the main contractor tendering for the works, in accordance with the relevant clauses of the Conditions of Contract and the Specifications.

(i) Furnish all labour, materials, transportation and services to install, maintain and nurture plant material in accordance with drawings and specifications as applicable to the various vegetation types. The nominated sub-contractor shall source hardened plants from suitable sources for the particular climate of the site.
(ii) Mention in which state site will be handed by the contractor to the Landscape nominated sub-contractor e.g. free of all builders rubble and debris, and that the planting shall be carried out in accordance with the relevant governing Specifications.

13.10.3 Trees

Trees shall be placed and planted in accordance with the issued planting plans.

13.10.4 Lawn

Cynodon Dactylon sprigs shall be planted as per supplier's specifications, and Planting Plans. Sprigs shall be kept moist, and out of direct sunlight. Sprigs shall be kept cool and moist up until planting. Dead or dying sprigs shall be replaced by the nominated sub-contractor at his own cost.

Soil shall be adequately prepared and de-weeded prior to sprigging.

Mowing shall commence once the foliage of sprigs has reached a height of 6cm. Not more than 1cm shall be removed during the first cut.

13.10.5 Sundries

55–75 mm diameter, 2400 mm long Tanalith-treated tree stakes and ties shall be installed. Stakes shall be driven to a minimum of 500 mm into the ground leaving 1.8 metre length above ground uniform with all other tree stakes.

Tree ties shall be plastic and (25 mm chain lock rubber ties or similar). Ties shall be checked and adjusted on a regular basis during the whole contract period and the Defects Notification Period. The nominated sub-contractor shall allow for replacing ties due to possible snapping, wherever required and as instructed by the Engineer or the Landscape Architect.

13.11 PALM TRANSPLANTS

The nominated sub-contractor shall be required to supply and plant Palm species, as listed in the Plant List.

Sub-species of plant species will not be accepted, unless advised otherwise by the Landscape Architect.

The period of moving the transplant will be as short as possible.

The transplant root ball shall be a minimum size of 1 x 1 metre.

The canopy of the tree will only be reduced with the permission of the Landscape Architect.

The transplant shall be well stabilized once it is in position.

13.12 PERIOD OF PLANT MAINTENANCE AND NURTURING

Notwithstanding the provisions of sub-clause 13.5 of these Specifications, the attention of the main contractor and the landscape nominated sub-contractor, is drawn to the following:

- The plant nursery shall be established at the site as soon as the nominated sub-contractor mobilises on site. The main contractor shall have priorly made provision for the necessary land extent at the on-set of the main contract under the responsibility of the main contractor.

- The preparation of the landscaped areas shall commence as soon as possible within the contract period.

- The transplant shall commence as soon as the preparation of the remaining landscaped areas is complete and/or ready.

- The landscaping works shall be duly completed concurrent with the other infrastructure works comprising the contract. For this purpose the main contractor and the nominated sub-contractor shall maintain constant positive liaison.

- The Taking-Over Certificate to the nominated sub-contractor for the landscaping works will be issued by the Engineer concurrent with the Taking-Over Certificate issuable to the main contractor for the whole of the Works.

- The Defects Notification Period (and the Defects Notification Certificate) for the landscaping works will be concurrent with the Defects Notification Period (and the Defects Notification Certificate) for the whole of the works.

13.13 STOCKPILING OF TOPSOIL ON SITE

Topsoil set aside shall be clean dry excavated material free from rubble, debris, rubbish, deleterious matter or other pollution and shall be spread and levelled to a compacted thickness of 150mm as shown on drawings and as directed to the nominated sub-contractor by the Landscaping Architect/ Engineer. If the excavated material from the foundations of the buildings and /or any other source on site is not sufficient, the nominated sub-contractor shall make the necessary arrangements to import such topsoil from elsewhere. His rates shall include for same. The nominated sub-contractor may alternatively make any necessary arrangements with the main contractor for that purpose.

The nominated sub-Contractor shall allow in his prices for loading up and carting away to tip all surplus excavated material arising from excavations or preparation of surfaces for landscaping. For this purpose he shall liaise with the main contractor.

For the implementation of the stockpiling of top soil as specified below, the nominated sub-contractor shall liaise with the main contractor and the latter shall extend all the necessary assistance to him.

The main contractor and the landscape nominated sub-contractor shall strictly adhere to the following specifications for the stockpiling of topsoil on site:

(i) Identify locations for stockpiles

- on plots
- near the road edge
- on plots which are identified for future phases.
- distributed to several sites to reduce transportation where possible.

(ii) Keep different soil types separate, sub-soil and topsoil should not be mixed as far as possible.

(iii) Stockpile heights should be no more than 2m.

(iv) Avoid moving topsoil when wet as this leads to compaction of the soil as it dries out.

(v) Weed cover to be left as a protective covering over the stockpiles, to minimize wind-blown dust and erosion of the stockpiles.

(vi) Do not drive over stockpiles when placing the material as this leads to compaction.

(vii) Do not contaminate soil stockpiles with construction waste, tree branches, root balls and other vegetation, concrete etc.

(viii) The topsoil quantities must be measured and records maintained for purposes of management of topsoil (for future use).

(ix) Topsoil allocated for landscaping must be kept intact and not used for any other purpose on site.

13.14 CHAIN LINK FENCING

Fencing shall be anti-intruder heavy duty galvanized chain link fencing or open mesh steel panel type as specified on drawings and complying to the relevant parts of BS 1722 & BS EN 10244 and shall conform to the following requirements.

Posts and bracings shall be hot dipped galvanized sections and shall comply to relevant parts of BS EN 10210 and BS EN ISO 1461. Line wire, stirrup wire and tying wire shall all be galvanized wire complying with the relevant parts of BS 1722 and BS EN 10244.

Specifications of fencing shall be submitted either by the main contractor or by the nominated sub-contractor as the case may be, after the decision by the Engineer, to the Engineer for approval prior to the procurement and site delivery. The nominated sub-contractor or the main contractor as the case may be, shall also submit to the Engineer attested copies of Mauritius Standard Bureau test certificates for samples of posts, bracings and fencing. The main Contractor or the nominated sub-contractor as the case may be, will be deemed to have allowed all costs arising for carrying out these tests in his rates for carrying out the works.

SECTION V

EMPLOYER'S REQUIREMENTS

SECTION V – EMPLOYER'S REQUIREMENTS

DRAWINGS

SECTION V – EMPLOYER'S REQUIREMENTS

THE LIST OF DRAWINGS IS HERETO ATTACHED.

THE DRAWINGS HAVE BEEN REPRODUCED UNDER VOLUME 2 of 2

ENTITLED:

"EMPLOYER'S REQUIREMENTS: TENDER DRAWINGS"

LIST OF DRAWINGS

GENERAL DRAWINGS

DRAWING NO.	TITLE
SPDL/C2024/29/LP/S7-S10/LAY/01	Location Plan
SPDL/C2024/29/SP/S7-S10/LAY/01	Site Plan

ROAD & DRAINAGE WORKS

SPDL/C2024/29/SRC/R/S7-S10/LAY/01	Road Layout (General)
SPDL/C2024/29/SRC/R/S7/LAY/01	Road Layout (S7)
SPDL/C2024/29/SRC/R/S8/LAY/01	Road Layout (S8)
SPDL/C2024/29/SRC/R/S9/LAY/01	Road Layout (S9)
SPDL/C2024/29/SRC/R/S10/LAY/01	Road Layout (S10)
SPDL/C2024/29/R/CS/01	Typical Road Cross Section
SPDL/C2024/29/R/S7/LS/01	Road Longitudinal Section For S7
SPDL/C2024/29/R/S8/LS/01	Road Longitudinal Section For S8
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SECTION V – EMPLOYER'S REQUIREMENTS

BILL OF QUANTITIES

SECTION V – EMPLOYER'S REQUIREMENTS

- PREAMBLE TO BILL OF QUANTITIES
- BILLS:
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PREAMBLE TO BILL OF QUANTITIES

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - PROCUREMENT REFERENCE NO.: SPDL/RFP/C2024/29

PREAMBLE TO BILL OF QUANTITIES

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PREAMBLE

1. THE BILL OF QUANTITIES

The Bill of Quantities comprises this Preamble, the Preliminaries and General Bill, the individual Bills in respect of all the components of the works, the Summary of the whole Bill.

2. THE QUANTITIES

The Quantities set out in the Bill of Quantities are the estimated quantities of the work and they are not to be taken as the actual and correct quantities of Works to be executed by the Contractor in fulfillment of his obligations under the Contract, which shall be measured on Site.

3. MEASUREMENT NET

The Works shall be measured net except where otherwise specifically described or prescribed in the contract.

4. RATES & PRICES

The rates and prices in the Bill of Quantities shall, except where otherwise provided in the Contract, cover all the Contractor's obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the Works.

The rates and prices are to be fully inclusive rates and/or prices or rates for the finished work described under the respective items and/or drawings, unless otherwise stated or unless there is a separate item for extra labour, cutting or waste and are to include for all materials, making, conveying, cartage, carriage and delivery, unloading, storing, unpacking, hoisting or conveying, setting, fixing and building into position and labour of every description, cutting and waste, templates, pattern and models, plant, temporary works, return of packings, taxes, levies, customs duties, surcharges, establishment charges, overheads, cost of all nature, and all obligations arising out of the Conditions of Contract, the provisions of Materials and Workmanship bills, the provision of the Preliminaries bills and the execution of the relevant work. Prices for plant, temporary works, services and other items provided shall include for the supply, maintenance, fuel, operating costs and subsequent removal and making good as necessary.

The prices for all items shall where applicable include for small quantities, short lengths and narrow widths.

Except where otherwise specified, Constructional Plant, Temporary Works, Materials both for Temporary and for Permanent Works, Labour (including the supervision thereof), Transport to and from the Site and in and about the Works, Contractor's General Preliminaries and Overhead, Watching, Lighting, Completion and

Maintenance of the Works shall not be measured and the cost thereof shall be deemed to be included in the rates and prices in the Bill of Quantities.

The Contractor shall be deemed to have inserted against each item in the Bills such rates and prices as he may deem necessary to cover the requirements of the Contract. Where no rate or price or the corresponding amount is inserted against any item in the Bills, the cost thereof will be deemed to have been included in other items priced by the Contractor.

5. QUANTITIES IN FINAL MEASUREMENT

The total quantity included in the final measurement of each item shall be measured to the nearest integer relative to that item, or to one decimal place if so indicated in the Bill of Quantities.

6. ABBREVIATIONS

The following abbreviations are used in the Bill of Quantities, the Specification and the Drawings, as well as in the List of Prices for Roadworks.

mm	millimetre
Lin.m	Linear Metre
m	metre
Sq.m or m^2	square metre
Cu.m or m^3	cubic metre
l/s	litre per second
m^3/h	metre cube per hour
kg	kilogramme
dia.	diameter
Num. or nr. or No.	number
h or hr	hour
c/c	centre to centre
Conc.	concrete
E.O.	Extra Over
DN	Nominal Diameter in mm
I.D.	Inside Diameter
O.D.	Outside Diameter
PVC	Polyvinyl Chloride
PE	Polyethelene
%	Percent
uPVC	Unplasticised Polyvinyl Chloride
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
l	Litre
DBST	Double Bituminous Surface Treatment
t	Metric Tonne
ha	hectare
Ch	Chainage
AMSL	above mean sea level

7. UNITS

All quantities and dimensions in the Bill of Quantities, the Specification and the Drawings are given in the "*Système International d'Unités*" (S.I) and the conversion to imperial units is given in the following table:

1 mm	=	0.03937 inch
1 m	=	1.0936 yard
1 sq.m	=	1.196 sq yard
1 cu.m	=	1.308 cu yard
1 km	=	0.6214 mile
1 kg	=	2.2046 pounds
1 tonne	=	0.9844 ton
1 litre	=	0.2200 imperial gallon

8. PROVISIONAL SUMS

Where in the Bill of Quantities, there is an item having the words "*Provisional Sum*", "*Prov Sum*" or any other defined abbreviation thereof entered into the Unit column, the percentage stated in the space provided for the Contractor's profits and charges shall be used for payment when the work is valued in accordance with the relevant clauses of the Conditions of Contract. If no percentage is given, it will be assumed that the Contractor does not require payment under this item.

The Contractor shall NOT spread any of his preliminaries, overheads and profits over any item of the Bill of Quantities being the subject of a Provisional Sum.

Provisional sums shall ONLY be expended if expressly instructed by the Engineer.

9. PROVISIONAL QUANTITIES

Items in the Bill of Quantities marked "*Provisional Quantity*" shall only be executed if they are the subject of a written instruction from the Engineer. The rates set out for such items shall be used for the valuation of the work so ordered by the Engineer in writing whether the quantities shown are used wholly or in part.

The net effect on the Accepted Contract Amount named in the Letter of Acceptance resulting from a difference between the provisional quantities entered in the Quantity column of the Bill of Quantities and the quantities of such items actually ordered by the Engineer on site shall NOT be taken into account for the determination of the Contractor's right to a Contract Price adjustment in accordance with Clause 12.3 of the Conditions of Contract.

The Contractor shall NOT spread any of his preliminaries, overheads and profits over any item in the Bill of Quantities being the subject of a Provisional Quantity.

10. DAYWORK

10.1 General

The Dayworks Bill of Quantities includes rates only for use when work is executed on a daywork basis in accordance with Clause 13.6 of the Conditions of Contract.

Work shall not be executed as Daywork except by written order of the Engineer's Representative.

The rates entered by the Contractor in the rates and items of the Daywork Schedules shall be deemed to include all the Contractor's overheads, preliminaries and profits. No additional payment whatsoever will be effected over and above the Dayworks rates given by the Contractor.

The Contract Rates in the Dayworks bill will apply for the whole duration of the Contract.

10.2 Labour

The Contractor shall be entitled to the following conditions in respect of labour employed on Daywork:

(a) The aggregate amount of wages, bonus, travelling and subsistence allowances and expenses, holidays with pay and insurances for such labour calculated on the actual time worked. The normal working day will be taken as 8 hours.

(b) The rates entered against the Daywork items are deemed to cover the Contractor's charges and profit, including superintendence and all allowances for labour, time-keeping and all clerical office work; the use, repairs, maintenance and sharpening of tools; the use of consumable stores and electrical power; the use and repair of stagings and scaffolding; the use of water, lighting and appliances of all description; supervision by the Contractor's staff, foreman, walking gangers (other than gangers or charge hands working with the gangs) spanner hands and, generally, all other incidental charges of any nature whatsoever.

(c) The Contractor shall carry out all Daywork within normal working hours unless the Engineer's Representative has given written approval to the contrary. Payment for labour employed on Daywork carried out outside normal working hours will only be entertained if and only if the Engineer's Representative shall have given such approval.

(d) In such cases, any overtime shall be paid in the same proportion as is paid to the workman in accordance with prevailing official regulations; thus if a man works one hour overtime for which he is paid for one and half hours the Contractor shall be paid one and a half times the normal hourly rate.

10.3 Material

The Contractor shall be entitled to payment of materials (except those materials or consumable stores incidental to labour costs incurred on Daywork, the payment of which is specified in sub-clause 10.2 – Labour, of this Preamble). Such payment shall be subject to the following conditions:

(a) The net cost of such materials delivered to store or stockpile at the Site. Such cost shall be calculated on the basis of invoiced price delivered to Site, i.e. including of all transport and other costs.

(b) The rates entered under items for materials shall include the Contractor's charges and profit, including, inter-alia, clerical office work; the insurance of materials, the stamp duty, and all other levies or imposition of any nature however incurred by the Contractor; the landing charges and other direct local costs and, generally, all other incidental charges whatsoever, including transport, wastage and any other on-costs from whatever cause arising.

(c) The cost of handling any material for use in work ordered to be carried out as Daywork from the aforesaid store or stockpile to the place where it is used on Site shall be deemed to be included in the Contractor's Daywork rates.

10.4 Plant

(a) The Contractor shall be entitled to payment in respect of plant which he has on Site and which is employed on Daywork as ordered by the Engineer at the net cost of such plant calculated from the hourly rates entered by the Contractor in the relevant bill items of the Dayworks Bill.

(b) The rates entered in the said Dayworks Bill shall be deemed to include inter-alia for the direct or hire cost of the plant; the cost of fuel, oil and lubricants on Site; the cost of drivers, mechanics, attendants and spanner hands necessary for the proper operation, repair and maintenance of plant; the cost of insurance, road taxes, police charges etc and generally of all other incidental charges or costs of any nature whatsoever, and shall cover matters consequent to the application of the rates.

(c) No payment shall be made for any plant on Daywork which has broken down or is being serviced nor for the driver, attendants and other Contractor's personnel which are unable to work because of such breakdown or servicing. Moreover, if as a result of such a breakdown or servicing, other plant on Daywork cannot be operated the Contractor shall not be entitled to payment in respect of such idle plant.

(d) In the event of breakdown of any plant, the Contractor shall be obliged to provide suitable replacement as ordered by the Engineer.

11. GENERAL

Except where specifically allowed for, no separate measurements for payment will be made for complying with the requirements of the specifications for road works, water supply, sewerage works, electricity supply and building works.

12. TRENCHWORKS

The quantities for trench excavation shall be measured along the centre line of the pipe. The term '*depth to invert*' means depth to the lowest internal surface of the barrel of the pipe.

The term '*cover*' means the distance from the ground level used for measurement to the highest external surface of the barrel of the pipe.

Unless otherwise described in the Bill of Quantities, trench works excavation as specified in Section 3 of the Specification shall be measured in the main categories of work listed in Sub-clauses (a) to (j) below. The rates for categories defined in Sub-clauses (a) to (g) shall apply for work in any material.

Depth of excavation shall be measured from the ground level existing just before excavation of the service trench.

(a) Excavation for structures, support etc, shall be measured by volume and shall be the product of the horizontal net allowable width as shown on drawings and the mean depth from the surface from which it is measured. The rates for such excavation shall apply for excavation to any depth, within the depth ranges indicated in the Bill of Quantities.

(b) Excavation for pipe trenches shall be measured by volume and shall be the product of the horizontal net allowable width as shown on drawings and the mean depth to invert, measured as per above. The length of trenches for sewerage pipe shall be measured along the centreline of pipe from centreline of manhole to centreline of the next manhole. Pipes and bedding for sewerage works shall be measured in a similar manner.

(c) Excavation for chambers shall be measured under Sub-clause 12 (a) above. Exploratory trenches shall be measured by volume as ordered by the Engineer on Site. The rate shall include, but not by way of limitation, for excavation by hand, backfilling, carting away excess material and making good damage caused to existing services.

(d) Excavation below the formation level shown on the Drawings to remove unsuitable material shall be measured by volume and shall be the product of horizontal area of the material ordered to be removed and the average depth of the final excavation levels designated by the Engineer, measured from the ground level existing just before excavation, as defined above.

(e) No separate payment shall be made for backfilling excavation in unsound material and supplying concrete, fill or granular material as specified.

(f) Excavation for pipe trenches below the maximum depth stated in the Bill of Quantities shall be measured by volume and shall be the product of the horizontal area of the trench and the mean distance from the maximum depth described in the Bill of Quantities to the invert of the pipe as shown on the Drawings or designated by the Engineer, over the length of trench where the maximum depth has been exceeded.

(g) The rates entered in the Bill of Quantities shall be all-inclusive with respect to all the various depth categories given for the excavations as per the appropriate Bill Items.

(h) Fill above ground level and backfill over permanent work (other than pressure pipelines) shall be measured by type of material and by volume as the net volume to the dimensions and levels shown on the Drawings or ordered by the Engineer. No separate payment for transport over any distance shall be made.

(i) Selected fill and backfill to pipelines shall be measured under Sub-clauses 15 (2) and (3) of this Preamble.

(j) Excavation for ducting shall be measured from ground level after removal of topsoil to provide a minimum cover of 800mm or otherwise as specified and/or shown on drawings.

Whatever the type of material and the method of measurement specified in Sub-clauses 12 (a) to (j) above, no separate payment shall be made inter-alia for making records of ground levels and topography; site clearance; stripping and replacing top-soil; supporting excavations; hand excavation; making good slips, falls, excess excavations, overbreak, and for any other reasons; trimming surface of excavations and embankments; making allowance for settlement; selection of materials for backfilling and backfilling against permanent work; compaction and preparation to receive other materials or finishings; compaction trials, conformance, sampling and testing of compaction; control of moisture content; location, preparation and restoration of borrow pits; scarification; location and shaping of disposal heaps and embankments and removal of surplus excavated and unsuitable materials to disposal heaps and keeping the Works and excavations dry, dewatering of trench in water-logged areas, keeping the site and trenches and all other excavations free from water from whatever cause arising, all barriers, lighting, warning signs, traffic control, and any other measures necessary to ensure complete safety around the area of the works, compacting the formation to 90% B.S Heavy or as otherwise stated.

13. CONCRETE WORKS

Unless otherwise specified in the Bill of Quantities, concrete work as specified in Section 5 of the Specification shall be measured in the categories of work listed under Sub-clauses (a) to (i) hereunder:

(a) Concrete shall be measured net by volume, area or length as stated in the Bill of Quantities. No deduction shall be made in or in respect of volume occupied by

reinforcement or in respect of small openings, recesses, chases and embedded fixtures having a cross sectional area less than 0.1 m^2.

(b) Concrete in each class shall be measured separately in each of the following categories irrespective otherwise of location in the Works:

- Plain concrete in-situ
- Reinforced concrete in-situ
- Precast concrete

(c) Concrete shall be presumed to be made with Ordinary Portland Cement unless otherwise stated.

(d) Where in the Bill of Quantities separate items are provided for concrete in particular locations, or for particular types of work, it shall not be deemed to prejudice the generality of the above rules.

(e) Except where specifically stated otherwise, shuttering has not been measured separately, but has been included in the description of the item to which it applies.

(f) Concrete in foundations, anchor blocks and the like shall be measured in cubic metres.

(g) Concrete in walls, floor slabs and suspended slabs shall be measured in square metres, stating the thickness. Surface treatment of the concrete shall be given in the description.

(h) Class A bedding and concrete in surrounds to pipes shall be measured as specified in Clause 15 of the Preamble to the Bill of Quantities.

(i) Bar or rod reinforcement except where otherwise specified shall be measured separately for each size of bar by mass as calculated from the dimensions shown on the Drawings, the basis of the calculated masses being 7,850 kg/m^3 for bar and wire diameters whose nominal size as manufactured is in metric units.

(j) Steel wire fabric for reinforcement shall be measured as the area shown on the Drawings for each weight of fabric as detailed in the Bill of Quantities, with no allowances for laps.

(k) Wires or other material required for supporting and securing the reinforcement in its correct position shall not be measured.

(l) The rate for steel reinforcement shall apply irrespective of location in the Works.

(m) No separate payment shall be made inter alia for supply of testing of concrete ingredients; storage of materials; determination of mix portions; making and testing of trial mixes; testing of concrete; control and mixing of concrete;

transporting, placing and compacting concrete, laying construction to falls, floating or troweling surfaces; construction joints (whether shown on the Drawings or not); moulds for and transporting and forming precast work; shuttering and surface finishes; forming holes, mortices and the like; precautions for concreting in unfavourable weather; curing; cement mortar or cement lime mortar; ascertaining requirements for reinforcement; working space and erection and handling of shuttering; rendering of concrete surfaces and preparation of surface finishing, forming of chamfers to all exposed external surfaces; building in all pipes and fittings, bolts, frames for covers, iron and steelworks etc. and making good.

The rates and prices for rendering whether included in another item or separately itemized, shall include, but not by way of limitation, for all materials, concrete, reinforcement, ties, formwork, chamfers, recesses and other features as shown on drawings.

(n) Concrete works as specified in Section 6 of the Specifications – "*Roadworks*" shall be measured and paid for all in accordance with the said Specifications only. Only and only if the specifications referred to above do not cover the method of payment of the concrete works associated with the roadworks, then the provisions of Clause 13 of this Preamble shall apply.

(o) Rates for thrust and anchor blocks shall include for concrete, reinforcement if shown on drawings, and all additional excavation, trimming and sawn formwork as necessary. The concrete shall be placed on the full extent of the excavations as detailed in the drawings but the anchor blocks shall be minimum size consistent with the drawings.

14. MISCELLANEOUS ITEMS

Chambers shall be measured by number complete and shall include all benching, step irons and cover slabs, etc

Concrete cover slabs, other than on manholes and chambers, shall be measured by number to the size specified in the Bill of Quantities.

Steel and cast iron covers shall be measured by number.

The following items as specified shall be measured by number:

- Step iron (except in manholes and chambers)
- Vermin screens
- Ventilators and louvres

Steel ladders shall be measured by number and rise.

Chainlink fences shall be measured by length in metres and the rate shall include for all columns, blocks, coping, corner columns, column bases, strip footing, straining posts, barbed wire etc., for the complete installation. Security gates shall be measured by number and shall include for all gateposts, hinges, gate strips, foundations and other necessary fittings.

15. WATER PIPELINES AND FITTINGS

Unless detailed in the Bill of Quantities, Pipelines as specified in Sections 3 and 4 of the Specification shall be measured as specified below:

(1) Construction of pipelines shall be measured separately for each nominal internal diameter of pipe for each strength, class, and material pipe. The measurement shall be by plan length on the centre line of the pipe through all fittings and chambers etc. Unless otherwise stated in the Bill of Quantities, pipelines shall be measured for complete construction including supply of pipes and joints where necessary, transport to site, storage, transport within site, laying in trench or on existing ground, jointing and testing, protection of pipes and joints as shown on the Drawings indicated in the Specification or ordered by the Engineer. No separate payment shall be made for cutting pipes to their exact dimension and for the unused lengths of pipes resulting from the cutting; for the provision of test pieces and connections to the pipeline, and gaskets, bolts, nuts, washers etc. and for the provision of anchors and testing equipment and material of any nature whatsoever. The Contractor shall be responsible to ascertain himself of the lengths of piping required. No claim on surplus material on completion of works shall be accepted.

(2) The supply, placing and compaction of the Class B bedding of pipes as specified in Clause 3.8 of the Specifications shall be measured separately. The Class B bedding shall be measured for each nominal internal diameter and material of pipe by the length of pipe bedding. The rates entered in the Bill of Quantities shall include for preparation of trench including excavation below the pipe invert to the levels shown on the Drawings, supply, placing and compaction of the appropriate bedding material, backfilling with selected fill material and fill material above the bedding including allowance for settlement and disposal of excess spoil to tips obtained by the Contractor and approved by the Engineer. No separate payment shall be made for the importation of selected fill or backfilling material as specified in Clause 2.6 of the Specifications.

(3) The supply, placing and compaction of concrete for Class A bedding of pipes as specified in Clause 3.8 of the Specifications shall be measured separately.

The class A bedding shall be measured by each length of the pipe bedding and the nominal diameter of the pipe. The rates entered in the Bill of Quantities shall include for preparation of the trench including excavation below the pipe invert to the levels shown on the Drawings, supply, placing and compacting concrete to form the bedding, including formation of flexible joint, backfilling with fill material above the concrete including allowance for settlement and disposal of excess spoil to tips obtained by the Contractor and approved by the Engineer.

(4) Valves and special fittings and equipment incorporated in the pipelines will be measured under separate items by number as detailed in the Bill of Quantities. The rates in the Bill of Quantities shall include for the supply of all flexible couplings, flange adaptors, lubricating agent, nuts, bolts and washers, sealing rings, transport to site, storage, transport on site, laying in trenches or chambers, jointing and testing.

(5) The rates and prices for connecting a pipeline to or into an existing pipeline shall include, but not by way of limitation, for any necessary trial holes to locate the existing pipeline; all additional excavation; measures to keep existing pipeline in service or interruption and resumption of services.

(6) When valves and special fittings and equipment are to be incorporated on existing pipelines, the rates shall include for, in addition to the above, the cutting of the existing pipe, the preparation of the cut surface, and protection as specified and all other incidental works.

(7) All costs in connection with the preparation and supply of Drawings, installation, Operation and Maintenance manuals and with attendance on Site by the Manufacturer's Representative shall be included in the rates entered in the Bill of Quantities.

(8) No separate payment shall be made inter alia for:

a. Any incidental cost like insurance of pipes and specials and insurance of labour involved with the handling of the pipes; repair of damaged pipes, coatings and lining; loading equipment, replacement of damaged pipes, storage, Constructional Plant, supply of materials, cuttings, jointing, welding, cleaning, painting, handling of pipes and specials, support of pipes in trenches, making good or any other incidental work;
b. Transport, grading, selection and compaction of bedding material, selected fill materials; transport; preparation; testing, construction of temporary anchorages, supply of formwork, curing or any incidental work.
c. Testing shall include for providing all consumables, water, transport of water, labour and equipment and for furnishing all specified test reports and certificates, obtainable form the relevant Authorities.
d. Disinfection of water supply pipeline shall include provision of all materials and test reports and certificates by the relevant Authorities.
e. The lengths of pipes and bedding for sewerage pipelines shall be measured along the centreline of the pipe across manholes and fittings.

16. SUPPLY AND INSTALLATION OF SPECIAL FIXTURES

The supply and installation of special fixtures to be fixed on concrete structures shall be measured by number as specified in the Bill of Quantities.

No separate payment shall be made for complying with the requirements of Clause 2.3 of the Specifications and the rate entered in the Bill of Quantities for the supply and fixing of special fixtures shall include the cost of their importation into Mauritius, the local charges, the stamp duty and other levies and imposition; their protection or making good; their insurance, transport and handling and, in general all other charges associated with their supply and fixing.

17. FIXING AND BUILDING IN

Unless expressly itemised separately in the Bill of Quantities, no separate measurement shall be made in respect of items whether specified or not requiring:

mortar; building in or fixing to blockwork, concrete, metalwork or timber; painting and protective treatments, welding, drilling; bolting inclusive of bolts, nuts and washers; screws, nails and plugs; jointing and joint materials; shuttering; boxing out and filling thereof; grouting; packing; bedding; insulation between different metals; making good; conduits and fittings; cutting; waste; labour; materials; temporary works; constructional plant; storing; handling and all incidental work to the items concerned and their surroundings.

18. JOINTS AND SEALANT TO JOINTS

The joints and their sealants shall be measured in linear metre along the length of the joint at its centre line. The rates of the Bill of Quantities shall include for the supply of the joints, of the joint fillers and for all other materials required for the complete construction of the joints. No separate payment shall be made inter alia for all forming, chamfering, caulking grooves, toggling, painting, priming, preparation and filling, and for all other operations necessary for carrying out the construction of the joints in accordance with the manufacturer's recommendations.

19. DRAINAGE SYSTEM

The rates shall be for constructing the drainage system complete including all earthworks and for the supply, laying, jointing and testing of all pipe work and the construction of manholes and soakaways as required, all in accordance with Section 6 "*Roadworks*" of the Specifications.

20. SWABBING, CLEANING AND DISINFECTION OF PIPES

No separate payment shall be made for complying with the requirements of Clauses 4.4.5 and 4.4.6 of the Specifications and for the supply of the materials for the swabbing, cleaning and disinfection of the pipelines. All the costs of these operations shall be incorporated in the rate for laying and testing the pipelines.

21. CHAMBERS

The rates for chambers shall be inclusive of excavation, working space, blinding, concrete to base slab, wall, roof slabs, joints, reinforcement to walls and roof slabs, F1 formwork to external surfaces, F2 formwork to internal surfaces, provision and building-in of galvanised cast-iron step irons, provision and fixing in position of heavy or medium duty cast iron manhole covers as the case may be.

22. SURVEY WORK

All survey work ordered on site by the Engineer in respect of water supply, roadworks, drainage works, electricity supply and building works and carried out in accordance with Clauses 1.17, 1.18 and 1.21 of the Specification shall be measured as described in the respective bill items of the Bill PG "*Preliminary and General Items*".

Survey works for all the above-listed components of works shall include and allow for transferring levels, check levelling, and erection of Bench Marks and preparation of

location and other plans. No separate payment shall be made for any of the above tasks.

23. DISCONNECTION AND BLANKING OFF OF EXISTING CONNECTIONS

The disconnection of existing connections and their blanking off as specified shall be measured as an item complete. No separate payment shall be made inter-alia for excavation, backfilling, measuring, cutting and welding, temporary supports, de-watering, preparation, painting and making good, provision of all blank flanges, couplings, jointing and testing.

24. METHODS OF PAYMENT

For the purpose of submitting monthly statements, the Contractor shall include in his monthly statement the percentages listed in this clause following the completion or stage specified and, in the order, shown.

i) Water Supply /Sewerage Works- Pipe line

	Percentage of Unit rate for pipeline
Completion of pipelaying and backfilling in preparation for testing	70%
Completion of testing, and disinfection as specified.	30%

ii) Water Supply /Sewerage Works- Chambers and Manholes

	Percentage of Unit rate for pipeline
Completion of base	20%
Completion of wall up to soffit of slab	40%
Completion of slab with manhole cover	30%
Completion of testing	10%

iii) Telecom/Electricity/CCTV - Cable Ducts

Completion of pipelaying and backfilling in preparation for testing	80%
Completion of testing, and plugging where specified	20%

iv) Telecom/Electricity/CCTV – Chambers and Manholes

Completion of base	20%
Completion of wall up to soffit of slab	40%
Completion of slab with manhole cover	30%
Completion of testing	10%

v) Preliminaries and General items-Bill no 1

For the pricing of the P&G Bill No.1, the tenderer/bidder shall follow the following directives/instructions: -

For certain items of the P&G Bill, payment shall be effected on a fixed portion and a time-based portion as shall be indicated by the tenderer/bidder in the pricing of the respective bill items.

The fixed portion will be paid under the first interim payment application. The time-based portion will be paid in equal monthly instalments during the contract period. The tenderer/bidder shall indicate prices for both the fixed portion, as per the sum item provided, and the time-based portion as per the rate item provided, in the respective items where applicable.

Attention is drawn that the time-based components will be utilised for assessing any cost associated with any extension of Time, where applicable and justified. Hence, it is mandatory for the tenderer to provide a price for both the sum item and the rate item where so indicated in the P&G Bill No.1.

25. ADDITIONAL AND CONTINGENT WORKS

A Provisional Sum has been entered in the Preliminary and General Items, to cater for any additional and contingent works to be carried out within the project, as may be instructed by the Engineer and/or Employer. The Employer reserves the right to undertake any additional or contingent works under separate contracts, and the Contractor shall not object to such a course of action.

26. MATERIALS ON SITE

Materials on site will be paid under this contract as per Clause 14.5 of the Conditions of Contract and Appendix A to Bid.

BILL OF QUANTITIES

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

MAIN SUMMARY OF BILL OF QUANTITIES

	Amount (Rs)
Bill No. 1 - Preliminary and General Items	.....
Bill No. 2 - Road Works	.....
Bill No. 3 - Water Supply	.....
Bill No. 4 - Sewerage Works	.....
Bill No. 5 - Electrical Works	.....
Bill No. 6 - Street Lighting Works	.....
Bill No. 7 - Telecommunication Works	.....
Bill No. 8 - Ancillary Works	.....
Sub- Total (A)	.....
Allow for 10% contigencies (10% of Sub- Total A)	.....
Sub- Total (B)	.....
Discount (if any)	.....
Sub- Total (C)	.....
Allow for 15% VAT (15% of Sub- Total C)	.....
GRAND TOTAL CARRIED TO BID SUBMISSION FORM	.....

Name: .....

In the capacity of: .....

Signed: .....

Duly authorised to sign the
Bid for and on behalf of: .....

Date: .....

Seal of Company: .....

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL No.1

PRELIMINARY AND GENERAL ITEMS

Amount (Rs)

Carried from Sheet 1 : .....

Carried from Sheet 2 : .....

TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL NO.1 - PRELIMINARY AND GENERAL ITEMS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
1.1	**Preliminary and General Items**				
1.1.1	Allow for the cost of Performance Security in accordance with the Conditions of Contract.	Sum			
1.1.2	Allow for the Contractor's All Risk Insurance in accordance with the Conditions of Contract. Insurance to cover for making good of all damages to private properties including boundary walls, occuring during the execution of works.	Sum			
1.1.3	Allow for the site establishment and Contractor's office as described in the Specification and all general costs not included elsewhere in the Bill of Quantities.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.4	Allow for all temporary accesses and all other works, constructional plants not included in other rates and all charges necessary for the proper execution of the Works.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.5	Allow for the setting out of the works complete with re-confirmation surveys and associated drawings including all labour, instruments, tools and materials in accordance with the Conditions of the Contract.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.6	Allow for the superintendence of the works in accordance with the Conditions of Contract.	Month	15		
1.1.7	Allow for protecting the works including watchmen, lighting and all other safety and environmental precautions in accordance with the Conditions of Contract and the Specifications.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.8	Allow for the support, diversion and crossing of main road, modification and protection of existing services, together with notification to the necessary statutory Authorities, where and when required as per Specifications.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.9	Allow for the cost of progress photographs in accordance with the specification (cost to include provision of camera with date printing facility).	No.	200		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL NO.1 - PRELIMINARY AND GENERAL ITEMS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
1.1.10	Allow for administrative requirements of the Contract as detailed in Clauses 1.16 and 1.21 of the Specifications *(15 months construction period + 2 months contract winding up)* .	Month	17		
1.1.11	Allow for consumables, office maintenance and running costs as per Clause 1.16 of the Specifications *(15 months construction period + 2 months contract winding up).*	Month	17		
1.1.12	Allow for supply and fixing of signboard as per Engineer's instructions.	No.	2		
1.1.13	Allow for all necessary liaison with Authorities as required during the whole Contract period in accordance with Clauses 1.9, 1.24 and 1.25 of the Specifications.	Month	15		
1.1.14	Allow for protection and relocation of essential Public Services and any laboratory tests either on-site or off-site as may be directed by the Engineer and the Authorities concerned. (Provisional)	PS			200,000
1.1.15	Allow for Contractor's on-cost on item 1.1.14	%		5	
1.1.16	Allow for transport for ancillary works and services on site in accordance with Clause 1.22 of the Specifications *(15 months construction period + 2 months contract winding up).*	Month	17		
1.1.17	Allow for surveys and drawings as per Clause 1.17 and 1.18 of the Specifications.				
	Fixed	Sum			
	Time - Related	Month	15		
1.1.18	Allow for confirmatory surveys as per Clause 1.32 of the Specifications.	Sum			
1.1.19	Allow for complete as-built survey and as-built drawings as per Clause 1.55 of the Specifications.	Sum			
1.1.20	Allow for submission of regular monthly environmental monitoring reports to the Engineer during the whole execution of the works.	Month	15		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 2

ROAD WORKS

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
Carried from Sheet 3 :	.....
Carried from Sheet 4 :	.....
Carried from Sheet 5 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 2 - ROADWORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	ROADWORKS WITHIN SITE				
2.1	***Earthworks***				
2.1.1	Clear **Plots and Green Spaces** of all bushes, shrubs, vegetation, weeds, undergrowth, hedges, and the like including cutting down of small trees, grubbing up of roots and cart away from site. Rate to allow for removal of average 200mm topsoil, deposit in temporary spoil heaps for re-use, including spreading, levelling and carting away from site as directed by Engineer.	m^2	70,000		
2.1.2	Clear site ***(road and reserves)*** , remove top soil layer (Average 300 mm thick). Store on site for re-use, including spreading, levelling. Remaining including unusable boulders, debris, etc to be carted away from site as directed by Engineer.	m^2	16,500		
2.1.3	Carry out bulk excavation for ***road and reserves*** in any material, including rock to required formation level to depth shown on drawings. Part to be used for fill and the remaining to be spread on plots or to be carted away as may be required. (Provisional Quantity)	m^3	8,000		
2.1.4	Allow for fill for ***road and reserves*** with suitable selected material obtained from bulk excavation(Item 2.1.3). Rate to include for compaction in layers of 150 mm thick.	m^3	3,000		
2.1.5	Allow for **imported fill** for ***road and reserves*** with suitable selected material obtained from borrow pits, to be approved by Engineer. Rate to allow for soil tests and compaction in layers of 150 mm thick. (Provisional Quantity)	m^3	1,000		
2.1.6	Level and compact subgrade up to Road formation level as per Specifications.	m^2	10,000		
2.1.7	Supply, mix, spread and compact well graded hardcore (0-100mm) as sub-base to compacted thickness of 250 mm.	m^2	10,000		
2.1.8	Ditto, but 150mm thick crusher run of size 0/20 for road base.	m^2	9,800		
2.1.9	Supply, lay and prime road base at the application rate indicated in Specifications.	m^2	9,800		
2.1.10	Supply, lay and compact 50 mm thick (compacted thickness) premix asphaltic concrete of size 0/14, as per Specification and as per Drawing No. SPDL/C2024/29/R/TD/01 to ../TD/04.	m^2	9,800		
2.2	***Concrete Works***				
2.2.1	Allow for asphalt cutting and removal of existing K1 kerb at Existing Round About.	m	100		
2.2.2	Supply and lay reinforced concrete precast kerb (Type K1) 1000 x 330 x 150 mm including excavation, compaction, concrete, footing and haunching (as per Drawing No. SPDL/C2024/29/R/TD/01)	m	100		
2.2.3	Ditto, but, precast Kerb (Type K1 with gully) 1000 x 330 x 150 mm, (as per Drawing No.SPDL/C2024/29/R/TD/01). Rate to allow laying of 3nos. 110mm uPVC pipes of 3m length each.	m	25		
2.2.4	Supply and lay reinforced concrete precast kerb (Type K4) 1000 x 185 x 150 mm including excavation, compaction, concrete, footing and haunching (as per Drawing No. SPDL/C2024/29/R/TD/01)	m	2,900		
2.2.5	Ditto,but, precast Kerb (Type K4 with gully) 1000 x 185 x 150 mm (as per Drawing No. SPDL/C2024/29/R/TD/01).	m	300		
	CARRIED TO CAST SUMMARY				

BILL 2 - ROADWORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
2.2.6	Ditto,but, precast Kerb (Type K4 with gully) 1000 x 185 x 150 mm (as per Drawing No. SPDL/C2024/29/R/TD/01). Rate to allow laying of 3nos. 110mm uPVC pipes of 1.5m length each.	m	50		
2.2.7	Ditto,but, precast or cast-in-situ Kerb (Type K3) 1000 x 200 x 150 mm to be laid at every 5m interval opposite to gully type kerbs (as per Drawing No.SPDL/C2024/29/R/TD/01).	m	300		
2.3	***Drains***				
2.3.1	Supply and lay precast drain type D500 (i.e. 500mm wide) to invert levels as given in Drawing No.SPDL/C2024/29/R/TD/03. Rate to allow for excavation, blinding, formwork, reinforcement, concrete to depth not exceeding 0.5m deep.	m	1,000		
2.3.2	Ditto, but, depth not exceeding **1.0m** deep.	m	175		
2.3.3	Supply and lay precast drain type D700 (i.e. 700mm wide) to invert levels as given in Drawing No.SPDL/C2024/29/R/TD/03. Rate to allow for excavation, blinding, formwork, reinforcement, concrete to depth not exceeding 0.7m deep.	m	160		
2.3.4	Ditto, but, depth not exceeding **1.0m** deep.	m	10		
2.3.5	Allow for 300mm drop in drain invert (items 2.3.1, 2.3.2, 2.3.3, & 2.3.4) to form catchpit as per Drawing No.SPDL/C2024/29/R/TD/03. Rate to allow for any additional wall construction to complete the catchpit.	No.	40		
2.4	***Drain With Grating Crossing Roads***				
2.4.1	Supply and lay precast concrete drain type D500 (i.e. 500mm wide) to invert levels as shown in Drawing No SPDL/C2024/29/R/TD/04. Rate to allow for excavation, blinding, formwork, reinforcement, concrete to depth not exceeding 1.5m deep.	m	125		
2.4.2	Supply and lay ductile iron gratings with protective coating as specified in the Specifications, to be placed over drains at road crossings (described in Item 2.4.1 above) as shown in Drawing No. SPDL/C2024/29/R/TD/04.	m	125		
2.4.3	Supply and lay precast concrete drain type D700 (i.e. 700mm wide) to invert levels as shown in Drawing No SPDL/C2024/29/R/TD/04. Rate to allow for excavation, blinding, formwork, reinforcement, concrete to depth not exceeding 1.5m deep.	m	15		
2.4.4	Supply and lay ductile iron gratings with protective coating as specified in the Specifications, to be placed over drains at road crossings (described in Item 2.4.3 above) as shown in Drawing No. SPDL/C2024/29/R/TD/04.	m	15		
2.5	***Drain Crossing Under Road***				
2.5.1	Supply and lay precast drain type DS500 drain (i.e. 500mm wide) under proposed internal roads, allowing for excavation, formwork, blinding, reinforcement, concrete to depth not exceeding 1.5 m deep, at road crossing (as per Drawing No SPDL/C2024/29/R/TD/05) within site. Rate to allow for cast in-situ concrete covers 200mm thick.	m	75		
	CARRIED TO CAST SUMMARY				

BILL 2 - ROADWORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
2.5.2	Supply and lay precast drain type DS500 drain (i.e. 500mm wide) under **existing road** in Morcellement Aurea Living Harmony allowing for cutting of asphalt, excavation, formwork, blinding, reinforcement, concrete to depth not exceeding 1.5 m deep (as per Drawing No SPDL/C2019/6/SRC/R/TD/05) . Rate to allow for cast in-situ concrete covers 200mm thick and laying of 60mm layer of premix asphalt 0/14mm with prime coat.	m	50		
2.6	***Concrete Pavement Over Drain and as Plot Access***				
2.6.1	Level and compact subgrade below formation level next and alongside drain along road reserves.	m^2	575		
2.6.2	Supply, lay and compact 100mm crusher run 0/20 (compacted thickness) on top of subgrade.	m^2	575		
2.6.3	Construct 1.20m to 1.50m wide cast-in-situ concrete cover slab 150mm thick on top of drain types D500 and D700 (Items 2.3.1 to 2.3.5) to be used as footpath as shown in Drawing No. SPDL/C2024/29/R/TD/03. Rate to include for all excavation, formwork, reinforcement, concrete, finishings and also	m^2	1,250		
Note:	*(i) Part of concrete cover slab to be laid on crusher-run*				
	(ii)Openings with precast slabs (500mm x 650mm) as shown in Drawing No. SPDL/C2024/29/R/CS/01 to be provided at interval of 5m and at drain junctions, or as necessary directed by Engineer.				
2.6.4	Construct in-situ reinforced concrete plot access including excavation, formwork, reinforcement, concrete, washed concrete finishing, including chamfer and grooving, all as per Drawing No. SPDL/C2024/29/R/TD/02.	m^2	500		
2.7	***Concrete Pavement Over Utility Services, along Road Reserves and Plot Access***				
2.7.1	Demolish and Cart Away Existing Concrete footpath for laying of services.	m^2	200		
2.7.2	Level and compact subgrade below formation level of footpath, jogging track and plot access as per Clause 6.12 of the Specifications.	m^2	1,650		
2.7.3	Supply, lay and compact 100 mm thick crusher run 0/20 (compacted thickness) on top of subgrade.	m^2	1,650		
2.7.4	Construct in-situ 1.20m to 1.50m wide concrete footpath including excavation, formwork, reinforcement, concrete, brushed finishing, including chamfer and grooving at 2m intervals all as per Drawing No. SPDL/C2024/29/R/TD/02.	m^2	1,650		
2.7.5	Construct in-situ reinforced concrete plot access including excavation, formwork, reinforcement, concrete, washed concrete finishing, including chamfer and grooving, all as per Drawing No. SPDL/C2024/29/R/TD/02.	m^2	650		
	CARRIED TO CAST SUMMARY				

BILL 2 - ROADWORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
2.8	***Heavy Duty Clay Brick Pavement***				
2.8.1	Remove **existing bricks** for the laying of drain and other services under cycle track or jogging track and **lay them again** after laying of drain and other services. Rate to allow for all necessary backfilling, rocksand and compaction of formation level of footpath as per Clause 6.12 of the Specifications.	m^2	225		
2.8.2	Supply and lay geotextile on the compacted crusher run layer, lapped 300mm wide on all sides and taped at joints.	m^2	500		
2.8.3	Supply and lay 50mm thick compacted rocksand layer bed on top of geotextile to receive the brick paving layer.	m^3	500		
2.8.4	Supply and lay 200mm x 100mm x 100mm heavy duty brick, complying to BS EN 1338, to approved Herringbone pattern, well bedded and jointed with rocksand, including all levelling, cutting, fair angles, forming fair returns and reveals. (Sample and colour to be approved by Client and/or Engineer).	m^2	300		
2.8.5	Construct cast-in-situ 150mm thick by 250mm deep concrete kerb at the edges of the Brick paving. The top of the kerbing shall be flush with the road asphalt level.	m	150		
2.9	***Outlet Works to Discharge Into Natural Watercourses and Drains***				
2.9.1	Allow for breaking of slab and wall of existing drain for connection of proposed drains. Rate to allow for making good and casting of 150mm thick reinforced concrete slab after connection is done.	Nr.	2		
2.9.2	Excavate and construct reinforced concrete pipe culvert 0.609m internal diameter as per Drawing No. SPDL/C2019/6/SRC/R/TD/10, complete with any additional works required at culvert entry and exit into other structures (concrete or masonry).	m	50		
2.9.3	Construct complete outlet structure, in the form of stilling basin, dispersion aprons, gabion matresses, including rip rap and allowing for excavation, formwork, blinding, reinforcement, concrete, masonry wing wall at drain outlet into Feeder to River Terre Rouge (as per Drawing No SPDL/C2024/29/R/TD/08).	No.	2		
2.9.4	Allow for cleaning of river banks, using heavy machinery, as directed by Engineer, for the purpose of construction of outfall/ discharge structures.	PS			200,000
2.9.5	Allow for Contractor's on-cost on item 2.9.4	%		5	
2.10	***De-Silting Chamber and Reinforced Concrete Manhole***				
2.10.1	Construct "complete" reinforced concrete De- silting Chamber (as per Drawing No. SPDL/C2024/29/R/TD/07, with internal dimensions 1.60m x 2.40m, depth to invert not exceeding 2.50m, inclusive of excavation, trimming, compaction of base, shorring, formwork, cover slab, reinforcement, concrete, waterproof joint, complete with step irons, frames, hinged and lockable double seal manhole covers D400 with identification mark (logo), etc. Rate to allow for supply and installation of hot- dipped galvanised grating for capture of debris to be installed on and across outlet and also to allow for connection of road side drains and culverts into De-Silting Chamber.	No.	3		
CARRIED TO CAST SUMMARY					

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
2.10.2	Construct "complete" reinforced concrete manhole (as per Drawing No. SPDL/C2024/29/R/TD/06, with internal dimensions 1.50m x 1.50m, depth to invert not exceeding 2.5m, inclusive of excavation, trimming, compaction of base, shorring, formwork, benching, slab, reinforcement, concreet, rubber ring, waterproof joint, building-in of pipes and concrete surround to pipe inlet and outlet, complete with step irons, frames, hinged and lockable double seal manhole covers D400 with identification mark (logo), etc. Rate to allow for connection of road side drains and culverts into manhole.	No.	4		
2.11	***Road Marking and Signs***				
2.11.1	Supply and apply reflectorised thermoplastic road marking to bituminous carriageway for marking and symbols as approved by the TMRSU. Provide and erect **Diamond Grade** reflective prohibitive or mandatory signs, priority signs, warning signs. Informatory signs with additional panels posts and fittings as approved by the TMRSU and/or Engineer. **Glass Reinforced Plastic (GRP)** should be used as Backing board. Rate to include for all necessary excavation, concreting and supports.	m^2	450		
2.11.2	Triangular Panel diameter 600 mm	Nr	6		
2.11.3	Circular Panel diameter 600 mm	Nr	5		
2.11.4	Octagonal Panel 600 mm (height)	Nr	17		
2.11.5	Arrow Panel 1500mm long x 600 mm high	Nr	2		
2.11.6	Square panels 600mm long x 600mm high	Nr	8		
2.12	***Miscellaneous***				
2.12.1	Allow for construction of french drain along the foot of existing retaining wall as per Drawing No. SPDL/C2024/29/R/TD/07.	m	700		
2.12.2	Allow for additional and/or enhancement works as may be requested by Authorities and directed by the Engineer, with regard to outlets into River Terre Rouge and other natural drains (Provisional Sum).	PS			100,000
2.12.3	Contractor's on-cost on item 2.12.2	%		5	
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 3

WATER SUPPLY

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
Carried from Sheet 3 :	.....
Carried from Sheet 4 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 3 - WATER SUPPLY

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	WATER SUPPLY				
3.1	***Earthworks***				
	Excavation *(after removal of top soil)* in any material including rock, rates to allow for backfilling, selected fill, sieved material, imported fill, normal backfill, as per typical trench section for water works, dewatering, anchor, thrust blocks, all necessary shoring and carting away of surplus material.				
3.1.1	Carry out confirmatory surveys of existing CWA pipes by excavation of trial pits. Rate to allow for neccessary excavation of trial pits in road reserve, backfilling and **reinstatement to original condition.** This trial pit should be carried out exactly on the alignment for final connection. Allow for liaison with CWA for confirmation of CWA MAIN. Produce all relevant details including photographs where appropriate for approval of Engineer.	no.	10		
3.1.2	Excavate trench (after removal of top soil) for (90/110mm) PE pipe depth to invert not exceeding 1.5m.	m^3	1,500		
3.1.3	Excavate in unsuitable material below formation level of trench where instructed by the Engineer.	m^3	100		
3.2	***Pipe Bedding***				
3.2.1	Supply, place and compact concrete Class C20 as concrete bedding and surround to pipe.	m^3	25		
3.2.2	Supply, place and compact granular material (0-100)mm as infill below formation level of trench whenever instructed by the Engineer.	m^3	100		
3.2.3	Supply, place and compact 150 mm thick 6 mm basalt aggregate bedding to (90/110) PE pipe.	m	1,600		
3.3	***Pipes and Fittings***				
3.3.1	Supply, lay, joint, test and disinfect **110 mm** electrowelded PE joint pipes **(rated PE100 - SDR11)** in trench as specified. (Rate to include for laying under other services, cuts, couplers and other required preparations, testing, disinfection and commissioning including production of Test Certificates from CWA).	m	925		
3.3.2	Ditto, but, **90mm** PE pipes.	m	675		
3.3.3	Supply, install, joint, test and disinfect Equal Tee 110 x 110 mm (rated PE100 - SDR11) to fit 110 mm PE pipe (Electro-welded type)	No.	10		
3.3.4	Ditto, but, Reducing Tee 110 x 90mm	No.	5		
3.3.5	Ditto, but, Equal Tee 90 x 90mm	No.	8		
3.3.6	Supply, install, joint, test and disinfect Reducer 110 x 90mm (Electro-welded type)	No.	2		
3.3.7	Ditto, but, Coupler 90mm (Electro-welded type)	No.	5		
3.3.8	Supply, install, joint, test and disinfect End Cap (Electro-welded type) to fit **110mm** PE pipe.	No.	5		
3.3.9	Ditto, but, **90mm** End Cap	No.	7		
3.3.10	Supply, install, joint, test and disinfect Double Socketed PE Bend 110mm x 90^o (Electro-welded type).	No.	2		
3.3.11	Ditto, but, PE Bend 110mm x 45^o (Electro-welded type).	No.	5		
	CARRIED TO CAST SUMMARY				

BILL 3 - WATER SUPPLY

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
3.3.12	Ditto, but, PE Bend 110mm x 22.5°.	No.	4		
3.3.13	Ditto, but, PE Bend 110mm x 11.25°.	No.	10		
3.3.14	Ditto, but, PE Bend 90mm x 45°.	No.	4		
3.3.15	Ditto, but, PE Bend 90mm x 22.5°.	No.	4		
3.3.16	Ditto, but, PE Bend 90mm x 11.25°.	No.	10		
3.4	***Valves and Fire Hydrants*** Rates inserted herein should include for: (a) Supply, installation, jointing, testing and disinfection of valves and fittings in complete assembly; (b) Necessary excavation, compaction, formwork, reinforcement, concrete works, pipes built -in for Precast Ring or Reinforced Concrete Chambers and marker post; (c) Any temporary works deemed necessary for the completion of the chambers.				
3.4.1	Supply, install, joint, test and disinfect **complete Gate/ Drain Valve assembly DN100** *(including DI flexible flange adaptor, DI flange spigot adaptor and DI coupler)* in Precast Ring Chamber including marker post and fixing of D400 chamber cover with **identification mark (logo)**as per drawing to fit **110mm** PE pipe.	No.	10		
3.4.2	Ditto, but, to fit **90mm** PE pipe.	No.	6		
3.4.3	Supply, install, joint, test and disinfect **complete Double Orifice Air Valve DN80 assembly** *(including DI flexible flange adaptor, DI flange spigot adaptor, DI Double flanged pipe piece DN80, Butterfly Valve and All flanged Tee with branch 80mm)* in Precast Ring Chamber including marker post and fixing of D400 chamber cover with **identification mark (logo)** as per drawing to fit **110mm** PE pipe.	No.	10		
3.4.4	Ditto, but, to fit **90mm** PE pipe.	No.	4		
3.4.5	Supply, install, joint, test and disinfect **complete Fire Hydrant DN80 assembly** *(including DI flexible flange adaptor, DI flange spigot adaptor, DI Double flanged pipe piece DN80, Butterfly Valve and DI All flanged Tee with branch 80mm,*) in Precast Ring chamber including marker post and fixing of Grade A chamber cover with **identification mark (logo)** as per typical drawing to fit **110mm** PE pipe.	No.	2		
3.4.6	Ditto, but, to fit **90mm** PE pipe.	No.	3		
3.5	***Thrust and Anchor Blocks***				
3.5.1	Construct thrust and anchor blocks *as per drawing* for bends, tees, end caps etc, including for formwork and concrete (Provisional Quantity).	m^3	25		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 3 - WATER SUPPLY

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	House/Property Connections				
3.6	***Earthworks***				
	Excavation (after removal of top soil) in any material, rates to allow for backfilling, selected fill, sieved material, imported fill, normal backfill, dewatering, all necessary shoring and carting away of surplus material.				
3.6.1	Excavate trench (after removal of top soil) for 20 mm PE communication pipes and 75mm PVC ducts, not exceeding 1.0m deep. (Rate to include for sieving of material for selected fill, normal fill, imported fill, placing thereof and carting away of surplus material).	m^3	900		
3.7	***Pipe Bedding***				
3.7.1	Supply, place and compact concrete Class C30 as concrete bedding and surround to pipe.	m^3	20		
3.7.2	Supply, place and compact 75 mm thick Class B bedding to 75mm PVC ducts.	m	400		
3.7.3	Ditto, but to 20mm PE pipe	m	1,050		
3.8	***Pipes and Fittings***				
3.8.1	Supply, install, joint, test and disinfect saddles for household connection taken off from 110 mm PE pipe to connect to 20mm PE communication pipes.	No.	53		
3.8.2	Ditto, but, taken off from 90mm PE pipe.	No.	43		
3.8.3	Supply, lay, joint, test and disinfect 20mm PE communication pipes in trench as shown on Drawing (Rate to include for cuts, couplers, end caps, encasing in 300mm PVC pipe 75mm with concrete Grade 15, and other required preparations).	m	1,050		
3.8.4	Supply and laying of 75mm PVC pipe as duct for road crossings.	m	400		
3.9	***Connection to Newly Laid Service Main to Existing CWA Pipelines***				
	Rates inserted herein should include for: (a) Supply, installation, jointing, testing and disinfection of fittings to complete connection; (b) Excavation and/or re-excavation, backfilling and **reinstatement of road** as per RDA's Specifications,including cut-back as specified. (c) Any additional supervision, pumping operations to deal with any discharge of water from the existing pipelines, disconnections of old pipelines after commisioning, working to CWA's (d) Continuous non-stop work until completion of connection in order to cause minimum disruption to water supply, etc.				
3.9.1	Connect newly laid service mains **110mm PE pipe** onto **Existing 200mm PE CWA main pipe**. Rate to include for excavation, cutting of existing main pipeline, installation of all necessary fittings as per fitting Schedule Drawing No. SPDL/C2024/29/W/TD/11, testing, backfilling and reinstatement as per Specifications.	No.	1		
3.9.2	Ditto, but, newly laid service mains **110mm PE pipe** onto **Existing 110mm PE CWA pipe**.	No.	1		
	CARRIED TO CAST SUMMARY				

BILL 3 - WATER SUPPLY

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
3.9.3	Ditto, but, newly laid service mains **110mm PE pipe** onto **Existing 90mm PE CWA pipe**.	No.	1		
3.9.4	Ditto, but, newly laid service mains **90mm PE pipe** onto **Existing 90mm PE CWA pipe**.	No.	2		
3.10	***Miscellaneous***				
3.10.1	Supply and place warning tape on top of selected fill for trench pipe.	m	3,050		
3.10.2	Mark on kerb exact position of house/property connections with an approved blue paint.	Sum			
3.10.3	Supply and place precast ring 450mm x 450mm and 80mm thick slab to protect plot connection ducts, rate to allow for painted engraved marking **"CWA"**.	No.	94		
3.10.4	Allow for any additional works as may be instructed by the Engineer and/or Central Water Authority.	PS			100,000
3.10.5	Contractor's on-cost on Item 3.10.4	%		5	
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 4 - SEWERAGE WORKS

Item	*Description*	*Unit*	*Qty*	*Rate*	*Amount (Rs)*
4.1	***Excavation***				
	Excavation in any material, rates to allow for cutting of asphalt, trimming and compaction of formation level, selected fill, backfilling with sieved material, imported fill, normal backfill as per typical trench section for sewer works, dewatering, all necessary shoring and carting away of surplus material.				
4.1.1	Excavate trial pits or trial tenches to locate existing sewer pipes as directed by Engineer. Rate to allow for all backfilling, compaction and reinstatement as per Specifications	No.	15		
4.1.2	Excavate 0.6m wide trench for gravity main uPVC pipes 160 mm and 200mm diameter, depth to invert n.e. 1.5 m, rate to include for extra excavations at manholes and branch connection *(shallow and deep)* positions .	m	925		
4.1.3	Ditto, but, depth greater than 1.5 m and n.e 2.0 m	m	800		
4.1.4	Ditto, but, depth greater than 2.0 m and n.e 2.5 m	m	370		
4.1.5	Ditto, but, depth greater than 2.5 m and n.e 3.0 m	m	100		
4.1.6	Ditto, but, depth greater than 3.0 m and n.e 3.5 m	m	100		
4.1.7	Ditto, but, depth greater than 3.5 m and n.e 4.0 m	m	20		
4.1.8	Ditto, but, depth greater than 4.0 m and n.e 4.5 m	m	10		
4.1.9	Excavation for unsuitable material below formation level where ordered by the Engineer (Provisional).	m^3	200		
4.2	***Pipe Bedding***				
4.2.1	Supply, lay and compact C20 as concrete bedding (Class A) and surround to 160/200 mm diameter pipes.	m^3	125		
4.2.2	Supply, place and compact (0-100)mm granular material in fill below formation level whenever ordered by the Engineer (Provisional).	m^3	200		
4.2.3	Supply, place and compact 150mm thick layer of 6 mm basalt aggregate bedding (from trench bottom upto 300mm above **160 mm** diameter uPVC pipes) in 600mm wide trench.	m	800		
4.2.4	Supply, place and compact 150mm thick layer 6 mm basalt aggregate bedding (from trench bottom upto 300mm above **200 mm** diameter uPVC pipes) in 600mm wide trench.	m	1,525		
4.3	***Pipes and Fittings for Gravity Main***				
4.3.1	Supply, lay, joint and test **DN 160mm** dia. **SN8** uPVC pipes as **branch sewer pipe (shallow or deep)** from Main Sewer to ICA, in trench as specified (Rate to include for cuts and other required preparations).	m	800		
4.3.2	Supply, lay, joint, test **shallow branch SN8 sewer pipe from DN 200 mm main sewer** (depth less or equal to 2m) up to ICA, found 1m inside plot. Rate to allow for Y- junction (200mm x 160mm branch), elbows, large radius bends, connection to 160mm uPVC pipes (Item 4.3.1) at both ends and any other fittings as may be required.	No.	45		
CARRIED TO CAST SUMMARY					

Item	*Description*	*Unit*	*Qty*	*Rate*	*Amount (Rs)*
4.3.3	Supply, lay, joint, test **shallow branch SN8 sewer pipe from manhole** (depth less or equal to 2m) up to IC A, found 1m inside plot. Rate to allow for large radius bends, connection to 160mm uPVC pipes (Item 4.3.1) at both ends , any other fittings as may be required and all concreting works.	No.	15		
4.3.4	Supply, lay, joint, test **deep branch SN8 sewer pipe from DN 200mm main sewer** (depth greater than 2m) up to ICA, found 1m inside plot. Rate to allow for Tee junction (200mm x 160mm branch), elbows, end cap, largeradius bends, connection to 160mm uPVC pipes (Item 4.3.1) at both ends and any other fittings as may be required.	No.	25		
4.3.5	Supply, lay, joint, test **deep branch SN8 sewer pipe from manhole** (depth greater 2m) up to IC A, found 1m inside plot. Rate to allow for external backdrop arrangement, including of Tee junction (160mm x 160mm), end cap, large radius bends, connection to 160mm uPVC pipes (Item 4.3.1) at both ends, any other fittings as may be required and all concreting works.	No.	11		
4.3.6	Supply, lay, joint and test **DN 200mm** dia. **SN8** uPVC pipes in trench as specified. (Rate to include for cuts, couplings, rocker pipes arrangement at manhole entries/exits and other required preparations)	m	1,525		
4.4	***Manholes***				
4.4.1	Construct complete manholes within internal roads, depth to invert n.e 1.5 m, inclusive of excavation, trimming, compaction of base, shoring, formwork, benching, slab, reinforcement, rubber ring, waterproof joint, building-in of pipes and concrete surround to pipe inlet and outlet, complete with step irons, frames, hinged and lockable double seal manhole covers D400 as per Drawing No. SPDL/C2024/29/S/TD/03 & ...../S/TD/05.	No	7		
4.4.2	Ditto, but, depth greater than 1.5 m and n.e 2.0 m	No	22		
4.4.3	Ditto, but, depth greater than 2.0 m and n.e 2.5 m	No	18		
4.4.4	Ditto, but, depth greater than 2.5 m and n.e 3.0 m	No	1		
4.4.5	Construct complete manholes within internal roads, depth to invert between 3.0 m and 3.5 m, inclusive of excavation, trimming, compaction of base, shoring, formwork, benching, slab, reinforcement, rubber ring, waterproof joint, building-in of pipes and concrete surround to pipe inlet and outlet, complete with Hot-Dipped Galvanised Mild Steel ladder, frames, hinged and lockable double seal manhole covers D400 as per Drawing No. SPDL/C2024/29/S/TD/04 & ...../S/TD/05.	No	3		
4.4.6	Ditto, but, depth greater than 3.5 m and n.e 4.0 m	No	1		
4.4.7	Ditto, but, depth greater than 4.0 m and n.e 4.5 m	No	1		
4.4.8	Extra over for backdrop arrangement on new manholes as per drawings, constructed within internal roads.	No	4		
	CARRIED TO CAST SUMMARY				

Item	*Description*	*Unit*	*Qty*	*Rate*	*Amount (Rs)*
4.4.9	Construct complete manhole over existing sewer line of diameter 315mm found in road reserve , depths to invert n.e 3.0 m, inclusive of excavation, trimming compaction of base, shoring, formwork, benching, slab, reinforcement, rubber ring, waterproof joint, building-in of pipes, flow diversion, pumping and concrete surround to pipe inlet and outlet, complete with step irons, frames and covers as per Drawing No. SPDL/C2024/29/S/TD/03 & ...../S/TD/05.	No	1		
4.4.10	Break through existing manholes and build in sewer lines inclusive of the formation of ramps, benching, channel and any making good (where directed by the Engineer). Rate to include for the supply and fixing of all pipework and temporary work for dealing with existing flows through the manholes.	No.	4		
4.5	***Inspection Chambers***				
4.5.1	Construction 600mm x 600mm reinforced blockwork inspection chambers, Type A, depth to invert n.e. 1.1 m, inclusive of excavation, trimming, compaction of base, shoring, formwork, benching, slab, reinforcement, rubber ring, waterproof joint, building-in of pipes, End Cap at Inlet and concrete surround to pipe inlet and outlet, complete with step irons, frames, hinged and lockable double seal medium duty covers C250 as per Drawing No.SPDL/C2024/29/S/TD/06.	No	12		
4.5.2	Ditto, but, 900mm x 1200mm reinforced blockwork inspection chambers, Type B, depth to invert between 1.1m and 2.0 m as per Drawing No. SPDL/C2024/29/S/TD/07.	No	72		
4.5.3	Construct complete reinforced concrete inspection chambers, Type C, depth to invert between 2.0m and 3.0m, inclusive of excavation, trimming, compaction of base, shoring, formwork, benching, slab, reinforcement, rubber ring, waterproof joint, building-in of pipes, End Cap at Inlet and concrete surround to pipe inlet and outlet, complete with step irons, frames, hinged and lockable double seal manhole covers C250 as per Drawing No. SPDL/C2024/29/S/TD/08.	No	12		
4.6	***Miscellaneous***				
4.6.1	Supply and place warning tape 200 mm wide inclusive of marking.	m	2,325		
4.6.2	Mark on kerb exact position of house/property connections with an approved brown paint.	Sum			
4.6.3	Allow for any additional works as may be instructed by the Engineer and/or Wastewater Management Authority.	PS			100,000
4.6.4	Contractor's on-cost on Item 4.6.3	%		5	
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 5

ELECTRICAL WORKS

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
Carried from Sheet 3 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 5 - ELECTRICITY SUPPLY

Item No.	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	Electrical Services -(Civil Works associated with HT, LV cables and Plot Connections)				
5.1	***Excavation***				
	Excavation (after removal of top soil) in any material including rock, rates to allow for backfilling, selected fill, sieved material, imported fill, normal backfill, dewatering, all necessary shoring and carting away of surplus material.				
5.1.1	Excavate trial pits or trial tenches to locate existing buried CEB ducts/ cables as directed by Engineer. Rate to allow for all backfilling, compaction and reinstatement as per Specifications	No.	15		
5.1.2	Excavate trench for HT, LV and service/plot underground cables.	m^3	3,250		
5.1.3	Excavate in unsuitable material below formation level where ordered by the Engineer (Provisional Quantity).	m^3	200		
5.2	***Pipe Bedding and Protection***				
5.2.1	Supply, place and compact concrete Class C20 as concrete bedding and surround to pipe (Provisonal quantity).	m^3	250		
5.2.2	Supply, place and compact granular material (0- 100mm) as infill below formation level wherever ordered by the Engineer (Provisonal quantity).	m^3	200		
5.2.3	Supply, place and compact rocksand bedding to HT, LV and service/plot underground cable ducts .	m^3	1,000		
5.3	***Pipes and Fittings***				
5.3.1	Supply, lay, joint and test 160 mm uPVC duct pipes for HT/LV cables.	m	3,500		
5.3.2	Supply, lay, joint and test 80 mm uPVC duct pipes for plot connection duct/service cable.	m	2,200		
5.3.3	Ditto, but, 63mm uPVC duct pipes for plot connection duct/service cable.	m	2,500		
5.3.4	Supply, lay, joint and test large radius bend for 160mm diameter uPVC duct pipe.	no.	20		
5.3.5	Ditto, but, for 80mm diameter uPVC duct pipe.	no.	188		
5.3.6	Supply, lay, joint and test End cap for 160mm diameter uPVC duct pipe.	no.	300		
5.3.7	Ditto, but, for 80mm diameter uPVC duct pipe.	no.	188		
5.3.8	Ditto, but, for 63mm diameter uPVC duct pipe.	no.	260		
5.4	***Warning Slabs, Tapes and Draw Wires***				
5.4.1	Supply and place heavily galvanised draw wire (5mm thick) or nylon type draw wire in 63mm, 80mm and 160mm uPVC duct pipe as approved by CEB.	m	9,000		
5.4.2	Supply and lay 200 micron thick and 300mm wide warning tape over the trench width; Colour Yellow; Marked "DANGER ELECTRICITY" in Red on top of HT, LV cable and plot connection/service cable.	m	3,000		
5.4.3	Supply and place 2 rows of standard protective concrete warning slabs (500mm x 200x 40mm) over trenches as shown on Drawing No. SPDL/C2024/29/E/TD/01 and ..E/TD/02. Concrete slabs to be of the apex pattern engraved "DANGER ELECTRICITY" or similar in reinforced concrete on top of cables.	m	1,600		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 5 - ELECTRICITY SUPPLY

Item No.	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
5.5	***Outdoor RMUs, Service Cable Pillars and Draw Pits***				
5.5.1	Supply and place precast ring 450mm x 450mm and 80mm thick slab to protect plot connection ducts, rate to allow for painted engraved marking "**CEB**".	No.	94		
5.5.2	Construct complete Service Cable Pillar Type A, as per Drawing Nos. SPDL/C2024/29/E/TD/06.	No	25		
5.5.3	Construct complete Service Cable Pillar Type B, as per Drawing Nos. SPDL/C2024/29/E/TD/07.	No	10		
5.5.4	Construct complete Outdoor RMU as per Drawing Nos. SPDL/C2024/29/E/TD/09 & …E/TD/10.	No	1		
5.5.5	Construct complete T - Drawpit with internal dimension not exceeding 2.0m x 3.0m for LV/HT cables, depth not exceeding 2.0m, as per Drawing No. SPDL/C2024/29/E/TD/05 . Rate to include for all excavation, blocklaying, concreting, warning slabs, backfilling and any other associated works.	No	5		
5.5.6	Ditto, but, Angular Drawpit with internal dimension not exceeding 1.5m x 1.5m, depth not exceeding 2.0m, as per Drawing No. SPDL/C2024/29/E/TD/04	No	20		
5.5.7	Ditto, but, Angular Drawpit with internal dimension not exceeding 1.2m x 1.2m, depth not exceeding 1.0m, as per Drawing No. SPDL/C2024/29/E/TD/03.	No	30		
5.5.8	Ditto, but, Angular Drawpit with internal dimension not exceeding 0.8m x 0.8m, depth not exceeding 1.0m, as per Drawing No. SPDL/C2024/29/E/TD/03.	No	10		
5.6	***Transformer Building***				
5.6.1	Transformer Building (Schedule A)	No.	3		
	CARRIED TO CAST SUMMARY				

BILL 5 - ELECTRICITY SUPPLY

Item No.	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
5.8	***Miscellaneous***				
5.8.1	Excavate by hand to expose underground coiled CEB HV/LV cables, to enable CEB to pull and remove the cables from the plots. Rate to allow for all coordination, any assistance required by CEB team and backfilling the plot with appropriate backfilling material as instructed by the Engineer and/or Central Electricity Board.	m^3	1,000		
5.8.2	Locate existing drawpits under existing footpath, demolish footpath and/or remove bricks for re-use, empty the drawpits under the supervision of CEB. Rate to allow for all coordination, any assistance required by CEB team and backfilling these drawpits, after cable pulling by CEB, with appropriate backfilling material as instructed by the Engineer and/or Central Electricity Board.	m^2	300		
5.8.3	Level and compact subgrade below formation level of footpath as per Clause 6.12 of the Specifications.	m^2	300		
5.8.4	Supply, lay and compact 100 mm thick crusher run 0/20 (compacted thickness) on top of subgrade.	m^2	300		
5.8.5	Construct in-situ 1.20m to 1.50m wide concrete footpath including excavation, formwork, reinforcement, concrete, brushed finishing, including chamfer and grooving at 2m intervals all as per Drawing No. SPDL/C2024/29/R/TD/02.	m^2	300		
5.8.6	Allow for demolishing and carting away of existing Outdoor RMU structure after decomissioning by CEB. Rate to allow for all coordination, any assistance required by CEB team and backfilling the RMU pits, after cable pulling by CEB, with appropriate backfilling material as instructed by the Engineer and/or Central Electricity Board.	No.	2		
5.8.7	Allow for any additional works as may be instructed by the Engineer and/or Central Electricity Board.	PS			100,000
5.8.8	Contractor's on-cost on Item 5.8.7	%		5	
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 5 - ELECTRICITY SUPPLY

SUMMARY OF SCHEDULE A - TRANSFORMER BUIlDING

	Amount (Rs)
Sheet 1 :	.....
Sheet 2 :	.....
Sheet 3 :	.....
Sheet 4 :	.....
Sheet 5 :	.....
Sheet 6 :	.....
Sheet 7 :	.....
Sheet 8 :	.....
TOTAL CARRIED TO BILL ITEM 5.6.1	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 5 - ELECTRICITY SUPPLY

Schedule A : TRANSFORMER BUILDING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	SUBSTRUCTURE				
	The whole bill for SUBSTRUCTURE will be re-measured on site				
A	***Excavation and Earthwork***				
	Excavation after removal of top soil (allowed elsewhere) in all types of soil inclusive of rock or any hard material as per Specifications. Rate to allow for keeping all excavations free from water, mud, all earthwork supports, depositing of excavated material in spoil heaps on site for re-use as backfilling, carting away from site and compaction of formation level.				
A.1	Excavate, starting from existing ground level, trenches to receive strip footing, column bases and cable ducts, not exceeding 2.0m deep, measured after removal of top soil.	m^3	70		
B	***Filling to Excavations***				
B.1	Backfill column and wall excavations up to hardcore level with selected material arising from excavations , containing stones n.e 100mm in size and compact in layers n.e 150mm thick to 95% BS Heavy , all to Engineer's approval.	m^3	10		
B.2	Import, place and compact hardcore filling 200mm thick *(compacted thickness)* with graded stone n.e 100mm, deposited, hand packed and compacted to 95% BS Heavy, to receive crusher run layer, all to Engineer's approval.	m^3	8		
	Note: Rate to include for any trimming or spreading, levelling and compacting of soil in layers of 200mm to 95% BS Heavy prior to receiving hardcore layer.				
C	***Surface Treatments***				
C.1	Blind surface of hardcore with 200mm thick *(compacted thickness)* layer of crusher run 0/20, deposited, hand packed, watered and compacted to 95% BS Heavy, to receive concrete floor, all to Engineers approval.	m^3	8		
C.2	Level and blind surface of crusher run with 25mm layer of rocksand prior to the laying of the polythene sheeting.	m^3	2		
C.3	Supply and lay on the rocksand layer 0.23mm thick polythene sheeting under floor slab and cable duct (horizontal and vertical faces) with 150mm laps bothways to receive concrete (measured net - no allowance for laps).	m^2	25		
C.4	Saturate top of ground and filling under floors with an approved anti-termite treatment undertaken by an approved specialist (10 years guarantee to be given).	m^2	45		
C.5	Ditto, but, perimeter of building over a width of 500mm.	m^2	15		
D	**Concrete**				
	Plain in-situ concrete, designed mix Grade 15/20 N/mm², 40mm aggregate, as described in Specifications.				
D.1	50mm thick blinding layer under footings, bases and the like	m^3	2		
	Note: Rate to allow for compaction of formation level.				
	CARRIED TO CAST SUMMARY				

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	Reinforced in-situ concrete designed mix Grade 30/20 N/mm², 20mm aggregate vibrated, as described in Specifications.				
D.2	Foundations in trenches (strip footing) and column base, cast against faces of excavation.	m^3	5		
D.3	Columns.	m^3	2		
D.4	Cable ducts and Plinth Beam.	m^3	8		
D.5	Surface bed and ramp - 150mm thick.	m^3	2		
E	**Formwork**				
	Sawn Formwork, strutting at/from any level, including rebates and groove formers as described in Specifications.				
E.1	Sides of columns (exposed faces measured).	m^2	10		
E.2	Sides of cable duct walls and plinth beam.	m^2	85		
E.3	Edge of surface bed, ramps, transformer base.	m^2	10		
F	**Reinforcement**				
	Reinforcement bars of various diameter to MS 10/BS 4449 hot rolled plain round mild steel and hot rolled deformed high yield steel, as described in Specifications.				
F.1	Strip footing, Column bases, cable ducts, plinth beam and the like.	kg	1900		
	Fabric mesh reinforcement complying with MS 34 & MS 35, including all necessary waste, cutting, overlapping and tying with stout gauge tying wire and steel chairs made up of 1Y8 at every square meter to be left in permanently where necessary.				
F.2	Welded mesh reinforcement type A252 (3.95 kg/m^2) to surface bed (measured net -no allowance for laps).	m^2	35		
G	***Masonry***				
	Hollow concrete blocks to BS 6073, minimum average compressive strength 3.5 N/mm², in cement mortar (1:3), comprising of reinforcement/wall ties continuous at every third courses of blockwall				
G.1	Walls (150mm thick).	m^2	35		
H	***Finishes***				
	Internal finish (13mm thick) - Smooth trowelled finished with cement and sand render (1:3) including hacking of concrete, binding products and forming arises and fair edges to Engineer's approval.				
H.1	Cable ducts, Blockwall, returns, reveals and the like.	m^2	40		
	External rendering work comprising 10mm backing coat of cement and sand (1:3) with wood floated and 10mm thick finishing coat of cement and sand (1:3) sponge finish render all to Architect's approval .				
H.2	Blockwall, returns, reveals and the like, externally below plinth.	m^2	30		
	CARRIED TO CAST SUMMARY				

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	Floor finish - cement and sand (1:3) screed as described with steel float finish all to Architect's approval				
H.3	Apply 25mm thick floor screed with floor hardener multidura or equivalent to obtain a monolithic and smooth steel float finish.	m^2	35		
I	***Decoration Externally***				
	Prepare and apply one sealer coat and two full coats anti-fungus paint BS colour to Engineer's and Client's approval on				
I.1	Blockwall, returns, reveals and the like, externally below plinth	m^2	5		
	CARRIED TO CAST SUMMARY				

BILL 5 - ELECTRICITY SUPPLY

Schedule A : TRANSFORMER BUILDING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	SUPERSTRUCTURE				
J	***Concrete*** Reinforced in-situ concrete designed mix Grade 30/20 N/mm², 20mm aggregate vibrated, as described in Specifications.				
J.1	Cills, lintels, jambs and the like.	m^3	1		
J.2	Columns	m^3	1		
J.3	Beams	m^3	2		
J.4	Slab of nominal thickness 125mm but with slope from 140mm to 125mm (with approved crystalline waterproofing admixture as per BS EN934).	m^3	5		
J.5	Upstand beam	m^3	2		
K	***Reinforcement*** Reinforcement bars of various diameter to MS 10/BS 4449 hot rolled plain round mild steel & hot rolled deformed high yield steel, as described in Specifications.				
K.1	Cills, lintels, jambs, columns, beams, slab and the like.	kg	1900		
L	**Formwork** Formwork in Class 2 finish as described; strutting at / from any level and including rebates or groove formers as described in Specifications.				
L.1	Sides and soffit of cills, lintels, jambs and the like (rate to allow for drip where shown on drawings).	m^2	10		
L.2	Sides of columns.	m^2	10		
L.3	Sides and soffit of beams.	m^2	30		
L.4	Soffit of suspended slab and concrete overhang.	m^2	45		
L.5	Edges of Slab and concrete overhang, n.e. 225mm high.	m^2	30		
M	***Masonry*** Hollow concrete blocks to BS 6073, minimum average compressive strength 3.5 N/mm², in cement mortar (1:3), comprising of reinforcement/wall ties continuous at every third courses of blockwall.				
M.1	Walls -100mm thick.	m^2	6		
M.2	Walls -150mm thick.	m^2	35		
N	***Finishes*** **Internal finish (13mm thick)** - Smooth trowelled finished with cement and sand render (1:3) including hacking of concrete, binding products and forming arises and fair edges to Architect's approval.				
N.1	Walls, beams , columns, cills, lintels, jambs, returns, reveals and the like.	m^2	110		
N.2	Ceiling	m^2	35		
	CARRIED TO CAST SUMMARY - SCHEDULE A				

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	External rendering (20mm thick) work comprising 10mm backing coat of cement and sand (1:3) with wood floated and 10mm thick finishing coat of cement and sand (1:3) sponge finish render all to Architect's approval				
N.3	Walls, beams , columns, cills, lintels, jambs, returns, reveals and the like	m^2	55		
N.4	Ditto, but to soffit & edges of overhangs.	m^2	15		
	Roof finish - cement and sand (1:3) screed as described with steel float finish all to Engineer's approval.				
N.5	Apply 25mm thick screed to roof, side and top of upstands, with hardener multidura or equivalent to obtain a monolithic and smooth steel float finish.	m^2	45		
N.6	**Roof Waterproofing** - Supply and lay an approved single layer bituminous waterproofing membrane on sealer coat and hot laid with melted oxidised bitumen by specialist all in accordance with manufacturer's specifications (10 years guarantee to be given - measured net).	m^2	45		
O	***Decoration Internally & Externally***				
	Decoration Internal - Prepare and apply one sealer coat and two full coats anti-fungus paint BS colour to Engineer's and Client's approval on.				
O.1	Walls, beams , columns, cills, lintels, jambs, returns, reveals and the like.	m^2	115		
O.2	Ceiling	m^2	35		
	Decoration External - Prepare and apply one sealer coat and two full coats anti-fungus paint BS colour to Engineer's and Client's approval on.				
O.3	Walls, beams , columns, cills, lintels, jambs, returns, reveals, rainwater pipes and the like.	m^2	70		
O.4	Ditto, but to soffit & edges of overhangs.	m^2	15		
P	**Rainwater installations; PVC pipes and fittings to BS 4660; Part 1 as described, with ringseal and solvent welded joints, jointed in accordance with manufacturer's recommendation.**				
P.1	Supply and fix 75mm diameter pressure PVC pipe on surface with and including standard brackets at 1.20m centres. Rate to allow for painting.	m	6		
P.2	Extra for Bend/Shoe 75mm diameter.	No.	2		
P.3	Supply and fix dome shaped 75mm diameter stainless steel grating to roof outlet.	No.	2		
Q	***Miscellaneous Items***				
Q.1	Supply and fix cable tray of dimension 500mm wide complete with hangers, bolts and all required accessories. All complete to Manufacturer's details but compliant to BS EN 61537.	m	2		
Q.2	Supply and install removable diamond type Checkered Plate made up of heavy duty cast iron with overall size 1050mm x 2625mm. Rate to allow for all necessary support in Galvanised Metal Steel U-Channel.	sum	1		
	CARRIED TO CAST SUMMARY - SCHEDULE A				

BILL 5 - ELECTRICITY SUPPLY

Schedule A : TRANSFORMER BUILDING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
Q.3	Removable GMS angle bar 75mm x 75mm x 10mm thick welded to 75mm x 75mm x 10mm thick GMS plate on both extremities which will be bolted onto the U- channel	m	3		
Q.4	Supply and fix Galvanised Metal Steel U-Channel with dimension 100mm x 75mm, inclusive of clamps, M16 bolts, supports and other fittings required for proper fixing.	sum			
Q.5	Supply and fix 200mm x 700mm wide x 50mm thick precast concrete cover slabs Grade 30 N/mm² with fairface finish on all exposed surfaces including all necessary formwork reinforcement and lifting handle as per drawing.	No.	15		
Q.6	Allow for 50mm oil drain pipe and pit to the approval of the Engineer.	Sum			
Q.7	Supply and place heavy duty removable type fencing in between RMU and Transformer.	sum			
R	***Electrical Installations*** **Electrical works in concealed system complete with isorange, conduits, single core cable, accessories and the like, all as per IEE regulations and including all civil works.**				
R.1	Main distribution panel complete with RCD's, CB's and earthing.	No.	1		
R.2	Internal wiring for lighting.	Lot	4		
R.3	Lighting fittings, fluorescent 2 x 36 W.	No.	4		
R.4	Lighting switch 1G x 1W.	No.	2		
R.5	External lighting including waterproofed lights.	Lot	4		
R.6	Earthing network.	Lot	1		
R.7	External power supply main cable from pillar (by others) to MDB (approximate distance 10 m).	Lot	1		
	CARRIED TO CAST SUMMARY - SCHEDULE A				

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
S	***Metal Openings*** ***Note:*** ***(a) It is the Contractor's responsibilty to check, measure & confirm on site the following openings prior to fabrication & installation.*** ***(b) Contractor to provide shop drawings for approval prior to manufacture with specifications & design guarantee.*** ***(c) The following galvanised mild steel openings shall be manufactured and installed to Contractor's design as per BS 1245: 2012. All openings shall be in approved metal sections with special reinforcement and 6mm thick laminated clear glass or as otherwise specified, to resist a cyclonic wind loading of 280 km/hr including all necessary mullions, transomes, beading, glazing beads and the like. All openings shall be protected with one coat 2 pack etch primer and painted with one coat undercoat and two coats of hard gloss enamel paint. Perimeter of openings to be pointed with silicone mastic all round internally and externally. All joints to be made weathertight with rubber gaskets, etc. as specified by specialist and to withstand water pressure test as witness and approved by Engineer. Doors / Windows to be fitted with all necessary approved ironmongery, handles, stainless steel hinges and/or friction hinges to both sides of openings etc, bolts & screws to be in stainless steel grade 316 and fixing within concrete and/or blockwork and/or timber subframe (m/s). Details of sections, fixing, fittings and general assembly to be approved by the Architect for appearance. Shop drawings and design calculations to be submitted for Architect/ Engineer Approval.***				
S.1	Double leaf louvred door in double skin with barrel bolt lock with padlock, of overall size 2000mm x 2500mm high.	No.	1		
S.2	Single leaf semi glazed door in double skin with clear glass glazing 550mm x 900mm x 6mm thick with barrel bolt lock with padlock, of overall size 1000mm x2200mm high.	No.	1		
S.3	Single leaf semi half louvred door in double skin with clear glass glazing 550mm x 900mm x 6mm thick with barrel bolt lock with padlock, of overall size 1000mm x2200mm high.	No.	1		
S.4	Double leaf door in double skin with barrel bolt lock with padlock, of overall size 1400mm x 2200mm high.	No.	1		
S.5	Single leaf door in double skin with barrel bolt lock with padlock, of overall size 1000mm x 2200mm high.	No.	1		
S.6	Fixed louvred panel of overall size 1950mm x 400mm high	No.	2		
S.7	Fixed louvred panel of overall size 2650mm x 400mm high	No.	1		
	CARRIED TO CAST SUMMARY - SCHEDULE A				

BILL 5 - ELECTRICITY SUPPLY

Schedule A : TRANSFORMER BUILDING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
T	***SOAKAWAY AND CATCHPIT***				
T.1	Construct 300mm x 300mm x 300 deep reinforced blockwork catchpit complete with grating and frame on top.	No.	1		
T.2	Construct soakaway measuring 1000mm x 1000mm x 2000mm deep as per Drawing No. LM-CD-SP21-114/SRC/AW/GP/SD/04 for rainwater drainage. Rate to allow for the following: - *(i) Excavation, filling materials, geotextile wrapping , rendered peripheral block work.* *(ii) Excavation of trench from septic tank outlet to absorption pit inlet.* *(iii) Supply, laying and testing of 110mm dia pipe to be laid from catchpit to soakaway, including 90^0 bend laid vertically in the soakaway as per Specifications and drawings, in the trench with all necessary bedding, selected fill, backfill and so on.* *(iv) Supply, lay and test 160mm uPVC pipe complete with screw-type end cap to be used as inspection pipe.* *(v) Supply and place precast ring and slab to protect inspection cap.*	No.	1		
U	***MISCELLANEOUS*** Any item of construction work which the Bidder considers to be necessary for the satisfactory completion of the building work. *(List below)* (i) (ii) (iii)				
CARRIED TO CAST SUMMARY - SCHEDULE A					

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 6

STREET LIGHTING WORKS

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 6 - STREET LIGHTING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	ROAD LIGHTING NETWORK				
	CIVIL WORKS				
6.1	***Excavation***				
	Excavation (after removal of top soil) in any material including rock, rates to allow for backfilling, selected fill with sieved material, imported fill, normal backfill, dewatering, all necessary shoring and carting away of surplus material.				
6.1.1	Excavate trench (after removal of top soil) for 80mm PVC duct pipes, depth to invert not exceeding 1.5 m.	m^3	1,025		
6.1.2	Excavate in unsuitable material below formation level of trench where instructed by the Engineer (Provisional quantity).	m^3	75		
6.2	***Pipe Bedding and Protection***				
6.2.1	Supply, place and compact concrete Class C 20 as concrete bedding and surround to duct pipes.	m^3	10		
6.2.2	Supply, place and compact granular material (0-100mm) as infill below formation level of trench wherever instructed by the Engineer (Provisonal quantity).	m^3	75		
6.2.3	Supply and place rocksand bedding to duct pipes as per Drawing No. SPDL/C2024/29/SL/TD/01.	m^3	425		
6.3	***Pipes and Fittings***				
6.3.1	Supply, lay, joint and test 80mm diameter uPVC yellow pipes for **Street lighting**. Rate to allow for necessary heavily galvanised (or nylon type) 5mm thick draw wires in uPVC pipes and PVC end caps at the ends of each stretch of pipelines.	m	1,700		
6.3.2	Supply, lay, joint and test 80mm diameter uPVC large radius bend.	No.	120		
6.3.3	Supply, lay, joint and test 80mm diameter uPVC End cap.	No.	25		
6.4	***Concrete Foundation Bases***				
6.4.1	Construct foundation for street lighting poles as per Drawing No. SPDL/C2024/29/SL/TD/01 , depth not exceeding 2m, for Street lighting Columns along Roads. Rate to include for all excavation, formwork, blinding, reinforcement, concrete Class 30, casting-in bolts, PVC pipes, 2no. large radius bends for drawing cables, base plates and anchorage assemblies, size not less than 0.9m x 0.9m x 2.0 deep. Rate to allow for ducts of services other than Street lighting through foundation, where required or ordered by Engineer.	No.	56		
	CABLING; LIGHTING COLUMNS AND LANTERNS				
6.5	***Cables for Street Lighting***				
6.5.1	Supply, lay, connect, test and commission the following Armoured Cables between lighting poles including terminations at both ends, glands, lugs, etc:				
6.5.2	Armoured cable 5C - 2.5mm²	m	2,100		
6.5.3	Armoured cable 5C - 4mm²	m	250		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 6 - STREET LIGHTING

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
6.6	***Road Lighting Columns***				
6.6.1	Supply, install, test and commission hot-dipped galvanised Tapered Type lighting poles rustic type similar to those installed at Aurea Living Harmony, 6m high complete with base plate, foundation bolts, access door at 2m high with vandal proof key, with single bracket of 1.5m length, designed to withstand a wind speed of 300km/hr (As per drawing No SPDL/C2024/29/SL/TD/01) to be installed along Roads, to the approval of the Engineer/ Architect/Client.	No.	56		
6.7	***Street Lanterns and Electrical Accessories inside Lighting Columns***				
6.7.1	Supply, install, test and commission **IP66** LED Street Lanterns **60 - 70W 4000K** complete with automatic dimming device, manufactured from die-cast aluminium and tempered glass for 6m high pole to the approval of the Engineer; District Council and Road Development Authority as the case may be.	No.	56		
6.7.2	Supply, install, test and commission the following inside each lighting columns for 6m high pole:- *Circuit Breakers 1P+N/4A + Terminal Blocks + Cable Glands + Circular Cable 3C 1.5mm²*	Set	56		
6.8	***Earthing***				
6.8.1	Supply, install, test and commission earthing rods 1.5m long complete with earth cable at each street lighting column.	No.	56		
6.8.2	Supply, install, test and commission one main earthing set next to the Electrical Distribution Pillar/Panel to achieve an earth resistance of less than or equal to 5 Ohms. Rate to allow for excavation and backfilling of earth pit as approved by Engineer.	No.	3		
6.9	***Electrical Distribution Panel***				
6.9.1	Supply, install, test and commision one Electrical Distribution Board consisting of the following: - - Polyester Cubicle to IP 65 - Main Incoming Circuit Breaker 4 Pole 16Amps - ELCB 3P + N 10 Amps 300mA - Contactor 4 Pole 20A 230V - Solar cell - Wiring Accessories ***Contractor to provide a schematic diagram of the proposed DB along with his Bid.***	No.	3		
6.10	***Miscellaneous***				
6.10.1	Supply and lay warning tape 200 micron; Colour Yellow; Marked "DANGER ELECTRICITY" in Red on top of pipes.	m	1,700		
6.10.2	Provision of operating and maintenance manuals	sum			
6.10.3	Construct complete Drawpit with internal dimension not exceeding 0.6m x 0.6m for Street lighting cables, depth not exceeding 1.0m, as per Drawing No. SPDL/C2024/29/E/TD/02 . Rate to include for all excavation, blocklaying, concreting, warning slabs, backfilling and any other associated works.	No.	40		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 7

TELECOMMUNICATION WORKS

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 7 - TELECOMMUNICATION WORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
	Telecommunication Works				
7.1	***Trenching Works*** Excavate trenches in any material, including rock, for telecom duct pipe configurations (as listed below) complete with excavation in all material, backfilling, selected fill with sieved material, imported fill, normal backfill, dewatering, all necessary shoring and carting away of surplus material, bedding, backfilling and compaction.				
7.1.1	1Ø45	m	875		
7.1.2	2Ø45	m	925		
7.1.3	3Ø45	m	350		
7.1.4	4Ø45	m	275		
7.1.5	5Ø45	m	130		
7.1.6	8Ø45	m	25		
7.1.7	2Ø60 + 3Ø45	m	150		
7.1.8	1Ø45 + 3Ø60 (manhole to cubicle)	m	150		
7.1.9	Excavate trial pits or trial tenches to locate existing telecom pipes under existing roads as directed by Engineer. Rate to allow for all backfilling, compaction and reinstatement to original state as per Specifications and to the requirement of Authorities.	No.	10		
7.2	***Pipeworks and Fittings*** Laying of pipes, jointing with glue and tightening joints, termination of pipe in manhole walls, mandrel test, concrete blocks every 50m where applicabe and fixing obturating caps.				
7.2.1	Supply, lay and joint PVC pipe Ø45, complete with 4mm nylon type draw wires and duct plugs at pipe ends	m	6,325		
7.2.2	Supply, lay and joint PVC pipe Ø60, complete with 4mm nylon type draw wires and duct plugs at pipe ends	m	750		
7.2.3	Supply, lay and joint PVC large radius bend Ø45	No.	25		
7.2.4	Supply, lay and joint PVC large radius bend Ø60	No.	75		
7.3	***Manholes and Cubicles*** Construction of reinforced concrete manhole complete with excavation in all material inlcuding rock, formwork, finishes, building in of pipe, concrete surround at pipes inlet and outlet of each manhole over a length of 1.5m, fixing of internal equipment (anchor iron, cable bearers, ladders etc.)				
7.3.1	Type L2C	No.	25		
7.3.2	Supply and fix D400 manhole Frame and covers with accessories to Manhole Type L2C	No.	25		
7.3.3	Supply and place precast ring 450mm x 450mm and 80mm thick slab to protect plot connection ducts, rate to allow for painted engraved marking "**MT**".	No.	94		
7.3.4	Construct reinforced concrete cubicle as per Drawing No. SPDL/C2024/29//T/TD/13 , inclusive of building in of pipes and fittings, concrete base, openings and all associated works.	No.	25		
	CARRIED TO CAST SUMMARY				

BILL 7 - TELECOMMUNICATION WORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
7.4	***Miscellaneous***				
7.4.1	Supply and lay warning tape across whole width and length of trench, colour green and marked "MAURITIUS TELECOM", Type 'BDC PLASTIC' or similar as approved by MT.	m	2880		
7.4.2	Supply and place concrete surround Grade 20 to pipe duct at road crossings and where specified by the Engineer.	m^3	10		
7.4.3	Provide Pipe support in concrete (Grade 20) 350 mm x 350 mm x 500 mm long between manholes.	No.	15		
7.4.4	Allow for Duct test with appropriate mandrel in the presence of officers from MT and/or Engineer as specified.	Sum			
7.4.5	Mark on kerb exact position of plot connections with an approved green paint.	Sum			
7.4.6	Supply as-built drawing in three soft copies and three hard copies showing the exact Telecom layout inclusive of manholes and all necessary test certificates. (as directed by Engineer)	sum			
7.4.7	Excavate under existing road within Morcellement Aurea to lay 45,60 & 80 mm pipes.Rate to include for setting out of pipes alignment,cutting out of asphalt,excavation to depth not exceeding 2.0 m deep,backfilling with crusher run(0/20) over full depth, selected fill, sieved material, imported fill, normal backfill, dewatering, all necessary shoring and carting away of surplus material.Rate to include also spreading of prime coat and laying of 60 mm premix asphalt concrete 0/14 mm.	m^2	200		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

SUMMARY OF BILL 8

ANCILLARY WORKS

	Amount (Rs)
Carried from Sheet 1 :	.....
Carried from Sheet 2 :	.....
TOTAL CARRIED TO MAIN SUMMARY OF BILL OF QUANTITIES	

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 8 - ANCILLARY WORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
8A	**EARTHWORKS OVER PLOTS**				
8A.1	Carry out **bulk excavation** to any depth over plot areas, in any material, including rock to Finished Plot Levels. Part to be used for fill and the remaining to be spread on plots or to be carted away as may be required or instructed by Engineer. (Provisional	m^3	5,000		
8A.2	Allow for **engineering fill** within plot areas with suitable selected materials obtained from bulk excavation to achieve the finished plot levels. Rate to include for soil tests, compaction in layers and testing as described in the Specifications. (Provisional Quantity)	m^3	5,000		
8A.3	Allow for **imported engineering fill** within plot areas with suitable selected material obtained from borrow pits, to be approved by Engineer. Rate to include for soil tests, compaction in layers and testing as described in the Specifications. (Provisional Quantity)	m^3	5,000		
8A.4	Allow for felling of trees with girth diameter 18cm or greater, including removal of branches, stumps, cutting in logs and carting away. Rate to include for all necessary liaisons and payments to the Forestry Department.	No.	50		
8B	**RETAINING WALL**				
8B.1	**Concrete Retaining Wall**				
8B.1.1	Construct Reinforced Concrete Retaining Wall **Type 1** of height not exceeding **2.10m**, as per Drawing No. LM-CD-SP21-114/SRC/AW/BW/TD/04. Rate to include for all excavation,triming, compaction, blinding, formwork, reinforcement, concrete grade 30, weepholes, french drains, backfilling and any making good to the exposed faces of the retaining wall.	m	15		
8B.1.2	Ditto, but, Reinforced Concrete Retaining Wall Type 2, height not exceeding **2.65m**.	m	30		
8B.1.3	Ditto, but, Reinforced Concrete Retaining Wall Type 3, height not exceeding **3.20m**.	m	10		
8B.1.3	Ditto, but, Reinforced Concrete Retaining Wall Type 3, height not exceeding **3.70m**.	m	20		
8B.2	***Masonry Retaining Wall***				
8B.2.1	Construct **Low masonry retaining wall**, height not exceeding 1.5m, as per drawing as per Drawing No. NHDC/0315/LOT2/ND/R/TD/10. Rate to include for all excavation,triming, compaction, blinding, supply and fixing of approved stones in mortar, reinforcement, concrete grade 30, weepholes, concrete coping etc.	m	70		
8B.2.2	Construct **High masonry retaining wall**, height not exceeding 1.5m, as per drawing as per Drawing No. NHDC/0315/LOT2/ND/R/TD/10. Rate to include for all excavation,triming, compaction, blinding, supply and fixing of approved stones in mortar, reinforcement, concrete grade 30, weepholes, concrete coping etc.	m	15		
8B.2.3	Demolish and Cart Away existing Masonry Wall over Plots D8 and D9.	m^3	100		
	CARRIED TO CAST SUMMARY				

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO. SPDL/RFP/C2024/29

BILL 8 - ANCILLARY WORKS

Item	*Description*	*Unit*	*Qty*	*Rate (Rs)*	*Amount (Rs)*
8C	**MISCELLANEOUS ITEMS**				
8C.1	***Handrail***				
8C.1.1	Supply and fix **Heavy Duty** Galvanised Iron Handrail with tubular cross section (straight or curve on plan) as per Drawing No. NHDC/0315/LOT4/STH/R/TD/19. Rate allow for fixing into concrete retaining wall (items 8B.1.1 and 8B.1.2) and to include any excavation, welding, concreting and any other works found deemed to be necessary by the Engineer to make the handrails safe for use.	m	60		
8D.1	***Landscaping Works***				
8D.1.1	Allow for landscaping Works	PS			5,000,000
8D.1.2	Contractor's on-cost on item 8D.1.1	%		5	
8D.1.3	Allow for Landscaping Works and installation of amenities in Greenspaces, to the satisfaction of the Municpaility of Vacoas Phoenix, as directed by the Engineer (Provisional Sum)	PS			1,000,000
8D.1.4	Contractor's on-cost on item 8D.1.3	%		5	
8D.1.5	Allow for Investigative works to locate and/or rehabilitate the existing undeground servives to the Show Residence Building found in Plot D41, as directed by the Engineer (Provisional Sum)	PS			1,000,000
8D.1.6	Contractor's on-cost on item 8D.1.5	%		5	
	CARRIED TO CAST SUMMARY				

PART 3

CONDITIONS OF CONTRACT

AND

CONTRACT FORMS

SECTION VI

GENERAL CONDITIONS OF CONTRACT

CONDITIONS OF CONTRACT – Part 1

The Conditions of Contract shall be those forming Part I of the **"Conditions of Contract for Construction for Building and Engineering Works Designed by The Employer**" First Edition 1999, prepared by FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS (FIDIC), subject to the variations and additions set out in Part II hereof entitled "Particular Conditions".

All Clauses Nos. refer to those used in the said FIDIC Conditions.

Definition:

The word "**Tender**" in the FIDIC document shall also mean "**Bid**" and vice versa for consistency with the other parts of this bidding document.

SECTION VII

PARTICULAR CONDITIONS OF CONTRACT

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - PROCUREMENT REFERENCE NO.: SPDL/RFP/C2024/29

FIDIC CONDITIONS OF CONTRACT- 1999 EDITION

PART II – PARTICULAR CONDITIONS OF CONTRACT

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PART II – PARTICULAR CONDITIONS

1 - GENERAL PROVISIONS

Note : The words 'Tender', 'Tenderer' and 'Bid', 'Bidder' can be used interchangeably without affecting the meaning of any of the words.

1.1 Definitions

1.1.2.2 Employer

The Employer is **SIT Property Development Ltd, Ground Floor, NG Tower, Cybercity, Ebene** and is represented by the **Officer In Charge**.

1.1.2.4 Engineer

The Engineer means whosoever is appointed from time to time by the Employer and notified in writing to the Contractor to act as Engineer for the purpose of the contract. The Engineer is **Scene - Ries Consult Ltd,** 3, Thelemaque Street, Rose Hill, Mauritius.

1.1.2.9 DAB

Delete the Sub - Clause in its entirety.

1.5 Priority of Documents

Delete the documents listed (a) to (h) and substitute:

"(a) the Contract Agreement,

(b) the Letter of Acceptance,

(c) the Bid Submission Form and Appendix to Bid,

(d) any Addenda,

(e) the Particular Conditions of Contract (Part II),

(f) the General Conditions of Contract (Part I)

(g) the Specification,

(h) the Drawings,

(i) the priced Bill of Quantities, and

(j) any other documents forming part of the Contract."

1.13 Compliance with Laws

Add the following paragraph:

(c) "The Contractor shall acquaint himself and comply with all regulations in respect of import of plant and equipment, materials, fiscal taxes, custom duties, registration duties, transfer of capital etc., also all regulations regarding the employment of his labour force, staff and other personnel, as well as the provisions of the Environment Protection Act of 2002 and subsequent amendments.

No claim by the Contractor for additional payment will be entertained by the Employer on the grounds of any misunderstanding or misinterpretation in respect of any such matter or otherwise."

2 – THE EMPLOYER

2.1 Right of Access to Site

Delete the first sentence of the Sub-Clause and replace with the following:

"The Employer shall give the Contractor right of access to, and possession of, such parts of the Site to enable the Contractor to perform the Works within the time stated."

2.2 Permits, Licenses or Approvals

At the end of the Sub-Clause , add the following:

"The Contractor shall be deemed to have satisfied himself as to the permits, licenses or approvals that may be required by the Laws of the Republic of Mauritius."

2.4 Employer's Financial Agreements

Delete the Sub-Clause in its entirety and replace with " Not Used."

3 – THE ENGINEER

3.1 Engineer's Duties and Authority

Add additional paragraph (d) as follows:

"(d) The written approval of the Employer is required before the Engineer can authorize any modification of the Works involving an increase in the Accepted Contract Amount as defined in sub-clause 1.1.4.1.

Specifically, the Engineer shall obtain approval of the Employer before taking any of the following actions:

(i) approving to the subletting of any part of the Works under Clause 4;

(ii) certifying additional costs for any amount determined under Clause 12;

(iii) determining extensions of time claimed under Clause 8;

(iv) instructing variations under Sub Clause 13.1

(v) fixing new rates or prices under Sub Clause 14;

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such works or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Sub-Clause 13.3 [*Variation Procedure*] and shall notify the Contractor accordingly, with a copy to the Employer."

3.2 Delegation by the Engineer

In Line 4 of the first paragraph, after the sentence: "The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both parties" add the following:

"The Engineer's Representative will however have no authority and shall not exercise any power under Clauses 1.9, 8.4, 8.5, 8.8, 10.1, 10.2, 12.4, 13.1, 14.13, 15.2, 15.3, 15.4, 15.5, 16.4, 19.4, 19.6, 20.5, 20.6.

The Engineer shall advise the Employer and the Contractor in writing of the duties and powers assigned under the Contract to the Resident Engineer."

The delegation of authority to the Resident Engineer shall exclude duties and responsibilities under the following Sub Clauses:-

Sub Clause 3.5 – *"Determinations"*

Sub Clause 11.9 – *"Performance Certificate"*

Sub Clause 14.13 - "*Issue of the Final Payment Certificate*"

3.3 Instructions of the Engineer

Insert the following under paragraph 2: -

"(d) gives an instruction via electronic mail"

Add the following paragraph:-

"The Engineer's written instruction shall be dated, numbered and registered.

Before the start of the works the Contractor shall check all documents submitted and notify the Engineer of any errors, omissions, or contradictions therein.

If in the opinion of the Contractor an Engineer's instruction goes beyond his contractual obligations which may give rise to claims, he shall give notice to the Engineer within a period of seven (7) days, following the date of issue of such instruction. Beyond the period of twenty-eight days, no claim shall be accepted by the Engineer. Such claims shall not suspend the execution of the written instructions unless the Engineer instructs otherwise."

4 – THE CONTRACTOR

4.2 Performance Security

In line 1 of the second paragraph, replace "28" by "14".

At the end of the second paragraph, insert the following:

"The Performance Security submitted by the Contractor shall be furnished by a **local bank** registered in Mauritius and acceptable by the Employer.

Performance Securities offered by insurance companies or other institutions shall not be accepted."

4.4 Subcontractors

After paragraph (d) add the following:

"(e) the Contractor shall submit a copy of the Subcontract Agreement made between him and each of his Subcontractors."

4.6 Co- operation

Add the following at the end of Sub-Clause 4.6:

"The Contractor will be required to maintain access to the Site at all times to such other contractor(s) or subcontractor(s) working at the site. The Contractor will also be required to share access with such other contractor(s) or subcontractor(s).

The Contractor will be required, if so requested, to attend coordination meetings arranged by the Employer and/or his representative in view of the phasing of the Works in relation to other on-going projects/contracts and interaction with the other parties. The Contractor shall abide to the phasing of the Works as required by the Employer and the associated conditions in order to allow the other contractors or subcontractors, as the case may be, to access specific sections of the Site as required.

Any delays incurred as a result of other contractors' or other subcontractors' works shall be referred to the Engineer who shall evaluate such delays in accordance with Sub-Clause 8.4 [*Extension of Time for Completion*] and award accordingly."

4.8 Safety Procedures

After paragraph (e) add the following:

"(f) Maintain such records and produce such reports concerning safety, health and welfare of persons as the Engineer may from time to time prescribe or may specifically request after an event of damage to property."

(g) "Provide beacons, flashing lamps, diversion signs, warning signs, traffic signs, lamps of sufficient luminance on roads within the site limits to ensure the safety of all road users and pedestrians, as per the requirements of the Road Development Authority, TMRSU, and the District/ Municipal Council.

The entire cost of installing and maintaining warning signs, traffic signs, beacons, flashing lights and all other safety requirements including the deployment of traffic policemen during and after normal working hours or on public holidays on the site shall be borne by the Contractor. During the execution of the works, he shall be responsible for any accidents or damage done to a third party resulting from his equipment or from the omission of warning signs, traffic signs, beacons, barricades or flashing lights and the like.

The Contractor shall take all necessary measures regarding spraying water at least four (4) times a day to keep dust nuisance to a minimum, all at his own cost.

The Contractor shall also ensure that all roads are kept clean during working hours and after every working day to ensure safety of the public and shall be deemed to have allowed for this in his rates."

4.10 Site Data

Delete sub-clause 4.10 and substitute with the following paragraphs:

The Contractor shall also be deemed to have satisfied himself of the following requirements, without limitation, as no claims through lack of knowledge in this respect will be considered:

- the location of the Works
- the general site conditions and potential difficulties for carrying out the Works, and in particular, the equipment necessary for the proper execution of the Works
- the physical conditions of the site, including the soils, subsoil conditions, rock types, existing structures, and above and underground services
- requirements for the Contractor's design of any temporary works
- local traffic conditions
- meteorological and climatic conditions, the possibility of flooding by rivers, depths of water table, wind velocity etc.
- conditions governing the importing of plant and equipment
- local conditions especially those concerning the supply of materials, such as aggregates, cement, reinforcement etc.
- supply of imported materials such as pipes and fittings to Mauritius
- means of communication and transportation
- supply of electricity, potable water and fuel etc.
- availability of skilled local manpower

- laws and regulations governing the employment of foreign labour, all the constraints imposed by the social, Monetary and customs legislation in force in Mauritius
- all other circumstances likely to have a bearing on the execution of Works or on its costs

The Contractor must not assume that exhaustive geotechnical investigations have been done to verify the subsoil nature of the site and the accuracy of such data if provided by the Employer. The Contractor shall be fully responsible for obtaining all the necessary information and its proper interpretation prior to submission to ensure sufficiency of his Bid.

The Contractor is at liberty to carry out his own subsoil investigation work any time he considers it necessary for the sufficiency of his Bid (including for the design of any works) and for the proper execution of the Works all at his own costs."

4.14 Avoidance of Interference

Add the following paragraphs:

"The Contractor shall provide and maintain all detours, temporary roads including any temporary drainage measures, barriers, warning and guide signs, temporary traffic lights, and any other road equipment at all hours during day and night.

He shall, within 7 days following the order to proceed with the works on a specific work front, submit a detailed traffic planning programme to the Engineer for approval. Such programme shall show all arrangements to be taken to ensure smooth and safe traffic flows on roads to be diverted. The Contractor shall liaise with the appropriate Authorities in the application of this Clause. No claim for any damage to the Works caused by the traffic will be entertained by the Employer, and any damage caused by diverted traffic will have to be made good at the Contractor's expense.

The Contractor shall be responsible for ensuring the safety of all persons and property on the site.

The Contractor, under the coordination of the Employer, shall also give 21 days notice to agricultural land owners or adjacent users whose property or operations may be affected by the Works.

The Contractor shall be responsible for the cost of and for publishing periodic notices in the local newspapers and inform residents of traffic diversions and locations of operations through radio/television broadcasting. The frequency and content of such notices and information through radio/television broadcasting shall be as directed by the Engineer.

The Contractor shall make his representatives available for meetings arranged by the Employer for public relations exercises both during and outside normal working hours as necessary.

Regarding Public Relations during the construction Works Contract, before the start of work at any given location, the following procedures shall be followed:

- Distribution of pamphlets/flyers by the Contractor to all stakeholders at least 21 days before work starts in that particular region/area. The pamphlet contents will first be vetted by the Employer.
- The pamphlets shall be in the form of a folded A4 sheet printed on one or more pages for easy reading in three languages namely English, French and Creole
- The Content shall clearly indicate when work will start, the duration and a road map will be inserted to show the working area and traffic diversion plan

An exhaustive list of the Contractor's contact persons including office and mobile telephone numbers shall be given to the residents by the Contractor.

The Contractor will be responsible for the initiation and cost of implementing the above requirements whether provided under an item in the BoQ, or otherwise.

4.17 Contractor's Equipment

Add the following at the end of Sub-Clause 4.17:

"The Contractor shall be responsible at all times for the provision and operation of suitable equipment necessary for his due and timely performance under the contract.

Contractor's Equipment which is owned by the Contractor (either directly or indirectly) shall be deemed to be the property of the Employer as from the time of arrival on the Site. This vesting of such equipment shall not:

(a) affect the responsibility or liability of the Employer,
(b) prejudice the right of the Contractor to the sole use of the vested Contractor's Equipment for the purpose of the Works, or
(c) affect the Contractor's responsibility to operate and maintain the said equipment.

The equipment shall be deemed to revert to the Contractor when he is given authorisation by the Engineer either to remove it from the Site or upon issue of the Taking-Over Certificate for the Works, whichever occurs first. The Contractor shall not remove any major items of equipment from site without the express consent in writing of the Engineer."

4.18 Protection of the Environment

Add the following at the end of Sub-Clause 4.18:

"The Contractor shall adhere to the Environmental Monitoring Plan (EMP) in all respects as set out in the Contract Specifications. The entire cost for meeting the provisions of the EMP and the protection of the environment generally shall be borne by the Contractor. During the full execution of the entire Works, the

Contractor shall be responsible for any accident or damage occurring to a third party resulting from non-compliance to this Clause."

4.19 Electricity, Water and Gas

Delete the Sub-Clause 4.19 in its entirety and substitute by:

"The Contractor shall be responsible for the provision of all power, water and other services he may require.

The Contractor shall make all arrangements as necessary with the applicable relevant statutory Authorities and provide at his own cost for the installation, supply, distribution and consumption of all temporary utility supplies namely electricity, water, gas telecommunication services and other utility services necessary for the execution of the works and the Contract generally."

4.20 Employer's Equipment and Free-Issue Material

Delete sub-clause 4.20 in its entirety.

4.23 Contractor's Operations on Site

Add the following at the end of Sub-Clause 4.23:

"The Contractor shall reinstate all properties whether public or private, which are damaged as a consequence of the construction and maintenance of the Works carried out by him to a condition as specified and at least equal to that which existed before his first entry on the site/s of work. The cost of such reinstatement shall be borne by the Contractor.

If, in the opinion of the Engineer, the Contractor has failed to take reasonable and prompt action to discharge his obligations regarding such reinstatement, the Engineer shall so inform the Contractor in writing.

The Employer reserves the right to employ others to carry out the amount of work necessary for the said reinstatement and shall deduct the cost thereof from any money or monies due or which shall become due from the Employer to the Contractor."

In the eventuality that the Contractor uses, or intends to use, any private or public property as temporary yard for his operations at the site, he shall priorly obtain such permission and/or authorizations from the rightful owner or Authority in writing; such written consent/agreement shall be provided to the Employer as documentary evidence prior to utilization of such premises, yards or properties.

4.25 Protection of Existing Works and Services

Add this new Sub-Clause 4.25:

"The Contractor shall acquaint himself with the position of all existing aboveground and underground services, such as surface water drains, electrical cables, telephone ducts, telephone and lighting poles, water mains, sewers, manholes and chambers

and the like before commencing any excavation or other work likely to affect these existing services.

Where work is to be carried out in the vicinity of overhead power lines, the Contractor shall ensure 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 equipment are operating or lying is in the vicinity of power lines. In this respect, the Contractor's attention is drawn to BS EN 50522:2010, BS EN 61936-1:2010+A1:2014, BS EN 61439-1:2011, BS EN61439-2:2011 which gives safe clearance for the various voltages.

The Contractor shall be held responsible for any injury to any of his working personnel or equipment resulting from existing works or services, and shall indemnify the Employer against any claims arising therefrom.

The Contractor shall also be responsible for the reinstatement of the services which would have been so affected. In all cases where such works or services are exposed, they shall be properly marked, shored, hung-up or otherwise protected. Special care shall be exercised in filling and compacting the ground under mains, cables, etc., and to leave uncovered exposed water meters, water house connection pipes, stopcock boxes/chambers and similar items.

Installations adjacent to the Works shall be kept securely in place until the work is completed and shall then be made as safe and permanent as before. Notwithstanding the foregoing requirements, and without reducing the Contractor's responsibility, the Contractor shall inform the Engineer immediately if and when any existing works or services are detected, exposed or damaged."

4.26 Diversion of Existing Services

Add this new Sub-Clause 4.26:

"The Employer will advise the service Authorities RDA/CEB/CWA/MT/WRU/WMA and the District/ Municipal Council of the award of the Contract. The Employer shall advise the Authorities that the successful Contractor shall be liaising with them during the course of the Contract for the diversion of services and reinstatement works as applicable.

The Contractor, under the coordination of the Employer shall be responsible for arranging for the temporary diversion and reinstatement of, or alterations to, services such as power and telephone lines, water mains, sewers and surface water drains etc., which are affected by the Works. The arrangements for such moving or alteration shall be subject to the agreement of the Engineer and service Authorities."

6 – STAFF AND LABOUR

6.2 Rates of Wages and Conditions of Labour

Delete paragraph 1 of Sub-Clause 6.2 and substitute with the following paragraphs:

"The Contractor shall make his own arrangements for the recruitment of workers, staff and personnel to be employed by him at the site or within the project.

The Contractor shall comply with the relevant Labour Laws and Regulations and shall pay rates of wages and observe hours and conditions of labour not less favourable than those established for the trade or industry by law or by machinery of negotiation or arbitration to which the parties are organisations of employers and trade unions representative respectively or substantial proportions of the employers and workers engaged in the trade or industry.

In addition to other legislation, the Contractor shall acquaint himself with the relevant enactments which set out a minimum remuneration and conditions of the employment of various categories of workers in Mauritius.

The Contractor shall in respect of all persons employed by him in Mauritius (whether in the execution of the Contract or otherwise) in every factory, workshop or place used by him for the execution of the Contract, comply with the general conditions of this Clause and, if required by the Employer, shall, before entering into the Contract, certify that to the best of his knowledge and belief he has complied with such general conditions for the three months immediately preceding the date of submission of the Contractor's Bid.

The Contractor shall recognise the freedom of his workpeople to be members of registered trade unions.

The Contractor shall at all times during the continuance of the Contract display for the information of his workpeople in any factory, workshop or place occupied by him for the execution of the Contract, a copy of this Clause.

The Contractor shall certify within eight days of his being required to do so by the Employer that to the best of his knowledge and belief the wages, hours of work and conditions of labour of all workpeople employed by him in the trade or industry in which he is offering himself as a Contractor are fair and reasonable having regard to the provisions set out in this Sub-Clause.

The Contractor shall keep proper wages books and time sheets showing the wages paid to and time worked by the workers in and about the execution of the Contract and he shall be bound whenever required to produce such wages books and time sheets when so instructed by the Engineer.

The Contractor shall not be entitled to payment of any money which would otherwise be payable under the terms of Contract in respect of the work and labour performed in the execution of the Contract unless and until he shall have filed together with his claim for payment a certificate:

(a) showing the rates of wages and hours of labour of the various classes of workmen employed in the execution of the Contract;

(b) whether any wages in respect of the said work and labour remain in arrears; and

(c) that all the labour conditions of the Contract have been duly complied with.

The Contractor or any sub-contractor employed by him shall be responsible for the direct supervision and payment of all labour employed on the Contract.

The Contractor shall be responsible for the observance of the provisions of this Clause by Sub-Contractors employed by him in the execution of the Contract."

6.5 Working Hours

Add the following at the end of Sub-Clause 6.5:

"Should the Contractor be allowed to work at night, he shall do so in such a way so as NOT to cause any disturbance or nuisance to inhabitants, or residential pockets or establishments adjoining the Site.

Should for any reason, the Contractor be allowed to work at night, he shall not be entitled to any additional payment in relation to the additional costs attributable to working outside normal working hours.

Provided that if any steps, taken by the Contractor in meeting his obligations under this Sub-clause result in additional supervision costs, such costs shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and deducted from any monies due or to become due to the Contractor, and the Engineer shall notify the Contractor accordingly, with a copy to the Employer."

6.6 Facilities for Staff and Labour

Insert the following paragraph to Sub-Clause 6.6 as follows:

"The Contractor shall provide on the Site, to the satisfaction of the Engineer or his representative, an adequate supply of drinking and other water for the use of the Contractor's staff and workers at his site establishment and at each working front.

The Contractor shall also provide at his own cost, mobile toilet facilities for his staff at each working front. These mobile facilities shall be regularly maintained by the suppliers.

In the event that such facilities are not provided, or are insufficient in the opinion of the Employer or Engineer, the Contractor will not be allowed to commence further work on that working front until such time as the specified facilities are provided."

6.7 Health and Safety

Insert the following paragraphs at the end of Sub Clause 6.7

"The Contractor shall ensure that all works are carried out in a safe manner and he shall comply with all provisions of the:

1. Occupational Safety, Health Act No. 28 of 2005

2. Health, Safety and Welfare Regulations 1980

3. All other mandatory regulations.

The Contractor shall maintain such records and make such records concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe and shall report to the Engineer, details of any accident as soon as possible after its occurrence. In the case of a fatality or serious accident, the Contractor shall, in addition notify the Engineer immediately by the quickest available means."

6.8 Contractor's Superintendence

Insert the following after the second paragraph of Sub-Clause 6.8:

"With regards to language, the contractor's authorised representative shall be fluent in English. Moreover, a reasonable proportion of the Contractor's superintending staff shall have a working knowledge of English or the Contractor shall have available on Site at all times a sufficient number of competent interpreters to ensure the proper transmission of instructions and information."

6.8.1 Foreign Staff and Labour

Add new paragraph 6.8.1 to Sub-Clause 6.8 as follows:

"The Contractor may import any personnel who are necessary for the execution of the works provided he complies with all local statutory laws and regulations. The Contractor shall also ensure that these personnel are provided with the required residence visas, work permits and proper and safe accommodations as the case may be. The Contractor shall be responsible for the return to the place where they were recruited or to their domicile as the case may be. In the event of the death in the country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial, all to the satisfaction of the Mauritian Authorities and/or the families concerned."

6.8.2 Measures against Insect and Pest Nuisance

Add new paragraph 6.8.2 to Sub-Clause 6.8 as follows:

"The Contractor shall at all times take the necessary precautions to protect all staff and labour employed on the Site from insect and pest nuisance, and to reduce their danger to health.

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government or the local medical or sanitary Authorities for the purpose of combating the said epidemic occurrence. The Contractor shall ensure that all his workmen working in an environment of foul sewage, in and around sewerage networks, are duly and satisfactorily vaccinated against all possible contamination and shall comply with all the regulations of the local Health Authorities, including the use of the appropriate vaccines insecticides and the lile, indicated by such Authorities."

6.8.3 Festivals and Religious Customs

Add new paragraph 6.8.3 to Sub-Clause 6.8 as follows:

"The Contractor shall in all dealings with labour in his employ have due regards to all recognised festivals, days of rest as published yearly under the Public Holidays Act No.22 of 1968 as amended, and religious or other customs. This shall apply both to local and/or imported labour."

Delays or disruptions occurring over recognised and gazetted public holidays or during specified non-working days, shall not entitle the Contractor to any extension of time or additional costs.

6.8.4 Supply of Water

Add new paragraph 6.8.4 to Sub-Clause 6.8 as follows:

"The Contractor shall, so far as reasonably practicable, provide on the Site to the satisfaction of the Engineer an adequate supply of drinking water and water for any other use for the Contractor's staff and workpeople."

6.8.5 Observance of Sub-Contractor

Add new paragraph 6.8.5 to Sub-Clause 6.8 as follows:

"The Contractor shall be responsible for the observance of the provisions of this Sub-Clause by any and all Sub-Contractors employed by him in the execution of the Contract."

6.8.6 Arms and Ammunition

Add new paragraph 6.8.6 to Sub-Clause 6.8 as follows:

"The Contractor shall not give, barter or otherwise dispose of to any person or persons any arms or ammunition of any kind or permit or suffer the same as aforesaid".

6.8.7 Alcoholic Liquor or Drugs

Add new paragraph 6.8.7 to Sub-Clause 6.8 as follows:

"The Contractor shall report to the Engineer details of any accidents as soon as possible after their occurrence. In case of any fatal or serious accident, the Contactor shall, in addition, notify the Engineer immediately by the quickest available means."

6.9 Contractor's Personnel

6.9.1 Records of Safety and Health

Add new paragraph 6.9.1 to Sub-Clause 6.9 as follows:

"The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe."

6.9.2 Reporting of Accidents

Add new paragraph 6.9.2 to Sub-Clause 6.9 as follows:

"The Contractor shall report to the Engineer details of any accidents as soon as possible after their occurrence. In case of any fatal or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means."

6.11 Disorderly Conduct

Add new paragraph 6.11.1 to Sub-Clause 6.11 as follows:

"The Contractor shall not, otherwise than in accordance with the Statutes, Ordinance and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs or permit or allow any such importation, sale, gift, barter or disposal by his subcontractors, agents or employees."

6.12 Records of Safety and Health

Add new sub-clause 6.12 as follows:

"The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe."

The Contractor shall employ at his own cost, the services of a duly registered Health & Safety Officer. The H&S officer shall inspect on a weekly basis the health and safety procedures put in place by the Contractor and the Environmental Monitoring Plan (EMP).

In addition, the Health and Safety officer shall provide the Engineer with signed monthly reports recording the status, health and safety procedures and EMP adopted by the Contractor and include recommendations (if any) on the same".

6.13 Reporting of Accidents

Add new sub-clause 6.13 as follows:

The contractor shall report to the Engineer details of any accidents as soon as possible after their occurrence. In case of any fatal or serious accident, the Contactor shall in addition, notify the Engineer immediately by the quickest available means.

7 – PLANT, MATERIALS AND WORKMANSHIP

7.9 Quality of Materials, Plant and Workmanship

Add new Sub-Clause 7.9 as follows:

"The Contractor shall be solely responsible for the supply of the materials and equipment required for the execution of the Works. He shall ascertain himself of the availability of such materials at all times during the Contract.

The Contractor shall ensure that during all phases of the performance of the Contract he has adequate materials and plant on site and ensure adequate supplies of plant and materials will be available to him during all phases of the construction works.

The Employer shall be under no liability whatsoever whether by way of indemnity or otherwise for or in respect of shortage of materials, and/or plant equipment during the execution of the works.

The Contractor shall guarantee the strength and quality of all materials supplied by him and shall be responsible for will all workmanship; the Contractor will not be relieved of any of his obligations with respect to the sufficiency of the materials, works and workmanship thereof by reason of no objection having been expressed by the Engineer although the same may have been inspected by the latter. The Contractor shall furnish all information as to the quality, weight, constituent substances, dimensions, levels, strength and description of the materials and works and give the Engineer such particulars as may be required and/or requested.

Where applicable, on receipt of any materials supplied to the Contractor from the Employer, the Contractor shall examine such materials and if no report to the contrary is received by the Engineer within seven (7) days of the delivery of any materials they shall be deemed to have been received by the Contractor without defect or deficiency.

The Contractor shall be required, so far as may be consistent with his obligations under the Contract, to make the maximum possible use of local materials. The origin of any materials proposed must be to the Engineer's approval.

All materials and items of any kind, whether obtained from demolition, excavations or found on or under the site or on or under any other site which the Contractor may be allowed by the Employer to occupy, shall remain the property of the Employer and shall not be used in the Works or sold or otherwise disposed of without the written authority of the Engineer. No excavations are to be made upon such site or such other site beyond those shown in the drawings or described in the Specifications without the prior written authority of the Engineer. A refusal by the Engineer to grant an authority under this Clause shall be final."

8 – COMMENCEMENT, DELAYS AND SUSPENSION

8.2 Time for Completion

Add the following at the end of the sub-clause:

"Notwithstanding the above, the Contractor shall deliver the works within the time (either number of days or months), as specified in Appendix To Bid if applicable, calculated from the Commencement Date, or such extended time as may be allowed under sub-clause 8.4."

8.4 Extension of Time for Completion

Add the following after the second paragraph:

"For the application of this Clause the following shall be considered exceptionally adverse climatic conditions:

a) **Rainfall** -Intensity of rainfall in excess of 50 mm per 24 hours or continuous rainfall at the site causing an interruption of work exceeding 4 hours. Rainfall data shall be obtained by the Contractor from the Meteorological Services for the measuring station nearest to the site and shall be submitted by the Contractor, as evidence in support of any claim for extension of time.

In addition, rain gauges (to be provided and paid for by the Contractor) shall be located at the site and amount of rainfall recorded on a daily basis jointly by the Engineer and the Contractor.

The exact location of the rain gauges will be indicated by the Engineer. The rain gauge shall be fenced and locked and be under the responsibility of the Engineer. If there is any discrepancy between the Mauritius Meteorological Services figures and rainfall recorded on site, the figures recorded on site verified by the Engineer will prevail.

The Contractor shall not be entitled to any claim for additional payment for any extension of time given as a result of adverse climatic conditions described under (a) above.

Extensions of time (if any) for exceptionally adverse climatic conditions shall be assessed and awarded in working days".

b) **Torrential Rain** - An official declaration of "Torrential rain" by the Meteorological Department of Mauritius- causing the work on site to be closed.

c) **Consequential Delays** - Extensions of time (without costs) may be granted for consequential (indirect) delays following exceptionally adverse climatic conditions after due consideration of the circumstances by the Engineer.

d) **Elections** - Extensions of time may be granted for unforeseen delays that may occur from time to time as a result of local and country elections. Such extensions shall however be determined solely by the Engineer. Each delay shall be evaluated and treated on its merits.

e) **Wayleaves** - In case of any delay in the obtaining of permanent wayleaves from the RDA, CWA, CEB, WMA, District/ Municipal Council, or from private landowners or along private roads which subsequently causes an unforeseeable delay to the Works Contract, the Contractor shall be entitled to an extension of time without cost. The Contractor will however, be required to obtain all temporary wayleaves necessary for his plant, labour, materials and equipment, and bear the costs thereof. Such delays will not entail costs associated with the extension of time. The Contractor shall make all prior arrangements and provide ample notice as per the requirement of the Contract.

f) **Wind - Cyclone Warning Class 3 and above** – The Contractor shall be entitled to an extension of time (without costs) for any delays incurred as a result of cyclones Class 3 and above prevailing in Mauritius.

g) **Non Approval of Traffic Diversion Schemes** - Extensions of time or costs requested as a result of delays to and disruption of construction activities due to **non-approval** of traffic diversion schemes by the Authorities or Engineer due to **non-compliance** by the Contractor with the Authorities requirements, shall not be considered. This shall be the sole responsibility of the Contractor who will be expected to beforehand plan the schedule of road closures and traffic diversion scheme in order to provide the Authorities with ample notice, as per the requirements of the contract.

8.7 Delay Damages

Delete the text of Sub-Clause 8.7 and substitute:

"If the Contractor fails to comply with the Time for Completion in accordance with Sub-Clause 8.2 for the Whole of the Works or, if applicable, any section within the relevant time prescribed by Sub-Clause 8.2, then the Contractor shall pay the Employer the amount per calendar day stated in Appendix to Bid as Delay Damages for such default and not as a penalty for every day or part of a day which shall elapse between the time prescribed by Sub-Clause 8.2 hereof or extended time as the case may be and the date of completion of the Works.

The Employer may, without prejudice to any method of recovery, deduct the amount of such damages from any monies due, or which may become due, to the Contractor following the procedures set out in the Conditions of Contract (Employer's Claims). The payment or deduction of any such damages shall not relieve the Contractor from his obligation to complete the Works or from any other of his obligations and liabilities under the Contract."

8.13 Engineer's Approval of Temporary Works

Add new Sub-Clause 8.13 as follows:

"Notwithstanding any approval, consent, advice or permission given by the Engineer or the Engineer's Representative with respect to Constructional Plant, Temporary Works or materials for Temporary Works, whether required by the Contract or not, the Contractor shall remain responsible for the cost and execution of all Temporary Works in fulfilment of the Contract as if no such approval, advice

or permission had been given, and shall have no claim on the Employer or the Engineer or the Engineer's Representative for additional payment in respect of any additional cost which the Contractor may consider to have been incurred as a result of giving such approval, consent, advice or permission, as aforesaid.

The costs for all Temporary Works shall be deemed to be included in the Contractor's rates for the Permanent Works. No claim shall be permitted should the Contractor's design of any of the temporary works in his Bid differ from that required under the Works Contract."

9 – TESTS ON COMPLETION

9.1.1 Cost of Tests

Add the following paragraph 9.1.1 to Sub-Clause 9.1:

"The cost of making any test shall be borne by the Contractor whether or not such test is clearly provided for or implied in the specifications and (in case only of test under load or for a test to ascertain whether the design of any finished or partially finished work is appropriate for the purpose which it was intended to fulfil) is particularized in the Specification in sufficient detail to enable the contractor to price or allow for same in the Schedule of prices and/or the Bills of Quantities".

9.1.2 Tests Ordered by the Engineer

Add the following paragraph 9.1.2 to Sub-Clause 9.1:

"If any test is ordered by the Engineer which is either:

(a) Not so provided for or implied, or
(b) (in case above mentioned) is not so particularized, or
(c) (though so provided for or implied) is ordered by the Engineer to be carried out by an independent person at any place other than the Site or at the place of manufacture or fabrication of materials tested, the cost of such test shall be borne by the Contractor if the test shows the workmanship or materials to be not in accordance with the provision of the Contract or the Engineer's instruction but otherwise by the Employer."

9.1.3 Facilities for Test on Completion

Add the following paragraph 9.1.3 to Sub-Clause 9.1:

"Except where otherwise specified, the Contractor shall provide such Labour, materials, electricity, fuel, water, tools and apparatus as may be required to carry out the Tests."

13 – VARIATIONS AND ADJUSTMENTS

13.1 Right to Vary

Add the following paragraph to Sub Clause 13.1;

"The omission of any work ordered by the Engineer under item (d) of this Sub Clause shall not entitle the Contractor to claim for any loss of profit or unabsorbed head office overheads for such omitted work."

13.5 Provisional Sums

Add the following paragraphs to sub Clause 13.5:

"Provisional Sums, (whether used or not) shall be deemed to form part of the Contract. As such, where fully described, they shall be considered to be defined for the purposes of the Contract. The Contractor is deemed to have allowed in his programme and P&G costs for carrying out the work under defined provisional sums.

Additional work (if any) instructed by the Engineer to be carried out under the Provisional Sum listed as **'Additional and Contingent Works'** in Bill 1 and other **Contingent Provisional Sum Items** listed in the Bill of Quantities, shall be considered to be undefined and shall, after due consideration of the circumstances, be considered as Variations under the Contract pursuant to Clause 13 and shall be valued in accordance with Clause 12".

The Contractor's "on-costs" (levied on invoices supplied for the purchase of materials and goods only) to be added to the amounts (if any) spent under each Provisional Sum shall be as set out in Part A – Appendix to Tender.

"As an exception to the above, the Provisional Sum for the cost of the DAB, if and when applicable, shall be used for payments to the Contractor of the Employer's share (one-half) of the invoices of the DAB for its fees and expenses, in accordance with GC 20.2. No prior instruction of the Engineer shall be required with respect to the work of the DAB. The Contractor shall produce the DAB invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Sub-Clause 14.3, which contain requests for payment under the Provisional Sum toward the cost of the DAB.

The Engineer's certification of such Statements shall be based upon such invoices and such evidence of payment by the Contractor. Contractor's overhead, profit, etc., shall not be included in the Provisional Sums for the cost of the DAB."

13.8 Adjustment for Changes in Cost

Delete this Sub-Clause in its entirety and substitute by:

"No adjustments to the contract price shall be made in respect of any rise or fall in the cost of labour, materials, and transport."

14 – CONTRACT PRICE AND PAYMENT

14.1 The Contract Price

Insert the following paragraphs after sub-paragraph (d) of Sub-Clause 14.1:

"The Contractor, before bidding, shall have acquainted himself with all regulations with respect to the importation of plant and equipment, material and labour regulations regarding fiscal taxes, custom duties, registration duties, transfer of capital, etc., and all regulations regarding the importation of unskilled labour, supervisory staff and other personnel for the execution of the work and shall comply with the said regulations.

The Contractor and his staff shall pay and shall be liable for all taxes, duties, charges, levies and the like which may be payable in respect of profits or income of himself or his employees or in respect of materials, or under the contract.

14.15 Currencies of Payment

Delete the whole text of Sub-Clause 14.15.

The contract price shall be indicated in Mauritian Rupees, and payments shall be effected in Mauritian Rupees only.

14.16 Import and Export Licences

Add new Sub-Clause 14.16 as follows:

"When dealing with his suppliers, the Contractor shall obtain his own information with regard to the granting of import and export licenses for materials, plant and any other items required for meeting his obligations under the Contract. The Contractor shall bear all expenses for plant, materials, equipment and other things required for the completion and maintenance of the Works and shall be deemed to have satisfied himself with regard to all his liabilities under the laws and regulations governing the granting of these licenses. The Employer shall not be responsible or liable for any failure on the part of the Contractor in this respect."

14.17 Taxation and Duties

Add new Sub-Clause 14.17 as follows:

"The Contractor and his staff shall be liable to pay all income or other taxes and customs duties as required by regulations which may be in force before, during or after the period of the Contract."

14.18 Regulations, Income Tax, Customs Duties and Immigration Laws

Add new Sub-Clause 14.18 as follows:

"Before the submission of his tender, the Contractor shall be deemed to have satisfied himself with all regulations in respect of importation of plant and

equipment, material and labour regulations, inter alia regarding fiscal taxes, custom duties, Value Added Tax, registration duties, transfer of capital, etc., and all regulations regarding the importation of unskilled labour, supervisory staff and other personnel for the execution of the work and shall comply with the said regulations.

No claim by the Contractor for additional payment will be entertained by the Employer on the grounds of any misunderstanding or any misleading information in respect of any such matter or otherwise."

17 – RISK AND RESPONSIBILITY

17.2 Contractor's Care of the Works

Insert in paragraph 3, line 2 of Sub Clause 17.2 after the sentence "From any cause up to [Employer's Risks]" add the following words "including cyclones and floods"

Insert the following paragraphs after paragraph 4:

"The Contractor will be responsible for the protection of all existing road furniture and bridges etc. against damage by his construction traffic. In particular, the Contractor shall take sufficient care so as not to damage the existing District/ Municipal Council, RDA classified or all other non-classified roads or road furniture (i.e. signage, kerbing, bollards, pathways, handrailing, drains, road markings, traffic lights, cables, electrical switchgear, streetlights and the like). Any damage to roads and/or road furniture caused by construction traffic or plant shall be made good by the Contractor at his own expense to the satisfaction of the Engineer and the relevant Authorities.

Damage (if any) to the wearing and base courses of existing roads within the site area and/or the area surrounding the site by the Contractor's construction traffic, shall be reinstated to at least the standard they were before construction commenced. The Contractor shall not be held responsible for the cost of remedying damage caused by others.

The Contractor will also be held liable for the costs of repairs for damage (if any) to residential and commercial properties in the catchment areas as a result of his methods of construction.

Any damage to properties by the Contractor which occurs as a result of the Works, including cracking of house walls, boundary walls, fences, pavements and the like, shall be made good to their original condition at the Contractor's expense. The Contractor's all risk insurance policy shall be deemed to cover these costs and indemnify the Employer against any claims by residents for costs as a result of damage to property.

The Contractor shall ensure that sufficient precautionary measures are taken and put in place to prevent the flow of debris/eroded soil etc. along all work fronts from the construction operations as a result of heavy rainfall.

Before undertaking any work, the Contractor is deemed to have adjusted his work methodology and work schedule to suit the local site conditions. In particular, he shall respect the requirements of the Traffic Management Plan (TMP) prepared by the Engineer and approved by the Traffic Management and Road Safety Unit (TMRSU).

The work schedule shall be conducive to the requirements of the concerned Local Authority. The Contractor's work schedule shall be prepared under two formats:-

i) The Contractor shall not be entitled to any extension of time should approvals by Authorities be delayed as a result of non-compliance by the Contractor with the requirements of the Authorities. Cost implications (if

any) resulting from any delays from these circumstances shall be borne solely by the Contractor.

ii) Delays in approvals by any Authority for any other reason other than non-compliance shall not be the responsibility of the Contractor. Such delay will entitle the contractor to an extension of time, but without any associated cost.

The Contractor shall ensure adequate deployment of plant, labour and materials on site immediately after approval is received from the relevant Authorities. Any delay in deployment of the above shall be the Contractor's sole responsibility.

Roads, depending on their widths, may be closed completely to allow work to be carried out and completed within an appropriate time limit subject to the approval of the Engineer and Local Authorities. Such approval will be considered only after the Contractor has proved beyond reasonable doubt that works cannot proceed with "single lane" closure.

Such traffic control for any single-lane traffic and/or road partial or full closures shall be the responsibility of the contractor, and shall be deemed to be included in his rates, as well as all the required associated arrangements, including notifications and clearances and/or approvals from the relevant Authorities.

Such site works shall be completed and reinstated before the work proceeds to another location and before the Contractor is given possession of any other road or part of the site.

Except in cases due to circumstances beyond his control, the Contractor shall be responsible for the consequences if the Works are not completed within the specified time limits. He shall take immediate remedial action to comply with such time limits imposed.

In preparing the above mentioned "Detailed Work Schedule" under the coordination of the Employer and Engineer, the Contractor shall take into account the following general requirements:-

- To strictly abide by the requirements of the TRMSU and District/ Municipal Council with regards to traffic diversions and traffic management

- Pedestrian access to all roadside buildings/shops/restaurants to be maintained at all times.

While awaiting final reinstatement, the Contractor shall regularly top up backfilled trenches to final road level. This shall be to the satisfaction of the Engineer and Local Authority in order that settled excavations do not become a danger to road users.

The Contractor shall ensure at all times that the final cover level of all newly constructed manholes are set and fixed flush with the final road level and do not constitute a danger to road users until the final reinstatement is cleared by the Authority in charge.

The Contractor shall attend Steering Committees which may be set-up and take part in public relations campaigns which may be organised and take the necessary action accordingly.

Temporary wayleaves will however need to be obtained by the Contractor for working along public roads prior to the commencement of work. These temporary wayleaves will need to be obtained from the responsible Authorities and possibly from private landowners along the routes.

The Contractor shall comply with the requirements of the said Authorities with respect to traffic diversions and/or any other measures required for the safety of road users and the general public.

Road signs shall comply with the standards required by the relevant Authority. Any special road signs that may be required will be subject to the Authorities' approval, and shall be deemed to be included in the contractor's rates.

Similarly where work is to be carried out by the Contractor within or across private properties or roads, he shall plan and organize the work in agreement with the requirements of the owners, all at his own costs.

The costs associated with the obtaining of temporary wayleaves shall be borne by the Contractor. Such costs shall be deemed to be included in the Contractor's rates.

The Contractor shall bear the cost of all the requirements of the different Authorities including the Traffic Police, District/ Municipal Council, Traffic Management and Road Safety Unit, National Transport Authority, Road Development Authority, Water Resources Unit, Irrigation Authority, Central Water Authority, Public Transport Companies, Central Electricity Board, Mauritius Telecom and Forestry Department.

Before undertaking any work on any road, the Contractor shall provide the Engineer with written proof of the authorisation and temporary wayleaves obtained from the Authorities in order to obtain the Engineer's approval prior to proceeding with the Works.

Provisional Acceptance Certificate – RDA/District/Municipal Council Roads

When the road reinstatement works on RDA, District/ Municipal Council roads have been substantially completed, the Contractor shall apply to the Road Development Authority, District/ Municipal Council for the issue of a Provisional Acceptance Certificate. The request shall be accompanied by:

(a) A Consulting Engineer's certificate to the effect that the works have been carried out as per the specifications of the Road Development Authority, District/ Municipal Council and

(b) The results of compaction tests on the sub-grade and crusher-run at intervals of 50m or as directed by RDA, District/ Municipal Council Representatives, carried out by the Materials Testing Laboratory of the Road Development Authority; when the latter is satisfied that the road surface and road furniture have been reinstated to a

condition similar to their initial condition, a Provisional Acceptance Certificate shall be issued.

(c) Any other condition that may be imposed the RDA, District/ Municpal Council.

The Road Development Authority and/or the District/ Municipal Council as the case may be, reserves the right, if it is not satisfied with the reinstatement, to have tests, including deflection tests carried out on the reinstated trenches and if the results are not conclusive, appropriate remedial action shall be requested from the Contractor and the cost for testing debited from any Bank Guarantee / Deposit – which have been priorily been requested b the concerned Authorities from the Contractor.

Following the issue of a Provisional Acceptance Certificate, the Contractor shall be responsible to maintain the reinstatement works for a maintenance period of twelve (12) months, whether or not this period goes beyond the Defects Notification Period under the Contract.

Any settlement of the trenches during the above-mentioned maintenance period shall be made good immediately by the contractor to the satisfaction of the Road Development Authority, District/ Municipal Council, failing which the relevant Authority shall carry out the works and claim the costs from the Contractor or deduct same from any Bank Guarantee / Deposit which would have been priorily requested by the concerned Authorities from the Contractor.

Final Acceptance Certificate - RDA/District Council Roads

One month prior to the end of the above-mentioned maintenance period, a joint site visit by the representatives of Road Development Authority, District/ Municipal Council, the Contractor and the Engineer shall be carried out.

All defects shall be noted and appropriate remedial measures requested from the Contractor by the Engineer.

If it is satisfied that all defects have been satisfactorily remedied, the Road Development Authority, District/ Municipal Council shall issue a Final Acceptance Certificate, stating the effective date on which the Contractor shall have completed his obligations towards the relevant Authority.

18 – INSURANCE

18.1 General Requirements for Insurance

Insert the following after the first paragraph:

"In this Clause the insuring party shall be the Contractor."

18.2 Insurance for Works and Contractor's Equipment

Delete the first line before sub-paragraph (a) and insert the following:-

"Insurance for the "Works" commonly referred to as the Contractor's All Risk Policy (CAR) shall be effected and maintained by the Contractor as the insuring Party." Such insurance shall compulsorily be obtained and produced to the Employer before any works can start.

18.3 Insurance against Injury to Persons and Damage to Property

Insert the following paragraphs at the end of Sub-Clause 18.3:

"The Insurance policy must specify that any employee of the Employer, the Engineer and his representatives, as well as the employees of any other company employed on the site are to be considered as third parties on the policy, over and above the members of the public in general.

The insurance policies shall include a clause forbidding their cancellation without the Insurer giving prior notice to the Employer. The Insurance Company shall be a company registered in Mauritius or, if a foreign company, shall have a "back to back" arrangement with a local insurance company approved by the Employer."

20 – CLAIM, DISPUTES AND ARBITRATION

20.1 Contractor's Claims

Insert the following at the end of Sub-Clause 20.1:

"Claims for additional costs (if any) associated with extensions of time shall be evaluated and calculated solely from the Contractor's relevant time-related items and relevant fixed cost items as inserted in Bill No 1 of the Bill of Quantities, and as detailed in Clause 24 of the Preamble to the Bill of Quantities."

20.2 Appointment of the Dispute Adjudication Board (DAB)

Delete the Sub-Clause in its entirety.

20.3 Failure to Agree Dispute Adjudication Board

Delete the Sub-Clause in its entirety.

20.4 Obtaining Dispute Adjudication Board's Decision

Delete the Sub-Clause in its entirety.

20.6 Arbitration

Delete this sub-Clause in its entirety and replace as follows:

(i) If any dispute or difference of any kind whatsoever shall arise between the Employer or the Engineer on his behalf on one hand and the Contractor on the other hand in connection with or arising out of the contract or the carrying out of the works (whether during the progress of the works or after their completion and whether before or after the termination, abandonment or breach of Contract) it shall be referred to the sole arbitration of a person mutually acceptable to the contracting parties; failing agreement within 30 days after either party has given to the other a written request to concur in the appointment of an Arbitrator, such dispute or differences shall be referred to and settled by a judge of the Supreme Court of Mauritius.

(ii) The appointment of the Arbitrator and proceeding of Arbitration shall be conducted in accordance with the Code of Civil Procedure in force in Mauritius.

(iii) The aggrieved party shall specify the dispute or difference to be referred to arbitration together with the amount(s) claimed in respect of such dispute or difference.

(iv) The non-settlement of disputes between the Employer and the Contractor shall not entitle the Contractor to stop or abandon the works.

(v) The said Arbitrator shall, without prejudice to the generality of his powers, have power to direct such measurement and such valuation as may in his opinion be desirable to determine the rights of the parties and to ascertain

and award any sum which ought to have been the subject of or included in any certificate and to open up, review and revise any certificate and to open decision, requirement or notice and to determine all matters in dispute which shall be submitted to him in the same manner as if no such certificate opinion, decision, requirement or notice, had been given.

(vi) The Arbitrator shall not enter on the reference until after the completion or alleged completion of works unless with the written consent of the Employer and the Contractor provided always:

(a) That such reference may be opened before such completion or alleged completion in respect of the withholding by the Engineer of any certificate or the withholding of any portion of the retention money to which the Contractor claims in accordance with the Conditions set out in Clause 14.9 of the Conditions of Contract Part II or in respect of the exercise of the Engineer's power to give a certificate under Clauses 15 and 16.

(b) That the giving of a certificate of completion under Clauses 15 and 16 hereof shall not be a condition precedent to the opening of such reference.

(vii) The place of arbitration shall be Mauritius.

(viii) The cost of Arbitration proceedings shall be equally shared by both parties.

(ix) The Arbitrator's decision shall be final and binding on both parties.

20.7 Failure to Comply with Dispute Adjudication Board's Decision

Delete the Sub-Clause in its entirety.

20.8 Expiry of Dispute Adjudication Board's Appointment

Delete the Sub-Clause in its entirety.

SECTION VIII

CONTRACT FORMS

Section VIII - 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.

TABLE OF FORMS

LETTER OF ACCEPTANCE

FORM OF CONTRACT AGREEMENT

FORM OF PERFORMANCE SECURITY

FORM OF ADVANCE PAYMENT SECURITY

APPENDIX A TO BID

LETTER OF ACCEPTANCE

LETTER OF ACCEPTANCE

[on letterhead paper of the Employer*]*

. . . . . *[date]*. . . . . .

To: . . . . . *[name and address of the Contractor]* . . . . . .

Subject: . . . . . *[Notification of Award Contract No]*. . . . . .

This is to notify you that your Bid dated . . . . *[insert date] . . . .* for execution of the . . . . . *.[insert name of the contract and identification number, as given in the Appendix to Bid]* . . . . . for the Accepted Contract Amount of the equivalent of . . . . . *.[insert amount in numbers and words and name of currency]*, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by **SIT Property Development Ltd.**

You are requested to furnish the **Performance Security** within **14 days** in accordance with the General Conditions of Contract, using for that purpose of the Performance Security Form included in Section VIII (Contract Forms) of the Bidding Document.

Authorized Signature: .....

Name and Title of Signatory: .....

Name of Agency: .....

Attachment: **Contract Agreement**

FORM OF CONTRACT AGREEMENT

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR.

CONTRACT NO: SPDL/RFP/C2024/29

CONTRACT AGREEMENT

THIS AGREEMENT made the . . . . . .day of . . . . . ., ..., between **SIT PROPERTY DEVELOPMENT LTD** (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 **INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - CONTRACT NO: SPDL/RFP/C2024/29** should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

   (a) the Letter of Acceptance

   (b) the Bid

   (c) the Addenda Nos . . . . . *[insert addenda numbers if any]*. . . . .

   (d) the Appendix to Bid

   (e) the Particular Conditions of Contract

   (f) the General Conditions of Contract;

   (g) the Specification

   (h) the Drawings; and

   (i) the completed Schedules,

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 where of the parties hereto have caused this Agreement to be executed in accordance with the laws of Mauritius on the day, month and year indicated above.

Signed on behalf of the Employer:

Name: ..... Signature: .....

Position: ..... Date: .....

Common Seal: .....

In presence of:

Name: ..... Signature: .....

Position: ..... Date: .....

Signed on behalf of the Contractor:

Name: ..... Signature: .....

Position: ..... Date: .....

Common Seal: .....

In presence of:

Name: ..... Signature: .....

Position: ..... Date: .....

FORM OF PERFORMANCE SECURITY

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR.

CONTRACT NO: SPDL/RFP/C2024/29

PERFORMANCE SECURITY

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

Beneficiary: SIT PROPERTY DEVELOPMENT LTD

Beneficiary Address: Ground Floor, NG Tower, Cybercity Ebène

Date: .....

PERFORMANCE GUARANTEE
No.:.....

We have been informed that .....*name of the Contractor*..... (hereinafter called "the Contractor") has entered into Contract No.....*reference number of the Contract*..... dated..... with you, for the execution of ..... *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 security is required.

At the request of the Contractor, 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)*..... such sum being payable in the types and proportions of currencies in which the Contract Price is payable, 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 not later than **twenty-eight (28) days** from the date of issuance of the Performance Certificate, calculated based on a copy of such Certificate which shall be provided to us, or on the.....day of ....., ..., whichever occurs first. 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)*.....

FORM OF ADVANCE PAYMENT SECURITY

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR.

CONTRACT NO: SPDL/RFP/C2024/29

ADVANCE PAYMENT SECURITY

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

Beneficiary: SIT PROPERTY DEVELOPMENT LTD

Beneficiary Address: Ground Floor, NG Tower, Cybercity Ebène.

Date: .....

Advance Payment Guarantee No.: .....

We have been informed that . . . . . *[name of the Contractor]. . . . .* (hereinafter called "the Contractor") has entered into Contract No. . . . . *[reference number of the Contract]. . . . .* dated . . . . . .with you, for the execution of . . . . . *[name of contract and brief description of Works]. . . . .* (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum . . . . . *[name of the currency and amount in figures]* [1]*. . . . . .* (. . . . . *[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.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number . . . . . *[Contractor's account number]. . . . .* at . . . . . *[name and address of the Bank]. . . . .* .

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 . . . . . , ... [2], whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

. . . . . [*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.

1 The Guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.

2 Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

APPENDIX A TO BID

SIT PROPERTY DEVELOPMENT LTD

INFRASTRUCTURE WORKS TO SITES S7, S8, S9 & S10 IN MORCELLEMENT AUREA LIVING HARMONY, COTE D'OR - PROCUREMENT REFERENCE NO.: SPDL/RFP/C2024/29

APPENDIX A TO BID

[Note: with the exception of the items for which the Employer's requirements have been inserted, the following must be completed before the bid is submitted]

Item	Sub-Clause	Data
Employer's name and address	1.1.2.2 & 1.3	Name: **SIT Property Development Ltd** Address: **Ground Floor, NG Tower, Cybercity, Ebène**
Contractor's name and address	1.1.2.3 & 1.3	Name:…… Address:……
Engineer's name and address	1.1.2.4 & 1.3	Name: **Scene Ries Consult Ltd** Address: **3, Thelemaque Street, Rose Hill, Mauritius** Tel: **4544294, 4654046**
Time for completion of the works	1.1.3.3	**450 days**
Defects notification period	1.1.3.7	**365 days**
Electronic transmission systems	1.3	E-mail followed by written form
Governing law	1.4	Laws of the Republic of Mauritius
Ruling language	1.4	English
Language for communications	1.4	English
Time for access to the site	2.1	At the Commencement date

Initials of signatory of Bid:…… Date: ……

Item	Sub-Clause	Data
Amount of Performance Security	4.2	**10 %** of the Accepted Contract Amount
Normal working hours	6.5	Normal working hours as per the Labour Laws of the Republic of Mauritius
Delay damages for the works	8.7 & 14.15(b)	**MUR 50,000** per calendar day
Maximum amount of delay damages	8.7	**10%** of the final Contract Price
Percentage of adjustment of Provisional sums	13.5(b)	**5%** on costs
Total Advance Payment	14.2	**10 %** of the Accepted Contract Amount less Provisional Sums, Dayworks and Contingency
Number and timing of installments	14.2	One installment
Start repayment of advance payment	14.2(a)	On 1st Certificate
Repayment amortisation of Advance Payment	14.2(b)	**10%**
Percentage of retention	14.3	**10%** of Interim Applications
Limit of Retention Money	14.3	**5%** of the Accepted Contract Amount
Plant and Materials for payment when shipped en route to the site	14.5(b)	**Nil**
Plant and Materials for payment when delivered to the site	14.5(c)	**Plants: Nil** **Materials:** • Kerbs, • Precast Drains, • Gratings, • PE Pipes, • Valves, • Sewer Pipes, • Manhole Covers, • uPVC Ducts

Initials of signatory of Bid:..... Date: .....

Item	Sub-Clause	Data
Minimum amount of interim Payment Certificates	14.6	**MUR 5 Million**
Currency / currencies of payment	14.15	**Mauritian Rupee (MUR)**
Maximum total liability of the contractor to the Employer	17.6	The Accepted Contract Amount
Periods for submission of insurance: a) Evidence of insurance b) Relevant policies	 18.1 18.1	 Within 14 days of the letter of acceptance Within 14 days of the letter of acceptance
Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	**MUR 100,000 per occurence**
Minimum amount of third party insurance	18.3	• **MUR 5 million** per occurrence with the number of occurrence unlimited • Workers' insurance ceiling of **MUR 10 million** cover
Date by which the dispute Adjudication Board shall be appointed	20.2	Not Applicable

Initials of signatory of Bid:…… Date: ……..