



TENDER DOCUMENT FOR

**PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS
AT
KISUMU INTERNATIONAL AIRPORT**

TENDER No. KAA/OT/KIA/0090/2024-2025

FEBRUARY 2025

MANAGING DIRECTOR/CEO KENYA AIRPORTS AUTHORITY P.O BOX 19001 – 00501 NAIROBI	GENERAL MANAGER (P & ES) KENYA AIRPORTS AUTHORITY P.O OX 19001 – 00501 NAIROBI
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INVITATION TO TENDER

PROCURING ENTITY: KENYA AIRPORTS AUTHORITY

CONTRACT NO; KAA/OT/KIA/0090/2024-2025

DATE: 11.02.2025

CONTRACT NAME: ***PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS
AT KISUMU INTERNATIONAL AIRPORT***

1. Kenya Airports Authority invites sealed tenders for ***Proposed Runway Widening and Pavement Repairs at Kisumu International Airport***
2. Tendering will be conducted under open competitive method (National) using a standardized tender document. Tendering is open to all qualified and interested Tenderers.
3. Qualified and interested tenderers may obtain further information and inspect the Tender Documents during office hours *0800hrs to 1300 hrs. and 1400hrs to 170hrs* at the address given below.
4. A complete set of Tender documents are downloadable from the KAA supplier login screen using the link <https://kaa.go.ke/corporate/procurement/>. Tender documents obtained electronically will be free of charge.
5. Tender documents may be viewed and downloaded for free from the website www.kaa.go.ke. Tenderers who download the tender document must forward their particulars immediately to tenders@kaa.go.ke to facilitate any further clarification or addendum. *No other communication channel shall be used except through this email address.*
6. All Tenders must be accompanied by a tender Security of Kenya shillings **1,400,000.00** valid for a period of 216 days from the tender opening date.
7. The Tenderer shall chronologically serialize all pages of the tender documents submitted including any attachments.
8. The tender shall be submitted online on or before **27TH February, 2025** at 11.00 am. Interested bidders who are not in KAA system and therefore do not have login credentials should contact KAA procurement through email: tenders@kaa.go.ke for login credentials early enough and not later than three (3) days before tender closing date. All relevant submission documents must be attached on the login screen (Technical Proposal on C folder under technical Rfx Response system will lead you to the second screen (C folder) where the system creates a folder specific to you for uploading your response documents, click on “Tech Bid” the system will allow you to create a document, click “create” button and attach the documents. and Financial Proposal on Price Submission Screen). A step-by-step manual/guide is available for downloading using the link <https://www.kaa.go.ke/corporate/procurement/manuals/>. Bidders should note that documents submitted for purposes of registration for login credentials do not form part of the tender document.

9. All Prices quoted should be inclusive of all costs and taxes; and must be in Kenya shillings and shall remain valid for 126 days from the closing date of Tender.
10. Tenders will be opened online immediately on **27TH February, 2025** at 11.00 am at the Conference Room, 1st Floor, Procuring Entity Headquarters complex building. In observing the protocols as provided by the Ministry of Health of the prevention of COVID-19 there shall be no physical attendance of the tender opening. However, a virtual link shall be provided to those tenderers who shall submit their tenders online and would wish to participate in the tender opening. Tenderers shall therefore be required to submit their email address to tenders@kaa.go.ke to enable them access this link during tender opening.
11. Bidders shall not have access to the eProcurement system after the official closing time.

12. The addresses referred to above are:

a. Address for obtaining further information and for purchasing tender documents

Name of Procuring Entity	-	KENYA AIRPORTS AUTHORITY
Physical address	-	Kenya Airport Authority Headquarters Complex building, Jomo Kenyatta International Airport, Airport North Road, 2 nd Floor, Procurement & Logistics Department.
Postal Address	-	P. O Box 19001 – 00501 Nairobi
Officer to be contacted	-	General Manager, Procurement and Logistics.
Email	-	tenders@kaa.go.ke

b. Address for Submission of Tenders.

Name of Procuring Entity	-	KENYA AIRPORTS AUTHORITY
Postal Address	-	include designation to be attention of) General Manager (Procurement & Logistics), P.O. Box 19001-00501 Nairobi

Tenders shall be submitted through the eProcurement portal.

c. Address for Opening of Tenders.

Name of Procuring Entity	-	KENYA AIRPORTS AUTHORITY Kenya Airports Authority Headquarters Complex Building, Jomo Kenyatta International Airport, Airport North Road, 2 nd Floor, Procurement & Logistics Department.
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Bidders should note that all our tenders shall be opened virtually through a link to be provided.
Date of advertisement of the Tender Notice: Date: **27TH February, 2025**

PART 1 – TENDERING PROCEDURES

SECTION 1 – INSTRUCTIONS TO TENDERERS

A. GENERAL PROVISIONS

1.0 Scope of Tender

- 1.1 The Procuring Entity as defined in the Appendix to **Conditions of Contract** invites tenders for Works Contract as described in the tender documents. The name, identification, and number of lots (Contracts) of this Tender Document are **specified in the TDS**.

2.0 Fraud and Corruption

- 2.1 The Procuring Entity requires compliance with the provisions of the Public Procurement and Asset Disposal Act, 2015, Section 62 “Declaration not to engage in corruption”. The tender submitted by a person shall include a declaration that the person shall not engage in any corrupt or fraudulent practice and a declaration that the person or his or her sub-contractors are not debarred from participating in public procurement proceedings.
- 2.2 The Procuring Entity requires compliance with the provisions of the Competition Act 2010, regarding collusive practices in contracting. Any tenderer found to have engaged in collusive conduct shall be disqualified and criminal and/or civil sanctions may be imposed. To this effect, Tenders shall be required to complete and sign the “Certificate of Independent Tender Determination” annexed to the Form of Tender.
- 2.3 Tenderers shall permit and shall cause their agents (where declared or not), subcontractors, sub-consultants, service providers, suppliers, and their personnel, to permit the Procuring Entity to inspect all accounts, records and other documents relating to any initial selection process, pre-qualification process, tender submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Procuring Entity.
- 2.4 Unfair Competitive Advantage -Fairness and transparency in the tender process require that the firms or their Affiliates competing for a specific assignment do not derive a competitive advantage from having provided consulting services related to this tender. To that end, the Procuring Entity shall indicate in the **Data Sheet** and make available to all the firms together with this tender document all information that would in that respect give such firm any unfair competitive advantage over competing firms.

3.0 Eligible Tenderers

- 3.1 A Tenderer may be a firm that is a private entity, a state-owned enterprise or institution subject to ITT 3.8, or an individual or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the tendering process and, in the event

the JV is awarded the Contract, during contract execution. Members of a joint venture may not also make an individual tender, be a subcontractor in a separate tender or be part of another joint venture for the purposes of the same Tender. The maximum number of JV members shall be specified in the **TDS**.

3.2 Public Officers of the Procuring Entity, their Spouses, Child, Parent, Brothers or Sister. Child, Parent, Brother or Sister of a Spouse, their business associates or agents and firms/organizations in which they have a substantial or controlling interest shall not be eligible to tender or be awarded a contract. Public Officers are also not allowed to participate in any procurement proceedings.

3.3 A Tenderer shall not have a conflict of interest. Any tenderer found to have a conflict of interest shall be disqualified. A tenderer may be considered to have a conflict of interest for the purpose of this tendering process, if the tenderer:

- a) Directly or indirectly controls, is controlled by or is under common control with another tenderer; or
- b) Receives or has received any direct or indirect subsidy from another tenderer; or
- c) Has the same legal representative as another tenderer; or
- d) Has a relationship with another tenderer, directly or through common third parties, that puts it in a position to influence the tender of another tenderer, or influence the decisions of the Public Officers; or
- e) Any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the goods or works that are the subject of the tender; or
- f) any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as a consultant for Contract implementation; or
- g) Would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the contract specified in this Tender Document; or
- h) Has a close business or personal relationship with senior management or professional staff of the Procuring Entity who has the ability to influence the bidding process and:
 - i. are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract; or
 - ii. may be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract.

3.4 A tenderer shall not be involved in corrupt, coercive, obstructive or fraudulent practice. A tenderer that is proven to have been involved in any of these practices shall be automatically disqualified.

3.5 A Tenderer (either individually or as a JV member) shall not participate in more than one Tender, except for permitted alternative tenders. This includes participation as a subcontractor in other Tenders. Such participation shall result in the disqualification of all Tenders in which the firm is involved. Members of a joint venture may not also make an individual tender, be a subcontractor in a separate tender or be part of another joint venture for the purposes of the same Tender. A firm that is not a tenderer or a JV member may participate as a subcontractor

in more than one tender.

3.6 A Tenderer may have the nationality of any country, subject to the restrictions pursuant to ITT3.9. A Tenderer shall be deemed to have the nationality of a country if the Tenderer is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or sub-consultants for any part of the Contract including related Services.

3.7 A Tenderer that has been debarred from participating in public procurement shall be ineligible to tender or be awarded a contract. The list of debarred firms and individuals is available from the website of PPRA www.ppra.go.ke.

3.8 A Tenderer that is a state-owned enterprise or a public institution in Kenya may be eligible to tender and be awarded a Contract(s) only if it is determined by the Procuring Entity to meet the following conditions, i.e. if it is:

- i) A legal public entity of Government and/or public administration,
- ii) financially autonomous and not receiving any significant subsidies or budget support from any public entity or Government, and
- iii) operating under commercial law and vested with legal rights and liabilities similar to any commercial enterprise to enable it compete with firms in the private sector on an equal basis.

3.9 Firms and individuals shall be ineligible if their countries of origin are:

- a) As a matter of law or official regulations, Kenya prohibits commercial relations with that country, or
- b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Kenya prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country.

A tenderer shall provide such documentary evidence of eligibility satisfactory to Procuring Entity, as Procuring Entity shall reasonably request.

3.10 Foreign tenderers are required to source at least forty (40%) percent of their contract inputs (in supplies, local subcontracts and labor) from citizen suppliers and contractors. To this end, a foreign tenderer shall provide in its tender documentary evidence that this requirement is met. Foreign tenderers not meeting this criterion will be automatically disqualified. Information required to enable the Procuring Entity determine if this condition is met shall be provided for this purpose in "SECTION III-EVALUATION AND QUALIFICATION CRITERIA, Item 9"

3.11 Pursuant to the eligibility requirements of ITT4.10, a tender is considered a foreign tenderer, if the tenderer is not registered in Kenya or if the tenderer is registered in Kenya and has less than 51 percent ownership by Kenyan citizens. JVs are considered as foreign tenderers if the individual member firms are not registered in Kenya or if are registered in Kenya and have less

than 51 percent ownership by Kenyan citizens. The JV shall not subcontract to foreign firms more than 10 percent of the contract price, excluding provisional sums.

3.12 The National Construction Authority Act of Kenya requires that all local and foreign contractors be registered with the National Construction Authority and be issued with a Registration Certificate before they can undertake any construction works in Kenya. Registration shall not be a condition for tender, but it shall be a condition of contract award and signature. A selected tenderer shall be given opportunity to register before such award and signature of contract. Application for registration with National Construction Authority may be accessed from the website www.nca.go.ke.

3.13 The Competition Act of Kenya requires that firms wishing to tender as Joint Venture undertakings which may prevent, distort or lessen competition in provision of services are prohibited unless they are exempt in accordance with the provisions of Section 25 of the Competition Act, 2010. JVs will be required to seek for exemption from the Competition Authority. Exemption shall not be a condition for tender, but it shall be a condition of contract award and signature. A JV tenderer shall be given opportunity to seek such exemption as a condition of award and signature of contract. Application for exemption from the Competition Authority of Kenya may be accessed from the website www.cak.go.ke.

3.14 A Kenyan tenderer shall be eligible to tender if it provides evidence of having fulfilled his/her tax obligations by producing a valid tax compliance or valid tax certificate issued by the Kenya Revenue Authority.

4.0 Eligible Goods, Equipment, and Services

4.1 Goods, equipment and services to be supplied under the Contract may have their origin in any country that is not ineligible under ITT3.9. At the Procuring Entity's request, Tenderers may be required to provide evidence of the origin of Goods, equipment and services.

4.2 Any goods, works and production processes with characteristics that have been declared by the relevant national environmental protection agency or by other competent authority as harmful to human beings and to the environment shall not be eligible for procurement.

5.0 Tenderer's Responsibilities

5.1 The tenderer shall bear all costs associated with the preparation and submission of his/her tender, and the Procuring Entity will in no case be responsible or liable for those costs.

5.2 The tenderer, at the tenderer's own responsibility and risk, is encouraged to visit and examine and inspect the Site of the Works and its surroundings and obtain all information that may be necessary for preparing the tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the tenderer's own expense.

5.3 The Tenderer and any of its personnel or agents will be granted permission by the Procuring Entity to enter up on its premises and lands for the purpose of such visit. The Tenderer shall indemnify the Procuring Entity against all liability arising from death or personal injury, loss of or damage to property, and any other losses and expenses incurred as a result of the examination and inspection.

5.4 The tenderer shall provide in the Form of Tender and Qualification Information, a preliminary description of the proposed work method and schedule, including charts, as necessary or required.

B. CONTENTS OF TENDER DOCUMENTS

6.0 Sections of Tender Document

6.1 The tender document consists of Parts 1, 2, and 3, which includes all the sections specified below, and which should be read in conjunction with any Addenda issued in accordance with ITT10.

PART 1: Tendering Procedures

Section I: Instructions to Tenderers

Section II: Tender Data Sheet (TDS)

Section III: Evaluation and Qualification Criteria Section IV: Tendering Forms

PART 2: Works' Requirements

Section V: Bills of Quantities

Section VI: Specifications

Section VII: Drawings

PART3: Conditions of Contract and Contract Forms

Section VIII: General Conditions (GCC)

Section IX: Particular Conditions of Contract

Section X: Contract Forms

- 6.2. The Invitation to Tender Notice issued by the Procuring Entity is not part of the Contract documents.
- 6.3. Unless obtained directly from the Procuring Entity, the Procuring Entity is not responsible for the completeness of the Tender document, responses to requests for clarification, the minutes of a pre-arranged site visit and those of the pre-Tender meeting (if any), or Addenda to the Tender document in accordance with ITT 10. In case of any contradiction, documents obtained directly from the Procuring Entity shall prevail.
- 6.4. The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document and to furnish with its Tender all information and documentation as is required by the Tender document.

7.0 Clarification of Tender Document, Site Visit, Pre-Tender Meeting

- 7.1 A Tenderer requiring any clarification of the Tender Document shall contact the in writing at the Procuring Entity's address specified in the TDS or raise its enquiries during the pre-Tender meeting if provided for in accordance with ITT 7.2. The Procuring Entity will respond in writing to any request for clarification, provided that such request is received not later than the period specified in the TDS prior to the deadline for submission of tenders. The Procuring Entity shall forward copies of its response to all tenderers who have acquired the Tender documents in accordance with ITT 7.4, including a description of the inquiry but without identifying its source. If so specified in the TDS, the Procuring Entity shall also promptly publish its response at the web page identified in the TDS. Should the clarification result in changes to the essential elements of the Tender Documents, the Procuring Entity shall amend the Tender Documents following the procedure under ITT 8 and ITT 22.2.
- 7.2 The Tenderer, at the Tenderer's own responsibility and risk, is encouraged to visit and examine and inspect the site(s) of the required contracts and obtain all information that may be necessary for preparing a tender. The costs of visiting the Site shall be at the Tenderer's own expense. The Procuring Entity shall specify in the TDS if a pre-arranged Site visit and or a pre-tender meeting will be held, when and where. The Tenderer's designated representative is invited to attend a pre-arranged site visit and a pre-tender meeting, as the case may be. The purpose of the site visit and the pre-tender meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 7.3 The Tenderer is requested to submit any questions in writing, to reach the Procuring Entity not later than the period specified in the TDS before the meeting.
- 7.4 Minutes of a pre-arranged site visit and those of the pre-tender meeting, if applicable, including the text of the questions asked by Tenderers and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Tenderers who have acquired the Tender Documents. Minutes shall not identify the source of the questions asked.
- 7.5 The Procuring Entity shall also promptly publish anonymized (no names) Minutes of the pre-arranged site visit and those of the pre-tender meeting at the web page identified in the TDS. Any modification to the Tender Documents that may become necessary as a result of the pre-arranged site visit and those of the pre-tender meeting shall be made by the Procuring Entity exclusively through the issue of an Addendum pursuant to ITT 8 and not through the minutes of the pre-Tender meeting. Non-attendance at the pre-arranged site visit and the pre-tender meeting will not be a cause for disqualification of a Tenderer.

8.0 Amendment of Tender Documents

- 8.1 At any time prior to the deadline for submission of Tenders, the Procuring Entity may amend the Tender Documents by issuing addenda.
- 8.2 Any addendum issued shall be part of the Tender Documents and shall be communicated in writing to all who have obtained the Tender Documents from the Procuring Entity. The Procuring Entity shall also promptly publish the addendum on the website in accordance with ITT 7.5.
- 8.3 To give Tenderers reasonable time in which to take an addendum into account in preparing their Tenders, the Procuring Entity should extend the deadline for the submission of Tenders, pursuant to ITT 22.2.

C. PREPARATION OF TENDERS

9.0 Cost of Tendering

The Tenderer shall meet all costs associated with the preparation and submission of its Tender, and the Procuring Entity shall not be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

10.0 Language of Tender

The Tender, as well as all correspondence and documents relating to the tender exchanged by the tenderer and the Procuring Entity, shall be written in the English Language. Supporting documents and printed literature that are part of the Tender may be in another language provided they are accompanied by an accurate and notarized translation of the relevant passages into the English Language, in which case, for purposes of interpretation of the Tender, such translation shall govern.

11.0 Documents Comprising the Tender

11.1 The Tender shall comprise the following:

- a) Form of Tender prepared in accordance with ITT 12;
- b) Schedules including priced Bill of Quantities, completed in accordance with ITT 12 and ITT 14;
- c) Tender Security or Tender-Securing Declaration, in accordance with ITT 19.1;
- d) Alternative Tender, if permissible, in accordance with ITT 13;
- e) Authorization: written confirmation authorizing the signatory of the Tender to commit the Tenderer, in accordance with ITT 20.3;
- f) Qualifications: documentary evidence in accordance with ITT 17 establishing the Tenderer's qualifications to perform the Contract if its Tender is accepted;
- g) Conformity: a technical proposal in accordance with ITT 16;
- h) Any other document required in the TDS.

11.2 In addition to the requirements under ITT 11.1, Tenders submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Tender shall be signed by all members and submitted with the Tender, together with a copy of the proposed JV Agreement. Change of membership and conditions of the JV prior to contract signature will render the tender liable for disqualification.

12.0 Form of Tender and Schedules

12.1 The Form of Tender and Schedules, including the Bill of Quantities, shall be prepared using the relevant forms furnished in Section IV, Tendering Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITT 20.3. All blank spaces shall be filled in with the information requested. The Tenderer shall chronologically serialize all pages of the tender documents submitted.

12.2 The Tenderer shall furnish in the Form of Tender information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Tender.

13.0 Alternative Tenders

- 13.1 Unless otherwise specified in the **TDS**, alternative Tenders shall not be considered.
- 13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the **TDS**, and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification Criteria.
- 13.3 Except as provided under ITT13.4 below, Tenderers wishing to offer technical alternatives to the requirements of the Tender Documents must first price the Procuring Entity's design as described in the Tender Documents and shall further provide all information necessary for a complete evaluation of the alternative by the Procuring Entity, 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 Tenderer with the Winning Tender conforming to the basic technical requirements shall be considered by the Procuring Entity.
- 13.4 When specified in the TDS, Tenderers are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified in the TDS, as will the method for their evaluating, and described in Section VII, Works' Requirements.

14.0 Tender Prices and Discounts

- 14.1 The prices and discounts (including any price reduction) quoted by the Tenderer in the Form of Tender and in the Bill of Quantities shall conform to the requirements specified below.
- 14.2 The Tenderer 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 Tenderer shall be deemed covered by the rates for other items in the Bill of Quantities and will not be paid for separately by the Procuring Entity. An item not listed in the priced Bill of Quantities shall be assumed to be not included in the Tender, and provided that the Tender is determined substantially responsive notwithstanding this omission, the average price of the item quoted by substantially responsive Tenderers will be added to the Tender price and the equivalent total cost of the Tender so determined will be used for price comparison.
- 14.3 The price to be quoted in the Form of Tender, in accordance with ITT 12, shall be the total price of the Tender, including any discounts offered.
- 14.4 The Tenderer shall quote any discounts and the methodology for their application in the Form of Tender, in accordance with ITT 12
- 14.5 It will be specified in the TDS if the rates and prices quoted by the Tenderer are or are not subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, except in cases where the contract is subject to fluctuations and adjustments, not fixed price. In such a case, the Tenderer shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Procuring Entity may require the Tenderer to justify its proposed indices and weightings.
- 14.6 Where tenders are being invited for individual lots (contracts) or for any combination of lots (packages), tenderers wishing to offer discounts for the award of more than one Contract shall specify in their Tender the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in

accordance with ITT 14.4, provided the Tenders for all lots (contracts) are opened at the same time.

- 14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of Tenders, shall be included in the rates and prices and the total Tender Price submitted by the Tenderer.

15.0 Currencies of Tender and Payment

- 15.1 The currency (ies) of the Tender and the currency (ies) of payments shall be the same.
- 15.2 Tenderers shall quote entirely in Kenya Shillings. The unit rates and the prices shall be quoted by the Tenderer in the Bill of Quantities, entirely in Kenya shillings
- (i) A Tenderer expecting to incur expenditures in other currencies for inputs to the Works supplied from outside Kenya (referred to as “the foreign currency requirements”) shall (if so allowed in the TDS) indicate in the Appendix to Tender the percentage(s) of the Tender Price (excluding Provisional Sums), needed by the Tenderer for the payment of such foreign currency requirements, limited to no more than two foreign currencies.
 - (ii) The rates of exchange to be used by the Tenderer in arriving at the local currency equivalent and the percentage(s) mentioned in (a) above shall be specified by the Tenderer in the Appendix to Tender and shall be based on the exchange rate provided by the Central Bank of Kenya on the date 30 days prior to the actual date of tender opening. Such exchange rate shall apply for all foreign payments under the Contract.
- 15.3 Tenderers may be required by the Procuring Entity to justify, to satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data in the Appendix to Tender are reasonable, in which case a detailed breakdown of the foreign currency requirements shall be provided by Tenderers.

16.0 Documents Comprising the Technical Proposal

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

17.0 Documents Establishing the Eligibility and Qualifications of the Tenderer

- 17.1 Tenderers shall complete the Form of Tender, included in Section IV, Tender Forms, to establish Tenderer's eligibility in accordance with ITT 4.
- 17.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract the Tenderer shall provide the information requested in the corresponding information sheets included in Section IV, Tender Forms.
- 17.3 If a margin of preference applies as specified in accordance with ITT33. 1, national tenderers, individually or in joint ventures, applying for eligibility for national preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITT 33.1.
- 17.4 Tenderers shall be asked to provide, as part of the data for qualification, such information, including details of ownership, as shall be required to determine whether, according to the

classification established by the Procuring Entity, a particular contract or group of contractors qualifies for a margin of preference. Further the information will enable the Procuring Entity identify any actual or potential conflict of interest in relation to the procurement and/or contract management processes, or a possibility of collusion between tenderers, and there by help to prevent any corrupt influence in relation to the procurement process or contract management.

- 17.5 The purpose of the information described in ITT 17.2 above overrides any claims to confidentiality which a tenderer may have. There can be no circumstances in which it would be justified for a tenderer to keep information relating to its ownership and control confidential where it is tendering to undertake public sector work and receive public sector funds. Thus, confidentiality will not be accepted by the Procuring Entity as a justification for a Tenderer's failure to disclose, or failure to provide required information on its ownership and control.
- 17.6 The Tenderer shall provide further documentary proof, information or authorizations that the Procuring Entity may request in relation to ownership and control which information on any changes to the information which was provided by the tenderer under ITT 6.4. The obligations to require this information shall continue for the duration of the procurement process and contract performance and after completion of the contract, if any change to the information previously provided may reveal a conflict of interest in relation to the award or management of the contract.
- 17.7 All information provided by the tenderer pursuant to these requirements must be complete, current and accurate as at the date of provision to the Procuring Entity. In submitting the information required pursuant to these requirements, the Tenderer shall warrant that the information submitted is complete, current and accurate as at the date of submission to the Procuring Entity.
- 17.8 If a tenderer fails to submit the information required by these requirements, its tenderer will be rejected. Similarly, if the Procuring Entity is unable, after taking reasonable steps, to verify to a reasonable degree the information submitted by a tenderer pursuant to these requirements, then the tender will be rejected.
- 17.9 If information submitted by a tenderer pursuant to these requirements, or obtained by the Procuring Entity (whether through its own enquiries, through notification by the public or otherwise), shows any conflict of interest which could materially and improperly benefit the tenderer in relation to the procurement or contract management process, then:
- (i) If the procurement process is still on going, the tenderer will be disqualified from the procurement process,
 - (ii) If the contract has been awarded to that tenderer, the contract award will be set aside,
 - (iii) The tenderer will be referred to the relevant law enforcement authorities for investigation of whether the tenderer or any other persons have committed any criminal offence.
- 17.10 If a tenderer submits information pursuant to these requirements that is incomplete, inaccurate or out-of-date, or attempts to obstruct the verification process, then the consequences ITT 17.8 will ensue unless the tenderer can show to the reasonable satisfaction of the Procuring Entity that any such act was not material, or was due to genuine error which was not attributable to the intentional act, negligence or recklessness of the tender.

18.0 Period of Validity of Tenders

- 18.1 Tenders shall remain valid for the Tender Validity period specified in the TDS. The Tender Validity period starts from the date fixed for the Tender submission deadline (as prescribed by the Procuring Entity in accordance with ITT 22). A Tender valid for a shorter period shall be rejected by the Procuring Entity as non-responsive.
- 18.2 In exceptional circumstances, prior to the expiration of the Tender validity period, the Procuring Entity may request Tenderers to extend the period of validity of their Tenders. The request and the responses shall be made in writing. If a Tender Security is requested in accordance with ITT 19, it shall also be extended for thirty (30) days beyond the deadline of the extended validity period. A Tenderer may refuse the request without forfeiting its Tender security. A Tenderer granting their quest shall not be required or permitted to modify its Tender.

19.0 Tender Security

- 19.1 The Tenderer shall furnish as part of its Tender, either a Tender-Securing Declaration or a Tender Security as specified in the TDS, in original form and, in the case of a Tender Security, in the amount and currency specified in the TDS. A Tender-Securing Declaration shall use the form included in Section IV, Tender Forms.
- 19.2 If a Tender Security is specified pursuant to ITT 19.1, the Tender Security shall be a demand guarantee in any of the following forms at the Tenderer's option:
- i. Cash;
 - ii. A bank guarantee;
 - iii. A guarantee by an insurance company registered and licensed by the Insurance Regulatory Authority listed by the Authority; or
 - iv. A guarantee issued by a financial institution approved and licensed by the Central Bank of Kenya, from a reputable source, and an eligible country.
- 19.3 If an unconditional bank guarantee is issued by a bank located outside Kenya, the issuing bank shall have a correspondent bank located in Kenya to make it enforceable. The Tender Security shall be valid for thirty (30) days beyond the original validity period of the Tender, or beyond any period of extension if requested under ITT 18.2.
- 19.4 If a Tender Security or Tender-Securing Declaration is specified pursuant to ITT 19.1, any Tender not accompanied by a substantially responsive Tender Security or Tender-Securing Declaration shall be rejected by the Procuring Entity as non-responsive.
- 19.5 If a Tender Security is specified pursuant to ITT 19.1, the Tender Security of unsuccessful Tenderers shall be returned as promptly as possible upon the successful Tenderer's signing the Contract and furnishing the Performance Security and any other documents required in the TDS. The Procuring Entity shall also promptly return the tender security to the tenderers where the procurement proceedings are terminated, all tenders were determined non-responsive or a bidder declines to extend tender validity period.
- 19.6 The Tender Security of the successful Tenderer shall be returned as promptly as possible once the successful Tenderer has signed the Contract and furnished the required Performance Security, and any other documents required in the TDS.
- 19.7 The Tender Security may be forfeited or the Tender-Securing Declaration executed:
- a) If a Tenderer withdraws its Tender during the period of Tender validity specified by the Tenderer on the Form of Tender, or any extension there to provide by the Tenderer; or
 - b) If the successful Tenderer fails to sign the Contract in accordance with ITT 47; or

furnish a Performance Security and if required in the TDS, and any other documents required in the TDS.

- 19.8 Where tender securing declaration is executed, the Procuring Entity shall recommend to the PPRA that PPRA debars the Tenderer from participating in public procurement as provided in the law.
- 19.9 The Tender Security or the Tender-Securing Declaration of a JV shall be in the name of the JV that submits the Tender. If the JV has not been legally constituted into a legally enforceable JV at the time of tendering, the Tender Security or the Tender-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITT 4.1 and ITT 11.2.
- 19.10 A tenderer shall not issue a tender security to guarantee itself.

20.0 Format and Signing of Tender

- 20.1 The Tenderer shall prepare one original of the documents comprising the Tender as described in ITT 11 and clearly mark it "ORIGINAL." Alternative Tenders, if permitted in accordance with ITT 13, shall be clearly marked "ALTERNATIVE." In addition, the Tenderer shall submit copies of the Tender, in the number specified in the TDS and clearly mark them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.
- 20.2 Tenderers shall mark as "CONFIDENTIAL" all information in their Tenders which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.
- 20.3 The original and all copies of the Tender shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written confirmation as specified in the TDS and shall be attached to the Tender. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Tender where entries or amendments have been made shall be signed or initialed by the person signing the Tender.
- 20.4 In case the Tenderer is a JV, the Tender shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.
- 20.5 Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Tender.

D. SUBMISSION AND OPENING OF TENDERS

21.0 Sealing and Marking of Tenders

- 21.1 The Tenderer shall deliver the Tender in a single sealed envelope, or in a single sealed package, or in a single sealed container bearing the name and Reference number of the Tender, addressed to the Procuring Entity and a warning not to open before the time and date for Tender opening date. Within the single envelope, package or container, the Tenderer shall place the following separate, sealed envelopes:
- a) In an envelope or package or container marked "ORIGINAL", all documents comprising the Tender, as described in ITT11; and

- b) In an envelope or package or container marked “COPIES” all required copies of the Tender; and
- c) If alternative Tenders are permitted in accordance with ITT 13, and if relevant:
 - i. In an envelope or package or container marked “ORIGINAL - ALTERNATIVE TENDER”, the alternative Tender; and
 - ii. In the envelope or package or container marked “COPIES-ALTERNATIVE TENDER”, all required copies of the alternative Tender.

The inner envelopes or packages or containers shall:

- a) bear the name and address of the Procuring Entity.
- b) Bear the name and address of the Tenderer; and
- c) Bear the name and Reference number of the Tender.

- 21.2 If an envelope or package or container is not sealed and marked as required, the Procuring Entity will assume no responsibility for the misplacement or premature opening of the Tender. Tenders that were misplaced or opened prematurely will not be accepted.

22.0 Deadline for Submission of Tenders

- 22.1 Tenders must be received by the Procuring Entity at the address specified in the **TDS** and no later than the date and time also specified in the **TDS**. When so specified in the **TDS**, Tenderers shall have the option of submitting their Tenders electronically. Tenderers submitting Tenders electronically shall follow the electronic Tender submission procedures specified in the **TDS**.
- 22.2 The Procuring Entity may, at its discretion, extend the deadline for the submission of Tenders by amending the Tender Documents in accordance with ITT 8, in which case all rights and obligations of the Procuring Entity and Tenderers previously subject to the deadline shall thereafter be subject to the deadline as extended.

23.0 Late Tenders

The Procuring Entity shall not consider any Tender that arrives after the deadline for submission of tenders, in accordance with ITT 22. Any Tender received by the Procuring Entity after the deadline for submission of Tenders shall be declared late, rejected, and returned unopened to the Tenderer.

24.0 Withdrawal, Substitution, and Modification of Tenders

- 24.1 A Tenderer may withdraw, substitute, or modify its Tender 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 ITT 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Tender must accompany the respective written notice. All notices must be:
 - (a) Prepared and submitted in accordance with ITT 20 and ITT 21 (except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” “MODIFICATION;” and
 - (b) Received by the Procuring Entity prior to the deadline prescribed for submission of Tenders, in accordance with ITT 22.

- 24.2 Tenders requested to be withdrawn in accordance with ITT 24.1 shall be returned unopened to the Tenderers.
- 24.3 No Tender may be withdrawn, substituted, or modified in the interval between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer on the Form of Tender or any extension thereof.

25.0 Tender Opening

- 25.1 Except in the cases specified in ITT 23 and ITT 24.2, the Procuring Entity shall publicly open and read out all Tenders received by the deadline, at the date, time and place specified in the TDS, in the presence of Tenderers' designated representatives and anyone who chooses to attend. Any specific electronic Tender opening procedures required if electronic Tendering is permitted in accordance with ITT 22.1, shall be as specified in the TDS.
- 25.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelopes with the corresponding Tender shall not be opened but returned to the Tenderer. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at tender opening.
- 25.3 Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Tender being substituted, and the substituted Tender shall not be opened, but returned to the Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Tender opening.
- 25.4 Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Tender. No Tender modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Tender opening.
- 25.5 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Tenderer and whether there is a modification; the total Tender Price, per lot (contract) if applicable, including any discounts and alternative Tenders; the presence or absence of a Tender Security or Tender-Securing Declaration, if required; and any other details as the Procuring Entity may consider appropriate.
- 25.6 Only Tenders, alternative Tenders and discounts that are opened and read out at Tender opening shall be considered further for evaluation. The Form of Tender and pages of the Bill of Quantities (to be decided on by the tender opening committee) are to be initialed by the members of the tender opening committee attending the opening.
- 25.7 At the Tender Opening, the Procuring Entity shall neither discuss the merits of any Tender nor reject any Tender (except for late Tenders, in accordance with ITT 23.1).
- 25.8 The Procuring Entity shall prepare minutes of the Tender Opening that shall include, as a minimum:
- (a) The name of the Tenderer and whether there is a withdrawal, substitution, or modification;
 - (b) The Tender Price, per lot (contract) if applicable, including any discounts;
 - (c) any alternative Tenders;

- (d) the presence or absence of a Tender Security, if one was required.
 - (e) number of pages of each tender document submitted.
- 25.9. The Tenderers' representatives who are present shall be requested to sign the minutes. The omission of a Tenderer's signature on the minutes shall not invalidate the contents and effect of the minutes. A copy of tender opening register shall be issued to a tenderer upon request.

E. EVALUATION AND COMPARISON OF TENDERS

26.0 Confidentiality

- 26.1 Information relating to the evaluation of Tenders and recommendation of contract award shall not be disclosed to Tenderers or any other persons not officially concerned with the Tender process until information on Intention to Award the Contract is transmitted to all Tenderers in accordance with ITT 43.
- 26.2 Any effort by a Tenderer to influence the Procuring Entity in the evaluation of the Tenders or Contract award decisions may result in the rejection of its tender.
- 26.3 Notwithstanding ITT 26.2, from the time of tender opening to the time of contract award, if a tenderer wishes to contact the Procuring Entity on any matter related to the tendering process, it shall do so in writing.

27.0 Clarification of Tenders

- 27.1 To assist in the examination, evaluation, and comparison of the tenders, and qualification of the tenderers, the Procuring Entity may, at its discretion, ask any tenderer for a clarification of its tender, given a reasonable time for a response. Any clarification submitted by a tenderer that is not in response to a request by the Procuring Entity shall not be considered. The Procuring Entity's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the tender shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Procuring Entity in the evaluation of the tenders, in accordance with ITT 31.
- 27.2 If a tenderer does not provide clarifications of its tender by the date and time set in the Procuring Entity's request for clarification, its Tender may be rejected.

28.0 Deviations, Reservations, and Omissions

- 28.1 During the evaluation of tenders, the following definitions apply:
 - (a) "Deviation" is a departure from the requirements specified in the tender document;
 - (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the tender document; and
 - (c) "Omission" is the failure to submit part or all of the information or documentation required in the Tender document.

29.0 Determination of Responsiveness

- 29.1 The Procuring Entity's determination of a Tender's responsiveness is to be based on the contents of the tender itself, as defined in ITT 11.
- 29.2 A substantially responsive Tender is one that meets the requirements of the Tender document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that, if accepted, would:
- a) Affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or
 - b) Limit in any substantial way, inconsistent with the tender document, the Procuring Entity's rights or the tenderer's obligations under the proposed contract; or
 - c) If rectified, would unfairly affect the competitive position of other tenderers presenting substantially responsive tenders.
- 29.3 The Procuring Entity shall examine the technical aspects of the tender submitted in accordance with ITT 16, to confirm that all requirements of Section VII, Works' Requirements have been met without any material deviation, reservation or omission.
- 29.4 If a tender is not substantially responsive to the requirements of the tender document, it shall be rejected by the Procuring Entity and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

30.0 Non-material Non-conformities

- 30.1 Provided that a tender is substantially responsive, the Procuring Entity may waive any non-conformities in the tender.
- 30.2 Provided that a Tender is substantially responsive, the Procuring Entity may request that the tenderer submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial non- conformities in the tender related to documentation requirements. Requesting information or documentation on such non-conformities shall not be related to any aspect of the price of the tender. Failure of the tenderer to comply with the request may result in the rejection of its tender.
- 30.3 Provided that a tender is substantially responsive, the Procuring Entity shall rectify quantifiable nonmaterial non-conformities related to the Tender Price. To this effect, the Tender Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner **specified in the TDS**.

31.0 Arithmetical Errors

- 31.1 The tender sum as submitted and read out during the tender opening shall be absolute and final and shall not be the subject of correction, adjustment or amendment in anyway by any person or entity.
- 31.2 Provided that the Tender is substantially responsive, the Procuring Entity shall handle errors on the following basis:
- a) Any error detected if considered a major deviation that affects the substance of the tender, shall lead to disqualification of the tender as non-responsive.
 - b) Any errors in the submitted tender arising from a miscalculation of unit price, quantity, subtotal and total bid price shall be considered as a major deviation that affects the substance of the tender and shall lead to disqualification of the tender as non-responsive. And
 - c) If there is a discrepancy between words and figures, the amount in words shall prevail

31.3 Tenderers shall be notified of any error detected in their bid during the notification of award.

32.0 Conversion to Single Currency

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

33.0 Margin of Preference and Reservations

33.1 A margin of preference may be allowed only when the contract is open to international competitive tendering where foreign contractors are expected to participate in the tendering process and where the contract exceeds the value/threshold specified in the Regulations.

33.2 A margin of preference shall not be allowed unless it is specified so in the TDS.

33.3 Contracts procured on basis of international competitive tendering shall not be subject to reservations exclusive to specific groups as provided in ITT 33.4.

33.4 Where it is intended to reserve a contract to a specific group of businesses (these groups are Small and Medium Enterprises, Women Enterprises, Youth Enterprises and Enterprises of persons living with disability, as the case may be), and who are appropriately registered as such by the authority to be specified in the TDS, a Procuring Entity shall ensure that the invitation to tender specifically indicates that only businesses or firms belonging to the specified group are eligible to tender. No tender shall be reserved to more than one group. If not so stated in the Invitation to Tender and in the Tender documents, the invitation to tender will be open to all interested tenderers.

34.0 Nominated Subcontractors

34.1 Unless otherwise stated in the TDS, the Procuring Entity does not intend to execute any specific elements of the Works by subcontractors selected/nominated by the Procuring Entity. In case the Procuring Entity nominates a subcontractor, the subcontract agreement shall be signed by the Subcontractor and the Procuring Entity. The main contract shall specify the working arrangements between the main contractor and the nominated subcontractor.

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

34.3 Domestic subcontractor's qualifications shall not be used by the Tenderer to qualify for the Works unless their specialized parts of the Works were previously designated so by the Procuring Entity in the TDS as can be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Tenderer may be added to the qualifications of the Tenderer.

35.0 Evaluation of Tenders

35.1 The Procuring Entity shall use the criteria and methodologies listed in this ITT and Section III, Evaluation and Qualification Criteria. No other evaluation criteria or methodologies

shall be permitted. By applying the criteria and methodologies the Procuring Entity shall determine the Lowest Evaluated Tender in accordance with ITT 40.

35.2 To evaluate a Tender, the Procuring Entity shall consider the following:

- a) Price adjustment in accordance with ITT 31.1(iii); excluding provisional sums and contingencies, if any, but including Day work items, where priced competitively;
- b) Price adjustment due to discounts offered in accordance with ITT 14.4;
- c) converting the amount resulting from applying (a) and (b) above, if relevant, to a single currency in accordance with ITT 32;
- d) price adjustment due to quantifiable non material non-conformities in accordance with ITT 30.3; and
- e) any additional evaluation factors specified in the TDS and 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 considered intender evaluation.

35.4 Where the tender involves multiple lots or contracts, the tenderer will be allowed to tender for one or more lots (contracts). Each lot or contract will be evaluated in accordance with ITT 35.2. The methodology to determine the lowest evaluated tenderer or tenderers based one lot (contract) or based on a combination of lots (contracts), will be specified in Section III, Evaluation and Qualification Criteria. In the case of multiple lots or contracts, tenderer will be will be required to prepare the Eligibility and Qualification Criteria Form for each Lot.

36.0 Comparison of Tenders

The Procuring Entity shall compare the evaluated costs of all substantially responsive Tenders established in accordance with ITT 35.2 to determine the Tender that has the lowest evaluated cost.

37.0 Abnormally Low Tenders and Abnormally High Tenders

37.1 An Abnormally Low Tender is one where the Tender price, in combination with other elements of the Tender, appears so low that it raises material concerns as to the capability of the Tenderer in regards to the Tenderer's ability to perform the Contract for the offered Tender Price or that genuine competition between Tenderers is compromised.

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

- 37.3 After evaluation of the price analyses, in the event that the Procuring Entity determines that the Tenderer has failed to demonstrate its capability to perform the Contract for the offered Tender Price, the Procuring Entity shall reject the Tender.

Abnormally High Tenders

- 37.4. An abnormally high tender price is one where the tender price, in combination with other constituent elements of the Tender, appears unreasonably too high to the extent that the Procuring Entity is concerned that it (the Procuring Entity) may not be getting value for money or it may be paying too high a price for the contract compared with market prices or that genuine competition between Tenderers is compromised.
- 37.5. In case of an abnormally high price, the Procuring Entity shall make a survey of the market prices, check if the estimated cost of the contract is correct and review the Tender Documents to check if the specifications, scope of work and conditions of contract are contributory to the abnormally high tenders. The Procuring Entity may also seek written clarification from the tenderer on the reason for the high tender price. The Procuring Entity shall proceed as follows:
- i. If the tender price is abnormally high based on wrong estimated cost of the contract, the Procuring Entity may accept or not accept the tender depending on the Procuring Entity's budget considerations.
 - ii. If specifications, scope of work and/or conditions of contract are contributory to the abnormally high tender prices, the Procuring Entity shall reject all tenders and may retender for the contract based on revised estimates, specifications, scope of work and conditions of contract, as the case may be.
- 37.6. If the Procuring Entity determines that the Tender Price is abnormally too high because genuine competition between tenderers is compromised (often due to collusion, corruption or other manipulations), the Procuring Entity shall reject all Tenders and shall institute or cause competent Government Agencies to institute an investigation on the cause of the compromise, before retendering.

38.0 Unbalanced and/or Front-Loaded Tenders

- 39.1 If in the Procuring Entity's opinion, the Tender that is evaluated as the lowest evaluated price is seriously unbalanced and/or front loaded, the Procuring Entity may require the Tenderer to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the tender prices with the scope of works, proposed methodology, schedule and any other requirements of the Tender document.
- 39.2 After the evaluation of the information and detailed price analyses presented by the Tenderer, the Procuring Entity may as appropriate:
- a) Accept the Tender; or
 - b) Require that the total amount of the Performance Security be increased at the expense of the Tenderer to a level not exceeding a 10% of the Contract Price; or
 - c) Agree on a payment mode that eliminates the inherent risk of the Procuring Entity

- paying too much for undelivered works; or
- d) Reject the Tender.

39.0 Qualifications of the Tenderer

- 39.1. The Procuring Entity shall determine to its satisfaction whether the eligible Tenderer that is selected as having submitted the lowest evaluated cost and substantially responsive Tender, meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.
- 39.2. The determination shall be based upon an examination of the documentary evidence of the Tenderer's qualifications submitted by the Tenderer, pursuant to ITT 17. The determination shall not take into consideration the qualifications of other firms such as the Tenderer's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the Tender document), or any other firm(s) different from the Tenderer.
- 39.3. An affirmative determination shall be a prerequisite for award of the Contract to the Tenderer. A negative determination shall result in disqualification of the Tender, in which event the Procuring Entity shall proceed to the Tenderer who offers a substantially responsive Tender with the next lowest evaluated price to make a similar determination of that Tenderer's qualifications to perform satisfactorily.

40.0 Lowest Evaluated Tender

- 40.1. Having compared the evaluated prices of Tenders, the Procuring Entity shall determine the Lowest Evaluated Tender. The Lowest Evaluated Tender is the Tender of the Tenderer that meets the Qualification Criteria and whose Tender has been determined to be:
 - a) Most responsive to the Tender document; and
 - b) The lowest evaluated price.

41.0 Procuring Entity's Right to Accept Any Tender, and to Reject Any or All Tenders.

The Procuring Entity reserves the right to accept or reject any Tender and to annul the Tender process and reject all Tenders at any time prior to Contract Award, without there by incurring any liability to Tenderers. In case of annulment, all Tenders submitted and specifically, Tender securities, shall be promptly returned to the Tenderers.

F. AWARD OF CONTRACT

42.0 Award Criteria

The Procuring Entity shall award the Contract to the successful tenderer whose tender has been determined to be the Lowest Evaluated Tender.

43.0 Notice of Intention to enter into a Contract

Upon award of the contract and Prior to the expiry of the Tender Validity Period the Procuring Entity shall issue a Notification of Intention to Enter into a Contract/Notification of award to all tenderers which shall contain, at a minimum, the following information:

- a) the name and address of the Tenderer submitting the successful tender;
- b) the Contract price of the successful tender;
- c) a statement of the reason(s) the tender of the unsuccessful tenderer to whom the letter is addressed was unsuccessful, unless the price information in (c) above already reveals the reason;
- d) the expiry date of the Standstill Period; and
- e) instructions on how to request a debriefing and/or submit a complaint during the stand still period;

44.0 Stand still Period

- 44.1 The Contract shall not be signed earlier than the expiry of a Standstill Period of 14 days to allow any dissatisfied tender to launch a complaint. Where only one Tender is submitted, the Standstill Period shall not apply.
- 44.2 Where a Standstill Period applies, it shall commence when the Procuring Entity has transmitted to each Tenderer the Notification of Intention to Enter into a Contract with the successful Tenderer.

45.0 Debriefing by the Procuring Entity

- 45.1 On receipt of the Procuring Entity's Notification of Intention to Enter into a Contract referred to in ITT 43, an unsuccessful tenderer may make a concern regarding their tender. The Procuring Entity shall provide the debriefing within five days of receipt of the request.
- 45.2 Debriefings of unsuccessful Tenderers may be done in writing or verbally. The Tenderer shall bear its own costs of attending such a debriefing meeting.

46.0 Letter of Award

Prior to the expiry of the Tender Validity Period and upon expiry of the Standstill Period specified in ITT 42.1, upon addressing a complaint that has been filed within the Standstill Period, the Procuring Entity shall transmit the Letter of Award to the successful Tenderer. The letter of award shall request the successful tenderer to furnish the Performance Security within 21 days of the date of the letter.

47.0 Signing of Contract

- 47.1 Upon the expiry of the fourteen days of the Notification of Intention to enter into contract and upon the parties meeting their respective statutory requirements, the Procuring Entity shall send the successful Tenderer the Contract Agreement.
- 47.2 Within fourteen (14) days of receipt of the Contract Agreement, the successful Tenderer shall sign, date, and return it to the Procuring Entity.
- 47.3 The written contract shall be entered into within the period specified in the notification of award and before expiry of the tender validity period.

48.0 Performance Security

- 48.1 Within twenty-one (21) days of the receipt of the Letter of Award from the Procuring Entity, the successful Tenderer shall furnish the Performance Security and, any other documents required in the **TDS**, in accordance with the General Conditions of Contract, subject to ITT 38.2 (b), using the Performance Security and other Forms included in Section X, Contract Forms, or another form acceptable to the Procuring Entity. A foreign institution providing a bank guarantee shall have a correspondent financial institution located in Kenya, unless the Procuring Entity has agreed in writing that a correspondent bank is not required.
- 48.2 Failure of the successful Tenderer to submit the above-mentioned Performance Security and other documents required in the TDS or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event the Procuring Entity may award the Contract to the Tenderer offering the next Best Evaluated Tender.
- 48.3 Performance security shall not be required for contracts estimated to cost less than the amount specified in the Regulations.

49.0 Publication of Procurement Contract

Within fourteen days after signing the contract, the Procuring Entity shall publish the awarded contract at its notice boards and websites; and on the Website of the Authority. At the minimum, the notice shall contain the following information:

- (a) name and address of the Procuring Entity;
- (b) name and reference number of the contract being awarded, a summary of its scope and the selection method used;
- (c) the name of the successful Tenderer, the final total contract price, the contract duration.
- (d) dates of signature, commencement and completion of contract;
- (e) names of all Tenderers that submitted Tenders, and their Tender prices as read out at Tender opening.
- (f) Procurement Related Complaint
- (g) The procedures for making Procurement-related Complaints shall be specified in the TDS.

50.0 Procurement Related Complaint

- 50.1 The procedures for making Procurement-related Complaints shall be specified in the **TDS**.
- 50.2 A request for administrative review shall be made in the form provided under contract forms.

SECTION II - TENDER DATA SHEET (TDS)

The following specific data shall complement, supplement, or amend the provisions in the Instructions to Tenderers (ITT). Whenever there is a conflict, the provisions herein shall prevail over those in ITT.

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
A. General	
ITT 1.1	<p>The name of the contract is: <i>PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT</i></p> <p>The reference number of the Contract is KAA/OT/KIA/0090/2024-2025 number and identification of lots (Contracts) comprising this Tender are <i>[insert number and identification of lots (contracts)]</i></p> <p>Lot 1- Name _____ N/A _____</p> <p>Lot 2- Name _____ N/A _____</p> <p>Lot... Name _____ N/A _____</p> <p>ETC</p>
ITT 2.4	The Information made available on competing firms is as follows: N/A
ITT 2.4	<p>The firms that provided consulting services for the contract being tendered for are:</p> <p>N/A</p>
ITT 3.1	Maximum number of members in the Joint Venture (JV) shall be: N/A
ITT 3.11	Pursuant to the eligibility requirements of ITT 3.10
B. Contents of Tender Document	
ITT 6.1	Addenda issued in accordance with ITT 8
ITT 6.3	Addenda issued in accordance with ITT 8
ITT 7.1	<p>The Tenderer will submit any request for clarifications in writing at the Address Attention: <i>General Manager, Procurement & Logistics</i> Postal Address: <i>P.O. Box 19001-00501 Nairobi, Kenya</i></p> <p>Physical Address: <i>Kenya Airports Authority Headquarters Complex Building, JKIA,</i></p>

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	<p><i>Airport North Road, 2nd Floor, Procurement & Logistics Department</i> tenders@kaa.go.ke</p> <p>Request for clarification should be received by Procuring Entity no later than: three (3) days. Procuring Entity will publish its response at the website _at https://kaa.go.ke/corporate/procurement/</p>
ITT 7.2	<p>A pre-arranged pretender site visit “shall” take place at the following data, time and place:</p> <p>There shall be a MANDATORY Pre-Tender Site Visit on Tuesday 17TH FEBRUARY, 2025 at 11:00 am at KISUMU INTERNATIONAL AIRPORT AIRSTRIP, Kisumu County . However, tenderers are requested to make arrangements to attend and acquaint themselves with the site conditions before submission of their tenders.</p> <p>A representative of the Employer will be available to meet the tenderers on the specified time for the site visit and sign the completed Certificate of Tenderer’s Visit to the Site. Tenderers must provide their own transport.</p> <p>The bidder’s representative must bring the following for the site visit.</p> <ol style="list-style-type: none"> 1. Original introductory letter on the company letterhead detailing the names and ID number of the bidder’s representative. 2. Certificate of Tenderer’s visit to site, 3. Original ID, 4. Original Degree Certificate and a certified copy 5. Copy of ID, 6. Copy of Certificate of Professional Registration by Engineer’s Board of Kenya of the personnel attending the site visit. 7. Appropriate Personal Protective Equipment (PPE), Helmet, High visibility reflective vests and Safety boots. <p>Pre -Tender Site visit is MANDATORY by the proposed Project Manager or an equivalent person who meets the minimum qualifications for a Project manager in the personnel categories. The Pre- Tender Site Visit Certificate shall be submitted as proof of attendance.</p> <p>Copies of the documents shall be left with the KAA representative on site.</p>
ITT 7.3	The Tenderer will submit any questions in writing, to reach Procuring Entity not later than three (3) days before the tender closing date.
ITT 7.5	Procuring Entity’s website where Minutes of the pre-tender meeting and the pre-arranged pretender will be published is https://kaa.go.ke/corporate/procurement/

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
C. Preparation of Tenders	
ITT 13.1	Alternative Tenders <i>[insert “shall be” or “shall not be”]</i> SHALL NOT BE ____ considered. <i>[If alternatives shall be considered, the methodology shall be defined in Section III, Evaluation and Qualification Criteria.]</i>
ITT 13.2	Alternative times for completion <i>[insert “shall be” or “shall not be”]</i> _SHALL NOT BE ____permitted. <i>[If alternative times for completion are permitted, the evaluation method will be as specified in Section III, Evaluation and Qualification Criteria.]</i>
ITT 13.4	Alternative technical solutions shall NOT be permitted for the following parts of the Works: __THE WHOLE OF THE WORKS
ITT 14.5	The prices quoted by the Tenderer shall NOT be subject to adjustment and it shall be inclusive of all costs and taxes.
ITT 15.2(a)	Foreign currency requirements NOT ALLOWED.
ITT 18.1	The Tender validity period shall be ____one hundred and Eighty-six_ (186) ____ <i>[insert a number of days that is a multiple of seven counting as of the deadline for Tender submission]</i> days.
ITT 18.2	<p>(a) The number of days beyond the expiry of the initial tender validity period will be thirty (30) days</p> <p>(b) The tender price shall be adjusted by the following percentages of the tender price:</p> <p>(i) By __N/A ____ % of the local currency portion of the Contract Price adjusted to reflect local inflation during the period of extension and</p> <p>(ii) By ____N/A ____ % the foreign currency portion of the contract price adjusted to reflect the international inflation during the period of extension.</p> <p>NOT APPLICABLE FOR THIS TENDER.</p>
ITT 19.1	<p>Tender Security amounting to KES 1,400,000.00. in the prescribed format valid for 216 days from the tender opening date.</p> <p>The tender security shall be in any of the following forms:</p> <p>a) cash or banker’s cheque, or</p> <p>b) a bank guarantee, or</p> <p>c) guarantee issued by a reputable insurance company approved by Public</p>

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	<p>Procurement Regulatory Authority (PPRA) or d) Letter of credit. <i>The Tender Security shall be valid for 216 days from the date of tender opening. Bidder should note the following:</i></p> <p><i>(i) Those who have obtained a digital tender security must provide it online with their tender document in the KAA portal. The digital tender security must have a mechanism to verify such as use of quick response (QR) code or an online portal. They do not need to provide a hard copy of the tender security physically.</i></p> <p><i>(ii) Those who do not provide a digital tender security as per (i) above will be required to submit an original Tender Security physically to the office of the General Manager, Procurement and Logistics department, KAA Headquarters, 2nd Floor on or before the closing/opening date and time.</i></p>
ITT 19.5	Other documents required are N/A
ITT 19.9	Letter of intent referred to in ITT 3.1 and ITT 11.2
ITT 20.1	In addition to the original of the Tender, the number of copies is: N/A____ [insert number of copies]
ITT 20.3	The written confirmation of authorization to sign on behalf of the Tenderer shall consist of: ____ <u>Power of Attorney certified by a Commissioner of Oaths.</u>
D. Submission and Opening of Tenders	
ITT 21.2	A tender package or container that cannot fit in the tender box shall be received as follows: --N/A--
ITT 22.1	<p>For <u>Tender submission purposes</u> only the following Procuring Entity's address is approved:</p> <p>Name of Procuring Entity: KENYA AIRPORTS AUTHORITY</p> <p>Postal Address and name of Officer to be intensioned: GENERAL MANAGER (PROCUREMENT & LOGISTICS) P.O. BOX 19001-00501 NAIROBI.</p> <p>Physical Address for hand courier delivery of the tender security only to our office: KENYA AIRPORTS AUTHORITY HEADQUARTERS COMPLEX BUILDING, JKIA, AIRPORT NORTH ROAD,</p>

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	<p>2ND FLOOR, PROCUREMENT & LOGISTICS DEPARTMENT</p> <p>Date and time for submission of Tenders 27TH FEBRUARY, 2025.....</p> <p>Please note that all our tenders shall be submitted electronically except the original tender security.</p>
ITT 25.1	<p>The Tender opening shall take place at the time and the address for Opening of Tenders provided below:</p> <p>Name of Procuring Entity: KENYA AIRPORTS AUTHORITY Physical address for the location (City, Street, Building, Floor Number and Room) KENYA AIRPORTS AUTHORITY HEADQUARTERS COMPLEX BUILDING, JKIA, AIRPORT NORTH ROAD, 2ND FLOOR, PROCUREMENT & LOGISTICS DEPARTMENT</p> <p>Date and time of tender opening: 27TH FEBRUARY, 2025. at 11:00am</p>
ITT 25.1	<p>If Tenderers are allowed to submit Tenders electronically, they shall follow the electronic tender submission procedures specified below:</p> <ol style="list-style-type: none"> 1. Upon accessing the tender documents, you will be required to respond to the tender online using the following link https://suppliers.kaa.go.ke/irj/portal. 2. Interested bidders who are not in KAA system and therefore do not have login credentials should contact KAA procurement through email: tenders@kaa.go.ke for login credentials early enough and not later than three (3) days before tender closing date. 3. All relevant submission documents must be attached on the login screen (Technical Proposal on C folder under technical Rfx Response system will lead you to the second screen (C folder) where the system creates a folder specific to you for uploading your response documents, do not click and attach your documents on the collaboration folder. click on "Tech Bid" the system will allow you to create a document, click "create" button and attach the documents. and Financial Proposal on Price Submission Screen). 4. A step-by-step manual/guide is available for downloading using the link https://www.kaa.go.ke/corporate/procurement/manuals/ 5. Completed Tender documents and its attachments shall be submitted

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	online before the closing date 27 TH FEBRUARY, 2025 at 11.00 am
E. Evaluation, and Comparison of Tenders	
ITT 30.3	The adjustment shall be based on the _____ [insert “average” or “highest”] price of the item or component as quoted in other substantially responsive Tenders. If the price of the item or component cannot be derived from the price of other substantially responsive Tenders, the Procuring Entity shall use its Lowest estimate.
ITT 32.1	<p>The currency that shall be used for Tender Evaluation and comparison purposes to convert at the selling exchange rate all Tender prices expressed in various currencies into a single currency is Kenya Shillings</p> <p>The source of exchange rate shall be: The Central Bank of Kenya</p> <p>The date for the exchange rate shall be: the deadline date for Submission of the Tenders</p> <p><i>For comparison of Tenders, the Tender price, corrected pursuant to ITT 31, shall first be broken down into the respective amounts payable in various currencies by using the selling exchange rates specified by the Tenderer in accordance with ITT 15.1</i></p> <p><i>In The second step, Procuring Entity will convert the amounts in various currencies in which the Tender Price is payable (excluding Provisional Sums but including Day work where priced competitively) to the single currency identified above at the selling rates established for similar transactions by the authority specified and, on the date, stipulated above.</i></p>
ITT 33.2	<p>A Margin of preference “shall not” apply.</p> <p><i>[If a margin of preference applies, the application methodology shall be defined in Section III – Evaluation and Qualification Criteria]</i></p>
ITT 33.4	<p>The invitation to tender is extended to the following groups that qualify for Reservations</p> <p>_____ N/A _____</p> <p>_____ (These groups are small and medium enterprises, women enterprises, youth enterprises and enterprises of persons living with disability, as the case may be; describe precisely which group qualifies).</p>
ITT 34.1	At this time, Procuring Entity “ does not intend ” to execute certain specific parts of the Works by subcontractors selected in advance.

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
ITT 34.2	Contractor's may propose subcontracting: Maximum percentage of subcontracting permitted is 10 % <i>of the total contract amount</i> . Tenderers planning to subcontract more than 10% of total volume of work shall specify, in the Form of Tender, the activity (ies) or parts of the works to be subcontracted along with complete details of the subcontractors and their qualification and experience.
ITT 34.3	This clause (ITT 34.2) is not applicable.
ITT 35.2 a	Price adjustment in accordance with ITT 31.2
ITT 35.2 (e)	Additional requirements apply. These are as detailed in the evaluation criteria in Section III, Evaluation and Qualification Criteria
ITT 48.2	Additional requirements are: _____ N/a _____

Reference to ITC Clause	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
ITT 50.1	<p>The procedures for making a Procurement-related Complaints are available from the PPRA website info@ppra.go.ke or complaints@ppra.go.ke.</p> <p>If a Tenderer wishes to make a Procurement –related Complaint, the Tenderer should submit its complaint following these procedures, in writing (by the quickest means available, that is either by hand delivery or email to:</p> <p>General Manager, Procurement & Logistics Kenya Airports Authority. Email address: tenders@kaa.go.ke</p> <p>In summary, a Procurement-related Complaint may challenge any of the following:</p> <ul style="list-style-type: none"> I. The terms of the Tender Documents; and II. Procuring Entity’s decision to award the contract

SECTION III- EVALUATION AND QUALIFICATION CRITERIA

General Provisions

- 1.1 This section contains the criteria that the Employer shall use to evaluate tender and qualify tenderers. No other factors, methods or criteria shall be used other than specified in this tender document. The Tenderer shall provide all the information requested in the forms included in Section IV, Tendering Forms. The Procuring Entity shall use the Standard Tender Evaluation Document for Goods and Works for evaluating Tenders.
- 1.2 Wherever a Tenderer is required to state a monetary amount, Tenderers should indicate the Kenya Shilling equivalent using the rate of exchange determined as follows:
 - a) For construction turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year (in which the amounts for that year is to be converted) was originally established.
 - b) Value of single contract - Exchange rate prevailing on the date of the contract signature.
 - c) Exchange rates shall be taken from the publicly available source identified in the ITT 14.3. Any error in determining the exchange rates in the Tender may be corrected by the Procuring Entity.

1.3. Evaluation and contract award Criteria

The Procuring Entity shall use the criteria and methodologies listed in this Section to evaluate tenders and arrive at the Lowest Evaluated Tender. The tender that; (i) meets the qualification criteria, (ii) has been determined to be substantially responsive to the Tender Documents, and (iii) is determined to have the Lowest Evaluated Tender price shall be selected for award of contract.

Preliminary examination for Determination of Responsiveness

The Procuring Entity will start by examining all tenders to ensure they meet in all respects the eligibility criteria and other requirements in the ITT, and that the tender is complete in all aspects in meeting the requirements of “Part 2 – Procuring Entity's Works Requirements”, including checking for tenders with unacceptable errors, abnormally low tenders, abnormally high tenders and tenders that are front loaded. The Standard Tender Evaluation Report for Goods and Works for evaluating Tenders provides clear guidelines on how to deal with review of these requirements. Tenders that do not pass the Preliminary Examination will be considered irresponsible and will not be considered further.

PART 1: PRELIMINARY EVALUATION CRITERIA, MANDATORY REQUIREMENTS.

PRELIMINARY EVALUATION REQUIREMENTS

Bidders shall be evaluated for mandatory qualification based on the requirements under the **QUALIFICATION FORM SUMMARY - A - PRELIMINARY EVALUATION**

No	Requirement	Compliance
1.	Duly filled, signed and stamped Form of Tender	Must meet
2.	Attach copy of Registration of Business/Certificate of Incorporation	Must meet
3.	A Copy of valid KRA tax compliance certificate.	Must meet
4.	Copy of valid Business Permit	Must meet
5.	Provide copy of CR12 or equivalent from country of origin (in case of joint venture with a foreign company), providing a list of directors and shareholding status. Where one or more of the shareholders is a company (Beneficial Ownership), the CR12 or equivalent from country of origin of such a company shall be provided. However, where the CR12 of the beneficial shareholders is not available, as at the time of the tender submission, the successful bidder shall be required to submit it before execution of the contract. This requirement is not applicable to sole proprietorships and partnerships registered under Business Names.	Must meet
6.	A written power of Attorney authorizing the signatory of the tender to commit the Tenderer certified by a commissioner for oaths. This requirement is not applicable to sole proprietorships	Must meet
7.	Duly filled, signed and stamped Certificate of Independent Tender Determination	Must Meet
8.	Duly filled, signed and stamped Self Declaration that the Person/Tenderer will not engage in any corrupt or fraudulent practice	Must meet
9.	Duly filled Declaration and commitment to the Code of Ethics	Must meet
10.	Self-Declaration that the Person/Tenderer is not Debarred in the Matter of the Public Procurement and Asset Disposal Act 2015	Must meet
11.	Duly filled Confidential Business Questionnaire Form	Must meet
12.	The Tender Security shall be required of Kshs. 1,400,000.00 valid for 216 days from the date of tender opening/closing. The tender security shall be in any of the following forms: a) cash or banker's cheque, or b) a bank guarantee, or c) guarantee issued by a reputable insurance company approved by Public Procurement Regulatory Authority (PPRA) or d) Letter of credit Bidders are required to note the following:	Must Meet

	<p>(i) Those who have obtained a digital tender security must provide it online with their tender document in the KAA portal. The digital tender security must have a mechanism to verify such as use of quick response (QR) code or an online portal. They do not need to provide a hard copy of the tender security physically.</p> <p>(ii) Those who do not provide a digital tender security as per (i) above will be required to submit an original Tender Security physically to the office of the General Manager, Procurement and Logistics department, KAA Headquarters, 2nd Floor on or before the closing/opening date and time.</p>	
13.	Bidders to serialize their bidding documents from the first to the last page including all the attachments.	Must Meet
14.	Proof of registration with the National Construction Authority in NCA 3 and NCA 4 as a Roads Contractor or Similar from the Country of Origin. A Copy of Current Practicing License and Registration Certificate	Must Meet
15.	Duly signed and stamped site visit/attendance certificate	Must Meet

NB: Bidders who are not responsive to any of the above requirements will be disqualified and shall not be evaluated further.

TECHNICAL EVALUATION.

Technical Evaluation shall be in accordance with QUALIFICATION FORM SUMMARY - B TECHNICAL EVALUATION.

B. TECHNICAL EVALUATION				
1	History of Non-Performing Contracts	<p>Duly filled Form CON-2 on Non-performance of a contract did not occur as a result of contractor's default for the last (5) five years from the date of this tender</p> <p><i>(failure to complete the projects for the last three (3) Financial Years delayed progress, Notice of Termination or Termination of Contracts in the last three (3) Financial Years will lead to disqualification)</i></p>	Due diligence where applicable.	

2	Financial Capabilities	<p>A Copies of the following documents as proof of access to liquid assets of not less than Three Hundred and Fifty Million Kenya Shillings (KES.350,000,000.00) or capacity to have a minimum cash flow of Three Hundred and Fifty Million Kenya Shillings (KES.350,000,000.00)</p> <p>This shall be evidenced by any of the following:</p> <ol style="list-style-type: none"> 1. Letter of line of credit from a Commercial Bank addressed to KAA MD specific to the tender indicating the amount to be availed. or 2. Three Hundred and Fifty Million Kenya Shillings (KES.350,000,000.00) Overdraft facility from a Commercial Bank specifically for this project and indicating the amount to be availed. or 3. Current bank statement for the last twelve(12) months with average turn Over of Three Hundred and Fifty Million Kenya Shillings (KES.350,000,000.00) 4. Or a combination of the above 	
3	Annual Construction Turnover	<p>Minimum average construction turnover of One Hundred Million Kenya Shillings or equivalent (KES 100,000,000.00) calculated as total certified payments received for contracts in progress and/or completed as a Prime Contractor within the last [2] Two years,</p> <p>Minimum Two (2) No. works valued at an average of One Hundred million Kenya Shillings (KES 100,000,000.00) or more.</p> <p>Completion Certificates or Certified payment statements</p>	
4	Specific Construction & Contract Management Experience	<p>A minimum number of [1] One similar contract(s) as specified below that have been satisfactorily and substantially completed as a Prime Contractor for the last (2) Two years from the date of tender submission deadline i.e. [1] One (number) contract(s) of minimum equivalent value Kenya shillings One Hundred Fifty Million Shillings (KES 150,000,000.00).</p> <p>The total value of the project(s) shall not be less than an equivalent One Hundred and Fifty Million Kenya Shillings (KES 150,000,000.00).</p>	<p>Form EXP 4.2(a and b)</p> <p>Must provide a list with the following details;</p> <ol style="list-style-type: none"> i. Name of Employer (Client), ii. Value of the works, iii. Completion Date. <p>Attach evidence inform of certified copies of the following documents;</p> <ol style="list-style-type: none"> i. LPO or Contract Agreement, ii. Completion Certificate,

		<p>a) <i>In case of subcontract experience, the tenderer shall submit a letter from the Employing Authority confirming subcontract agreement, scope and amount).</i></p> <p>b) <i>Bidders who provide projects contracted by private entities other than Government Agencies, Parastatals, Ministries, County Governments shall provide bank statements reflecting the interim payment certificates (IPC's) paid for such projects.</i></p> <p>c) <i>In case the Works are to be tendered as individual contracts under multiple contract procedure, the minimum number of contracts required for purposes of evaluating qualification shall be selected from the options mentioned in ITT 37.4</i></p> <p>d) <i>The similarity of the contracts shall be based on the following: [Based on Section VII, Scope of Works, specify the minimum key requirements in terms of physical size, complexity, construction method, technology and/or other characteristics including part of the requirements that may be met by specialized subcontractors, if permitted in accordance with ITT 34.3</i></p>	<p>Sub Contract experience SHALL NOT apply.</p> <p><i>All submitted Documents may be verified with the issuing agencies, KAA reserves the right to verify all submitted documents</i></p>	
	Contractor's Representative and Key	Qualifications and technical experience of site personnel to manage and execute the works on	<p>Form PER- 1 and PER-2</p> <ul style="list-style-type: none"> Copies of academic 	

Personnel	<p>the site.</p> <p>Site Agent (Principal Site Representative of the Contractor):</p> <ol style="list-style-type: none"> 1. BSc Civil Engineering 2. Registered Professional Civil Engineer with Engineers Board of Kenya (EBK) and a Corporate member of the Institution of Engineers of Kenya (IEK) and must have a valid Practicing License for 2024 - Mandatory 3. Experience – 15 years with over Ten (10) years Post Registration experience 4. Specific experience on asphalt concrete pavements (roads / airports) – Eight (8) years. <p>Assistant Site Agent</p> <ol style="list-style-type: none"> 1. BSc Civil Engineering 2. Experience – Eight (8) years 3. Registered as a Professional Civil Engineer with Engineers Board of Kenya (EBK) with over 5 years post Registration experience. Must have a valid Practicing License for 2024 4. Specific experience on asphalt concrete pavements (roads / airports) – Five (5) years <p>Site Foreman (Earthworks)</p> <ol style="list-style-type: none"> 1. National Diploma in Civil Engineering 2. Registered with KETRAB 3. Experience – Ten (10) years 4. Specific experience on in 	<p>certificates</p> <ul style="list-style-type: none"> • Copies of professional certificates • Copies of current practicing license • Curriculum vitae signed by the nominee • A written undertaking signed by the nominee confirming his/her availability to carry out the assignment upon winning the bid. The written undertaking shall be addressed to MD/CEO Kenya Airports Authority and must be specific to this tender • <i>Certificates shall be signed & stamped by Commissioner of Oaths)</i>
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		<p>earthworks (roads / airports) – Ten years</p> <p>Site Foreman (Asphalt)</p> <ol style="list-style-type: none"> 1. National Diploma in Civil Engineering 2. Registered with KETRAB 3. Experience – Ten (10) years 4. Specific experience in Asphalt works (roads / airports) – Ten years <p>Engineering Surveyor</p> <ol style="list-style-type: none"> 1. BSC in Surveying/Photogrammetry 2. Registered as a Full Member with ISK. 3. Experience on roads/aircraft pavements or similar survey work – Ten (10) years. <p>Lab Technologist</p> <ol style="list-style-type: none"> 1. National Diploma in Civil Engineering. 2. Registered with KETRAB 3. Experience – Ten (10) years in similar works 		
	Contractors key equipment	<p>Equipment and Machinery</p> <p>Must demonstrate availability of the following key minimum equipment necessary to undertake the work. The equipment must be serviceable and in good working condition.</p> <ol style="list-style-type: none"> 1. Cat 140H motor grader or equivalent complete. - 1 No. 2. Vibrating roller (10 tonnes). - 1 No. 3. Cat 950G wheel loader or equivalent. - 1 No. 4. 15 Tonne Tipper lorry. - 5 No. 5. Asphalt paver. - Automatic or similar - 1 No. 	<p>Form EQU</p> <ul style="list-style-type: none"> • The equipment must be owned by the bidder, must provide CLEAR copies of log book or proof of ownership 	

		6. Pneumatic self-propelled roller -15 tonnes - 1 No 7. Sheep foot roller – 14 tons – 1 No. 8. Tandem Vibratory steel drum roller – 1No 9. Traxcavator with loader attachments-1.0m ³ - 1 No. 10. Backhoe – 1No. 11. One to one & a half tonne capacity pick-up. – 1 No. 12. Self-propelled water tanker 6,000-20,000 litre minimum capacity with pick-up pump. – 1 No. 13. Pressure bitumen distributor 4500-8000 litres capacity. – 1 No.		
	Proposed Methodology	Adequacy and quality of the proposed methodology	a) Technical approach and methodology <ul style="list-style-type: none"> Provide a detailed work methodology <ol style="list-style-type: none"> Procedure execution of activities as outlined in BoQ Allocation machinery/labour execution activities Procedures in quality control of the activities described in BoQs Provided a Methodology on safety during the construction period: <ol style="list-style-type: none"> Personal protective equipment Signages Delineation of construction and passage of traffic Passage of traffic at night 	

			<p>Provided a specific Quality management plan</p> <ol style="list-style-type: none"> 1.Scope Management 2.Time Management 3.Material Quality Management 4.Financial Management 5.Risk Management 6.Health & Safety Management 7.Environmental Management 8.Communication Management 9.Procurement Management 10. Human Resource Management <p>b) Work plan/Program of Works (PoW)</p> <ol style="list-style-type: none"> 1.PoW Resourced with Equipment-Min. allocation pursuant to the <i>Schedule E of</i> <p>2.Technical Proposal - – To be submitted in A3 Size Paper well legible Fonts</p> <ol style="list-style-type: none"> 1. PoW captures Monthly outputs for each activity 2. PoW details BoQ Quantities, Units and Rates 3. PoW is superimposed with Cashflow Projections as detailed in Schedule A of the technical proposal <p>c) Site Organization and staffing (Schedule B of</p>	
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			Technical proposal)	
24	Priced Bill of Quantities	Fill all rates, and amounts, NO Alterations of the Quantities accepted, All bidders own Corrections must be Countersigned NO Errors noted in the Bills of Quantities NO Alterations of the units of measurements accepted,	Bills of Quantity in the Prescribed Format	

NOTE:

Tenderers who will not meet ANY of the above Preliminary and Technical requirements that is mandatory will not be evaluated any further.

Tender Evaluation (ITT 35)

FINANCIAL EVALUATION

Only the bids which will be responsive to the technical requirement shall undergo financial evaluation which shall include evaluation of:

- i. Duly completed and signed Form of Tender and the appendix to the form of tender in the format contained in this bid document
- ii. Priced Bill of Quantities in the format contained in this bid document.

The financial evaluation will be based on the lowest evaluated bidder.

Note: Bidders are hereby notified that due diligence shall be carried out on information provided by the bidder. Any false information provided will lead to automatic disqualification irrespective at any stage of the procurement process or contract execution.

Price evaluation: In addition to the criteria listed in ITT 35.2 (a) – (d) the following criteria shall apply:

- i. Alternative Completion Times, if permitted under ITT 13.2, will be evaluated as follows.....N/A.....
- ii. Alternative Technical Solutions for specified parts of the Works, if permitted under ITT 13.4, will be evaluated as follows ...N/A.....
- iii. Other Criteria; if permitted under ITT35.2 (d)N/A.....

Multiple Contracts

Multiple contracts will be permitted in accordance with ITT 35.4. Tenderers are evaluated on basis of Lots and the lowest evaluated tenderer identified for each Lot. The Procuring Entity will select one Option of the two Options listed below for award of Contracts.

OPTION 1

- i. If a tenderer wins only One Lot, the tenderer will be awarded a Contract for that Lot, provided the tenderer meets the Eligibility and Qualification Criteria for that Lot.
- ii. If a tenderer wins more than One Lot, the tender will be awarded Contracts for all won Lots, provided the tenderer meets the aggregate Eligibility and Qualification Criteria for all the Lots. The tenderer will be awarded the combination of Lots for which the tenderer qualifies and the others will be considered for award to second lowest the tenderers.

OPTION 2

The Procuring Entity will consider all possible combinations of won Lots [contract(s)] and determine the combinations with the lowest evaluated price. Tenders will then be awarded to the Tenderer or Tenderers in the combinations provided the tenderer meets the aggregate Eligibility and Qualification Criteria for all the won Lots.

Alternative Tenders (ITT 13.1)

An alternative if permitted under ITT 13.1, will be evaluated as follows:

The Procuring Entity shall consider Tenders offered for alternatives as specified in Part2-Works Requirements. Only the technical alternatives, if any, of the Tenderer with the Best Evaluated Tender conforming to the basic technical requirements shall be considered.

Margin of Preference

- a) If the TDS so specifies, the Procuring Entity will grant a margin of preference of fifteen percent (15%) to be loaded to one valuated price of the foreign tenderers, where the percentage of shareholding of Kenyan citizens is less than fifty-one percent (51%).
- b) Contractors applying for such preference shall be asked to provide, as part of the data for qualification, such information, including details of ownership, as shall be required to determine whether, according to the classification established by the Procuring Entity, a particular contract or group of contractors qualifies for a margin of preference.
- c) After Tenders have been received and reviewed by the Procuring Entity, responsive Tenders shall be assessed to ascertain their percentage of shareholding of Kenyan citizens. Responsive tenders to shall be classified into the following groups:
 - i. Group A: tenders offered by Kenyan Contractors and other Tenderers where

- Kenyan citizens hold shares of over fifty one percent (51%).
- ii. Group B: tenders offered by foreign Contractors and other Tenderers where Kenyan citizens hold shares of less than fifty one percent (51%).
- d) All evaluated tenders in each group shall, as a first evaluation step, be compared to determine the lowest tender, and the lowest evaluated tender in each group shall be further compared with each other. If, as a result of this comparison, a tender from Group A is the lowest, it shall be selected for the award. If a tender from Group B is the lowest, an amount equal to the percentage indicated in Item 3.1 of the respective tender price, including unconditional discounts and excluding provisional sums and the cost of day works, if any, shall be added to the evaluated price offered in each tender from Group B. All tenders shall then be compared using new prices with added prices to Group B and the lowest evaluated tender from Group A. If the tender from Group A is still the lowest tender, it shall be selected for award. If not, the lowest evaluated tender from Group B based on the first evaluation price shall be selected.

Post qualification and Contract award (ITT 39).

more specifically, - to use the technical evaluation criteria provided above in no. 2 and 3 above.

- a) In case the tender was subject to post-qualification, the contract shall be awarded to the lowest evaluated tenderer, subject to confirmation of pre-qualification data, if so required.
- b) In case the tender was not subject to post-qualification, the tender that has been determined to be the lowest evaluated tenderer shall be considered for contract award, subject to meeting each of the following conditions.
 - i. Contractors key equipment listed on the table “Contractor's Equipment” below and more specifically as listed in the **Technical Evaluation Criteria** [specify requirements for each lot as applicable]
 - ii. Other conditions depending on their seriousness.

a) History of non-performing contracts:

Tenderer and each member of JV in case the Tenderer is a JV, shall demonstrate that Non-performance of a contract did not occur because of the default of the Tenderer, or the member of a JV in the last three (3) years. The required information shall be furnished in the appropriate form.

b) Pending Litigation

Financial position and prospective long-term profitability of the Single Tenderer, and in the case the Tenderer is a JV, of each member of the JV, shall remain sound according to criteria established with respect to Financial Capability under Paragraph (i) above if all pending litigation will be resolved against the Tenderer. Tenderer shall provide information on pending litigations in the appropriate form.

c) Litigation History

There shall be no consistent history of court/arbitral award decisions against the Tenderer, in the last

Three (3) years. All parties to the contract shall furnish the information in the appropriate form about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the years specified. A consistent history of awards against the Tenderer or any member of a JV may result in rejection of the tender.

SECTION IV: TENDERING FORMS

QUALIFICATION FORMS

1. FOREIGN TENDERERS 40% RULE.
2. TENDERER'S ELIGIBILITY- CONFIDENTIAL BUSINESS QUESTIONNAIRE
3. Form EQU: EQUIPMENT.
4. FORM PER -1.
5. FORM PER-2.
6. TENDERERS QUALIFICATION WITHOUT PRE-QUALIFICATION.
 - 6.1 FORM ELI-1.1.
 - 6.2 FORM ELI-1.2.
 - 6.3 FORM CON –2.
 - 6.4 FORM FIN –3.1.
 - 6.5 FORM FIN –3.2.
 - 6.6 FORM FIN –3.3.
 - 6.7 FORM FIN –3.4.
 - 6.8 FORM EXP -4.1.
 - 6.9 FORM EXP - 4.2(a).
 - 6.9 FORM EXP - 4.2 (a) (cont.).
 - 6.10 FORM EXP -4.2 (b).

OTHER FORMS

7. FORM OF TENDER.
8. FORM OF TENDER SECURITY - DEMAND BANK GUARANTEE.
9. FORM OF TENDER SECURITY (TENDER BOND).
10. FORM OF TENDER-SECURING DECLARATION.
11. APPENDIX TO TENDER.

TECHNICAL PROPOSAL FORMS

Site Organization. Method Statement. Mobilization Schedule. Construction Schedule.

1.0 QUALIFICATION FORMS

2.0 FOREIGN TENDERERS 40%RULE

Pursuant to ITT 3.9, a foreign tenderer must complete this form to demonstrate that the tender fulfils this condition.

ITEM	Description of Work Item	Describe location of Source	COST in K. shillings	Comments, if any
A	Local Labor			
1				
2				
3				
4				
5				
B	Sub contracts from Local sources			
1				
2				
3				
4				
5				
C	Local materials			
1				
2				
3				
4				
5				
D	Use of Local Plant and Equipment			
1				
2				
3				
4				
5				
E	Add any other items			
1				
2				
3				
4				
5				
6				
	TOTAL COST LOCAL CONTENT			
	PERCENTAGE OF CONTRACT PRICE			

3.0 FORM EQU: EQUIPMENT

The Tenderer 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 Tenderer.

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

Omit the following information for equipment owned by the Tenderer.

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	

4.0 FORM PER -1

Contractor's Representative and Key Personnel Schedule

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

Contractor' Representative and Key Personnel

1.	Title of position: Contractor's Representative	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
2.	Title of position: [_____]	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
3.	Title of position: [_____]	
	Name of candidate:	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
4.	Title of position: [_____]	
	Name of candidate:	

	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	
5.	Title of position:	
	Name of candidate	
	Duration of appointment:	
	Time commitment: for this position:	
	Expected time schedule for this position:	

5.0 FORM PER-2

Resume and Declaration - Contractor's Representative and Key Personnel.

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

Name of Tenderer

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

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

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

Declaration

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

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

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

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

- a) Be taken into consideration during Tender evaluation;
- b) Result in my disqualification from participating in the Tender;
- c) Result in my dismissal from the contract.

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

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Tenderer:

Signature: _____

Date: (day month year): _____

TENDERER'S QUALIFICATION WITHOUT PRE-QUALIFICATION

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

6.0 FORM ELI -1.1

Tenderer Information Form

Date: _____

ITT No. and title: _____

Tenderer's name
In case of Joint Venture (JV), name of each member:
Tenderer's actual or intended country of registration: <i>[indicate country of Constitution]</i>
Tenderer's actual or intended year of incorporation:
Tenderer's legal address [in country of registration]:
Tenderer's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITT 3.6 <input type="checkbox"/> In case of JV, letter of intent to form JV or JV agreement, in accordance with ITT 3.5 <input type="checkbox"/> In case of state-owned enterprise or institution, in accordance with ITT 3.8, documents establishing: <ul style="list-style-type: none">• Legal and financial autonomy• Operation under commercial law• Establishing that the Tenderer is not under the supervision of the Procuring Entity
2. Included are the organizational chart and a list of Board of Directors.

7.0 FORM ELI -1.2

Tenderer's JV Information Form

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

Date: _____

ITT No. and title: _____

Tenderer's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITT 3.6. <input type="checkbox"/> In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Procuring Entity, in accordance with ITT 3.8. 2. Included are the organizational chart and a list of Board of Directors.

8.0 FORM CON – 2

Historical Contract Non-Performance, Pending Litigation and Litigation History

Tenderer's Name: _____

Date: _____

JV Member's Name ITT No. and title: _____

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1.☐ Contract(s) not performed since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1

Year	Non-performed portion of contract	Contract Identification	Total Contract Amount (current value, currency, exchange rate and Kenya Shilling equivalent)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Procuring Entity: <i>[insert full name]</i> Address of Procuring Entity: <i>[insert street/city/country]</i> Reason(s) for nonperformance: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>

Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3.☐ Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below.

Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount (currency), Kenya Shilling Equivalent (exchange rate)
		Contract Identification: _____ Name of Procuring Entity: _____ Address of Procuring Entity: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	
		Contract Identification: _____ Name of Procuring Entity: _____ Address of Procuring Entity: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	
Litigation History in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4. <input type="checkbox"/> Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below.			
Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (currency), Kenya Shilling Equivalent (exchange rate)
<i>[insert year]</i>	<i>[insert percentage]</i>	Contract Identification: <i>[indicate complete contract name, number, and any other identification]</i> Name of Procuring Entity: <i>[insert full name]</i> Address of Procuring Entity: <i>[insert street/city/country]</i> Matter in dispute: <i>[indicate main issues in dispute]</i> Party who initiated the dispute: <i>[indicate "Procuring Entity" or "Contractor"]</i> Reason(s) for Litigation and award decision <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>

9.0 FORM FIN – 3.1:

Financial Situation and Performance

Tenderer's Name: _____

Date: _____

JV Member's Name _____

ITT No. and title: _____

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

Sources of Finance

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

No.	Source of finance	Amount (Kenya Shilling equivalent)
1		
2		
3		

Financial documents

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

- a. Reflect the financial situation of the Tenderer or in case of JV member, and not an affiliated entity (such as parent company or group member).
- b. Be independently audited or certified in accordance with local legislation.
- c. Be complete, including all notes to the financial statements.
- d. Correspond to accounting periods already completed and audited.

Attached are copies of financial statements for the _____years required above; and complying with the requirements.

10.0 FORM FIN – 3.2:

Average Annual Construction Turnover

Tenderer's Name: _____

Date: _____

JV Member's Name _____

ITT No. and title: _____

		Annual turnover data (construction only)		
Year	Amount Currency	Exchange rate	Kenya equivalent	Shilling
<i>[indicate year]</i>	<i>[insert amount and indicate currency]</i>			
Average Annual Construction Turnover *				

11.0 FORM FIN – 3.3:

Financial Resources

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

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

12.0 FORM FIN – 3.4:**Current Contract Commitments / Works in Progress**

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

No.	Name of Contract	Procuring Entity's Contact Address, Tel,	Value of Outstanding Work [Current Kenya Shilling /month Equivalent]	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months [Kenya Shilling /month)]
1					
2					
3					
4					
5					

13.0 FORM EXP - 4.1

General Construction Experience

Tenderer's Name: _____

Date: _____

JV Member's Name _____

ITT No. and title: _____

Page _____ of _____ pages

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

14.0 FORM EXP - 4.2(a)

Specific Construction and Contract Management Experience

Tenderer's Name: _____

Date: _____

JV Member's Name _____

ITT No. and title: _____

Similar Contract No.	Information			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor <input type="checkbox"/>	Member in JV <input type="checkbox"/>	Management Contractor <input type="checkbox"/>	Sub-contractor <input type="checkbox"/>
Total Contract Amount	Kenya Shilling			
If member in a JV or sub-contractor, specify participation in total Contract amount				
Procuring Entity's Name:				
Address:				
Telephone/fax number				
E-mail:				

15.0 FORM EXP - 4.2 (a) (cont.)

Specific Construction and Contract Management Experience (cont.)

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

16.0 FORM EXP - 4.2(b)**Construction Experience in Key Activities**

Tenderer's Name: _____

Date: _____

Tenderer's JV Member Name: _____

Sub-contractor's Name (as per ITT 34): _____

ITT No. and title: _____

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

Information				
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor <input type="checkbox"/>	Member JV <input type="checkbox"/>	in Management Contractor <input type="checkbox"/>	Sub-contractor <input type="checkbox"/>
Total Contract Amount	Kenya Shilling			
Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year	Total quantity in the contract (i)	Percentage participation (ii)		Actual Quantity Performed (i) x (ii)
Year 1				
Year 2				
Year 3				
Year 4				
Procuring Entity's Name:				
Address: Telephone/fax number E-mail:				

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

17.0 FORM OF TENDER

INSTRUCTIONS TO TENDERERS

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are not bound to accept the lowest or any tender you may receive.

5. We, the undersigned, further declare that:

- i) No reservations: We have examined and have no reservations to the tender document, including Addenda issued in accordance with ITT 28;
- ii) Eligibility: We meet the eligibility requirements and have no conflict of interest in accordance with ITT 3 and 4;
- iii) Tender-Securing Declaration: We have not been suspended nor declared ineligible by the Procuring Entity based on execution of a Tender-Securing or Proposal-Securing Declaration in the Procuring Entity's Country in accordance with ITT 19.8;
- iv) Conformity: We offer to execute in conformity with the tendering documents and in accordance with the implementation and completion specified in the construction schedule, the following Works: *[insert a brief description of the Works]*;
- v) Tender Price: The total price of our Tender, excluding any discounts offered in item 1 above is: *[Insert one of the options below as appropriate]*
- vi) Option 1, in case of one lot: Total price is: *[insert the total price of the Tender in words and figures, indicating the various amounts and the respective currencies]*; Or
Option 2, in case of multiple lots:
 - a) Total price of each lot *[insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies]*; and
 - b) Total price of all lots (sum of all lots) *[insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies]*;
- vii) Discounts: The discounts offered and the methodology for their application are:
- viii) The discounts offered are: *[Specify in detail each discount offered.]*
- ix) The exact method of calculations to determine the net price after application of discounts is shown below: *[Specify in detail the method that shall be used to apply the discounts]*;
- x) Tender Validity Period: Our Tender shall be valid for the period specified in TDS 18.1 (as amended, if applicable) from the date fixed for the Tender submission deadline specified in TDS 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- xi) Performance Security: If our Tender is accepted, we commit to obtain a Performance Security in accordance with the Tendering document;
- xii) One Tender Per Tender: We are not submitting any other Tender(s) as an individual Tender, and we are not participating in any other Tender(s) as a Joint Venture member or as a subcontractor, and meet the requirements of ITT 3.4, other than alternative Tenders submitted in accordance with ITT 13.3;

- xiii) **Suspension and Debarment:** We, along with any of our subcontractors, suppliers, Project Manager, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the Public Procurement Regulatory Authority or any other entity of the Government of Kenya, or any international organization.
- xiv) **State-owned enterprise or institution:** *[select the appropriate option and delete the other] [We are not a state-owned enterprise or institution] / [We are a state-owned enterprise or institution but meet the requirements of ITT 3.8];*

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

Name of Recipient	Address	Reason	Amount

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

- xv) **Binding Contract:** We understand that this Tender, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;
- xvi) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Tender, the Most Advantageous Tender or any other Tender that you may receive;
- xvii) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption;
- xviii) **Collusive practices:** We hereby certify and confirm that the tender is genuine, non-collusive and made with the intention of accepting the contract if awarded. To this effect we have signed the "Certificate of Independent Tender Determination" attached below.
- xix) We undertake to adhere by the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal, copy available from *_(specify website)_* during the procurement process and the execution of any resulting contract.
- xx) **Beneficial Ownership Information:** We commit to provide to the Procuring Entity the Beneficial Ownership Information in conformity with the Beneficial Ownership Disclosure Form upon receipt of notification of intention to enter into a contract in the event we are the successful tenderer in this subject procurement proceeding.

xxi) We, the Tenderer, have duly completed, signed and stamped the following Forms as part of our Tender:

- a) Tenderer's Eligibility; Confidential Business Questionnaire – to establish we are not in any conflict to interest.
- b) Certificate of Independent Tender Determination – to declare that we completed the tender without colluding with other tenderers.
- c) Self-Declaration of the Tenderer – to declare that we will, if awarded a contract, not engage in any form of fraud and corruption.
- d) Declaration and commitment to the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal

Further, we confirm that we have read and understood the full content and scope of fraud and corruption as informed in “**Appendix 1- Fraud and Corruption**” attached to the Form of Tender.

Name of the Tenderer: **[insert complete name of person signing the Tender]*

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

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

Signature of the person named above: *[insert signature of person whose name and capacity are shown above]* **Date signed** *[insert date of signing]* day of *[insert month]*, *[insert year]*

Date signed _____ day of _____, _____

Notes

** In the case of the Tender submitted by joint venture specify the name of the Joint Venture as Tenderer*

*** Person signing the Tender shall have the power of attorney given by the Tenderer to be attached with the Tender.*

TENDERER'S ELIGIBILITY - CONFIDENTIAL BUSINESS QUESTIONNAIRE

Instruction to Tenderer

Tender is instructed to complete the particulars required in this Form, one form for each entity if Tender is a JV. Tenderer is further reminded that it is an offence to give false information on this Form.

Tenderer's details

	ITEM	DESCRIPTION
1	Name of the Procuring Entity	
2	Reference Number of the Tender	KAA/OT/KIA/0090/2024-2025
3	Date and Time of Tender Opening	
4	Name of the Tenderer	
5	Full Address and Contact Details of the Tenderer.	1. Country 2. City 3. Location 4. Building 5. Floor 6. Postal Address 7. Name and email of contact person.
6	Current Trade License Registration Number and Expiring date	
7	Name, country and full address (<i>postal and physical addresses, email, and telephone number</i>) of Registering Body/Agency	
8	Description of Nature of Business	
9	Maximum value of business which the Tenderer handles.	
10	State if Tenders Company is listed in stock exchange, give name and full address (<i>postal and physical addresses, email, and telephone number</i>) of state which stock exchange	

General and Specific Details

b) **Sole Proprietor**, provide the following details.

Name in full _____ Age _____
Nationality _____ Country of Origin _____ Citizenship _____

Partnership, provide the following details.

	Names of Partners	Nationality	Citizenship	% Shares owned
1				
2				
3				

b) **Registered Company**, provide the following details.

- i) Private or public Company.....
- ii) State the nominal and issued capital of the Company Nominal Kenya Shillings
(Equivalent)..... Issued Kenya Shillings
(Equivalent).....

Give details of Directors as follows

	Names of Director	Nationality	Citizenship	% Shares owned
1				
2				
3				

(e) **DISCLOSURE OF INTEREST- Interest of the Firm in the Procuring Entity.**

- i) Are there any person/persons in Procuring Entity who has/have an interest or relationship in this firm?
Yes/No.....

If yes, provide details as follows.

	Names of Person	Designation in the Procuring Entity	Interest or Relationship with Tenderer
1			
2			
3			

ii) **Conflict of interest disclosure**

	Type of Conflict	Disclosure YES OR NO	If YES provide details of the relationship with Tenderer
1	Tenderer is directly or indirectly controls, is controlled by or is under common control with another tenderer.		
2	Tenderer receives or has received any direct or indirect subsidy from another tenderer.		
3	Tenderer has the same legal representative as another tenderer		
4	Tender has a relationship with another tenderer, directly or through common third parties, that puts it in a position to influence the tender of another tenderer, or influence the decisions of the Procuring Entity regarding this tendering process.		
5	Any of the Tenderer's affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the tender.		
6	Tenderer would be providing goods, works, non-consulting services or consulting services during implementation of the contract specified in this Tender Document.		
7	Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract.		
8	Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who would be involved in the implementation or supervision of the such Contract.		
9	Has the conflict stemming from such relationship stated in item 7 and 8 above been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract.		

Certification

On behalf of the Tenderer, I certify that the information given above is complete, current and accurate as at the date of submission.

Full Name.....

Title/Designation

(Signature)

(Date)

CERTIFICATE OF INDEPENDENT TENDER DETERMINATION

I, the undersigned, in submitting the accompanying Letter of Tender to the Procuring Entity for **PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT TENDER No. KAA/OT/KIA/0090/2024-2025** [Name and number of tender] in response to the request for tenders made by: **KENYA AIRPORTS AUTHORITY** do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of _____ [Name of Tenderer] that:

1. I have read and I understand the contents of this Certificate;
2. I understand that the Tender will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am the authorized representative of the Tenderer with authority to sign this Certificate, and to submit the Tender on behalf of the Tenderer;
4. For the purposes of this Certificate and the Tender, I understand that the word “competitor” shall include any individual or organization, other than the Tenderer, whether or not affiliated with the Tenderer, who:
 - a) has been requested to submit a Tender in response to this request for tenders;
 - b) could potentially submit a tender in response to this request for tenders, based on their qualifications, abilities or experience;
5. The Tenderer discloses that [check one of the following, as applicable]:
 - a) The Tenderer has arrived at the Tender independently from, and without consultation, communication, agreement or arrangement with, any competitor;
 - b) the Tenderer has entered into consultations, communications, agreements or arrangements with one or more competitors regarding this request for tenders, and the Tenderer discloses, in the attached document(s), complete details thereof, including the names of the competitors and the nature of, and reasons for, such consultations, communications, agreements or arrangements;
6. In particular, without limiting the generality of paragraphs (5)(a) or (5)(b) above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - a) prices;
 - b) methods, factors or formulas used to calculate prices;
 - c) the intention or decision to submit, or not to submit, a tender; or
 - d) the submission of a tender which does not meet the specifications of the request for Tenders; except as specifically disclosed pursuant to paragraph (5)(b) above;
7. In addition, there has been no consultation, communication, agreement or arrangement with any competitor regarding the quality, quantity, specifications or delivery particulars of the works or services to which this request for tenders relates, except as specifically authorized by the procuring authority or as specifically disclosed pursuant to paragraph (5)(b) above;
8. the terms of the Tender have not been, and will not be, knowingly disclosed by the Tenderer, directly

or indirectly, to any competitor, prior to the date and time of the official tender opening, or of the awarding of the Contract, whichever comes first, unless otherwise required by law or as specifically disclosed pursuant to paragraph (5)(b) above.

Name _____

Title _____

Date _____

[Name, title and signature of authorized agent of Tenderer and Date].

SELF - DECLARATION FORMS

FORM SD1

SELF DECLARATION THAT THE PERSON/TENDERER IS NOT DEBARRED IN THE MATTER OF THE PUBLIC PROCUREMENT AND ASSET DISPOSAL ACT 2015.

I,, of Post Office Box being a resident of in the Republic of do hereby make a statement as follows: -

1. THAT I am the Company Secretary/ Chief Executive/Managing Director/Principal Officer/Director of (*insert name of the Company*) who is a Bidder in respect of Tender No. **TENDER No. KAA/OT/KIA/0090/2024-2025** for **PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT** for **KENYA AIRPORTS AUTHORITY** and duly authorized and competent to make this statement.
2. THAT the aforesaid Bidder, its Directors and subcontractors have not been debarred from participating in procurement proceeding under Part IV of the Act.
3. THAT what is deponed to herein above is true to the best of my knowledge, information and belief.

Title _____ Signature _____ Date _____

Bidder Official Stamp

FORM SD2

SELF DECLARATION THAT THE PERSON/TENDERER WILL NOT ENGAGE IN ANY CORRUPT OR FRAUDULENT PRACTICE

I, of P. O. Box being a resident of..... in the Republic of do hereby make a statement as follows: -

1. THAT I am the Chief Executive/Managing Director/Principal Officer/Director of
(insert name of the Company) who is a Bidder in respect of **TENDER No. KAA/OT/KIA/0090/2024-2025** for **PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT** for **KENYA AIRPORTS AUTHORITY** and duly authorized and competent to make this statement.
2. THAT the aforesaid Bidder, its servants and/or agents /subcontractors will not engage in any corrupt or fraudulent practice and has not been requested to pay any inducement to any member of the Board, Management, Staff and/or employees and/or agents of Procuring Entity.
3. THAT the aforesaid Bidder, its servants and/or agents /subcontractors have not offered any inducement to any member of the Board, Management, Staff and/or employees and/or agents of Procuring Entity)
4. THAT the aforesaid Bidder will not engage /has not engaged in any corrosive practice with other bidders participating in the subject tender
5. THAT what is deponed to herein above is true to the best of my knowledge information and belief.

Title _____

Signature _____

Date _____

Bidder's Official Stamp

DECLARATION AND COMMITMENT TO THE CODE OF ETHICS

I (person) on behalf of (*Name of the Business/ Company/Firm*) declare that I have read and fully understood the contents of the Public Procurement & Asset Disposal Act, 2015, Regulations and the Code of Ethics for persons participating in Public Procurement and Asset Disposal and my responsibilities under the Code.

I do hereby commit to abide by the provisions of the Code of Ethics for persons participating in Public Procurement and Asset Disposal.

Name of Authorized signatory.....

Sign.....

Position.....

Office address.....

Telephone..... Email.....

Name of the firm/Company.....

Date.....

Company Seal/ Rubber Stamp where applicable

Witness

Name

Sign..... Date.....

APPENDIX 1- FRAUD AND CORRUPTION

(Appendix 1 shall not be modified)

Purpose

The Government of Kenya's Anti-Corruption and Economic Crime laws and their sanction's policies and procedures, Public Procurement and Asset Disposal Act (*no. 33 of 2015*) and its Regulation, and any other Kenya's Acts or Regulations related to Fraud and Corruption, and similar offences, shall apply with respect to Public Procurement Processes and Contracts that are governed by the laws of Kenya.

Requirements

The Government of Kenya requires that all parties including Procuring Entities, Tenderers, (applicants/proposers), Consultants, Contractors and Suppliers; any Sub-contractors, Sub-consultants, Service providers or Suppliers; any Agents (whether declared or not); and any of their Personnel, involved and engaged in procurement under Kenya's Laws and Regulation, observe the highest standard of ethics during the procurement process, selection and contract execution of all contracts, and refrain from Fraud and Corruption and fully comply with Kenya's laws and Regulations as per paragraphs 1.1 above.

Kenya's public procurement and asset disposal act (*no. 33 of 2015*) under Section 66 describes rules to be followed and actions to be taken in dealing with Corrupt, Coercive, Obstructive, Collusive or Fraudulent practices, and Conflicts of Interest in procurement including consequences for offences committed. A few of the provisions noted below highlight Kenya's policy of no tolerance for such practices and behavior: -

1. A person to whom this Act applies shall not be involved in any corrupt, coercive, obstructive, collusive or fraudulent practice; or conflicts of interest in any procurement or asset disposal proceeding;
2. A person referred to under subsection (1) who contravenes the provisions of that sub-section commits an offence;
3. Without limiting the generality of the subsection (1) and (2), the person shall be: -
 - a) disqualified from entering into a contract for a procurement or asset disposal proceeding; or
 - b) if a contract has already been entered into with the person, the contract shall be voidable;
4. The voiding of a contract by the Procuring Entity under subsection (7) does not limit any legal remedy the Procuring Entity may have;
5. An employee or agent of the Procuring Entity or a member of the Board or committee of the Procuring Entity who has a conflict of interest with respect to a procurement: -
 - a) shall not take part in the procurement proceedings;
 - b) shall not, after a procurement contract has been entered into, take part in any decision relating to the procurement or contract; and
 - c) shall not be a subcontractor for the bidder to whom was awarded contract, or a member of the group of bidders to whom the contract was awarded, but the subcontractor appointed shall meet all the requirements of this Act.
6. An employee, agent or member described in subsection (1) who refrains from doing anything prohibited under that subsection, but for that subsection, would have been within his or her duties shall disclose the conflict of interest to the Procuring Entity;
7. If a person contravenes subsection (1) with respect to a conflict of interest described in subsection (5)(a) and the contract is awarded to the person or his relative or to another person in whom one of them had a direct or indirect pecuniary interest, the contract shall be terminated

and all costs incurred by the public entity shall be made good by the awarding officer. Etc.

In compliance with Kenya's laws, regulations and policies mentioned above, the Procuring Entity:

- a) Defines broadly, for the purposes of the above provisions, the terms set forth below as follows:
 - i) "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
 - ii) "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
 - iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
 - iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - v) "obstructive practice" is:
 - Deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede investigation by Public Procurement Regulatory Authority (PPRA) or any other appropriate authority appointed by Government of Kenya 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
 - Acts intended to materially impede the exercise of the PPRA's or the appointed authority's inspection and audit rights provided for under paragraph 2.3 e. below.
- b) Defines more specifically, in accordance with the above procurement Act provisions set forth for fraudulent and collusive practices as follows:

"fraudulent practice" includes a misrepresentation of fact in order to influence a procurement or disposal process or the exercise of a contract to the detriment of the procuring entity or the tenderer or the contractor, and includes collusive practices amongst tenderers prior to or after tender submission designed to establish tender prices at artificial non-competitive levels and to deprive the Procuring Entity of the benefits of free and open competition.
- c) Rejects a proposal for award of a contract if PPRA determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;
- d) Pursuant to the Kenya's above stated Acts and Regulations, may sanction or recommend to appropriate authority (ies) for sanctioning and debarment of a firm or individual, as applicable under the Acts and Regulations;
- e) Requires that a clause be included in Tender documents and Request for Proposal documents requiring (i) Tenderers (applicants/proposers), Consultants, Contractors, and Suppliers, and

their Sub-contractors, Sub-consultants, Service providers, Suppliers, Agents personnel, permit the PPRA or any other appropriate authority appointed by Government of Kenya to inspect all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the PPRA or any other appropriate authority appointed by Government of Kenya; and

- f) Pursuant to Section 62 of the above Act, requires Applicants/Tenderers to submit along with their Applications/Tenders/Proposals a “Self-Declaration Form” as included in the procurement document declaring that they and all parties involved in the procurement process and contract execution have not engaged/will not engage in any corrupt or fraudulent practices.

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

² Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Investigating Authority or persons appointed by the Procuring Entity to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information

18.0 FORM OF TENDER SECURITY- [Option 1–Demand Bank Guarantee]

Beneficiary: _____

Request for Tenders No: _____

Date: _____

TENDER GUARANTEE No.: _____

Guarantor: _____

1. We have been informed that _____ (here in after called "the Applicant") has submitted or will submit to the Beneficiary its Tender (here in after called" the Tender") for the execution of _____ under _____ Request _____ for _____ Tenders No. _____ ("the ITT").
2. Furthermore, we understand that, according to the Beneficiary's conditions, Tenders must be supported by a Tender guarantee.
3. At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of __(__) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:
 - (a) has withdrawn its Tender during the period of Tender validity set forth in the Applicant's Letter of Tender ("the Tender Validity Period"), or any extension thereto provided by the Applicant; or
 - b) having been notified of the acceptance of its Tender by the Beneficiary during the Tender Validity Period or any extension there to provide by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance.
4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii) thirty days after the end of the Tender Validity Period.
5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

[signature(s)]

19.0 FORM OF TENDER SECURITY [Option 2–Insurance Guarantee]

TENDER GUARANTEE No.:

1. Whereas [*Name of the tenderer*] (hereinafter called “the tenderer”) has submitted its tender dated [*Date of submission of tender*] for the [*Name and/or description of the tender*] (hereinafter called “the Tender”) for the execution of _____ under Request for Tenders No. _____ (“the ITT”).
2. KNOW ALL PEOPLE by these presents that WE of [**Name of Insurance Company**] having our registered office at (hereinafter called “the Guarantor”), are bound unto Procuring Entity (hereinafter called “the “Procuring Entity”) in the sum of (Currency and guarantee amount) for which payment well and truly to be made to the said Procuring Entity, the Guarantor binds itself, its successors and assigns, jointly and severally, firmly by these presents.

Sealed with the Common Seal of the said Guarantor this ____day of _____ 20 ____.

3. NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Applicant:
 - a) has withdrawn its Tender during the period of Tender validity set forth in the Principal’s Letter of Tender (“the Tender Validity Period”), or any extension thereto provided by the Principal; or
 - b) having been notified of the acceptance of its Tender by the Procuring Entity during the Tender Validity Period or any extension thereto provided by the Principal;
 - i. failed to execute the Contract agreement; or
 - ii. has failed to furnish the Performance Security, in accordance with the Instructions to tenderers (“ITT”) of the Procuring Entity’s Tendering document.then the guarantee undertakes to immediately pay to the Procuring Entity up to the above amount upon receipt of the Procuring Entity’s first written demand, without the Procuring Entity having to substantiate its demand, provided that in its demand the Procuring Entity shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.
4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary’s notification to the Applicant of the results of the Tendering process; or (ii) twenty-eight days after the end of the Tender Validity Period.
5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

[Date]

[Signature of the Guarantor]

20.0 TENDER-SECURING DECLARATION FORM

[The Bidder shall complete this Form in accordance with the instructions indicated]

Date:*[insert date (as day, month and year) of Tender Submission]*

Tender No.:*[insert number of tendering process]*

To: *[insert complete name of Purchaser]* I/We, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Tender-Securing Declaration.
2. I/We accept that I/we will automatically be suspended from being eligible for tendering in any contract with the Purchaser for the period of time of [insert number of months or years] starting on [insert date], if we are in breach of our obligation(s) under the bid conditions, because we – (a) have withdrawn our tender during the period of tender validity specified by us in the Tendering Data Sheet; or (b) having been notified of the acceptance of our Bid by the Purchaser during the period of bid validity, (i) fail or refuse to execute the Contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the instructions to tenders.
3. I/We understand that this Tender Securing Declaration shall expire if we are not the successful Tenderer(s), upon the earlier of:
 - a) our receipt of a copy of your notification of the name of the successful Tenderer; or
 - b) thirty days after the expiration of our Tender.
4. I/We understand that if I am/we are/in a Joint Venture, the Tender Securing Declaration must be in the name of the Joint Venture that submits the bid, and the Joint Venture has not been legally constituted at the time of bidding, the Tender Securing Declaration shall be in the names of all future partners as named in the letter of intent.

Signed.....

Capacity / title (director or partner or sole proprietor, etc.)

Name: Duly authorized to

sign the bid for and on behalf of: *[insert complete name of Tenderer]*

Dated on day of *[Insert date of signing]*

Seal or stamp

21.0 APPENDIX TO TENDER

Schedule of Currency requirements

Summary of currencies of the Tender for [insert name of Section of the Works]

<i>Name of currency</i>	<i>Amounts payable</i>
Local currency: _____	
Foreign currency #1: _____	
Foreign currency #2: _____	
Foreign currency #3: _____	
Provisional sums expressed in local currency _____	[To be entered by Procuring Entity]

TECHNICAL PROPOSAL

The tender shall complete these sections as a Technical Proposal to indicate how he/she intends to proceed with the works. Procuring Entity will review these Proposals and determine the extent to which they meet the required standards to complete the works.

Site Organization

[Insert Site Organization information]

Method Statement

[Insert Method Statement]

Mobilization Schedule

[Insert Mobilization Schedule]

Construction Schedule

[Insert Construction Schedule]

PART II: WORK REQUIREMENTS

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SECTION VI – SPECIFICATIONS

GENERAL

The specifications for the works shall be as per the Ministry of Roads and Public Works Standard Specification for Roads and Bridge Construction (1986) as amended herein by the special specification.

Specific attention shall be made to the following FAA Advisory Circulars

- 1) No.150/5370 – 10G – Standard for Specifying Construction of Airports.
- 2) No.150/5380 – 6C – Guidelines and Procedures for Maintenance of Airport pavements.
- 3) ICAO Annex 14, on Aerodrome Design and Operation.

The Items in the Bills of Quantities shall be read in conjunction with these specifications.

The following design codes shall be used for this Contract.

- a) BS 8110: 1997 Reinforced Concrete Design.
- b) BS 8666 – Cutting and Bending of steel.

SPECIAL SPECIFICATIONS.

1.1 Location of Site

The Project Location is at Kisumu International Airport – Kisumu County.

1.2 Scope of Works:

The works specified under this contract shall include all general and ancillary works and work of any nature that is deemed necessary for the due and satisfactory construction, completion and maintenance of the works to the full extent and meaning of the Drawings and Specifications, whilst complying with all Conditions of Contract.

The summary below is the scope of the works.

- i. Widening of runway by 7.5m on each side increasing the runway from 45m to 60m
- ii. Crack sealing of existing runway width
- iii. Spot improvement repairs
- iv. Installation of Sub soil drains below the extension
- v. Laying of Asphalt Concrete to extension
- vi. Pavement Markings
- vii. Electrical works - Reinstatement of Edge Lights
- viii. Preliminaries and General.

1.3 Notice to Airmen (NOTAM)

The Contractor shall be required to ensure availability of publication and adherence to NOTAM and supplementary information where applicable before commencement of any activities where so required. The Contractor shall be required to ensure strict compliance to both internal and local government regulations such as by ICAO, Airport Council International- ACI, IATA, AAC, KCAA, Communications Authority of Kenya -CAK etc.

The Contractor shall keep records and track validity of the required permits from all government agencies

and shall notify the Engineer of their expiry dates before their expiry.

The Contractor shall ensure all staff accessing restricted areas meet all regulations and have valid permits to access such locations. The Contractor shall be responsible and price in his rates for all costs arising from meeting the requirements. The program of works shall take into consideration duration required to publish a NOTAM and the program shall be revised from time to time as may be required to comply with AIP's (Aeronautical information Publications) and NOTAMs.

1.4 Health Safety and Accidents

The Contractor will responsible for the provision of all safety measures meeting all the aviation regulations and national standards. The Contractor shall be required to provide PPE's including helmets, safety boots, reflective vest, safety goggles, prospective gloves ,as required, for his own staff and that of the Employer's personnel as shall be directed from time to time, air side safety requirement, preparations of Method Statements, Phasing plans where required and Security plans, Safety cones, black/yellow highly reflective warning tapes, solar powered directional signage, information signs, warning signs demarcating hazards and construction site.

The Contractor shall be required to employ at his own cost a qualified Environment and Safety officers.

The Contractor shall equip all motorized equipment with flashing beacon lights at all times.

In addition to providing, equipping and maintaining adequate first aid stations throughout the works in accordance with the Laws of Kenya. The Contractor shall allow for this in the rates and be responsible for all site welfare arrangements at his own cost.

1.5 Use of Explosives

- a) The requirements of the Laws of Kenya governing explosives and other requirements and regulations of Government of Kenya and other authorities shall be complied with.
- b) No explosives of any kind shall be used without prior written consent of the Engineer.
- c) The Contractor shall be solely responsible for the provision, handling, and storage and transporting of all explosives, ancillary materials and all other items of related kind whatsoever required for blasting.
- d) Before the beginning of the Defects Liability Period the Contractor shall remove all unused explosives from the site on completion of the Works or which are ordered by the Engineer, and submit to the Engineer written confirmation of compliance with the instruction.
- e) The Contractor shall submit to the Engineer monthly returns detailing the quantity of explosives brought to the site together with the quantities used during the month and the location and quantity of rock blasted.

TECHNICAL SPECIFICATIONS

Spec No	Section Title	Division Number	Division Title
01 11 00.00	Summary of Work	01	General Requirements
01 14 23.13	Safety Measures	01	General Requirements
01 31 13.13	Project Coordination	01	General Requirements
01 31 19.00	Project Meetings	01	General Requirements
01 32 23.01	Requirements for Benchmarks, Setting Out and Level Tolerance	01	General Requirements
01 33 00.13	Submittal Procedures	01	General Requirements
01 45 29.13	Field Laboratory	01	General Requirements
01 52 23.13	Engineer's Requirements	01	General Requirements
01 71 13.13	Mobilization and Demobilization	01	General Requirements
01 77 00.13	Closeout Procedures	01	General Requirements
01 78 23.00	Operation and Maintenance Data	01	General Requirements
02 22 33.13	Pavement Skid Resistance Testing	02	Existing Condition
02 32 26.13	Geotechnical Investigations	02	Existing Condition
02 41 13.13	Removing Existing Pavements	02	Existing Condition
03 31 13.13	Structural Concrete and Blinding Concrete	03	Concrete
03 48 23.13	Concrete Bases, Foundations, Pits and Wind Cone Markers	03	Concrete
31 11 00.13	Clearing, Grubbing and Demolition	31	Earthwork

31 22 23.13	Area Grading	31	Earthwork
31 23 16.33	Excavation and Fill	31	Earthwork
31 23 33.13	Trenching and Backfill	31	Earthwork
31 32 13.16	Cement Soil Stabilization for Backfill	31	Earthwork
32 01 16.71	Cold Milling Asphalt Paving	32	Exterior Improvements
32 01 16.76	Asphalt Concrete Overlay	32	Exterior Improvements
32 05 43.13	Availability of Materials	32	Exterior Improvements
32 05 53.13	Construction Water	32	Exterior Improvements
32 11 16.16	Aggregate Subbase Course	32	Exterior Improvements
32 11 16.19	Selected Fill & Drainage Layer	32	Exterior Improvements
32 11 23.13	Soil Cement Base Course	32	Exterior Improvements
32 11 23.33	Crushed Aggregate Base Course	32	Exterior Improvements
32 11 33.13	Portland Cement-Stabilized Base Course	32	Exterior Improvements
32 11 33.23	Recycled Base Course	32	Exterior Improvements
32 12 13.16	Bituminous Tack Coat	32	Exterior Improvements
32 12 13.23	Bituminous Prime Coat	32	Exterior Improvements
32 12 16.13	Asphalt Concrete Surface Course	32	Exterior Improvements
32 12 19.19	Porous Friction Asphalt Paving Wearing Course	32	Exterior Improvements
32 13 13.26	Portland Cement Concrete Pavement	32	Exterior Improvements

32 13 73.13	Fuel-Resistant Concrete Paving Joint Sealant	32	Exterior Improvements
32 14 13.13	Interlocking Concrete Block Paving	32	Exterior Improvements
32 16 13.13	Concrete Curbs and Gutters	32	Exterior Improvements
32 17 23.13	Pavement Markings	32	Exterior Improvements
32 31 13.53	High-Security Chain Link Fences and Gates	32	Exterior Improvements
32 91 19.13	Topsoil Placement and Grading	32	Exterior Improvements
32 92 19.19	Grassing	32	Exterior Improvements
33 15400	Plumbing Works	33	Utilities
33 42 13.23	Pipes for Storm Sewers and Foul Water Lines	33	Utilities
33 42 16.13	Precast Concrete Pipe Culverts	33	Utilities
Spec No	Revised Section Title	Division Number	Division Title
33 44 19.19	Utility Oil and Gas Separators	33	Utilities
33 46 26.13	French Drain	33	Utilities
33 47 13.23	Grouted Stone Pitching	33	Utilities
33 47 13.26	Concrete Lining	33	Utilities
33 49 13.13	Box Culverts, Headwalls and Wingwalls	33	Utilities
33 49 13.23	Manholes, Inlets, Pits, etc.	33	Utilities
33 49 33.13	Cement Concrete Drain with Grating	33	Utilities
33 49 33.23	Cement Concrete Slotted Drain	33	Utilities
34 41 13.13	Traffic Signs and Sign Boards	34	Transportation
Spec No	Revised Section Title	Division Number	Division Title
33 44 19.19	Utility Oil and Gas Separators	33	Utilities

33 46 26.13	French Drain	33	Utilities
33 47 13.23	Grouted Stone Pitching	33	Utilities
33 47 13.26	Concrete Lining	33	Utilities
33 49 13.13	Box Culverts, Headwalls and Wingwalls	33	Utilities
33 49 13.23	Manholes, Inlets, Pits, etc.	33	Utilities
33 49 33.13	Cement Concrete Drain with Grating	33	Utilities
33 49 33.23	Cement Concrete Slotted Drain	33	Utilities
34 41 13.13	Traffic Signs and Sign Boards	34	Transportation

SECTION 01 11 00 SUMMARY OF THE WORKS

1.1 Scope of the Works

These sections cover the following major Civil Work items:

1. Widening of runway by 7.5m on each side increasing the runway from 45m to 60m
2. Crack sealing of existing runway width
3. Spot improvement repairs
4. Installation of Sub soil drains below the extension
5. Laying of Asphalt Concrete to extension
6. Pavement Markings
7. Electrical Works - Reinstatement of Edge Lights
8. Preliminaries and General.

END OF SECTION

SECTION 01 14 23.13 SAFETY MEASURES

PART 1 - GENERAL

- A. This Section covers the requirements for safety measures, which are applicable during the execution of works at an active airport.
- B. This Specification shall be read in conjunction with the drawings showing safety measures as applicable for the various phases of the construction works.
- C. The Contractor shall submit to the Engineer a safety plan, addressing methods taken and persons appointed for the air operations safety, including the proposed construction periods, working hours, so that notices can be distributed to the Airport Authorities.

PART 2 - RESTRICTED AREAS

2.1 AIR OPERATIONS AREAS

- A. For the purpose of this Project, the term Air Operations Area shall mean any area of the airport used or intended to be used for the landing, take-off, or surface manoeuvring of aircraft, including such paved or unpaved areas necessary for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron. The limits of the Air Operations Area are defined as:
 - 1. An area including the runway and extending on each side of the runway centre line or extended runway centre line, to a distance of 75 metres. The area is further extended beyond each end of the runway for a distance of 6 metres.
 - 2. An area of 26 metres along all edges of taxiways and aprons.
- B. If so required, these limits may be extended.

2.2 IMAGINARY SURFACES

- A. The following imaginary surfaces are established with relation to the airport and its runway:
 - 1. Transitional Surfaces: surfaces extended from the edge of the runway strip outward and upward.
 - 2. Approach/Take-off Surfaces: surfaces centred on the extended runway centerline and extending outward and upward from each runway end.
- B. The slope and size of each such imaginary surface is based on the category of the runway.

2.3 OTHER RESTRICTED AREAS

- A. Further restrictions may be necessary for stockpiling materials and for the movement and parking of equipment and vehicles in the vicinity of navigational aids, or to prevent interference of the line-of-sight from the control tower.

31 PART 3 - LIMITATIONS OF OPERATIONS

- A. The Contractor shall control his operations and the operations of his Sub- Contractors and all suppliers so as to provide for the free and unobstructed movement of aircraft in the Air Operations Areas of the airport and no construction or placing of materials or equipment shall take place that will penetrate one of the Imaginary Surfaces.
- B. When the work requires the Contractor to conduct his operations within an Air Operations Area or through one of the Imaginary Surfaces, the work shall be coordinated with the Airport Authority at least 24 hours prior to commencement of such work. The Contractor shall not close or enter an Air Operations Area until so authorized.
- C. Closing an Air Operations Area or starting construction that will penetrate the Imaginary Surfaces, is not allowed until the necessary marking and associated lighting is in place and until the relevant Notice to Airmen (NOTAM) has been issued by Air Traffic Control (ATC).
- D. When the Works require the Contractor to work within an Air Operations Area of the airport on an intermittent basis (intermittent opening and closing of the Air Operations Area), the Contractor shall maintain constant communications, immediately obey instructions to vacate the Air Operations Area and obey the instructions to resume work in such Air Operations Area.
- E. Due to the nature of the phasing of the works, some phases of the construction works will be required to be undertaken at night, between the time of the last departure of the day, and the time of the first flight the following morning.

PART 4 - MARKING AND/OR LIGHTING REQUIREMENTS

4.1 FIXED OBSTRUCTIONS

- A. The Contractor shall provide danger markers and/or lights on all heaps or dumps of materials, plant, structures and other possible obstructions in the Air Operations Areas or on those penetrating the Imaginary Surfaces.
- B. These danger markers shall be flags for day-time and lights for night-time periods and shall be displayed around, on top of, or around the highest edge of the obstruction.
- C. Flags used to mark fixed obstructions shall not be less than 0.6 x 0.6 m and displayed at least every 15 m to mark extensive obstructions. The colour of the flags shall be orange, except where such colour merges with the background.
- D. Lights used to mark fixed obstructions shall be fixed low-intensity obstruction lights with a distribution of 360 degrees horizontal and 10 degrees minimal vertical. The colour of the lights shall be red, with an intensity sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general level of illumination against which they would normally be viewed. In no case shall the intensity be less than 10cd or red light.
- E. Fixed obstructions penetrating or adjacent to approach and take-off surfaces shall be provided with double red obstruction lights with a transfer relay which switchers over to the stand-

by lamp in case of failure of the normal operating lamp.

- F. All obstruction markers and lights shall be kept continuously in operation, during all days between sunrise and sunset for the markers and between sunset and sunrise for the lights.

4.2 VEHICLES AND EQUIPMENT

- G. All mobile obstructions such as equipment, plant, vehicles of the contractor, subcontractors, suppliers, visitors, etc. shall be marked in day-time and lighted in night-time while operating in the Air Operational Areas.
- H. All mobile obstructions will be identified by means of a flag on a staff in day time. Flags used shall be attached to and flying above the vehicle. The flag shall be not less than 0.9 x 0.9 m and consist of a checkered pattern of orange and white squares of not less than 0.3 m on each side.
- I. Vehicles of the Engineers staff of the Contractor, the Engineer or the Employer may, however, be equipped with flasher lights in lieu of flags for day-time operations as well. These flasher lights or flags shall be provided and fixed by the Contractor.
- J. All vehicles operating by night-time in the Air Operations Areas or near the Imaginary Surfaces shall be equipped with low-intensity yellow flasher lights. Distribution shall be 360 degrees horizontally and minimum 10 degrees vertically and the intensity shall be not less than 40cd of yellow light during night-time and not less than 200cd when used during day-time. The flash frequency shall be between 60 and 90 flashers per minute.

4.3 CLOSED AIR OPERATIONS AREAS

- K. The Contractor shall furnish, erect and maintain temporary closed markings and associated lighting and markers, when:
1. The Works require closing of an Air Operations Area or
 2. The Works under construction or the (substantially) completed works obtain or have the appearance of a serviceable area.
- L. The closed marking shall be placed as follows:
1. Runway: a closed marking shall be placed at each end of the runway (or portion thereof) declared closed, and additional markings shall be so placed that the maximum interval does not exceed 300 metres.
 2. Taxiway: closed markings shall be placed at least at each entrance of the taxiway or portion thereof closed.
- M. The closed markings shall be in the form of a cross. Each of the legs of the cross shall be as shown on the applicable drawings or as required by ICAO standards and regulations. The colour shall be of a single contrasting colour, either yellow or white. Marking material

other than paint on the surface may be used.

- N. In addition to closed markings, when the closed runway or taxiway (or portions thereof) is intercepted by a usable runway or taxiway, or abuts a usable apron, danger markers shall be placed across the entrance(s) to the closed area continuously or sufficiently close so as to delineate the boundary of the closed area.
- O. These danger markers shall consist of conspicuous upstanding devices such as flags, cones, marker boards, drums, etc.. The markers shall be at least 0.5 m in height and shall be alternately red and white or orange and white. Flags are to be in accordance with Chapter 4 hereof.
- P. In addition to closed markings and danger markers, when the closed runway, taxiway or apron is intercepted by a usable runway or taxiway or abuts a usable apron which is used at night, danger lights shall be placed across the entrance(s) to the closed area at intervals not exceeding 4.5 metre. These danger lights shall consist of red fixed lights, as specified in Clause 4.1 D hereof.

4.4 UNSERVICEABLE AREAS

- Q. Unserviceable areas are small portions of taxiways or aprons unfit for the movement of aircraft but where it is still possible for aircraft to bypass the area safely.
- R. Unserviceability markers and lights shall be displayed as warning to pilots. The markers for day-time and the lights for night-time shall be as described in Clause

4.5 DIVERTED ROUTES

- S. For temporarily displaced runway thresholds and diverted aircraft taxi routes or vehicle routes, temporary marking and lighting may be necessary.

PART 5 - COORDINATION OF CONSTRUCTION ACTIVITIES

5.1 INSTRUCTIONS

- A. When Air Operations Areas have to be entered for construction activities, surveys, inspections, etc. the following shall be adhered to.
- B. The Contractor shall comply with the instructions regarding movements of his lorries, plant, etc., so as to prevent interference with aircraft or related traffic. The location of haul routes shall require approval.
- C. The Contractor shall provide flagmen and warning signs and operate traffic control arrangements as required and shall also act accurately and shall immediately respond to the directions by Air Traffic Control.
- D. Vehicles, equipment, materials, etc. not actually being used for construction purposes, will be restricted from the Air Operations Areas.

- E. No vehicles or equipment shall be left unattended in Air Operation Areas. A driver or operator shall be continuously present in order to move the vehicle or the equipment out of the Air Operation Area, whenever necessary.
- F. The Contractor's attention is drawn to the fact that the operation of aircraft at the airport will at all times have priority over construction operations and that at any time it may be required to temporarily suspend work due to operating aircraft.
- G. Neither vehicles, equipment nor personnel shall use any active runway, taxiway, apron, or any portion of the landing area without permission. Any unauthorized use or crossings by vehicles, equipment or personnel of any active runway, taxiway or apron will be cause for banishment from the airport.
- H. Only those trenches for which material is on hand and ready for placing therein shall be opened. As soon as practicable after material has been placed and work approved, trenches shall be backfilled and compacted as required. In the meantime, all resulting hazardous conditions shall be marked and lighted in accordance with safety provisions herein.
- I. The areas in use for aircraft operations must be kept clean and free from stones, etc. to avoid damage to aircraft.

5.2 SAFETY OFFICER

- A. In order to comply with the instructions and safety precautionary measures the Contractor shall appoint a safety officer for coordinating all safety matters in the Air Operations Areas and near Imaginary Surfaces.
- B. The safety officer shall continuously inspect the markers and lights, to determine whether they are in compliance with the instructions.
- C. In order to maintain constant communications with Air Traffic Control, the safety officer shall be provided with a two-way radio.

5.3 CONSEQUENCES OF SAFETY MEASURES

- A. Interruptions in the execution of the works caused by operating aircraft shall have been considered by the Contractor and are deemed to be included in his proposed method of construction and in his programme of works.
- B. Interruptions and delays due to aircraft operations will not be accepted as grounds for financial claim or for extension of time.
- C. The costs of safety measures shall be borne by the Contractor and shall be included in the relevant unit rates.

PART 6 - CONTROL OF SMOKE, DUST AND FLYING DEBRIS

- A. The contractor shall take all precautions necessary to control smoke, dust and flying debris

arising from any of his operations and blowing onto aircraft operation areas.

- B. Earthwork areas shall be watered and covered as required to limit the creation of dust.
- C. All vehicles used by the contractor must have clean tires to prevent weed seeds, spoil and other debris being left on the apron or access route. Vehicles must be washed where necessary before leaving the site. Runoff water should be directed towards a pollution entrapment area e.g. grassed swale, gross pollutant trap.
- D. Debris should be confined to dustbins or the like in and around the buildings and if exceptionally found on or adjacent to any aircraft pavement area they should be removed as soon as possible and as directed by the Client.
- E. Burning of rubbish on or adjacent to the site constitutes a hazard to flight operations, and is strictly forbidden.
- F. The contractor shall keep the site clear of all rubbish and standing water that may attract birds to the site. Such rubbish shall be removed from the site as directed by the Client.
- G. The contractor shall be responsible at all times for keeping all areas of aircraft operation, roads, footpaths and all other areas within the airside area within which he is working free of mud, dust, dirt, flying debris and any other materials because of the danger of personal injuries, low visibility, ingestion into aircraft engines, tire damage or further equipment damage. The contractor shall take all necessary precautions such as mechanical sweeping to prevent such situations to occur.
- H. The contractor shall keep the site and his working areas generally clean, tidy and free from any loose materials. All loose material shall be fastened so that it can not be blown away.

PART 7 - SECURITY

- A. Prior to the start of all works the contractor shall ensure that the boundaries of the site are secure against entry by unauthorized personnel.
- B. Before any work commences a security pass shall be provided in consultation with the airport authority for all the contractors' staff. The pass system shall allow for a clear identification of the wearer and areas of access permitted for the wearer. The different areas of access shall be agreed with the airport authority and the Client.
- C. The contractor shall submit for approval by the airport authority all personnel and vehicles requiring access passes to the airside area. The contractor shall ensure that all entry to airside area will be gained only by production of a valid security pass.
- D. The contractor shall keep an updated record of all passes and submit the record to the airport authority and the Client weekly.
- E. All vehicles and mobile equipment the contractor wishes to use within the airside area shall be required to have a vehicle pass. The pass shall allow identification of the area of access permitted. All vehicle passes shall be clearly displayed at all times.

F. The airport authority reserves the right to refuse any pass application to airside area without giving any explanation.

G. All submissions for airside area access passes shall be made at least 10 days prior to the date of commencement of the pass.

H. The contractor will ensure that pass system is strictly enforced throughout the contract period. Persistent non-observance of the system by any personnel will result in their removal from the site.

END OF SECTION

SECTION 01 31 13.13 PROJECT COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes administrative and engineering requirements for Project coordination.

1.2 COORDINATION

- A. The Contractor shall coordinate construction scheduling, submittals, and work of the various sections of the Project to ensure efficient and orderly sequence of installation of each items of work.
- B. The Contractor shall verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. The Contractor shall coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate sections in preparation for Substantial Completion and for portions of work designated for Employer's partial occupancy.
- F. After Employer's occupancy of premises, the Contractor shall coordinate with the Employer access to site for correction of defective work and work not in accordance with Contract documents, to minimize disruption of Employer's activities.

END OF SECTION

SECTION 01 31_19.00 PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes meetings to be conducted during implementation of the Project

1. Preconstruction meeting
2. Site mobilization meeting
3. Progress meetings
4. Coordination meetings with other Contractors

1.2 PRECONSTRUCTION MEETING

A. The Engineer will schedule a meeting with the Contractor as soon as possible after the Notice of Commence had been issued.

B. Attendance Required: Employer, Engineer, and Contractor.

C. Agenda

1. Distribution of Contract Documents.
2. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
3. Designation of personnel representing the parties in Contract, and the Engineer.
4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures and joint measurement submittals.
5. Scheduling.
6. Other related matters

D. The Engineer will record minutes and distribute copies within five (5) days after meeting to Employer and Contractor.

1.3 SITE MOBILIZATION MEETING

A. A meeting will be scheduled by the Engineer at the Project site prior to Contractor occupancy.

B. Attendance Required: Employer, Engineer and Contractor

C. Agenda

1. Use of premises by Employer, the Engineer and Contractor.

2. Employer's requirements.
 3. Construction facilities and controls
 4. Temporary utilities
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for materials testing.
 10. Procedures for maintaining Project record documents.
 11. Requirements for start-up of plant
 12. Inspection and acceptance of plant and equipment put into service during construction period.
 13. Contractor's safety program
 14. Contractor's Quality Control
 15. Layout and sequencing of the works by the Contractor.
 16. Communication procedures
- D. The Engineer will record minutes and distribute copies within five (5) days after meeting to Employer and Contractor.

1.4 PROGRESS MEETINGS

- A. A regular progress meeting will be scheduled by the Engineer every other week or as maybe necessary throughout the progress of work.
- B. Attendance Required: Contractor, Employer and Engineer
- C. Agenda
1. Comments to minutes of previous meeting.
 2. Status of work
 3. Field observations, problems and solutions if any
 4. Coordination with other Contractors
 5. Technical issues
 6. Submittal
 7. Administrative issues

8. Payment issues
 9. Variation orders
 10. Other contractual issues
 11. Any other business
- D. Record minutes and distribute copies within five (5) days after meeting to participants, with copies furnished to Engineer, Employer representative, participants, and those affected by decisions made.

1.5 COORDINATION MEETINGS WITH OTHER CONTRACTORS

- A. Coordination meetings with other Contractors will be scheduled by the Engineer and Employer throughout the progress of the works.
- B. Attendance required: Employer, Engineer and the various Contractors involved in the ongoing activities of the Project.
- C. Location will be decided by the Engineer and Employer.
- D. Record minutes and distribute copies within five (5) days after meeting to participants, Engineer, Employer and those affected by the decisions made.

END OF SECTION

SECTION 01 32 23-01 REQUIREMENTS FOR BENCHMARKS, SETTING OUT AND LEVEL TOLERANCES

PART 1 - BENCHMARKS

- A The Contractor shall establish a local grid covering the entire construction site, which shall match the existing local grid.
- B The Contractor shall confirm the co-ordinates and levels of the Control Points as indicated on the Drawings and use those control points in setting out his works.
- C At the beginning and during the construction of the works the Contractor shall establish additional benchmarks, as directed by the Engineer. These benchmarks shall be integrated with the above-mentioned grid.
- D For each structure and building additional benchmarks are required.
- E The benchmarks shall consist of steel or copper pipes or pins, suitable to the environment, 20 mm in diameter and cast in concrete bases of 300mm in diameter x 500 mm deep. The benchmarks shall be clearly marked and protected, throughout the duration of the works. If necessary, damaged or disturbed benchmarks shall be promptly restored.
- F The accuracy of the leveling shall be such that the vertical error of closure will not exceed 10 mm for one kilometre of bench level run.
- G The Engineer may authorize third parties to make use of the available benchmarks.
- H Maps indicating all data related to the benchmarks and other fixed points shall be produced and distributed among responsible persons.
- I All the works as well as all main features such as buildings, intersections and other facilities shall be expressed in the coordinates of the local grid. These main features as well as the precise points will be specified by the Engineer.
- J Prior to the provisional handover of the project, the coordinates in the local grid of the runway thresholds and of the aerodrome reference point shall be converted into geographical coordinates. The latitude and longitude shall be mentioned in the applicable system.
- K The geographical coordinates of the specified main features shall be indicated on the "As Built" General Lay-out drawing.
- L The Contractor's attention is drawn to the fact that above may have to be treated as classified information.

PART 2 – SETTING OUT

2.1 Runways and Taxiways

- A The benchmarks shall be placed as a grid parallel to and perpendicular to the centreline.
- B The distance between the benchmarks shall be not more than 250 m.
- C Each benchmark shall bear its centreline station number, the perpendicular distance to the centreline and the elevation.
- D In the extended runway/taxiway centreline concrete reference bases shall be erected to mark the exact location of such centreline.
- E These bases shall have the same dimension as the benchmarks.

2.2 Earthworks and Aggregate Bases

- A. On the area involved, a grid of steel pegs shall be placed at intervals of as specified in the applicable sections.
- B. The grid shall be placed parallel and at right angles to the centreline of the projected course.
- C. Extra pegs shall be placed at locations of changing grades.

2.1 Surface Courses

- A. On the area involved, a grid of steel pegs shall be set parallel and at right angles to the centreline of the course to be placed.
- B. The grid shall have intervals not as specified in the applicable sections.
- C. The peg lines shall be placed approximately 0.15 metres outside the paving lane for guidance of the electronic equipment on the paver.
- D. The pegs shall be precisely set, so that after compaction, the finished elevations of the courses conform to the projected elevations.

PART 3 – LEVEL TOLERANCES

- A In view of the permitted tolerances as defined in the relevant technical sections it must be clearly understood that these tolerances are not intended as a means for varying the final elevations of layers of materials to be placed in sequence.
- B The final surface elevations, as indicated on the drawings, are to be strictly adhered to and so are the elevations of the underlying layers, determined from design layer thicknesses and final elevations.

PART 4 - WORLD GEODETIC SYTEM – 1984 (WGS – 84)

- A The WGS-84 coordinate system is a Conventional Terrestrial System (CTS), realized by modifying the Navy Navigation Satellite System (NNSS), or TRANSIT, Doppler Reference Frame (NSWC 9Z-2), in origin and scale, and rotating it to bring its reference meridian into coincidence with the Bureau International de l'Heure (BIH)-defined zero meridian.
- B The existing WGS-84 established reference points established in the airport pavements (runway, taxiway(s) and apron) have to surveyed in x, y and z coordinates to at least three local or temporary bench marks before any works will be allowed to take place in the vicinity of these reference points.
- C Upon completion of the pavement works the WGS-84 reference points have to be re-established at the original location and the x, y, z coordinates shall be surveyed and made available to the Engineer.
- D At least the Aerodrome Reference Point, runway thresholds, runway centreline, apron stands, taxiway centreline, all new aircraft parking positions and also the elevation of the ARP and RW thresholds shall be surveyed using the WGS 84 system. These will be recorded in degrees, minutes, seconds and 1/100 of seconds.
- E Survey results and coordinates shall be handed over to the Airport authorities.

END OF SECTION

SECTION 01 33 00.13 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section sets forth general provisions regarding submittals required from the Contractor which include:

1. Monthly Progress Reports
2. Survey Data
3. Shop Drawings
4. As-built Drawings and Final Construction Report
5. Product Data
6. Samples
7. Construction Photographs as Specified
8. Miscellaneous

1.2 MONTHLY PROGRESS REPORTS

A. The Contractor shall maintain a daily log describing the important events pertaining to the works, the working hours, the number of labourers employed, effective time of operation equipment, overtime hours, progress of work and instructions, notifications and recommendations made by the Engineer. The daily log shall at all times be available to the Engineer upon request.

B. The Contractor shall submit to the Engineer four (4) copies of the monthly progress reports within seven (7) days after the end of every month indicating the progress made, construction activities, inventories of materials used and stored on jobsite, number of working days, the summary of the daily log of the month and all important events in relation to the works.

1.3 SURVEY DATA

A. Within four (4) weeks of completion of any field survey works, two (2) copies of each drawing shall be submitted to the Engineer for review before the submission of the final drawings containing two (2) sets.

B. Two (2) copies of the field data neatly bound in a folder and an electronic copy shall be submitted to the Engineer. The field data shall be signed by the field Engineer.

C. Within one month before the issuance of the Taking Over Certificate the Contractor shall submit to the Engineer two copies of obstacle survey within the vicinity of the airport.

1.4 SHOP DRAWINGS

- A. The Contractor shall submit shop drawings where so required by particular sections of the specifications or as requested by the Engineer. Shop drawings shall be based upon the drawings and specifications requirements, in the approved scale, clearly showing all details for fabrication and assembly.
- B. The drawings shall be in two (2) copies, and submitted as soon as possible to the Engineer for review and in any case in sufficient time to permit modifications to be made if such are deemed necessary by the Engineer. For each submission of drawings, a minimum time of two (2) weeks shall be allowed for review of the Engineer. The Engineer's review of drawing shall not relieve the Contractor from any responsibility under the Contract.
- C. Each drawing shall be examined and commented on by the Engineer and will be returned to the Contractor, who shall then print the necessary copies of each drawing requiring no correction for distribution.
- D. Drawings requiring correction shall be corrected and resubmitted.
- E. Where drawings are inspected, the said inspection does not relieve the Contractor from his responsibility or from the necessity of furnishing material or performing work required by the drawings and specifications, which shall in the event of a dispute, take precedence over shop drawings.

1.5 AS-BUILT DRAWINGS

- A. Within one month after the issuance of the Taking Over Certificate, the Contractor shall prepare and submit 2 sets of as-built drawings and final construction report as draft. And within 15 days after the Engineer has commented the draft, the Contractor shall submit five sets of Final Construction Report and Final As-Built Drawings.
- B. Final As-Built Drawings of the works consist of five (5) sets in hardcopy and five (5) sets electronic copy (AutoCAD latest edition).

1.6 PRODUCT DATA

- A. The Contractor may submit manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data in lieu of shop drawings.
- B. When contents of submitted literature from manufacturers include data not pertinent to submittal, clearly indicate which portion of contents is being submitted for review.
- C. After review, distribute as directed by the Engineer copies for record documents.

1.7 SAMPLES

- A. The Contractor shall submit samples free of charge, of the plant and materials to be incorporated into the works, whenever called for by the Engineer, and all plant and

materials subsequently delivered to the site for use in the works, are to be identical to the samples approved by the Engineer.

- B. All samples shall be delivered a minimum of two (2) weeks in advance of commencement of the works in order to give the Engineer sufficient time in which to make decisions regarding choice.
- C. The quantity of the samples provided shall be sufficient for the Engineer to determine whether or not the sample(s) comply with the standard required. Each sample shall be labelled indicating the generic name of the sample, the manufacturer's name and the model number, brand name and supplier's name, and any other relevant data.
- D. The Contractor shall accompany each delivery of samples with a transmittal voucher, listing the sample data enumerated above for each sample transmitted, and referencing each sample to the appropriate drawings, sheet and detail, and to the respective item in the Specifications and the Bill of Quantities.
- E. In addition to the foregoing requirements, the Contractor shall provide sample panels of various work items, well in advance of such item commencing on site all as directed by and for approval of the Engineer.

1.8 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall provide record progress photographs taken at a fixed points and angle as, when and where directed by the Engineer at intervals of not more than (30) days.
- B. The photograph shall be sufficient in number and location to record the exact progress of works.
- C. Photographs shall be taken by digital camera at a resolution of minimum 3.0 megapixels.
- D. On all photographs the date of taking the photograph shall be automatically imprinted by the camera.
- E. The Contractor shall provide one (1) print of each photograph taken at a size of minimum 150 x 100 mm. All prints shall be placed in an album with a subtitle clearly representing the content of the photograph.
- F. All photographs shall be provided in digital format (JPEG) on CD-rom.
- G. Albums and CD-roms to accommodate the photographs shall be supplied by Contractor.

1.9 MISCELLANEOUS

- A. The Contractor shall submit method of work execution, manufacturer's catalogues, specification of plant and materials, details of testing and commissioning procedures, manufacturer's recommended spare lists, operating and maintenance manuals, and other technical data so required by particular sections of specifications or as directed by the

Engineer.

END OF SECTION

SECTION 01 45 29.13 FIELD LABORATORY

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The Contractor shall construct, equip and maintain a material testing laboratory, with equipment, furniture, fittings, telephone, etc., to the approval of the Engineer.
- B. The laboratory is for the use of the Contractor.
- C. The construction of the laboratory shall start immediately after the site hand-over and shall be completed and operational within 1 month from that date.
- D. The size of the laboratory shall provide adequate space for performing the tests and for storing equipment and samples. Sufficient storage space, a curing tank for concrete samples and toilets shall be provided inside the laboratory. A possible floor plan is included in this section.
- E. On final completion of the contract, the laboratory and its equipment, furniture, fittings, etc. shall revert to the Contractor and be removed from site.
- F. The Contractor shall have available sufficient experienced laboratory technicians and skilled assistants to conduct the work without delay. These technicians and assistants shall be subject to the approval of the Engineer.
- G. Two of these experienced assistants shall be available from time to time during the duration of the contract to the Engineer to conduct necessary testing.
- H. All necessary forms for recording laboratory tests shall be supplied by the Contractor and shall be subject to the approval of the Engineer.
- I. The contractor may propose to perform tests, which are not required on a regular basis, in an offsite testing facility to the approval of the Engineer.
- J. The Engineer shall have access to the laboratory at all times.
- K. In addition to the tests specified in the relevant Specifications, the Contractor shall perform (or have performed by external laboratory) any additional test requested by the Engineer.

PART 2 - PRODUCTS

2.1 STANDARD TEST METHODS

- A. The equipment and size of the laboratory shall permit execution of at least the tests that are mentioned in Part 1 of the relevant Specifications.

PART 3 - EXECUTION

3.1 STANDARD MATERIAL SPECIFICATIONS

- A. The Standard Material Specifications shall be governed as stated in the relevant Specifications.
- B. When delivered to the works, the items must be accompanied by manufacturer's Certificate of Guarantee to ensure approval by the Engineer.

3.2 APPARATUS REQUIRED FOR TESTING

- A. Notwithstanding that any test, piece of equipment, or apparatus is not specifically mentioned or described in the various pages hereof, the Contractor shall supply at his own expense all apparatus and equipment of whatever kind necessary to carry out any test mentioned in or required by the provisions of the various clauses in this specification and the cited standards for Materials and Testing incorporated in this specification.
- B. The Engineer shall be the final arbiter on which tests are necessary for the execution of the works.
- C. All testing shall be done according to ASTM standards, and shall be for the approval of the Engineer.
- D. The field laboratory shall at the very least be equipped with equipment necessary to undertake the following tests:

Soils and Aggregate Tests

- Aggregate grading
- Atterberg Limits
- Maximum Dry Density
- CBR
- UCS
- Field Densities (including calibrated Nuclear Density Tests)
- Loose and Rodded Unit weight of aggregates

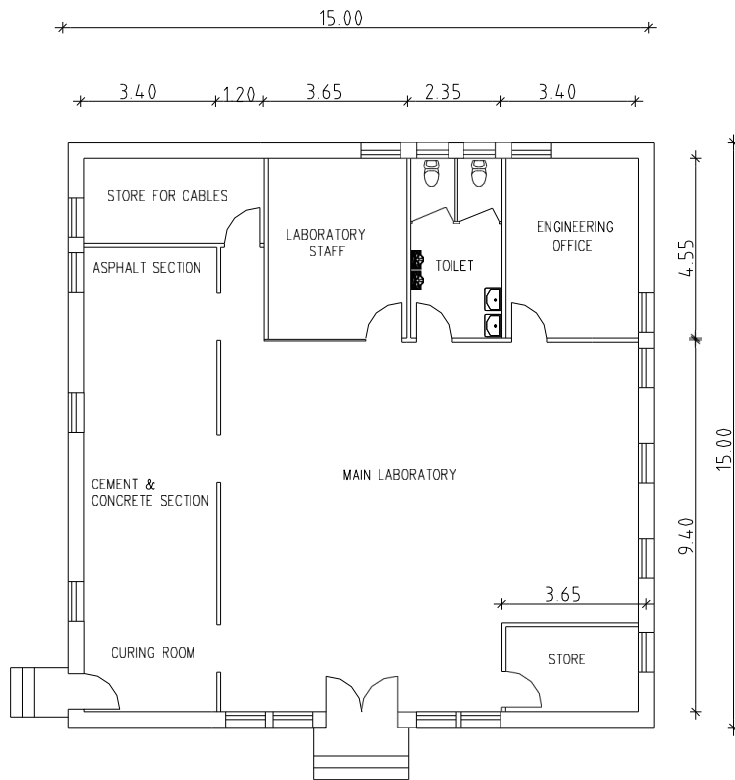
Asphalt Tests

- Marshall Density
- Bitumen recovery
- Grading and Bitumen Content

- Field Density
- Maximum Theoretical Relative Density (RICE)
- Bitumen properties (Penetration, Softening Point, Viscosity)*
- Indirect Tensile Strength (ITS)
- Cores (100mm and 150mm diameter)

Concrete Tests

- Cube Strength (UCS)
- Slump Tests
- Cores (100mm and 150mm diameter)



LABORATORY FLOOR PLAN

END OF SECTION

SECTION 01 52 23.13_ENGINEER'S REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall provide and maintain a field office, certain transport facilities, field equipment, services, and labour for the Engineer's representative and his staff as prescribed in this section.
- B. It is anticipated that the Engineer's staff could include the following compliment of on-site staff during various stages of the project:
- Engineer's Representative,
 - Assistant Engineer's Representative for Civil Works
 - Materials Technician
 - Clerk/Inspector of Works
 - Surveyor
 - Chainmen
 - Secretary
 - Office Attendant

PART 2 - FIELD OFFICE

2.1 OFFICE FACILITY

- A. As from the date of site hand-over the Contractor shall provide neatly painted office facilities and covered car ports (with metal sheet roofing) on the site or in the vicinity of the site, consisting of at least the following:
1. 1 room of 30 m². One L-shaped desk (min. 2.85 m²) with an executive type armchair and 2 visitor's chairs, one meeting table with 8 chairs and two lockable cabinets each of approximately 1.0 m x 0.4 m x 2.0 m and two lockable filing cabinets each of approximately 0.4 m x 0.8 m x 1.2 m; one white board min. 1.5 x 1.2m.
 2. 1 adjoining room, of 20 m². One L-shaped desk (min. 2.85 m²) with an executive type armchair and two additional chairs and one lockable cabinet of approximately 1.0 m x 0.4 m x 2.0 m and two lockable filing cabinets each of approximately 0.4 m x 0.8 m x 1.2 m; one white board min. 1.5 x 1.2m.
 3. 2 rooms, each of 30 m² and each including two desks (min. 2.85 m²) each with an executive type armchair, 2 additional chairs and two lockable cabinets each of approximately 1.0 m x 0.4 m x 2.0 m and two lockable filing cabinets each of approximately 0.4 m x 0.8 m x 1.2 m;
 4. 1 meeting room of 30 m², including a meeting table with chairs for 15 persons and

equipped with white board 2 x 1 m;

5. 1 kitchenette, including hot and cold water, refrigerator, microwave oven, coffee machine, bottle water cooler, cooking range, cutlery, crockery, glassware and a working area at least 2m²;
 6. 2 washrooms, with adequate ventilation, one of which shall have two toilets, one wash hand basin and one of which shall be adjoining the ER's office and have direct access from the inside.
 7. All offices to be provided with a rack for hanging drawings as well as one drawing table, slightly inclined, at least two A0 drawings long and one A0 drawing wide with two draughtsman stools.
 8. The offices shall lie East-West with a covered porch, at least 2m wide on the South side covering all the entrance doors. If required the north-facing windows shall be provided with adequate awnings.
 9. All doors shall be provided with mosquito-proof gauze doors. Similarly all air-conditioning units shall be made mosquito proof.
 10. The areas of all walkways and car ports shall be covered with at least 75mm of crushed stone (max. size 19mm).
- B. Upon completion of the Works or so much later as the Engineer deems necessary, the complete field office, including furniture and equipment will be handed over to the Employer.

2.2 FURNITURE AND EQUIPMENT FOR THE FIELD OFFICE

- A. The Contractor shall provide all necessary furniture, equipment, installations, etc. to the approval of the Engineer.

2.3 OTHER REQUIREMENTS AND PROVISIONS

- A. The Contractor shall submit working drawings on ACAD 2005 (or later) indicating the design and all details and make of materials which he proposes to use, including information such as folders, test reports etc. as the Engineer may require.
- B. The electrical installation to the office facilities is subject to the requirements of local standards and specifications. All electrical wiring shall be in concealed conduits.
1. Each room shall have a minimum of four electrical outlets, placed at approximately 0.30 m above the floor unless otherwise indicated. All rooms shall be air conditioned with an appropriate system.
 2. Electrical power supply is to be arranged by the Contractor by either connecting the system to the local power supply system if so allowed or by installing power generators, including full stand-by units fully operational.

3. All inner and outer spaces of the building shall be provided with lighting. The rate of the light to be provided shall be decided by the Engineer and be approximately 25 Watts per square metre of floor space.
4. The field office shall have lightning protection, and shall have a circuit breaker at the electrical feeder cable.

C. The field office shall be provided with a cold water system, the water pipes being of copper or a type as approved by the Engineer.

1. The Contractor shall also provide ground tanks and roof tanks for water storage, automatic electric pumps etc. to a complete operational system.
2. If regular supply from the local network is available then subject to the approval of the Engineer only roof tanks require to be installed.

D. If no guaranteed water supply from the local distribution system can be obtained then the Contractor shall provide for supply with water tankers. If so required the Contractor shall supply drinking water separately in a separate well-insulated storage tank. The Contractor shall make sure that water is available at all times. The Contractor shall install all sanitary equipment and provide for a sewage discharge system as required by the Engineer.

The Contractor shall make his own arrangements for the disposal of sewage water, including the construction and installation of septic tanks, soak-away pits, treatment plant, pumping, pipelines or whatever may be required to provide a good working sewage system, in accordance with the instruction of the Engineer.

E. When the use of gas is selected for the cooking range, the contractor shall supply and install a gas distribution system including three large size gas containers for the field office.

1. The Contractor shall take care of regular gas supply as required.
2. Gas containers shall be placed outside and under a shade.

F. The field office shall, as further specified in clause 3.4 of this section, be provided with a telephone system consisting of a PABX with a number of extensions, fax connection and a two-channel, fast internet connection like ISDN or DSL.

1. The system shall be linked up with the local network in accordance with the requirements of the relevant authorities and to the satisfaction of the Engineer.
2. A minimum of one telephone per room shall be available.
3. The costs for the installation of temporary telephone lines to, telephone installation in, telephone equipment and telephone call charges in the Engineer's site office will be borne by the Contractor.

G. The contractor shall provide for proper access to the field office and at least 6 parking places.

H. The contractor shall provide suitable sign boards indicating the project name, the Client's name, the Engineer's name and the Contractor's name.

l. The Contractor shall provide and maintain the following thermometers:

1. maximum and minimum thermometer for measuring atmospheric shade temperature, at an approved location;
2. a thermometer for measuring concrete, asphalt and ground temperatures.

PART 3 - GENERAL PROVISIONS

3.1 SURVEY AND TEST EQUIPMENT

- A. From the date of hand-over of the site until the final completion, the Contractor shall provide the Engineer with all necessary surveying instruments, other equipment and labour required for checking of setting out, measurements and tests the Engineer deems necessary for proper control of the works.
- B. The Contractor shall be solely responsible for all equipment and instruments supplied and he shall ensure that they are at all times in operational state, accurate and properly adjusted.
- C. All these instruments shall remain the property of the Contractor.
- D. The survey instruments and measuring devices provided shall include the following:

- two levelling instruments, equivalent to type WILD NA K2;
- three levelling staffs;
- two steel tapes, length 100 m;
- two steel tapes, length 50 m;
- four steel tape, length 20 m;
- two double pentagon prism levels;
- one theodolite, equivalent to type WILD T2 E;
- two aluminium straight edges, length three metres including measuring devices;
- two sun shades;
- One Total Station, including tripod, relevant software and all accessories as recommended by the manufacturer, equivalent to Sokkia NET2100;

3.2 PROVISIONS

- A. From the date of hand-over of the site until the facilities revert to the Contractor, the Contractor has the obligation to provide the following assistance to the Engineer:

1. for cleaning and maintenance of the Engineer's field office;
 2. for service to the Engineer's staff in the Engineer's field office;
 3. for guarding and protecting the Engineer's field office;
 4. for translations if so required;
 5. for assistance in survey works and testing, as required.
- B. From the date of hand-over of the site until the facilities revert to the Contractor, the Contractor has the following obligations:
1. provide and maintain a continuous supply of electric current, either from the public supply system or, when this system should be unreliable due to interruptions or excessive voltage fluctuations, by his own generating units;
 2. provide and maintain a continuous supply of running drinking water;
 3. provide and maintain adequate sewage disposal facilities at least 10 m from any building;
 4. provide a refuse removal service at least once daily;
 5. provide and maintain gas/electricity or cooking;
 6. maintain the office and keep the installed equipment, such as water pumps, refrigerators, airco units, etc. in good working order;
 7. provide for the Engineer's field office and field laboratory all transparency and printing paper, photo copying paper and all further stationary as required by the Engineer;
 8. make available a facility for printing/copying drawings on or near the site; costs of printing and copying required for the works will be borne by the Contractor.
 9. make provisions for coffee, tea and non alcoholic beverages.
- C. From commencing the execution of the Works the Contractor shall insure all the works, persons and facilities against any damage, loss or injury as required under the Conditions of Contract.

3.3 ENGINEER'S TRANSPORTATION

- A. For the transportation of the Engineers personnel the following number and type of vehicles will be made available by the Contractor during the complete construction period, 24 hours per day, 7 days per week.

4x4 Double Cab Light Delivery Vehicles:	2 nos.
4-Wheel Station Wagon Sedan	1 no

B. All vehicles shall have air-conditioning.

C. At least one of the vehicles shall have 4-doors access to the passenger compartment.

D. Maintenance, repair and fuel will be the Contractor's responsibility.

3.4 COMMUNICATION AND ELECTRONIC EQUIPMENT

A. The following electronic equipment must be made available to the Engineer (during the complete construction period) in order to perform his duties using hardware, software and modern means of communication:

1. 1No. facsimile installation;
2. 1No. telephone switchboard with 6 telephones;
3. 4No. mobile telephones with a minimum of 8GB RAM with min 48MP camera
4. 3No. mobile telephones with a minimum of 4GB RAM with min 20MP camera
5. 2No. desktop computers equipped Windows 10 or latest and provided with a minimum of Pentium IV, 4.3 GHz processor, 1TB hard disk and 64GB RAM, including the MS Office, MS Project, Civil 3D 2025, Adobe Reader and relevant applications software Internet/e-mail access; and
6. 4No. laptop computers equipped Windows 10 or latest and provided with a minimum of Pentium IV, 4.3 GHz processor, 1TB hard disk and 64GB RAM, including the MS Office, MS Project, Civil 3D 2025, Adobe Reader and relevant applications software Internet/e-mail access;
7. Network with network server for file and print serving, equipped with tape streamer, UPS and further back-up facilities suitable for above-mentioned 6 nr. computers;
8. 1No. high resolution digital camera;
9. 1No. flatbed high resolution colour scanner for A3 format;
10. 1No. laser printers for both A3 and A4 size paper;
11. 1 colour printer for both A3 and A4 size paper;
12. 1 photocopy machine for both A3 and A4 size paper.

3.5 ENGINEERS ACCOMODATION

A. Accommodation shall be provided for the Engineer's staff under this contract either at Kisumu town or within a 20km travel distance of the airport.

B. This accommodation shall be provided for at a self catering establishment or hotel which shall

be graded as a minimum Three-Star establishment.

C. Accommodation shall be available for the full duration of the project, upon commencement of the project.

END OF SECTION

SECTION 01 71 13.13 MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.1 SCOPE OF WORKS

- A. This section includes mobilization, demobilization of plant including incidentals necessary to complete the work.

1.2 MOBILIZATION

- A. Contractor shall mobilize, and put into work all personnel, plant and equipment required to undertake the contract.
- B. Mobilization shall include the obtaining and transportation to jobsite of equipment, personnel, constructional plant, and all necessary items for the execution and completion of the works, and shall also include the setting up and the verification of all equipment, instrument, and all other plant until it is rendered operable.
- C. Mobilization shall include a sufficient supply of spares for the constructional plant. Breakdowns are to be repaired on site by the most expeditious method possible at no cost to the Employer. In the event of repairs being beyond the ability of personnel or tools at site to effect repairs in reasonable time, such that the construction plant has to be removed from the site, then a replacement of machine or equipment or plant of a similar capacity shall be provided by the Contractor at no additional mobilization cost to the Employer nor extension of time for completion of works.
- D. It is anticipated that the Contractors Site Office be located within the Airport Boundary north of RWY 07-25 and west of the Transmitting Station. This large area should be located outside of the Existing Fence, in an area close to Control Point D9N.
- E. Mobilisation shall include the establishment of a hot mix asphalt production plant. This plant shall be an asphalt batching plant equipped with aggregate storage bins, bitumen storage tanks, and hot-mix storage silos.
- F. Mixing shall be in batch mixing plant(s) in accordance with the requirements of ASTM D 995. The mixing plant shall have provision to separately weigh the filler to be added to the aggregate. The minimum production capacity of the batching plant shall be 120t/hour, and the hot-mix storage silos shall be capable of storing 200t of hot mix asphalt.

1.3 DEMOBILIZATION

- A. Demobilization shall include the removal of all constructional plant and equipment from the site and the cleaning up of all areas of work.
- B. Demobilization shall include the removal of all supplementary markers furnished and installed by the Contractor and temporary structures/facilities provided that the Employer or the Engineer has not taken the option to retain all such markers and temporary structures/facilities. Only those markers which the Employer or the Engineer has released, shall be removed by the Contractor as part of the demobilization.
- C. Demobilization shall include the removal and disposal of debris and materials not

incorporated with the contract work prior to Contractor's moving out of the project.

D.It is a requirement of this contract that ALL areas (including quarries and borrow pits) be neatly trimmed and that a certificate of approval be obtained from the Engineer.

END OF SECTION

SECTION 01 77 00.13 CLOSEOUT PROCEDURES

PART 1 - GENERAL

SECTION INCLUDES

- A. Closeout Procedures
- B. Final Cleaning
- C. Spare Parts

1.2 CLOSEOUT PROCEDURES

- A. The following project closeout procedure defines the responsibilities of the Contractor, the Engineer and Employer in closing the project:
 - 1. The Contractor advises the Engineer in writing that the work has reached substantial completion and provides list of items to be completed or corrected. Closeout may be conducted by areas or portions of work if requested by the Engineer.
 - 2. The Engineer inspects the work to determine if the work is substantially complete and issues a punch list of items to be completed and/or corrected.
 - 3. Contractor completes and corrects punch list items and notifies the Engineer in writing that the work is ready for final inspection.
 - 4. When the work is found acceptable under the requirements of the contract documents and the contract is fully performed, the Engineer will issue the taking over certificate as described in the contract conditions.
- B. If Contractor fails to complete and correct punch list items, requiring the Engineer to make additional inspections, Contractor shall reimburse to the Employer for the Engineer's account, as appropriate, for time spent in processing additional re- submittals at rate of 2.5 times rate of direct personal expense (DPE). DPE is defined as direct salaries of Engineer's personnel engaged on project and portion of costs of mandatory and customary contributions and benefits related thereto, including employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions, and similar contributions and benefits.

FINAL CLEANING

- C. Final cleaning shall be executed prior to final inspection.
- D. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.

- E. Clean equipment and fixtures to sanitary condition
- F. Replace filters of opening equipment
- G. Clean debris from the roofs, gutters, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscape surfaces
- I. Remove waste and surplus materials, rubbish, temporary works, and construction facilities from project and from the site.

SPARE PARTS

- J. Provide all products, spare parts, and maintenance materials required by the various sections of specifications. Unless otherwise stated, required spares and maintenance materials provided shall be sufficient, in the Engineer's opinion for two (2) years of operation after the date of acceptance listed in the taking-over certificate.
- K. Provide a complete listing of all products and spares provided as agreed with the Engineer.

END OF SECTION

SECTION 01 78 23.00 OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

SECTION INCLUDES

- A. Format
- B. Maintenance Data
- C. Manual for Equipment and System
- D. Instruction of Owner Personnel

FORMAT

- A. Prepare data in the form of an instructional manual.
- B. Binders: Commercial quality, 2 ring binders with hardback, cleanable, plastic covers; 2-inch maximum ring size. When multiple binders are used, correlate data and related consistent groupings.
- C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS, list title of Project, and identify subject matter of contents.
- D. Arrange content by systems under section numbers and sequence of Table of Contents of Project Manual.
- E. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text Manufacturer's printed data or typewritten data on 20-pound paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

MAINTENANCE DATA

- A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of the Engineer and the Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- B. For each Product or System: List names, addresses, and telephone numbers of sub contractors and suppliers, including local source of supplies and replacement parts.

- C. Product Data: mark each sheet to clearly identify specific products and component parts and data applicable to installation, delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems and to show control and flow diagrams.
- E. Typed text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Warranties and Bonds: Bind in copy of each.

MANUAL FOR EQUIPMENT AND SYSTEM

- A. Each item of Equipment and Each System: Include description of unit or system and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- B. Panel board Circuit Directories: Provide electrical service characteristics, controls and communications.
- C. Include as-installed color-coded wiring diagrams.
- D. Operating Procedures: Includes start-up, break-in, and routine normal operating operations and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer and any special operating conditions.
- E. Maintenance Requirements: Includes routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions, and alignment, adjusting, balancing, and instructions.
- F. Provide servicing and lubrication schedule and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide as-installed control diagrams by controls manufacturer.
- K. Provide Contractor's coordination drawings, with as-installed colored-coded piping diagrams.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual Sections.

INSTRUCTION OF EMPLOYER PERSONNEL

- A. Before final inspection, instruct the Employer's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agrees upon times. Provide instruction for durations specified in the individual specifications, or for such duration as necessary level satisfactory to the Engineer
- B. For equipment requiring seasonal operation, perform instructions for other seasons within 6 months.
- C. Use operation and maintenance manuals as basis of instruction. Review contents of manual wit personnel in detail to explain all aspects of operation and maintenance.

Prepare and insert additional data in Operation and Maintenance Manual when need of such data becomes apparent during construction.

END OF SECTION

SECTION 02 22 33.13 PAVEMENT SKID RESISTANCE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item is for the determination of the friction characteristics of the new runway surfacing after its construction.
- B. This item shall include the use of equipment, qualified personnel, labour, transport and access to the site required to carry out the investigations in a professional manner and to the approval of the Engineer.

1.2 RELATED SECTIONS

- A. Sections to be referred to:
 - 1. Section 32 12 19.19 Porous Friction Course

PART 2 - PRODUCTS

2.1 Working Statement

- A. Prior to the execution of the investigations, a method statement describing the execution of the works shall be submitted for approval of the Engineer. This statement shall address amongst others planning of the works, list of personnel and vehicles, coordination with the airport operational and security departments, etc.

2.2 Deliverables

- A. The following shall be deliverable from the pavement skid resistance (friction) testing:
 - Pavement skid resistance (friction) results in printed and electronic format, referenced to the project chainage of the runway.

2.3 Equipment

- A. The suitable equipment necessary for the fiction testing shall be available, in good condition, and approved by Engineer before the various operations are started.
- B. Equipment for the friction testing shall be one of the following types of Continuous Friction Measuring Equipment (CFME) :

Mu-meter Trailer Skiddometer Trailer

Surface Friction Tester Vehicle Runway Friction Tester Vehicle TATRA Friction Tester Vehicle
GRIPTESTER Trailer

PART 3 - EXECUTION

3.1 PAVEMENT SKID RESISTANCE TESTING

- A. The Contractor shall undertake the testing over the entire length of the runway (3000m), in two check runs, and ten standard runs to be confirmed by the Engineer on site.
- B. The check runs shall confirm that the operation of the CFME is consistent throughout the full runway surface friction assessment, and should be conducted before and after completion of the standard runs, under the same conditions.
- C. The location of the standard runs shall be as follows:

Runway width	Lateral displacement of standard runs each side of the centreline (m)				
45m	1.5	4	7	11	17

- D. The tests should be conducted under controlled conditions with the CFME self- wetting system switched on. The runway should be free from precipitation during the assessment, with no wet patches.
- E. The test should be conducted uninterrupted for a particular run, and undertaken at a constant speed, allowing for acceleration and safe deceleration.
- F. An average friction value should be determined every 10 metres along a run, enabling a 100m rolling average to be calculated.
- G. The Design Objective Friction Value for the new surface (Column 5) shall be as per Table A-1 below (from Annex 14 – Attachment A)

Table A-1.

Test equipment	Test tire		Test speed (km/h)	Test water depth (mm)	Design objective for new surface	Maintenance planning level
	Type	Pressure (kPa)				
(1)	(2)	(3)	(4)	(5)	(6)	
Mu-meter Trailer	A	70	65	1.0	0.72	0.52
	A	70	95	1.0	0.66	0.38
Skiddometer Trailer	B	210	65	1.0	0.82	0.60
	B	210	95	1.0	0.74	0.47
Surface Friction Tester Vehicle	B	210	65	1.0	0.82	0.60
	B	210	95	1.0	0.74	0.47
Runway Friction Tester Vehicle	B	210	65	1.0	0.82	0.60
	B	210	95	1.0	0.74	0.54
TATRA Friction Tester Vehicle	B	210	65	1.0	0.76	0.57
	B	210	95	1.0	0.67	0.52
GRIPTESTER Trailer	C	140	65	1.0	0.74	0.53
	C	140	95	1.0	0.64	0.36

H. The friction value provided in column 5 is the absolute value and shall be applied without any tolerance.

END OF SECTION

SECTION 02 32 26.13 GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item consists of the scope of works for the geotechnical investigations to be conducted for the Runway, Taxiways and Apron.
- B. This item is required to investigate and confirm the bearing capacity of the working platform on which the buildings will be constructed.
- C. This item includes the use of equipment, qualified personnel, labour, transport and access to the site required to carry out the investigations in a professional manner.

1.2 SCOPE OF TESTING

A The scope of field investigations shall consist of:

- a) Excavation and logging of test pits to identify soil stratification and to obtain soil samples for laboratory testing.
- b) Field density and moisture content as per ASTM D1556 or Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) as per ASTM D2922.
- c) Soil classification according to the Unified Soil Classification System as per ASTM D2487.

Moisture – Density Relation of Soil (Modified Proctor) as per ASTM D1557.

Californian Bearing Ratio of Laboratory Compacted Soil as per ASTM D1883.

- d) Laboratory testing of samples obtained from boreholes.
- e) Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils as per ASTM D1586.

Determining Average Grain Size as per ASTM E112.

1.3 QUANTITY OF TEST

A The quantity of tests to be conducted shall be as indicated in Table 1.

1.	Test pits	Six (6) nos
2.	Field density test	Six (6) nos for every test pit
3.	Soil classification	Two (2) nos for every test pit

4.	Modified Proctor	Two (2) nos for every test pit
5.	CBR	Two (2) nos for every test pit
1.	Bore holes	Six (6) nos
7.	SPT	Every borehole, until 6.0m below existing ground, for every significant change of soil with a minimum of one (1) SPT every 2.0 m
8.	Average Grain Size	One (1) no for every SPT

Table 1: Quantity of Tests

1.4 REFERENCES

A. Testing Requirements:

ASTM D 516 Sulfate Ion in Water

ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 Laboratory Compaction Effort of Soil using Modified Effort ASTM D 1586 Penetration Test and Split-Barrel Sampling of Soils ASTM D 1883 CBR of Laboratory Compacted Soil

ASTM D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 7012 Unconfined Compressive Strength (UCS) and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

ASTM E 112 Determining Average Grain Size

BS 1377-3:1990 Methods of test for soils for civil engineering purposes.

Chemical and electro-chemical tests

1.5 ELATED SECTIONS

Not Applicable

1.6 ABBREVIATIONS

A. The following abbreviations apply to this scope of services:

ACS Airport Coordinate System

ASTM American Society for Testing and Materials

BS	British Standards
CBR	Californian Bearing Ratio
USCS	Unified Soil Classification System

PART 2 - PRODUCTS

2.1 DELIVERABLES

- A. A geotechnical report shall be prepared in the English language, which shall contain at least the following information:
1. Drawing with the locations and coordinates of all test pits;
 2. Field logs and photographs (color) of all test pits
 3. Results of all laboratory tests;
 4. Summary of all results

PART 3 - EXECUTION

3.1 SETTING OUT

- A. Setting out of the locations for the test pits shall be in accordance with the ACS as established for the topographical surveys.

3.2 TEST PITS

- A. Test pits shall be excavated manually or by mechanical excavator to a depth of 3.0m or until solid rock or cemented material is encountered, whichever is less.
- B. In case solid rock or cemented material is encountered, attempts shall be made to determine the thickness of the layers.
- C. Every 0.5m until a depth of 3.0m (total of 6) below ground level, the field density of the in-situ soil shall be obtained.
- D. At a depth of 1.0m and 2.0m below ground level, a sample of sufficient material shall be obtained to conduct the test as described in Table 1. The samples shall be properly stored, sealed and labelled in plastic bags for transportation to the soil laboratory.
- E. A digital color photograph shall be taken of each test pit. The photo should bear a mark enabling identification of the test pit location.
- F. A graphic field log of the soil condition shall be prepared of each test pit. The graphic log should at least include the following:
1. Location of test pits in ACS
 2. Date when sample was taken

3. Test pit number
4. Surface elevation
5. Name of excavator
6. Soil stratification and depth of layers
7. Visual description of each soil layer
8. Depth of water table

3.3 BOREHOLES

A. A graphic field log of the soil condition shall be prepared of each borehole. The graphic log should at least include the following:

1. Location of borehole in ACS
2. Date when sample was taken
3. Boring number
4. Surface elevation
5. Name of driller
6. Soil stratification and depth of layers
7. Visual description of each soil layer
8. Depth of water table

3.4 LABORATORY TEST

A. Soil classification and modified proctor test shall be conducted as per the applicable standards.

B. For each soil sample the CBR shall be established for three (3) compactive efforts (10, 25 and 56 blows). Compaction to be made at Optimum Moisture Content. Each test shall be conducted under soaked conditions.

3.5 EQUIPMENT

A. Suitable equipment necessary for proper soil investigations shall be available, in good condition before the various operations are started.

END OF SECTION

SECTION 02 41 13.13 REMOVING EXISTING PAVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of removing existing pavement, and all other pavement items within the limits shown on the drawings or as required by the Engineer.
- B. The item shall include breaking-up, removal and disposal of the pavement materials.

1.2 RELATED SECTIONS

- A. Sections to be referred to:
 - 1. Section 31 23 16.33 Excavation and Fill
 - 2. Section 32 01 16.71 Cold Milling Asphalt Paving

PART 2 - PRODUCTS

Not applicable.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall obtain approval of the Engineer for his method of demolition. Every effort shall be made to remove only the pavement within the limits shown.
- B. Plant and equipment for pavement removal shall be of suitable types and standards.

3.2 DISPOSAL AND STOCKPILING OF MATERIALS

- 3.2.1 The Contractor shall during his inspection of the site in the Tender Period obtain further information on central dumping areas where disposal of broken up materials may take place.
- 3.2.2 Materials shall be disposed off. Temporary stockpiling of materials within the airport property boundary shall not be permitted.
- 3.2.3 Broken up materials shall become property of the Contractor.
- 3.2.4 When the Contractor is required to locate a disposal area outside the airport property boundary, he shall obtain and file with the Engineer the permission in writing from the property owner for the use of his property for this purpose.
- 3.2.5 Disposal of material outside the airport property boundary shall be in accordance with the requirements of the property owner.

3.3 EXISTING STRUCTURES, CABLES, PIPES AND OTHER UTILITIES

- 3.3.1 Prior to the start of any pavement removal works the Contractor shall collect all possible information on location and depth of existing structures, cables, pipes and other utilities.
- 3.3.2 All care shall be taken by the Contractor not to damage the permanent features. Any damage to these features due to pavement removal works shall be repaired at the Contractor's expense.
- 3.3.3 Whenever any public utility is encountered and must be removed or relocated the Contractor shall advise and notify the Local Authority or owner and attempt to secure prompt action.

END OF SECTION

SECTION 03 31 13.13 STRUCTURAL CEMENT CONCRETE, BLINDING CONCRETE AND NO FINES CONCRETE

PART 1 - GENERAL

DESCRIPTION

- A. This item shall consist of either plain or reinforced structural cement concrete, and blinding concrete, prepared and constructed in accordance with this specification at the locations and of the form and dimensions shown on the drawings. This section does not describe Portland Cement Concrete Pavement.
- B. The concrete shall be composed of coarse aggregate, fine aggregate, portland cement, and water.

STANDARD TEST METHODS

C. Testing Requirements

ASTM C 31	making specimen in the field
ASTM C 39	compressive strength
ASTM C 40	impurities in sand
ASTM C 42	field cores and beams
ASTM C 78	flexural strength
ASTM C 88	soundness
ASTM C 109	strength of cement
ASTM C 117	wet sieving
ASTM C 125	fineness modulus: definition
ASTM C 131	abrasion - L.A. machine
ASTM C 136	sieve analysis
ASTM C 138	yield, air content
ASTM C 143	slump
ASTM C 174	measuring cores
ASTM C 192	making specimen in the lab

D. Material Specifications

ASTM A 185	steel wire fabric
ASTM A 615	reinforcing steel
ASTM A 617	steel for dowels
AASHTO M 254	coated dowels
ASTM C 33	aggregates
ASTM C 87	impurities / strength
ASTM C 94	ready-mixed concrete
ASTM C 127	spec. gravity/absorption
ASTM C 128	spec. gravity/absorption
ASTM C 150	cement
ASTM C 171	curing materials
ASTM C 172	sampling concrete
ASTM C 260	air-entraining
ASTM C 309	liquid curing
ASTM C 494	chemical admixtures
ASTM C 618	fly ash and pozzolanas
ASTM D 98	calcium chloride
ASTM D 1751, 1752	joint filler

1.2 RELATED SECTION

A. Sections to be referred to:

1. Section 32 05 53.13 Construction Water
2. Section 32 13 73.13 Fuel-Resistant Concrete Paving Joint Sealant

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Only materials in accordance with the requirements of this specification shall be used in Work. They may be subjected to inspection and tests at any time during the progress of their preparation or use.
- B. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor for examination and test.
- C. Materials shall be stored and handled to ensure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.
- D. In no case shall the use of pit-run or naturally mixed aggregate be permitted.
- E. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregate shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates shall not be permitted.

2.2 COARSE AGGREGATE

- A. The coarse aggregate for concrete shall be in accordance with the requirements of ASTM C 33.
- B. Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1.

ASTM Sieve Size		Percentage by weight passing		
		1½"-No.4	1"-No.4	¾"-No.4
2"	50 mm	100	--	--
1½"	38 mm	95-100	100	--
1"	25 mm	--	90-100	100
¾"	19 mm	35-70	--	90-100
½"	12.5 mm	--	25-60	--
3/8"	9.5 mm	10-30	--	20-55
No. 4	4.75 mm	0-10	0-15	0-20

Table 1: Gradation for three sizes of coarse aggregate

- C. Soundness loss shall be in accordance with ASTM C 33.

D. Abrasion loss shall be less than 45 percent when tested in accordance with ASTM C 131.

E. The selection of any of the gradations shown in Table 1 shall be such that the maximum aggregate size used will not interfere with the reinforcement or cover to steel (if any).

For reinforced concrete, gradation 3/4" down shall normally be used. For plain concrete 1" down or 1½" down may be used, unless instructed otherwise.

2.3 FINE AGGREGATE

A. The fine aggregate for concrete shall be in accordance with the requirements of ASTM C 33.

B. The fine aggregate shall be well graded from fine to coarse and shall meet the grading requirements shown in Table 2.

ASTM Sieve Size		Percentage by Weight Passing
3/8"	9.5 mm	100
No. 4	4.75 mm	90-100
No. 8	2.36 mm	95-95
No. 16	1.18 mm	45-75
No. 30	0.60 mm	25-55
No. 50	0.30 mm	10-30
No. 100	0.15 mm	2-10
No. 200	0.075 mm	0-5

Table 2: Requirements for Gradation of Fine Aggregates

C. Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate.

D. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such a deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified for admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

E. The fineness modulus shall be between 2.3 and 3.1.

F. Dry sieving is usually satisfactory for routine testing. However, when accurate determination of the amount of fines is desired firstly test in accordance with ASTM C 117 - washing.

2.4 CEMENT

- A. Cement shall be Portland type, originating from approved manufacturers, shipped in sealed, labelled bags or in bulk.
- B. The quality of the Portland cement shall be in accordance with ASTM C 150 type I or V or as instructed, and shall be accepted only upon specific approval of the Engineer based on test certificates originating from recognized laboratories. The basis for this acceptance shall be compliance with the above ASTM specification, especially a compressive strength of standard cement mortar samples at 28 days of not less than that specified when tested in accordance with ASTM C 109.
- C. Cement shall not be used in the work until it has passed the seven days and twenty eight days tests, except with the permission of the Engineer to avoid delay of the work.
- D. The tests necessary for approval are included in the item.
- E. Approval of a cement quality shall not waive the responsibility of the Contractor to produce concrete of the strength specified.
- F. Cement used shall have been manufactured at least fifteen days previous to use.
- G. Stale cement or cement reclaimed from cleaning bags shall not be used.
- H. All cement shall be subjected to a check test at any time requested by the Engineer.
- I. All cement shall be stored in watertight sheds on a floor sufficiently raised above ground, or in watertight silos.
- J. Each consignment, brand and type of cement shall be kept separate in the sheds.
- K. Cement which for any reason has become partially set or contains lumps or caked cement, shall be rejected.
- L. Whenever tests of factory or field samples subsequent to the original approved tests show that the cement does not comply with the specification, the consignment from which the sample was taken will be rejected and the Contractor shall remove it forthwith from the site at his own expense and replace it with cement of satisfactory quality.

2.5 WATER

- A. Water shall be in accordance with section "Construction Water".

2.6 ADMIXTURES

- A. The use of any material added to the concrete mix shall be approved by the Engineer.
- B. The Contractor shall submit certificates indicating that the material to be furnished meets requirements.
- C. The Engineer may require the Contractor to submit complete test data from an approved

laboratory showing that the material to be furnished meets all of the requirements of the cited specifications.

- D. Subsequent tests will be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.
- E. Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolans meeting the requirements of ASTM C 618 with the exception of loss of ignition, where the maximum should be less than 6 percent.
- F. Air-entrainment admixtures shall meet the requirements of ASTM C 260 and shall be added to the mixer in the amount necessary to produce the specified air content.
- G. The air-entrainment agent and the water reducer admixture shall be compatible.
- H. Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding.
- I. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

2.7 JOINT MATERIAL

- A. Premoulded joint material for expansion joints shall meet the requirements of one of the following specifications: ASTM D 994, D 1751, D 1752.
- B. The joint sealing filler shall meet the requirements of section "Joint Sealants".

2.8 STEEL REINFORCEMENT

- A. Concrete reinforcing shall consist of deformed bars of either structural (grade 40), intermediate (grade 60), or hard grade billet steel (grade 75), meeting ASTM A 615 as shown on the drawings.
- B. To qualify as deformed, bars shall be in accordance with the requirements of ASTM A 615.
- C. If no grade indicated on the drawings grade 60 (intermediate) shall be used.
- D. Welded wire fabric shall be in accordance with the requirements of ASTM A 185.

2.9 CALCIUM CHLORIDE

- A. When calcium chloride is permitted by the Engineer in the concrete as an accelerator, it shall meet the requirements of ASTM D 98.

2.10 CURING MATERIALS

- A. Waterproof paper, white polyethylene film, and white burlap polyethylene sheeting for curing concrete shall be in accordance with ASTM C 171.
- B. Liquid membrane - forming compounds for curing concrete shall be in accordance with ASTM C 309, Type 2 (all resin base).

PART 3 - PART 3 - EXECUTION

3.1 CONCRETE PROPORTIONS

- A. Materials for one cubic metre of structural cement concrete are as given in Table 3.

Type of Coarse Aggregate	Minimum cement content (kg)	Maximum W/C-ratio (%)	Fine Aggregate (% of total aggr)	Total Aggregate (kg)	Slump (cm)
Gravel	325	0.5	34-38	1900	5 – 12.5
Crushed Stone	325	0.5	38-43	1900	5 – 12.5

Table 3: Concrete Proportioning

B. The proportions in above table are based on the use of well-graded aggregates. If it is impossible with the aggregates selected to prepare concrete of the proper consistency without exceeding the maximum net water content specified, the total weight of aggregate shall be reduced by the Engineer until concrete of the proper consistency is obtained without exceeding the maximum net water content specified.

C. The Contractor shall not be compensated for any additional cement which may be required by such adjustment.

D. The weights specified in table 3 were calculated for aggregates of the following bulk specific gravities:

1. natural sand and gravel 2.65 t/m³
2. crushed stone 2.70 t/m³

E. For aggregates of specific gravities differing more than ± 0.02 from those given under 3.1.D, the weights given in table 3 shall be corrected. The quantities shown for cement and water shall control, and the weights of aggregates shall be varied to secure the proper yield based on absolute volumes.

F. When a special mix requiring a reduction in the amount of water desired, the quantities of aggregate shall be increased to maintain the specified yield.

G. Yield tests, made in accordance with specification

ASTM C 138, shall be made for the purpose of determining the cement content per cubic metre of concrete.

H. If at any time such cement content is found to be less than that specified per cubic metre, the batch weights shall be reduced until the amount of cement per cubic metre of concrete is in accordance with the requirements.

I. The net mixing water shall be adjusted for the moisture contained in the aggregates, and for the moisture which they will absorb, in order to determine the amount of water to be added at the mixer.

The absorption of the fine and coarse aggregates shall be determined by ASTM C 127 and C 128.

3.2 CHLORIDE AND SULPHATE IN MIX

A. The total chloride ion content of the constituents of each mix, expressed as a percentage by weight of cement in the mix, must not exceed the following percentages:

1. Prestressed concrete: 0.1
2. Concrete made with sulphate resistant Portland cement or super-sulphated cement: 0.2
3. Concrete made with ordinary Portland cement or rapid hardening cement and containing embedded metal: 0.35
4. Concrete without embedded metal: 0.50

B. The total sulphate content of the constituents of each mix, expressed as SO₃ must not exceed 4% by weight of the cement in the mix.

3.3 TESTING

A. Testing Specimen

1. From the concrete proportions for structural concrete, trial mixes shall be made and from each trial mix six cylinders shall be made and cured in accordance with ASTM C 192, and tested in accordance with ASTM C 39.
2. Normally, several trial mixes shall be prepared and tested simultaneously.
3. The six specimen of each group are to be tested at the end of 28 days. The average strength and the standard deviation of the six specimen is to be calculated for each group.

The test results are to be compared with the requirements under clause

3.3.B hereof.

4. Trial mixes are to be continued until a design mix can be selected that fulfills the requirements.
5. Additional specimen may be made and tested to obtain the 7-days strength results. These results may be used as an indication of the 28-days strength. The 7-days strength shall not be less than 65% of the required 28- days strength.

B. Compressive Strength

1. The required characteristic design strength of the group of six tests cylinders at 28 days shall be at least 25.0 N/mm²
2. The characteristic strength is defined as $X - K \cdot S$, where: X = average of 6 tests

S = standard deviation K = 1.65 (95% value)

C. Slump Test

1. For each trial mix, one slump test is to be carried out in accordance with ASTM C 143.

Results shall be within the range specified.

D. Control Tests

1. Six test cylinders for compressive strength tests shall be made during each day that concrete is placed during the progress of the Works. One group of three cylinders is to be made during the first half of a days shift and a second group of three cylinders is to be made during the last portion of the days shift.

Each group of test cylinders shall be molded from the same batch of concrete and prepared in accordance with ASTM C 31.

2. Additional groups of test cylinder may be required at the start of the concrete works

and when the aggregate source of characteristics, or the mix design, is changed. The six test cylinders mentioned above shall be used for the 28-days test, and additional test cylinders may be prepared for the 7-days test. When a satisfactory relationship between the 7-days and the 28-days strength has been established and approved, the 7-days results may be used as an indication of the 28-days strength.

3. The characteristic compressive strength of the field-made test specimens, tested at the end of 28-days, shall be as specified at Clause 3.3B, calculated from this series of six.
4. If these strength criteria are not met, and if the structural adequacy remains in doubt, the Engineer may order tests on cores drilled from the area in question, in accordance with ASTM C 42, or he may order load tests or take other action appropriate to the circumstances.
5. If cores are drilled and tested for compressive strength, the concrete will be considered structurally adequate, if the average of 3 cores is at least 85% and no single core has a strength of less than 75% of the strength specified under clause 3.3.B hereof.

3.4 BLINDING CONCRETE

A. Blinding concrete shall be placed as working aprons at the locations shown on the drawings or as directed by the Engineer and shall be constructed in accordance with this specification.

B. The concrete proportions shall be as follows:

1. cement content 150 kg/m³
2. water/cement ratio 0.65-0.75
3. ratio fine aggregate to coarse aggregate by volume 1 to 2

C. The coarse aggregate shall be in accordance with clause 2.2, using 1 inch maximum size.

3.5 CONSTRUCTION METHODS

A. General

1. The Contractor shall furnish all labour, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein.
2. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work and shall be such as to produce satisfactory work. All work shall be subject to the inspection and approval of the Engineer.
3. The Contractor shall employ, at all times, a sufficient force of workmen of such experience and ability that the work can be prosecuted in a satisfactory and

workmanlike manner.

4. The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited without interruption.

B. Proportioning and Measuring Devices

1. When standard package cement is used, the cement quantity for each batch need not be weighed but shall be equal to one or more whole sacks of cement.
2. The aggregate shall be measured separately by weight.
3. Mixing water shall be measured wither by volume or by weight.
4. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment.
5. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

C. Mixing Conditions

1. The concrete shall be mixed at the work site in a central mixing plant or in truck mixers. The mixer shall be of an approved type and capacity.
2. Mixing time shall be measured from the time all materials, except water, are emptied into the truck. When mixed at the work site or in a central mixing plant, the mixing time shall be not less than 50 seconds nor more than 90 seconds. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time.
3. Any concrete mixed less than the specified time shall be discarded at the Contractor's expense.

The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

4. The mixer shall be operated at the drum speed as shown on the manufacturer's name plate on the approved mixer.
5. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity, as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to 10% above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.
6. The batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the frum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.
7. Mixed concrete from the central mixing plant shall be transported in truck mixers,

truck agitators, or non-agitating trucks having special bodies.

8. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor 60 minutes when the concrete is hauled in truck mixers or truck agitators.
9. Retempering concrete by adding water or by other means shall not be permitted, except if accomplished within 45 minutes after the initial mixing operation.
10. Concrete that is not within the specified slump limits at time of placement shall be discarded.

3.6 WORKING LIMITATIONS

A. Sufficient Light

1. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

B. Cold Weather (not applicable)

C. Warm Weather

1. The Contractor shall be required to take special precautions to prevent the formation of plastic shrinkage cracks.
2. The concrete shall be placed at the lowest temperature practicable, and in no case when the temperature of the fresh concrete is higher than 32° C.
3. Concrete temperatures are to be reduced by the following methods:
 - a) By shading aggregate and cement stockpiles from direct rays of the sun.
 - b) By cooling of mixing water which can be achieved by special plant or by burying, insulating, shading or white-painting the pipe line and water storage tanks. Tank cars used for transporting water should be insulated or painted white.
 - c) By sprinkling forms and subgrade with cool water just prior to placing.
4. When temperature conditions are critical, concrete placement shall be restricted to the evening or night.
5. A copy of weather data shall be included in the permanent records of the job.

3.7 FORMS

A. Concrete shall not be placed until all forms and reinforcement have been inspected and

approved by the Engineer.

- B. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as designed on the drawings. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear the responsibility for their adequacy. The surfaces of the forms shall be smooth and free from irregularities, dents, sags, and holes.
- C. The internal ties shall be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolour the surface when exposed to weathering.
- D. All forms shall be wetted with water or with a nonstaining mineral oil which shall be applied shortly before the concrete is placed.
- E. Forms shall be constructed so that they can be removed without damaging the concrete or concrete surface.
- F. The forms shall not be removed before the expiry of at least 30 hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least 60% of the design strength under clause 3.3.B of the concrete has developed.

3.8 PLACING REINFORCEMENT

- A. All reinforcement shall be accurately placed, as shown on the drawings and shall be firmly held in position during concreting.
- B. Bars shall be fastened together at intersections.
- C. The reinforcement shall be supported by approved metal chairs.
- D. Shop drawings, lists and bending details shall be supplied by the Contractor when required.

3.9 EMBEDDED ITEMS

- A. Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.
- B. Exact sizes for recesses or holes in concrete slabs, beams, etc. for piping, ducting etc. have to be determined and provided by the Contractor.
- C. Inserts or boxes as required are to be placed in correct position before placing concrete.

3.9 PLACING CONCRETE

- A. All concrete shall be placed during daylight, unless otherwise approved.
- B. The concrete shall not be placed until the depth and character of foundation, the adequacy of

forms and false-work, and the placing of the steel reinforcing have been approved.

- C. Concrete shall be placed as soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. The method and manner placing shall be such as to avoid segregation and displacements of the reinforcement.
- D. Troughs, pipes, and chutes shall be used as aids in placing concrete when necessary.
- E. Dropping the concrete a distance of more than 1.50 m, or depositing a large quantity at one point, will not be permitted.
- F. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.
- G. The concrete shall be compacted with suitable vibrators and shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction.
- H. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into comers and angles of the forms. The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs.
- I. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.

3.10 CONSTRUCTION JOINTS

- A. When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set.
- B. For the proper bonding of old and new concrete such provisions shall be made for grooves, steps, keys, dove-tails, reinforcing bars other devices as may be prescribed.
- C. The work shall be arranged so that a section commenced on any day shall be finished during daylight of the same day.
- D. Before depositing new concrete on or against concrete which has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

3.11 EXPANSION JOINTS

- A. Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings.
- B. The premoulded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such a manner that it will not be displaced when concrete is deposited against it.

3.12 DEFECTIVE WORK

- A. Any defective work disclosed after the forms have been removed shall be immediately removed and replaced.
- B. If any dimensions are deficient, or if any of the concrete is bulged, uneven, or shows honeycombing, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

3.13 SURFACE FINISH

- A. All exposed concrete surfaces shall be true, smooth, free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated.
- B. Mortar finishing shall not be permitted, nor shall dry cement or sand cement mortar be spread over the concrete during the finishing of horizontal plane surfaces,
- C. When directed, the surface finish of exposed concrete shall be a rubbed finish.
- D. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface.
- E. When approved, the finishing can be done with a rubbing machine.

3.14 CURING AND PROTECTION

- A. All concrete shall be properly cured and protected.

The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material.

- B. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations.
- C. Water absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least 3 days.
- D. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete.
- E. Traffic shall not be allowed on concrete surfaces for 14 days after the concrete has been placed, or before the concrete has developed a flexural strength of 3.8 N/mm².

3.15 DRAINS OR DUCTS

- A. Drainage pipes, conduits and ducts that are to be encased in concrete shall be installed by the contractor before the concrete is placed.
- B. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

3.16 FILLING JOINTS

- A. All joints which require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools.
- B. Joint filling shall not be started until final curing and shall be done only when the concrete is completely dry.
- C. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

3.17 PROTECTIVE COATING FOR CONCRETE

- A. The surface of the structures which will come in permanent contact with soil shall be given two coatings with an approved bituminous material, depending on the ambient temperature.
- B. The first coating shall not be applied before a 7 day curing period of the concrete or plaster has lapsed and the second coat at least 24 hours after the first coat.
- C. In case no shuttering is used and concrete is poured directly in the excavated trench or pit, plastic sheets shall be used as protection between the concrete and the soil.

3.18 NO FINES CONCRETE

- A. No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used. Class NF 19 means a no-fines concrete with a 19 mm nominal single size aggregate. The volume of aggregate per 50 kg of cement for each class of concrete shall be as follows:

Class Aggregate per 50 kg cement

NF 38 0,33 m³

NF 19 0,30 m³

NF 13 0,27 m³

- B. Cement shall be measured by mass or in full pockets of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.
- C. The aggregate shall be moist or wetted before the cement is added. Where drum mixers are

used, about 20% of the water shall be poured into the drum before the aggregate and cement are loaded. The mixing time in the drum shall be about 45 to 50 seconds.

- D. The quantity of water added shall be just sufficient to form a smooth grout which will adhere to and completely coat each and every particle of aggregate, and which is just wet enough to ensure that, at points of contact of aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water for every 50 kg of cement.
- E. Mixing shall be done in an approved batch-type mechanical mixer, but small quantities may be hand mixed.
- F. No-fines concrete shall be placed in accordance with the procedure approved by the engineer. It shall be placed in its final position within 15 minutes of having been mixed.
- G. The concrete shall be worked sufficiently to ensure that it will completely fill the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping shall be avoided and the concrete shall not in any circumstances be vibrated.
- H. All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods:
 - (i) Retaining formwork in place.
 - (ii) Covering exposed surfaces with sacking or other approved material kept continuously wet.
 - (iii) Covering exposed surfaces with plastic sheeting.

END OF SECTION

SECTION 03 48 23.13 CONCRETE BASES, FOUNDATION, PITS AND WIND CONE MARKERS

PART 1 - GENERAL

1.1. DESCRIPTION

- A. This item shall consist of the furnishing and installation of concrete bases or footings for airfield lighting units, PAPI, floodlighting poles, windcones, concrete pits for transformers, earth rods, test links, pull boxes, fuel tanks, generators, distance to go markers and bands for windcones, in accordance with this specification and all conforming the locations and dimensions as shown on the drawings or as required by the Engineer.
- B. This item shall also include all excavation, backfilling, removal and restoration of any paved or unpaved area and all formwork etc. to complete the item.
- C. The items under this section shall be provided or constructed in close co- operation with the supplier of the equipment, in order to avoid all interference with materials installed in a later stage of the work, with special reference to hole, pipe, bolt and thread sizes.

1.2 REFERENCES

Not Applicable

1.3 RELATED SECTION

- A. Sections to be referred to:
 - 1. Section 03 31 13.13 Structural Concrete and Blinding Concrete
 - 2. Section 32 17 23.13 Pavement Markings

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Concrete and reinforcements for bases, pits, foundations and markers shall conform to Section for structural concrete as specified in Section Structural Concrete and Blinding Concrete.
- B. Aggregates shall have a maximum size of 25 mm.
- C. Quality shall be that of structural cement concrete.

2.2 CONDUIT ELBOW ASSEMBLIES

- A. Elbows as used in concrete light bases or footings, if any, shall conform to the dimensions on the drawings.
- B. The elbows shall be hot-dip galvanised, (the weight of the coating shall be not less than 0.75 kg per square metre) or PVC or glass fibre.

- C. If required, elbows are to be provided with a threaded socket at the top end and with an earthing device at the lower end and consisting of a bolt, two nuts with two washers, all nickel plated brass.

2.3 STEEL BASE PLATE

- A. Steel base plate as used for hollow concrete bases, if any, shall be fabricated from 10 mm minimum thickness standard steel plate or as shown on drawings.
- B. The dimensions of the base plates with bolt circles shall be as shown on the applicable drawings.
- C. The plates shall be treated after fabrication for corrosion protection by hot-dip galvanising. The minimum weight of the coating shall be not less than 0.75 kg per square metre. The entire top of the base plate shall be wiped smooth after application of the coating so that a flat surface within ± 0.25 mm is provided.
- D. The steel base plate shall be provided with stainless steel bolts and nuts as indicated on the drawings.
- E. Stainless steel earthing bolts with washers and nuts shall be supplied if indicated on the drawings.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. The Contractor shall do all excavation of sufficient size to permit the placing of the structure. Excavated material not required or acceptable for backfill shall be disposed of.
- B. Common excavation shall not be carried below the required depth. When this is done, the trench or pit shall be backfilled at the Contractor's expense with material approved by the Engineer and compacted to at least the density of the surrounding earth material.
- C. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed.
- D. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing steel is to be placed.
- E. Where a firm foundation is not encountered at the design grade, due to unstable soil, this soil shall be removed and replaced with sand or with approved granular material. The Engineer shall determine the depth of removal of unstable soil and the amount of backfill necessary. The backfill shall be compacted and shaped to a firm but slightly yielding condition to form the bed for the structure.

- F. The foundation of the structure shall be controlled and compacted to the depth and density specified by the Engineer.
- G. Where indicated on the drawings working floors of blinding concrete 50 mm thick shall be made.
- H. The Contractor shall do such bracing, sheeting, or shoring necessary to perform and protect the excavation and the structure as required for safety and conformance to governing laws, and perform all grading and pumping, if necessary, to prevent water running in and keep the excavated pits dry.
- I. The bracing, sheeting, or shoring shall be removed by the Contractor after placing and completion of the structure. Removal shall be effected in a manner, which will not disturb or mark finished concrete.

3.2 CONCRETE LIGHT BASES, FOUNDATIONS OR FOOTINGS AND PITS

- A. Concrete bases, footings, transformer pits, test link pits and earthing rod pits shall be constructed as indicated on the drawings and figures. Bases, footings and pits may be prefabricated or cast in place.
- B. Bases, footings and pits shall not be placed or constructed before earthwork operations in that particular area are finished. Prefabricated bases shall be placed in mortar on 50 mm of blinding concrete.
- C. After formwork and, where applicable, steel conduits, support tube sockets, and/or steel reinforcements have been placed, concrete shall be poured and the top of the footing, pit or cover, trowel finished.
- D. The bases, footings and pits shall be cured for at least 4 days. They are to be protected against damage, particularly during pavement operations. To avoid damage to the bases and pits, it shall be allowed to keep roller wheels a small distance away, as directed by the Engineer, from the base walls. Compaction of backfill and base material shall be accomplished with pneumatic tampers. The conduit holes are to be plugged both sides by readily removable plugs.
- E. After concrete has hardened and after approval of the Engineer, the steel base plates shall be placed. A sealing strip between steel base plate and concrete shall be supplied and placed.

3.3 CONCRETE FOOTING FOR FLOOD LIGHT POLE

- A. The bases for the light poles shall be constructed in reinforced Portland cement concrete in accordance with the requirements for structural concrete as specified in Section Structural Concrete and Blinding Concrete and as shown on the drawings.
- B. The concrete bases shall be built on prepared foundations, conform to the dimensions indicated on the drawings or as required by the Engineer.
- C. Instructions of the manufacturer of the poles shall strictly be followed with regard to conduits,

anchor bolts, etc.

- D. The required reinforcement, anchor bolts, lighting poles and conduits shall be placed as indicated on the drawings and shall be approved by the Engineer before the concrete is poured.
- E. In order to achieve a firm bond between the base and the surrounding soil, backfilling along the vertical faces of the base will not be permitted. The volume of poured concrete shall be equal to the volume of excavation, as indicated on the drawings.

3.4 FOUNDATION SLABS FOR PAPI SYSTEMS

- A. The Contractor shall construct reinforced concrete foundation slabs for each indicator.
- B. The dimensions and details of the slabs shall be as indicated on the drawings.
- C. Reinforcement shall be as shown on the drawings.
- D. After excavation to the required depth, the subgrade shall be compacted to the density as required by the Engineer and the concrete for the slabs is to be placed on a separation layer of polyethylene sheeting.
- E. Anchors for the supports shall be placed according to Manufacturer's instructions. The surface of the slabs shall be smooth finished and the concrete properly cured during the first seven days.
- F. After approval of the Engineer the units shall be assembled and the excavation shall be filled with stone chippings or clean gravel.

3.5 FOOTINGS OR FOUNDATIONS FOR WINDCONES, FUEL TANKS AND GENERATORS

- A. The bases for these assemblies shall be constructed of reinforced Portland cement concrete with cast-in foundation bolts, all in accordance with the applicable drawings and with the instructions of the supplier of the above assemblies.
- B. Concrete and reinforcement shall conform to section for structural concrete as specified in Section Structural Concrete and Blinding Concrete.

3.6 WIND CONE CIRCULAR BANDS

- A. The locations of the wind cones shall be marked by a circular band of reinforced cement concrete, as shown on the drawings.
- B. Such a band shall be centred around the wind cone support. The band is to be elevated above finished terrain level.
- C. The subsoil shall be levelled and compacted to 95% of the MDD at OMC.
- D. In the centre plane of this band a light reinforcement should be placed of wire mesh, diameter 6 mm, spacing 200 mm.

- E. The upperside of the concrete band shall be painted with black and reflective white marking paint, which shall meet the requirements of section pavement markings as specified in Section Painted Pavement Markings.
- F. Expansion joints shall be made as indicated on the drawings.

END OF SECTION

SECTION 31 11 00.13 CLEARING, GRUBBING AND DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of clearing or clearing and grubbing and the demolition and removal of structures and fences, including the disposal of all these materials, for all areas within the limits designated on the drawings or as required by the Engineer.
- B. Clearing shall consist of the cutting and removal of trees, stumps, brush, shrubs, anthills, logs, hedges, the removal of debris and rubbish and other loose objects or material on or projecting above the surface of the designated areas. The grubbing of stumps and roots will not be required under clearing.
- C. Clearing and grubbing shall consist of clearing as described above of the surface of the designated areas and the grubbing of all roots, stumps, ant nests, debris and rubbish of any nature, natural obstructions or such objects which in the opinion of the Engineer are unsuitable for the foundation of strips or pavements, or other required structures.
- D. Removal of structures shall consist of the demolition and removal of brickwork and concrete or steel structures, like buildings, walls, culverts, head walls, duct banks, pits, footings, foundations, etc.
- E. Removal of fences shall consist of the demolition and removal of existing fences, including gates, the cutting of the poles, the neatly securing of the fence material, the storage of such materials and the removal of footings and foundations.

1.2 REFERENCES

Not Applicable

1.3 RELATED SECTION

A. Sections to be referred to:

- 1. Section 31 23 16.33 Excavation and Fill

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 GENERAL

- A. The areas to be cleared or cleared and grubbed shall be staked out as per the directions of the Engineer. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations.
- B. Plant and equipment for demolition and clearance work shall be of suitable types and standards.
- C. All spoil materials removed by clearing or by clearing and grubbing shall be disposed of by burning, when permitted by local laws, and/or by removal to approved disposal areas. Piles for burning shall be placed in adjacent open spaces where no damage to other vegetation, or other property will occur.
- D. The Contractor will be responsible for controlling fires in compliance with all applicable laws and regulations. He shall be particularly bound to coordinate with the Local Authorities and to follow their instructions in order to prevent the fires being misleading or dangerous. Ashes resulting from burning shall be removed and disposed of. In no case shall any discarded materials be left in windrows or piles adjacent to or within the Site limits.
- E. For stripping of brush, sods, grass, topsoil etc. refer to the section Excavation and Fill of this Specification.
- F. The removal of existing structures and utilities shall be accomplished by the Contractor as to permit orderly progress of the work. If required, trench support and pumping shall be done.
- G. Any blasting necessary shall be done at the Contractor's responsibility, and the utmost care shall be taken not to endanger life or property.

3.2 EXISTING STRUCTURES, CABLES, PIPES AND OTHER UTILITIES

- A. Prior to the start of any clearing and/or grubbing works the Contractor shall collect all possible information on location and depth existing structures, cables, pipes and other utilities.
- B. All care shall be taken by the Contractor not to damage these features.
- C. Any damage to these features due to clearing and/or grubbing works shall be repaired at the Contractor's expense.
- D. Whenever any of these features is encountered and must be removed or relocated the Contractor shall advise and notify the Local Authority or owner and attempt to secure prompt action.

3.3 CLEARING

- A. The Contractor shall clear the indicated areas of all objectionable materials and objects.

- B. The Contractor shall preserve and protect from injury all trees, bushes and shrubs not to be removed.
- C. The trees, stumps and brush that are to be removed shall be cut to a height of not more than 0.25 m above the ground.
- D. All cleared materials (that are not disposed of by means of burning) shall be loaded, transported and dumped in disposal areas and if so required covered with 0.3 m of soil.

3.4 GRUBBING

- A. In areas designated to be cleared and grubbed, all stumps, roots, brush, anthills, ants-nests, buried logs, grass and other unsatisfactory objects shall be removed to a depth of at least 1 metre, if so required.
- B. All grubbed material (that is not disposed of by means of burning) shall be dumped in disposal areas shall be covered with 0.3 m of soil, if so required.
- C. All holes remaining after the grubbing operation shall have the sides broken down to flatten out the slopes, and shall be filled with acceptable material, moistened and properly compacted in layers to the required density.

3.5 DEMOLITION AND REMOVAL OF STRUCTURES

- A. Any building, culvert or other structure to be removed, shall be demolished and removed, and all materials therefrom that cannot be reused shall be disposed of to spoil areas. The remnants of foundation, footings, wells, cesspools, and all such structures shall be destroyed by breaking out or breaking down, to a depth of at least 1 metre below the existing terrain level or 1 metre below finished grade level whichever is more.
- B. Underground services shall be disconnected before any demolition works take place. These services shall be removed to a depth of at least 1 metre below the existing terrain level or 1 metre below finished grade level, whichever is more.
- C. Demolition works also include the excavation and removal of pavements necessary to clear the structures to be removed.
- D. All holes remaining after the removal works shall have the sides broken down to flatten out the slopes, and shall be filled with acceptable material, moistened and properly compacted as specified or instructed.
- E. The restoration of pavements after the removal of structures is not included in this Section.

3.6 DEMOLITION AND REMOVAL OF FENCES

- A. Existing fences and/or gates to be removed shall be removed in such a way that the materials can be neatly stored in the indicated storage areas for possible later use.

B. Wiremesh is to be cut from the poles and neatly rolled or piled up. Posts are to be cut and disposed of.

C. All holes remaining after the removal works shall be treated as specified or instructed.

3.7 DISPOSAL OF MATERIAL

A. The Contractor shall during his inspection of the Site in the Tender Period, obtain approval on dumping areas where disposal of cleared materials and construction materials may take place.

B. Products and materials arising from the work and to be disposed of shall become the property of the Contractor except where otherwise provided.

C. Materials shall be removed from site as the work proceeds.

D. Brick rubble or other hard material arising from the work may be reused after recycling, subject to the approval of the Engineer and in compliance with the specification.

E. Any broken concrete or masonry which cannot be used in construction, and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. The manner and location of disposal of materials shall be subject to the approval of the Engineer and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the Site, he shall obtain and file with the Engineer, the permission in writing from the property owner for the use of his property for this purpose.

END OF SECTION

SECTION 31 22 23.13 AREA GRADING

PART 1 - GENERAL

1.1. DESCRIPTION

A. Section covers requirements for: grading designated areas,

1. outside the normal fill and excavation areas;
2. at locations and to the extent in accordance with the lines and grades as shown on the drawings or as instructed by the Engineer.

1.2 REFERENCES

A. Testing Requirements:

ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil using Modified Effort
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 31 23 16.33 Excavation and Fill

PART 2 - PRODUCTS

2.1 FILL MATERIAL

A. Refer to the Section for Excavation and Fill.

PART 3 - EXECUTION

3.1 GENERAL

- A. Total excavation / fill necessary to obtain specified graded area < 500 m3 per hectare.
- B. Quantities exceeding 500 m3, to be considered as common excavation or fill.
- C. Disturbed or damaged adjacent areas due to Contractor's operations shall be restored at no additional cost.

3.2 DISPOSAL OF MATERIALS

- A. All excavated materials shall be disposed off either:
 - 1. in designated spoil or stockpile areas within the property boundary as indicated on the drawings or as instructed by the Engineer, or;
 - 2. in dump areas outside the property boundary as approved by the Engineer.
- B. The Contractor shall obtain approval and all necessary permits and licenses for the use of dump areas outside the property boundary from the respective local authorities, taking into account environmental aspects and other requirements in force by legislation.
- C. Excavated materials, which have to be disposed off outside the property boundary shall become the property of the Contractor unless stated otherwise. Excavated materials to spoil shall not be temporarily stockpiled, but removed from site as the work proceeds.
- D. For the location and use of spoil and stockpile areas within the property boundary the Contractor shall obtain approval from the Engineer.
- E. Excavated materials, which have to be disposed off or stockpiled within the property boundary shall remain or become the property of the Owner or the Employer unless stated otherwise.
- F. The Contractor shall set-out and clearly mark all approved spoil and stockpile areas within the property boundary. Before dumping of the excavated materials can commence the Contractor shall, at his own expense, clear said areas and take elevations in sufficient detail for submission to and approval by the Engineer.
- G. During the course of the grading operations all excavated materials dumped in spoil or stockpile areas within the property boundary shall be evenly spread out and compacted with all slopes dressed uniformly and properly drained.
- H. The surface levels of spoil and stockpile areas in its final state shall not extend more than 200 mm above the ground levels of the adjacent area unless instructed otherwise.

3.3 SURFACE LEVEL TOLERANCES

- A. Surface level tolerances shall be as per Table 1. The finished level tolerances are in relation to design levels.
- B. Level deviation in excess of tolerances shall be corrected by loosening, removing or adding materials, spreading and re-compacting by sprinkling and rolling.

3.4 COMPACTION REQUIREMENTS AND TOLERANCES

- A. Compaction shall be as per Table 1.
- B. Field densities tests shall be determined in accordance with ASTM D 1557 in combination with ASTM D 1556 or ASTM D 2922.

Finished Ground Level of Graded Areas in:	Minimum Test Area (m2)	Field Density (%MDD at OMC)	Finished Ground Level Tolerances (mm):
Runway Safety Areas (Strip, Overrun, Blast pad)	1,000	As per Section Excavation and Fill	-20 / +20
All other Areas	1,000	As per Section Excavation and Fill	-20 / +20

Table 1: Field Densities and Finished Levels

END OF SECTION

SECTION 31 23 16.33 EXCAVATION AND FILL

PART 1 - GENERAL

1.1. DESCRIPTION

A. This Section specifies the general earthworks requirements, classifications of excavation, soil and geosynthetic filter fabrics, compaction requirements and construction methods for excavation and spoiling, and placing of fill, including a pioneer layer, spoiling, all of which shall conform to the dimensions and typical sections shown on the drawings.

B. Where this section refers to structures, it shall mean small structures only, such as one-storey buildings and drainage structures, unless specified otherwise.

1.2 REFERENCES

A. Testing Requirements:

ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 Laboratory compaction characteristics of soil using modified effort

ASTM D 2487 Classification of soils for engineering purposes ASTM D 2922 Density of soil and soil-aggregate in-place by nuclear methods

ASTM D 4318 Atterberg Limits (LL, PL and PI)

1.3 RELATED SECTIONS

A. Sections to be referred to:

1. Section 31 11 00.13 Clearing, Grubbing and Demolition
2. Section 32 91 19.13 Topsoil Placement and Grading

1.4 DEFINITIONS

A. "Fill": The material used for the purpose of filling a depression or raising a site to the required level, excluding the material used for topsoil, if any.

B. "Subgrade": The uppermost material located in the fill structure or in unmoved excavation areas immediately below pavement constructions or under structures.

C. "Formation Level": The surface level of the ground in its final shape after completion of earthworks (excavation and placing of fill), before placing structures, laying pavements or top soiling.

- D. “Compaction”: The densification of a soil by means of mechanical manipulation. The insitu soil dry densities expressed as a percentage of the maximum dry density (MDD) at optimum moisture content (OMC), as per the specified laboratory test method.
- E. “Aircraft Pavements”: Pavements where ground manoeuvring of aircraft takes place, such as runways, taxiways, aprons, hangar floors, including blastpads, stopways, overruns and shoulders. Pavements intended to serve aircraft towing tractors shall be considered as aircraft pavements as well.
- F. “Aircraft Safety Areas”: Unpaved areas intended to protect aircraft in the event of an aircraft running off the aircraft pavements, such as the graded portion of the runway strip and taxiway strips.
- G. “Road Pavements”: Pavements intended to serve vehicles other than aircraft and aircraft towing tractors.
- H. There will be no distinction in classification of material between Soft, Intermediate and Hard material. The contractor will be required to make an assessment of the material quality and classification as only one rate for excavation and fill for all material at the Kisumu Airport construction site.

I.5 GENERAL REQUIREMENTS

- A. Material from specified excavations, acceptable for fill construction, shall be used in specified fill areas, as indicated on the drawings.
- B. When the volume of acceptable materials from specified excavations is not sufficient for specified fill, the deficiency shall be obtained from borrow areas/locations approved by the Engineer.
- C. All material declared unacceptable for fill operations and all surplus material shall be disposed of in spoil areas as instructed.
- D. The Engineer shall have final control over the excavation, stockpiling, placing of fill, spoiling, transport and deposition and shall determine the acceptability of material to be used in fill areas.
- E. All over-excavation, over-break or over-blasting beyond designated excavation limits, the Contractor shall replace in an approved manner at his own expense.
- F. When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the Engineer shall be consulted for further action.
- G. All operations of the Contractor in connection with transport, deposition and spoiling shall be approved by the Engineer and the appropriate authorities.

PART 2 - PRODUCTS

2.1 SOIL CLASSIFICATION

- A. This classification of soil is based on suitability for use in the construction of fill under pavements and structures. The ASTM version of Unified Soil Classification System (ASTM D 2487) is used for this purpose.
- B. "Suitable materials" shall include materials assigned with group symbols GW, GP, GU, GM, GC, SW, SP, SU, SM, SC.
- C. "Unsuitable materials" shall include materials assigned with group symbols CL, ML, OL, CH, MH, OH, PT.

2.2 MATERIALS

- A. Suitable materials shall be used for fill under pavement and structures.
- B. CL and ML materials may be used for fill under pavements and structures subject to the following conditions:
 - 1. At a depth of 3.0 m or more below the formation level, provided that the Plasticity Index of the fill material is less than 25.
 - 2. At a depth of 1.0 m or more below the formation level, provided that the Plasticity Index of the fill material is less than 10.
- C. Unsuitable materials assigned as CL, ML, OL, MH and CH may be used for fill outside (future) pavements or structures, like backfill of borrow pits, subject to the approval of the Engineer.
- D. Unsuitable materials, when approved by the Engineer as suitable to support vegetation, may be used for the topsoiling in accordance with the Section "Topsoil placement and grading" of these Specifications.

2.3 GEOSYNTHETIC FILTER FABRIC

- A. The geosynthetic filter fabric shall be used as indicated on the drawings, both below and above the pioneer rock layer.
- B. The filter shall be constructed of woven polypropylene mat or nonwoven sheet of continuous filaments of spunbonded polypropylene.
- C. The filter shall not be affected by bacteria, natural acids, salts or alkali or by ultra- violet light after exposure to direct sunlight during one month. It shall have good resistance to rot, moisture, mildew and insects and show no wet shrinkage or stretching. The size of the openings in the mat or sheet shall be determined on the basis of the subsoil that should be prevented to pass.

The filter shall have the following characteristics:

$\frac{EOS}{D(15)} < 1$, in which $D(15)$

EOS = equivalent opening size. In a sieve test shall be determined, what grain size of a standard sand will be allowed to pass the filter. The equivalent opening size is equivalent to the grain size of which 5 per cent in weight of the material is able to pass the filter.

$D(15)$ = grain size from the distribution curve of the subsoil material for which 5 per cent in weight of the grains have a smaller diameter than $D(15)$.

- D. The filter shall have a permeability that is greater than the permeability of the subsoil in the final situation.
- E. Filters made of other materials, such as polyamide, or polyester may be used, provided the filter characteristics are the same as for the polypropylene filter.
- F. The filter material shall be supplied to the site on rolls, properly protected during transport and storage against ultra violet light.
- G. The permeability of the various subsoils shall be tested in the laboratory in accordance with ASTM D653. The permeability of the filter shall be tested in the field laboratory or by the manufacturer. Certificates provided by the manufacturer, indicating amongst other things the permeability of the filter, will be acceptable, but the Engineer has the right to required tests at the site.

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. The Contractor may use any type of earth-moving, compaction and watering equipment he may desire or has at his disposal, provided the equipment is in satisfactory condition and of such capacity that the construction schedule can be maintained and that the specified quality can be obtained.

3.2 PREPARATORY WORKS

- A. Prior to any earthworks operations, the Contractor shall make his own survey consisting of classification and distribution, investigation of material to be excavated, preparation of the cross-sections and measurements of the existing ground surface, and shall inform the Engineer with the results.
- B. Such survey shall be recorded and signed as agreed by the Engineer and the Contractor and shall form the basis for quantity measurements of material to be excavated, borrowed, filled and spoiled.
- C. Failing such surveys and the agreements being signed by the Contractor, the surveys of the Engineer shall be final and binding upon the Contractor.

D. Excavation or placing of fill in any area shall not start unless the area is completely cleared and grubbed in accordance with the Section "Clearing, Grubbing and Demolition" of these Specifications.

3.3 PROTECTION OF THE WORKS

A. If it is necessary to interrupt existing surface drainage, sewers, underdrainage, conduits, utilities, or similar underground structures or parts thereof, then the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve them or provide temporary replacements. The Contractor shall notify the Engineer when such facilities are encountered. The Contractor shall at his own expense satisfactorily repair and pay the cost of all damage to such facilities or structures which may result from any of his operations or from negligence during the period of the contract

B. The Contractor shall keep earthworks free of water including:

1. arranging for the rapid removal of water either shed on to the earthworks or entering the earthworks from any source;
2. lowering and maintaining by appropriate measures the water level in excavations, sufficiently to enable the earthworks to be constructed.
3. In carrying out these requirements the Contractor shall:
 - a) form and maintain excavation and fill areas with appropriate falls and gradient and sealed surfaces;
 - b) provide where necessary temporary watercourses, drains, pumping and the like;
 - c) discharge accumulated water and ground water into the permanent outfalls of the drainage system where practicable;
 - d) provide adequate means for trapping silt on temporary systems discharging into permanent drainage systems.

C. Ditches constructed on the project shall be maintained to the required cross-section and kept free from debris or obstructions. Any erosion damage shall be repaired until the Works are handed over.

D. The Contractor shall be responsible for the stability of all fill structures made under the Contract and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

3.4 COMPACTION REQUIREMENTS

A. All earthworks shall at least be compacted to a depth and to a minimum compaction rate as

specified in Table 1.

- B. The rate of compaction is expressed as a relationship in terms of a percentage between the in-situ density and the maximum dry density (MDD) at optimum moisture content (OMC).
- C. The in-situ soil density shall be determined in accordance with ASTM D1556 or ASTM D2922 and the maximum dry density (MDD) shall be determined by ASTM D1557 (modified proctor procedure "C") and ASTM D 698 (standard proctor procedure "C").
- D. Nuclear density tests as per ASTM D2922 are only allowed when a satisfactory laboratory calibration can be made and when the Contractor is authorised to operate the nuclear equipment.
- E. Field compaction control using sensors mounted on compaction equipment is also acceptable, provided the Contractor has established the proper correlation with test methods specified above and has demonstrated the integrity of the system to the satisfaction of the Engineer.
- F. Field density test shall be made at least once per lot of 2,500 m² of compacted layer. A test lot will be approved if the average value of 4 random field density tests is above the specified compaction and no single value is more than 2% below the specified compaction. Additional field density test shall be made when, in the opinion of the Engineer, the need for further compaction control arises.

Area	Applicable to Compaction of Excavation Areas and Fill		Applicable to Compaction of Fill Only	
	Test Method for MDD	Subgrade Formation Level	All Fill Except Subgrade	Existing Ground Below Fill
Aircraft Pavements	ASTM D 1557	95% MDD to 500 mm depth	90% MDD	90% MDD
Aircraft Safety Areas	ASTM D 1557	90% MDD at formation level		85% MDD
Road Pavements	ASTM D 1557	95% MDD to 300 mm depth		90% MDD
Small Structures	ASTM D 1557	90% MDD to 300 mm depth		90% MDD

Other Areas	ASTM D 698	85% MDD at formation level		85% MDD
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Table 1: Earthworks Compaction Requirements

3.5 STOCKPILING

- A. Any materials to be stockpiled shall remain the property of the Employer.
- B. Well in advance of the earthworks operations, the Contractor shall in close coordination with the Employer identify areas for stockpiling in the vicinity of the work site.
- C. Material, intended to be stockpiled, shall be placed in layers of about 1m in loose depth and compacted by rolling with 3-4 passes of a suitable roller. Stockpile should be shaped to shed water and sited to avoid potentially water-logged areas. The areas adjacent to stockpile which have been disturbed by the Contractor shall be graded and put into condition acceptable for seeding or planting, if required.
- D. The Contractor shall ensure that he does not adversely affect the stability of excavations or fills by his methods of stockpiling material. Temporary stockpile locations on site, for acceptable material, shall be determined by the Engineer.
- E. Temporary stockpiling of acceptable material, re-excavation of stockpiled material, transport and deposition in fill areas shall not be measured and not be paid for separately but shall be deemed to be included in the unit rates for specified excavation items.

3.6 EXCAVATION CLASSIFICATION

- A. This classification is based on difference in equipment, tools, use and sources and locations where the excavations take place.
- B. "Unclassified Excavation". Unclassified excavation shall consist of the excavation, transport and deposition of all material, regardless of its nature, which is not classified under one of the following items.
- C. "Muck Excavation". Muck excavation shall consist of the excavation, transport and deposition of soils and organic matter not suitable for subgrade or for fill structures. Muck shall include peat, roots, humus, stumps or other material not satisfactory for incorporation in embankment or fill structures.
- D. "Rock Excavation". Rock excavation shall consist of the excavation, transport and deposition of all solid rock in ledges, in bedded deposits, in unstratified masses and conglomerate deposits that are so firmly cemented that they cannot be removed without blasting. All boulders containing a volume of more than 0.5 cubic metre will be classified as "Rock Excavation".
- E. "Rippable Excavation". Rippable excavation shall consist of the excavation, transport and

deposition of material which cannot be excavated without ripping by a tractor mounted rippers or rooters

- F. "Topsoil Excavation". Topsoil excavation shall consist of the stripping, transport and deposition of existing topsoil from areas and to the thickness as explicitly indicated on the drawings as topsoil excavation.
- G. "Drainage Excavation". Drainage excavation shall consist of the excavation, transport and deposition of the materials carried out for the primary purpose of drainage and includes drainage ditches such as intercepting, inlet, outlet, or any other type explicitly shown on the drawings as drainage excavation.
- H. "Borrow Excavation". Borrow excavation shall consist of the excavation, transport and deposition of approved material required for the construction of fill or for other portions of the work in excess of the quantity of acceptable material available from specified excavations on the site. Borrow material may be obtained from areas within or outside the airport property.

3.7 EXCAVATION CONSTRUCTION METHODS

- A. If not specified otherwise, the excavation item(s) shall include excavation, transport of the material and deposition in fill or spoil areas.
- B. Where excavation reveals a combination of suitable and unsuitable materials, as specified in Clause 2.1, the excavation shall be carried out in such a manner that both materials are excavated separately.
- C. Except in locations where it is to be left in place as instructed by the Engineer, the existing topsoil shall be stripped from all areas of excavation and from all areas to be covered by fill structures, to depths as instructed by the Engineer.
- D. Requirements for stripping of the existing topsoil are specified in Section "Topsoil placement and grading" of these Specifications.
- E. Muck, peat, matted roots or other selected subsoil which is not acceptable for subgrade shall be excavated to the depth as instructed by the Engineer.
- F. The cuts and the top of the areas under pavements (subgrade) and outside pavements in excavation shall be formed to the lines and levels as indicated on the drawings and compacted as specified in Clause 3.2 of this Section.
- G. Rock, loose rock, boulders and other material unacceptable for subgrade shall be excavated to an extra depth of minimum 250 mm below the top of the subgrade (the formation level) or as instructed by the Engineer.
- H. The extra depth, that results due to rock removal or excavation of other unacceptable material, shall be refilled with approved fill material, obtained from the specified excavation and shall be compacted as specified.
- I. All loose or protruding rocks on the back slopes of the cuts shall be barred loose, or otherwise

removed to the line of finished grade or slope.

- J. Blasting, when necessary, will be permitted only when the operations are approved by the Engineer, all permissions are obtained (appropriate authorities) and proper precautions have been taken for the protection and safety of all persons, the work and the property. All damage done to the work or property shall be repaired at the Contractor's expense. Any approval given will not relieve the Contractor of his responsibility in blasting operations.
- K. Areas within the airport property where borrow excavation takes place shall be indicated in the drawings. They will only be available after a written agreement from the Engineer has been obtained.
- L. When sources for borrow excavation are outside the airport property, it shall be the Contractor's responsibility to locate the source and obtain the required permits, subject to the approval of the Engineer.
- M. The Contractor shall notify the Engineer sufficiently in advance of the beginning of borrow excavation so that necessary measurements and tests can be made.
- N. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material, to enable obtaining a uniform product. All work involved with clearing, stripping and removal of unacceptable materials from borrow pits shall be performed by the Contractor at his own expense. Borrow pits shall be excavated to regular lines to permit accurate measurements and shall be drained and left in a neat and presentable condition with all slopes dressed uniformly.
- O. All suitable material from drainage excavation shall be placed in specified fill areas and unsuitable material shall be used, for topsoiling purposes or disposed of, as instructed.

3.8 FILL CONSTRUCTION METHODS

- A. If not specified otherwise, placing of fill item shall include the spreading, watering, discing, mixing, aerating, grading, (re)compaction and levelling of material delivered from specified excavations, intended for construction of the fill structures, except spoiling.
- B. All roots, debris, large stones, muck, peat, existing topsoil or other yielding or objectionable materials that would cause interference with the compaction of fill shall be removed from the area to the extent and to the depth as specified in Section "Clearing and Grubbing" of these Specifications.
- C. Except in locations where it is to be left in place as instructed by the Engineer, the existing topsoil shall be stripped from areas to be covered by fill structures, according to requirements specified in Section "Topsoil placement and grading" of these Specifications.
- D. The area shall then be surface compacted as specified in Table 1 of this Section.
- E. In fill areas, layer placement shall begin in the lowest portion of the fill structure. As placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.

- F. Fill structures shall be constructed with acceptable material, as specified, placed in successive horizontal layers of not more than 200 mm in loose depth, for the full width of the cross section, unless otherwise approved by the Engineer.
- G. The grading operations shall be conducted, to produce a soil structure as shown on the typical cross section or as directed. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the fill structure.
- H. Stones or fragmentary rocks larger than 100 mm in their greatest dimension shall not be allowed in the top 150 mm of the fill structure.
- I. The material in the layers shall be within $\pm 2\%$ of the optimum moisture content before rolling to obtain the specified compaction. Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer may be required. Should the material be too wet to permit proper compaction or rolling, all work on all of the affected portions of the fill structure shall be delayed until the material has dried to the required moisture content. Sprinkling of dry material to obtain the proper moisture content shall be done with approved equipment that will satisfactorily distribute water. Sufficient equipment to furnish the required water shall be available at all times.
- J. Compaction areas shall be kept separate and no layer shall be covered by another layer until the proper density is obtained. Rolling operations shall be continued until all layers are compacted to not less than the specified compaction.
- K. Any areas inaccessible to a roller shall be compacted by mechanical tampers.
- L. During construction of fill the Contractor shall route his equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the traffic evenly over the entire width of the fill.
- M. Fill operations shall be suspended at any time when satisfactory results cannot be obtained because of adverse weather or other unsatisfactory conditions in the field.
- N. Tests shall be taken at specified intervals. Based on these tests the Contractor shall make corrections and adjustments in work method or moisture content in order to achieve the specified compaction.
- O. Any area found to lack the required compaction shall be further recompact or watered and/or scarified, or otherwise manipulated as the Engineer may instruct, until the specified compaction is obtained.

3.9 SPOILING

- A. The Contractor shall during his Site inspection in the Tender Period, contact the Employer to obtain information regarding the destination of unacceptable materials and surplus materials. These materials remain the property of the Employer unless the Employer transfers his ownership to the Contractor.
- B. Unacceptable materials and surplus materials that are released by the Employer, shall become the property of the Contractor. They shall not be spoiled or stockpiled on site and shall be

removed off the airport property.

- C. The Contractor shall make his own arrangements with other public agencies, the municipality or private companies or landowners for the spoiling of unacceptable and surplus materials that became his property .
- D. Topsoil material, if required, shall be stockpiled at approved locations, further specified in Section “Topsoil placement and grading” of these Specifications.
- E. The surface elevation of spoil areas shall not extend above the surface elevation of adjacent area. The spoil material shall be placed/spoiled and compacted to a reasonable density as instructed by the Engineer. All spoil areas shall be graded to allow positive drainage of the area itself and of adjacent areas. If required, the spoil area and adjacent area shall be put into condition acceptable for seeding or planting.

3.10 TOLERANCES

- A. In those areas upon which any pavement construction is to be placed, the top of the subgrade shall not vary from the design levels by more than 15 mm. The finished levels shall be determined by taking levels in a grid of 10 by 10 metre or less. A lot will be accepted for grade if not more than 10 percent of the measurements exceed the specified tolerance, but are less than 20 mm.
- B. In areas outside pavement constructions the top of the formation shall not vary from the design levels by more than 25 mm. The finished levels shall be determined by taking levels in a grid of 20 x 20 metres or less. A lot will be accepted for grade if not more than 10 percent of the measurements exceed the specified tolerance, but are less than 40 mm.
- C. The size of a lot shall be between 2,500 – 5,000 m².
- D. Any deviation in excess of the above tolerances shall be corrected by reshaping and recompaction of the material.

3.11 PIONEER LAYER

- A. An initial layer, known as a pioneer layer consisting of rockfill material, shall be constructed over a weak roadbed where selected material is used to provide a stable platform for the construction of subsequent layers.
- B. This rockfill shall be constructed across water-logged or soft clayey ground exhibiting excessive movement under normal compaction equipment and haulage trucks, and such conditions preclude the effective compaction of the bottom fill layers, in particular in the vicinity of the runway extension.
- C. The maximum size of rock which may be used in rock fill is 200 mm. The engineer may prescribe that 5% of the oversize material shall be bladed off after the material has been dumped, and it shall be disposed of as required. The compacted layer shall not contain any rock fragments the largest dimension of which exceeds the thickness of the compacted

layer.

- D. This layer shall be constructed by successive loads of suitable coarse material being dumped and spread in a uniform layer with a thickness just sufficient to provide a stable working platform for constructing the further fill layers which are to be compacted to a controlled density.
- E. Light hauling equipment shall be used, and, where necessary, end tipping for placing the material, and the layer shall be compacted by light compaction equipment being used, which will give the most effective compaction without the roadbed being overstressed.
- F. The compacted volume of material used may be determined by 70% of the loose volume in trucks being taken as an alternative to taking cross-sections before and after construction.
- G. Rock fill shall be brought up in layers not exceeding 600 mm and every effort shall be made to fill the voids with the finer material to form a dense, compact mass.
- H. Each (rock) layer shall be levelled and smoothed with suitable grading equipment and by distribution of spalls and finer fragments of rock.
- I. Density requirements will not apply to portions of fill structure constructed of materials which cannot be tested in accordance with specified methods (like rock fill).

3.12 ROADBED PREPARATION

- A. Any part of the roadbed which is classified as being suitable for use in situ, save that it fails to meet density requirements, shall be scarified, watered and compacted to a percentage of modified AASHTO density. The type of compaction and the depth of compaction shall be as directed by the engineer. If necessary, roadbed material may have to be temporarily bladed off to windrow in order to achieve the necessary depth of compaction.
- B. Where any additional material has to be imported to obtain the required level and layer thickness, and where the thickness of the layer of imported material would be less than the specified layer thickness after compaction, then the roadbed material shall be scarified, the necessary imported material placed, and this combined material mixed and compacted to the full specified depth of the layer. The imported material shall be measured and paid for under "Cut and borrow to fill"

END OF SECTION

SECTION 31 23 33.13 TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1. DESCRIPTION

A. Section covers requirements for trenching,

1. Consisting of excavation in any material and backfill of trenches with sand and suitable fill material, compaction and disposal of surplus material and restoring ground surface to its original state;
2. For the purpose of laying underground cabling, water mains and sewage lines;
3. At locations and to the extend and details as shown on the drawings or as instructed by the Engineer.

1.2. REFERENCES

Not Used

1.3. RELATED SECTION

1.3.1. Sections to be referred to:

- | | | |
|----------|---------------------|---|
| 1.3.1.1. | Section 31 23 16.33 | Excavation and Fill |
| 1.3.1.2. | Section 32 11 16.19 | Selected Fill, Drainage Layer |
| 1.3.1.3. | Section 31 32 13.16 | Cement Soil Stabilization for Backfill |
| 1.3.1.4. | Section 03 31 13.13 | Structural Concrete and Blinding Concrete |

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Trenches may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed.
- B. Graders, scrapers or bulldozers shall not be used to excavate the trench.
- C. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, trenches shall be excavated to a minimum depth of 0.75 m below finished grade for AFL and RC cables and 1 m for HV, LV, water mains and sewage lines.
- D. When rock excavation is encountered, the rock shall be removed to a depth of at least 0.8 m below finished grade. Rock excavation shall consist of the removal of boulders and detached rock ½ cubic metre in volume or greater, and of all rock in place in ledges or

masses which can be removed only by the use of bars and sledges or by blasting.

- E. Before any rock is removed the Engineer shall have the opportunity to obtain the necessary data to determine the quantity.
- F. The Contractor shall excavate all trenches to a width not less than 0.3 m. The trench shall be widened, as directed by the Engineer, where more than two cables are to be installed parallel in the same trench.
- G. At all times during construction, the trenches shall be kept free of standing water.

3.2 EXCAVATION NEAR EXISTING FACILITIES

- A. These trenches shall be excavated manually in order to avoid damages to existing cables and utilities.
- B. Any damage to existing cables or utilities shall immediately be reported to the Engineer and the relevant Authorities, and shall be promptly repaired or replaced by the Contractor at his own expense and in a manner and with materials as required by the Engineer or the Authorities.
- C. If the Authorities require that the repair of damaged cables or utilities shall be carried out by their own workmen or by other Contractors, then the Employer shall be entitled to recover from the Contractor the cost thereof or may deduct the cost from any payment due or that become due to the Contractor.
- D. Special attention shall be paid to the sections of existing cables, which have to remain in use or be re-used for intermediate power supply upon completion of the works. Therefore, the Contractor shall determine the exact location of these cables, whether indicated on the drawings or not, before starting any of his operations in a particular area.

3.3 BACKFILL, PROTECTION AND DISPOSAL OF SURPLUS MATERIAL

- A. The cables to be laid on a first layer of backfill of sand or earth free from clay or silts or particles larger than 4 mm, to a depth of at least 0.1 m or as indicated on the drawings. The next layer or layers shall contain all cables as shown on the drawings and shall be of the same material. The above-described layers shall be lightly to moderately compacted.
- B. The remainder of the backfill shall not contain particles larger than 30 mm diameter and shall be placed in layers not exceeding 0.2 m and shall be compacted to the density as required for embankments in unpaved areas and paved areas in the relevant sections.
- C. Protective cement concrete tiles shall be used for all trenches or certain trenches, to be minimum 40 mm thick and of a uniform size and placed covering cables with an overwidth of 100 mm, and over the full trench length as indicated on the drawings, on top of the layers of sand fill, containing the cables. The tiles shall be pre-fabricated; the concrete shall be structural concrete in accordance with the requirements of the Section for Structural Concrete and Blinding Concrete.

D. After the first layer of this backfill, a vividly coloured polythene identification tape such as "Heptape", or a plastic net such as "Plyage" or similar shall be placed 0.3 m above the cables for the full width of the trench, colour is to be "Red".

E. The tolerance of backfill is +25 / -25 mm.

3.4 BEDDING

A. Wherever the use of fine granular material is specified in this section for the bedding of culverts, it shall mean sand or other cohesionless material, all of which shall pass through a 6,70 mm sieve and not more than 10% of which shall pass through a 0,15 mm sieve.

B. Selected Granular Material, Selected Fill Material and Common Fill Material shall be as specified in Drg No KIS-DD-WA04.

3.5 SEPARATION DISTANCES BETWEEN UTILITIES

A. Separation distances between cables and utilities in the same trench conform to the requirements as shown on the drawings.

3.6 CLEANING UP OF SITE

A. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to its original condition. The restoration shall include any necessary top soiling, seeding or planting.

END OF SECTION

SECTION 31 32 13.16 CEMENT SOIL STABILIZATION FOR BACKFILL

PART 1 - GENERAL

1.1. DESCRIPTION

A. This item shall consist of furnishing, mixing, placing, shaping and compacting a composed mixture of soil or sand cement placed as backfill in accordance with this specification requirements. Soil or sand cement as backfill material shall be used in trenches and at other locations, where compaction requirements of natural soil is difficult to achieve or where shown on the drawings.

1.2 REFERENCES

A. Testing Requirements:

ASTM C 117 Materials Finer than 75 micron (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 136 Sieve Analysis for Fine and Coarse Aggregates ASTM C 150 Specification for Portland Cement

ASTM C 595 Specification for Blended Hydraulic Cement

ASTM C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM D 558 Moisture-Density Relations for Soil-Cement Mixtures ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone

Method

ASTM D 1633 Compressive Strength of Molded Soil-Cement Specimen ASTM D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear

Methods (Shallow Depth)

ASTM D 4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils

1.3 RELATED SECTION

Not Used

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The material to be stabilized shall be soil, blended soil, natural sands or processed granular material.
- B. The material shall be free of roots, sods, weeds or not more than 2% of any other organic matter.
- C. The material shall be within the gradation limits as indicated in Table 1, when tested in accordance with ASTM C 117 (wet sieving) and ASTM C 136.

ASTM Sieve		Percentage Passing by Weight
12.5 mm	(1/2 inch)	100
4.75 mm	(No. 4)	90-100
1.18 mm	(No. 16)	50-100
425 micron	(No. 40)	40-90
75 micron	(No. 200)	0-15

Table 1: Grading Requirements

- D. The material passing 425 μm (No. 40) sieve shall meet the following requirements, when tested in accordance with ASTM D 4318.
 - 1. Liquid limit - max. 25%
 - 2. Plasticity Index - max 6%
- E. The cement shall be a standard brand and shall comply with the current specification of ASTM C 150 for Portland Cement, Type I or ASTM C 595 for blended hydraulic cements. Cement with mineral admixtures such as fly ash or natural pozzolans shall conform to ASTM C 618.
- F. The water shall comply with the requirements of the Section for Construction Water.

2.2 COMPOSITION

- A. The minimum cement content shall be 2.5% by weight of dry soil. The cement content in the mixture shall be agreed with the Engineer on the basis of a trial mix programme.
- B. The specified laboratory 7 days compressive strength of the trial mixture shall be minimum 2.5 N/mm², based on the average of six specimens according to ASTM D 1633, Method A. The specimens shall be moist cured for 6 days and soaked for 24 hrs before testing.
- C. The minimum compressive strength of laboratory specimens using production mix at 7 days when tested under the above conditions, shall be 2.5 N/mm² based on the average of six

specimens.

D. The mix consistency shall allow easy and effective compaction.

PART 3 - EXECUTION

3.1 EQUIPMENT AND PLANT

- A. The soil or sand cement may be constructed with any equipment that will meet the requirements, provided the equipment is in a satisfactory condition and of such capacity, that the specified quality can be obtained.
- B. Provisions shall be made by the Contractor for furnishing water at the work site, using equipment of ample capacity.

3.2 PREPARATION

- A. The grade and shape of the area to be provided with soil or sand cement shall conform to the typical cross section shown on the drawings.
- B. Any soft yielding areas shall be removed and replaced with an acceptable soil and compacted as specified in the Section for Excavation, Embankment and Fill of these specification requirements.

3.3 MIXING AND SPREADING

- A. The soil or sand cement and water shall be plant-mixed, either at the work site or in a central batching plant.
- B. The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of soil or sand cement during mixing operations, and it shall not exceed the optimum moisture content as determined by ASTM D 558.

3.4 LAYER THICKNESS

- A. The compacted thickness of a construction layer shall not be less than 100 mm and not more than 250 mm.

3.5 COMPACTION AND FINISHING

- A. Immediately upon completion of the spreading operations, the mixture shall be thoroughly compacted using suitable static or vibratory compaction equipment.
- B. The field density of the compacted mixture, as determined in accordance with ASTM D 1556,

shall be at least 95% on average (mean value of 3 tests), with no single value less than 93%, of the maximum laboratory density as determined in accordance with ASTM D 558.

- C. Field density measurements may also be conducted by the nuclear testing methods in accordance with ASTM D 2922, provided that a satisfactory laboratory calibration can be made and that the Contractor is authorised to operate the nuclear equipment.
- D. Compaction of the mixture shall commence within 30 minutes from the time of placement.
- E. The compaction and finishing operations shall be completed within 2 hours from the time that water has been added to the mixture. The compacted surface shall be dense and shall conform to the required grades.

3.6 SURFACE TOLERANCES

- A. Soil or sand cement for backfilling shall be finished to produce a smooth surface. At any point it shall not differ more than 15 mm from the design elevations.

3.7 PROTECTION AND CURING

- A. The completed soil or sand cement base shall be protected against drying out by spraying water as soon as possible, but no later than 6 hours after the completion of finishing operations.
- B. The finished backfill shall be kept moist continuously for at least 3 days or until it is covered by a subsequent layer of construction, whichever is earlier.
- C. Construction traffic shall not be permitted to use the finished backfill for at least 3 days.

END OF SECTION

SECTION 32 01 16.71 COLD MILLING ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of removing existing pavement layers by means of a milling machine to the depth and grades as shown on the applicable drawings or as required by the Engineer.

1.2 REFERENCES

Not Used

1.3 RELATED SECTION

- A. Sections to be referred to:
1. Section 32 01 16.76 Asphalt Concrete Overlay
 2. Section 02 41 13.13 Removing Existing Pavements

32 PART 2 - PRODUCTS

Not Used

33 PART 3 - EXECUTION

- A. The milled and broken up asphalt material, also known as Recycled Asphalt Product (RAP) shall be used as wearing course material for the perimeter road, or as common fill, or disposed of as directed by the Engineer.
- B. Products and materials arising from the works, which are to be disposed off or used for other works within the airport boundary shall remain the property of the Employer.
- C. In case disposal takes place in dumping areas outside the airport boundary the materials shall become the property of the Contractor, except where stated otherwise.
- D. The Contractor should perform a detailed topographical survey prior to milling to determine the exact surface levels existing, survey grid subject to approval by the engineer.
- E. The Contractor shall submit a milling programme and work method to achieve the design levels and contours.
- F. The Contractor shall during the Tender Period obtain information on central dumping areas where disposal of broken up materials may take place.
- G. The method of removal shall be one which is acceptable to the Engineer. Every effort shall be made to remove only the pavement within the limits designated.

H. The underlying pavement after milling shall be cleared thoroughly and further treatment shall conform to Section Asphalt Concrete Overlay.

END OF SECTION

SECTION 32 01 16.76 ASPHALT CONCRETE OVERLAY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of placing an Asphalt Concrete Overlay on a prepared existing pavement in accordance with this specification.
- B. The Asphalt Concrete Overlay shall be constructed to depth, typical cross- sections and elevations as shown on the drawings or as instructed by the Engineer.
- C. A detailed grid measurement of the levels of the existing pavement and the possible amendment of the overlay design drawings shall be included in this item.
- D. The total thickness of the Asphalt Concrete Overlay shall be constructed in accordance with the Section for Asphalt Concrete Surface Course (ACSC).

REFERENCES

- E. Material Specification Requirements:

ASTM D 2028 Cutback Asphalt (Rapid Curing Type)

RELATED SECTION

- F. Sections to be referred to:

- 1. Section 01 14 23.13 Safety Measures
- 2. Section 32 12 16.13 Asphalt Concrete Surface Course
- 3. Section 32 12 13.16 Bituminous Tack Coat
- 4. Section 32 17 23.13 Pavement Markings

PART 2 - PRODUCTS

2.1 ASPHALT MIXTURE

- A. The individual materials of the asphalt mix shall be in conformity with Clause 2 of Section 32 12 16.13 or Section 32 12 16.29.
- B. The asphalt mix shall be composed in accordance with the requirements of Clause 2.5 of Section 32 12 16.13 or Section 32 12 16.29.

2.2 ASPHALT LEVELING COURSE

- A. The individual materials of the asphalt mix shall be in conformity with Clause 2 of Section

32 11 26.26.

- B. The asphalt mix shall be composed in accordance with the requirements of Clause 2.5 of Section 32 11 26.26.

2.3 BITUMINOUS TACK COAT

- A. Bituminous Tack Coat shall comply with the relevant requirements of Section 32 12 13.16.
- B. The Contractor shall propose a type of tack coat with the shortest possible setting or breaking time in order not to lose time for overlay paving. Alternately the use of straight bitumen with proper spraying system at the required temperature is also acceptable.

2.4 BITUMINOUS MORTAR

- A. Cracks and joints in the existing asphalt and concrete pavement shall be filled with a bituminous mortar after milling.
- B. Bituminous mortar shall consist of a uniform mixture of:
 - 1. 1 part cut back asphalt (RC) as per ASTM D 2028;
 - 2. 3 parts fine sand free from clay, organic matters or other deleterious substances;
 - 3. 2 percent Portland cement by weight of mixture;
- C. Bituminous mortar application shall only be used when an overlay is applicable.

2.5 CEMENT SLURRY

- A. Cement slurry shall be used on milled concrete areas.
- B. Cement slurry shall consist of a mixture of 1 part cement + 3 parts water.

2.6 PAVEMENT MARKING

- A. Pavement marking shall comply with the requirements of Section 32 17 23.13.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION WORKS

- A. In advance of the paving operations the Contractor shall submit a paving lane schedule for approval by the Engineer.

- B. In advance of the paving operations the Contractor shall carry out a detailed measurement of the levels of the existing pavement along the paving lanes as approved by the Engineer.
- C. At the start of the project, preconstruction meetings shall be held with all parties concerned to discuss the applicable construction methods and the related safety measures.
- D. The safety measures as specified in Section 01 14 23.13 shall be strictly adhered to.

3.2 PREPARATORY WORKS

- A. Prior to the start of any construction activities, safety measures shall be applied in conformity with Section 01 14 23.13.
- B. Electrical circuits, in areas where construction works are in progress, shall be disconnected. (Temporarily) closed areas shall be marked by the applicable markings and signs and any existing marking on these areas which might lead to confusion shall be properly obliterated.
- C. If works have to be executed during night time an effective mobile floodlighting system shall be installed.
- D. All operational airfield ground lighting fixtures and other features which are located on the working area or on routes for construction traffic shall be carefully removed, cleaned and properly stored in order to avoid damage due to construction activities. Any damage due to construction activities shall be remunerated at the Contractors expense. Existing cables and conduits shall be effectively protected from damage during the construction works.

3.3 EQUIPMENT

- A. All equipment to be used, if not specified in this section, shall be in conformity with the relevant clauses of the related section as mentioned in Clause 1.3.
- B. Cold Milling Machine
 - 1. Milling of asphalt and concrete shall be performed with cold milling equipment to be approved by the Engineer.
 - 2. The milling width shall be at least 1.8 m and the milling depth shall be between 0 and 150 mm.
 - 3. The machine shall be capable of milling transverse slopes as indicated on the drawings.
 - 4. The machine shall be capable of operating manually and with depth and slope control devices such as electronic slope sensors, string line, or mobile reference systems (ski or shoe).
- C. Routing Equipment

1. Routing of joints and cracks shall be performed with mechanical routing equipment to be approved by the Engineer.
2. The routing width shall be 15 - 25 mm and the routing depth shall be variable between 0 and 50 mm.
3. The equipment shall be capable of manoeuvring along curved or angled cracks.

3.4 PAVEMENT SURFACE PREPARATION

A. General

1. Any previously laid temporary transition ramp shall be removed prior to the start of the overlay work and the broken up material shall immediately be dumped in the designated spoil area.

B. Removal/Surface Preparation

1. Existing runway centre line and touchdown zone lights shall be removed, cleaned and properly stored.
2. All bases of the light fixtures mentioned in Clause 3.2E shall be removed and the holes shall be backfilled with asphalt or dry lean concrete as agreed with the Engineer.
3. Backfilling is not required if the surrounding pavement is to be removed to the full depth of the light base during the same work period.

C. Milling and Material Utilization

1. The existing asphalt or cement concrete pavement shall be milled as shown on the applicable drawings or as directed by the Engineer.
2. Depth control shall be done by means of a ski of at least 10 m attached to the milling equipment in order to smoothen small irregularities.
3. The minimum depth of milling shall be such that all rubber deposits and existing pavement marking is removed and that a clean surface is exposed.
4. The Contractor shall make every effort to remove only the pavement within the limits designated.
5. The milled surface shall be thoroughly cleaned of all loose or deleterious material by power blowers, power brooms and, if necessary, supplemented by hand brooms.
6. The Contractor shall propose measures to ensure that, in case of adverse weather, discharge of rainwater from the runway surface is ensured. This may be done, by milling or cutting transverse trenches (300 mm width) in the shoulders at 50 m intervals longitudinally.
7. The milled material shall be utilized directly or temporarily stored within the airport boundaries or removed from the site, as instructed by the Engineer.

D. Remedial Works to Asphalt

1. After milling and cleaning, the asphalt surface shall be inspected by the Contractor.
2. Cracks of more than 6 mm wide shall be cleaned and blasted dry with compressed air and filled with bituminous mortar.
3. Debonded pieces of asphalt or severely damaged areas of the underlying course shall be removed and backfilled with asphalt after consulting the Engineer. Tack coat shall be applied prior to placement of the asphalt.
4. The joint between runway pavement and shoulder pavement shall be thoroughly cleaned. Vegetation in the joint shall be removed including roots and holes shall be backfilled with suitable bituminous material.
5. After the repair works, the area shall again be cleaned, so that an excellent bond will be obtained between prepared existing pavement and the next course.
6. An asphalt levelling course shall be applied on the areas as designated on the drawings.
7. Thickness control of the levelling course shall be by means of a long ski attached to the paver or by string lines.

E. Remedial Works to Concrete

1. After milling and cleaning, the concrete surface shall be jointly inspected by the Contractor and the Engineer.
2. Spalls along pavement joints, corners and cracks, exceeding 25 mm in width and 100 mm in length, shall be repaired as follows:
 - a) Remove unsound concrete and blow out the area with compressed air.
 - b) Place a strip of wood at locations of joints.
 - c) Apply tack coat to all concrete sides.
 - d) Place asphalt mix in layers of maximum 50 mm. Each layer shall be properly compacted.
 - e) Remove the wooden strip.
3. Cracks of more than 6 mm wide shall be cleaned and blasted dry with compressed air and filled with bituminous mortar.
4. Joints, not filled with sealant material, shall be routed, cleaned and filled with bituminous mortar.
5. In slabs, which do not have a full width transverse crack, a saw cut shall be made of approximately 150 mm depth. The sawcut shall be filled with bituminous material.
6. The joint between runway pavement and shoulder pavement shall be thoroughly cleaned. Vegetation in the joint shall be removed including roots and holes shall be

- backfilled.
7. After the repair works, the area shall again be cleaned, so that an excellent bond will be obtained between prepared existing pavement and the next course.
 8. An asphalt levelling course shall be applied on the areas as designated on the drawings.
 9. Thickness control of the levelling course shall be by means of string lines.

3.5 APPLICATION OF REINFORCEMENT

- A. Asphalt reinforcement shall be applied on the areas as designated on the drawings.
- B. No air traffic or construction traffic shall be allowed to operate on areas covered with the reinforcement.

3.6 APPLICATION OF ASPHALT OVERLAY

- A. The asphalt overlay shall be applied as shown on the applicable drawings.
- B. Prior to application of the asphalt overlay, the surface shall be cleaned and tack coat shall be applied. The tack coat shall be allowed sufficient time to set or cure.
- C. Sufficient equipment shall be on site and sufficient quantities of asphalt shall be produced in stock that, in case of an emergency or break down of equipment, a temporary transition can be made to the existing surface, so that air traffic is able to operate.
- D. The planning of paving operations on the runway shall be such that, at the end of the working period, the full agreed width of the runway is paved to allow aircraft operations.

3.7 CONSTRUCTION OF TRANSITION RAMPS

- A. Transitions ramps between the overlay and the existing pavement shall be constructed as shown on the drawings.
- B. Temporary longitudinal transition ramps at the end of each working period shall be constructed over the full width of the runway by feathering out to the existing pavement. The larger aggregate of the asphalt mix shall be raked out where the ramp becomes thinner.
- C. Permanent longitudinal transition ramps shall be formed by means of a heel cut into the existing pavement. A cold planing machine should mill off the existing pavement, to obtain the required depth as shown on the drawings. All loose material shall be removed and the exposed surface shall be tack coated prior to laying the new material.

3.8 PERMANENT JOINT BETWEEN NEW WORK AND EXISTING PAVEMENT

- A. The permanent joint between new work and existing bituminous pavement shall be formed by keying into the existing asphalt to a depth as shown on the drawings or as required by

the Engineer.

- B. All loose material shall be removed and the vertical edge shall be tack coated prior to laying new material.
- C. The permanent joint between new work and existing concrete pavement shall be made as follows:
 - 1. Exposing and thoroughly cleaning the concrete edge for its full depth and for a length as required.
 - 2. Forming a 25 mm wide expansion joint, and placing joint filler over the full depth and width against the concrete edge.
 - 3. After laying asphalt cutting out 40 mm of the joint filler and placing joint sealant, in accordance with section Joint Sealants.

3.9 OPENING TO TRAFFIC

- A. Upon completion and acceptance of each paving stage the Contractor shall clean the working site and remove all equipment to the designated areas in accordance with Section 01 14 23.13.
- B. Paving operations shall be planned in such a way that sufficient time is available for the asphalt to cool down to ambient temperatures at the moment air traffic movements commence.
- C. Temporary markings shall be applied as shown on the drawings. The temporary marking shall be maintained until the permanent marking is applied.
- D. The existing airfield ground lighting system shall be reinstalled at the end of the construction works.
- E. At the end of each working period and prior to hand-over of the work area to the airport authorities, a joint inspection of the work area shall be conducted by the Contractor, the Engineer and representatives of the Airport Authorities or Air Traffic Control.
- F. During this inspection, the Contractor shall have staff and equipment stand-by in order to conduct additional works if so required by one of the inspectors.
- G. No hand-over shall take place until all the planned works for a specific working period have been completed and the area has been cleared in full conformity with all related sections.

3.10 MATERIAL ACCEPTANCE

- A. Material acceptance shall be based on the applicable clauses of the related sections mentioned in Clause 1.3.

END OF SECTION

SECTION 32 05 43.13 AVAILABILITY OF MATERIALS

PART 1 - GENERAL

DESCRIPTION

- A. The Contractor shall be clearly aware of the fact that supply of fine and coarse aggregate for fill, base course, asphalt and structural concrete, etc. is entirely his responsibility.
- B. For as far as materials are required in excess of those from suitable specified excavations, the Contractor shall make his own arrangements to acquire land for quarries and borrow areas at his own expense.
- C. Long hauls to reach acceptable quarries may be necessary to obtain high quality aggregates.
- D. In addition to other sections of this Specification, areas within the project boundary fence will not be available for quarries or borrow unless a written agreement from the Engineer is obtained.
- E. Material taken from these quarries or borrow pits within the site may be free of charge.
- F. Calcareous materials such as limestone, etc. shall not be used in combination with brackish or salt construction water.

END OF SECTION

SECTION 32 05 53.13 CONSTRUCTION WATER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes: supplying suitable water for use in:

1. Existing sub-grade - moistening and compaction;
2. Embankment and fill layers - moistening and compaction;
3. Aggregate base courses - moistening and compaction;
4. Cement treated base courses and soil cement - mixing and curing;
5. Portland cement concrete and mortar - mixing and curing.

B. Sourcing and supplying suitable water shall be the Contractor's responsibility.

C. Acquiring suitable water: no payment for purchase and hauling or for any other provisions.

REFERENCES

D. Testing Requirements:

AASHTO T 26 Quality of Water to be used in Concrete ASTM C 109 Compressive Strength
 of Hydraulic Mortars

ASTM C 191 Time of Setting of Hydraulic Cement by Vicat Needle

E. Material Specification Requirements: ASTM C 150 Portland Cement

RELATED SECTION

F. Sections to be referred to:

1. Section 03 31 13.13 Structural Concrete and Blinding Concrete
2. Section 32 13 13.26 Portland Cement Concrete Pavement

PART 2 - PRODUCTS

2.1 CONSTRUCTION WATER

A. Quality

1. Water for embankment, fill layers, sub-grades and aggregate base courses:
 - a) clear, free from injurious amounts of oil, sugar, acid, clay, silt, strong alkalies or vegetable matter;

b) pH value : \square 5.

c) In addition, brackish water may be used for the same work items, but with:

salinity : $< 1,0 \%$, provided that, aggregates used shall not contain water soluble solids exceeding 3 % by weight.

2. Water for soil cement and cement treated base courses:

a) clear, free from injurious amounts of oil, sugar, acid, clay, silt, strong alkalies or vegetable matter;

b) salinity : $< 0.5 \%$;

c) pH value : > 5 ;

d) chlorides : maximum 5,000 ppm (mg/l);

e) sulphate : maximum 3,000 ppm (mg/l).

3. Water for Portland cement concrete and mortar:

a) fresh, clear, free from injurious amounts of oil, acid, alkali, sugar, deleterious mineral or organic matter;

b) salinity : $< 0.2 \%$;

c) pH value : > 5 ;

d) no impurities in sufficient amounts to cause discoloration of the concrete.

In addition:

1) Water for non-reinforced or mass Portland cement concrete:

(i) chlorides : maximum 2,000 ppm (mg/l);

(ii) sulphate : maximum 1,000 ppm (mg/l).

2) Water for reinforced Portland cement concrete:

(i) chlorides : maximum 1,000 ppm (mg/l);

(ii) sulphate : maximum 500 ppm (mg/l).

3) Water not to contain impurities in sufficient amounts to cause:

(i) change in time of setting for Portland cement: $> 25 \%$,

(ii) as initial setting time according to ASTM C 191;

(iii) reduction in compressive strength of mortar: $> 10 \%$,

(iv) according to test method ASTM C 109 for the types of cement and for the ages shown in Table 3 of ASTM C 150,

(v) as compared to same tests executed and results obtained with distilled water.

4) Water known to be of potable quality may be used without testing.

B. Related Sections

Figures for chlorides and sulphate content in water for concrete mentioned in Clause 2.1.A.3 are indicative. For total allowable chloride and sulphate content in concrete mixes, refer to the respective paragraphs in the Sections for:

1. Portland Cement Concrete Pavement;
2. Structural Cement Concrete and Blinding Concrete

PART 3 - EXECUTION

3.1 CONSTRUCTION WATER

- A. Before start of the works, Contractor to submit to Engineer for approval a source and supply of water, its suitability, composition and intended application.
- B. Contractor to ensure for adequate and continuous water supply and storage during period of construction.

END OF SECTION

SECTION 32 11 16.16 AGGREGATE SUB-BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of a sub-base course composed of granular materials, constructed on a prepared sub-grade or underlying course in accordance with this specification and in conformity with the dimensions and lines and grades as shown on the drawings or as instructed by the Engineer.

1.2 REFERENCES

A. Testing Requirements:

- | | |
|------------|---|
| ASTMC 117 | Materials finer than 75-micron (No. 200) Sieve in Mineral Aggregates by washing |
| ASTMC 136 | Sieve Analysis of Fine and Course Aggregates |
| ASTMD 1556 | Density and Unit Weight of Soil in Place by Sand Cone Method |
| ASTMD 1557 | Laboratory Compaction Characteristics of Soil (Moisture-Density Relations, Procedure 'C') |
| ASTMD 1883 | CBR (California Bearing Ratio) of Laboratory-Compacted Soils |
| ASTMD 2922 | Density of Soil and Soil-Aggregate in Place by Nuclear Method |
| ASTMD 4318 | Liquid Limit, Plastic Limit and Plasticity Index of Soils. |

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 32 05 43.13 Construction Water

PART 2 - PRODUCTS

2.1 AGGREGATE

- A. The sub-base material shall consist of hard durable particles or fragments of granular aggregates and shall be free from vegetable matter, lumps or clay, and other objectionable or foreign substances.
- B. The sub-base material will be mixed or blended with fine sand, stone dust, or other similar binding or filler material produced from approved sources.
- C. The mixture must be uniform and shall comply with the requirements of this specification and shall be capable of being compacted into a dense and stable sub-base.
- D. The aggregate shall comply with the requirements as shown in Table 1.

Test	Size	Requirement	Reference
Grading	All	Table 2	
Lab CBR, soaked	mixture	> 35 %	ASTM D 1883
Liquid limit	0.425mm	< 25 %	ASTM D 4318
Plasticity Index	0.425mm	< 6 %	ASTM D 4318

Table 1: Aggregate Requirements

2.2 JOB MIX

- A. The gradation (Job Mix) of the combined dry aggregate fall within the design range indicated in Table 2, when tested in accordance with ASTM C117 and C136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

ASTM Sieve Size		Percentage Passing by Weight
2 inch	50 mm	100
1 inch	25 mm	55 – 100
No. 4	4.75 mm	30 – 75
No. 40	0.425 mm	10 – 30
No. 200	0.075 mm	0 - 15

Table 2: Aggregate Grading

- B. The selection of the grading within this envelope shall however be such that the maximum size aggregate used shall be not more than one-half of the thickness of the layer to be constructed, e.g. a 100 mm layer will require a 50 mm down grading.
- C. Not less than 20% shall be retained between each pair of successive sieves specified, except

for the largest pair.

2.3 WATER

A. Water shall be in accordance with the Section for Construction Water.

PART 3 - EXECUTION

3.1 GENERAL

- A. The sub-base course shall be placed where designated on the drawings. The **material** shall be shaped and thoroughly compacted within the tolerances specified.
- B. Granular sub-bases which, due to grain sizes or shapes, are not sufficiently stable to support without movement the construction equipment, shall be mechanically stabilized to the depth necessary to provide such stability as directed by the Engineer.
- C. The mechanical stabilization shall principally include the addition of a fine-grained medium to bind the particles of the sub-base material sufficiently to furnish a bearing strength, so that the course will not deform under the traffic of the construction equipment.
- D. The addition of the binding medium to the sub-base material shall not increase the soil constants of that material above the limits specified.

3.2 OPERATION IN PITS AND QUARRIES

- A. All work involved in clearing and stripping of quarries and pits including handling unsuitable material encountered shall be performed by the Contractor at his own expense.
- B. The material shall be obtained from pits or sources that have been approved.
- C. The material in the pits shall be excavated and handled in such a manner that a uniform and satisfactory product can be secured.
- D. Unless otherwise directed, pits shall be adequately drained and shall be left in a neat and presentable condition with all slopes dressed uniformly.
- E. Quarries shall be left as neat and presentable as practicable.

3.3 EQUIPMENT

- A. All equipment necessary for the proper construction of this work shall be in first- class working condition, and shall have been approved by the Engineer before construction is permitted to start.
- B. Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design to ensure uniform application.
- C. The processing equipment shall be designed, constructed, and operated and shall have

sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a sub-base course of the gradation and consistency as required.

3.4 PREPARING UNDERLYING COURSE

- A. Before any sub-base material is placed, the underlying course shall be prepared and conditioned as specified. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.
- B. Grade control between the edges of the pavement shall be by means of grade stakes, steel pins, or forms placed in lanes parallel to the centreline of the pavement and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.
- C. To protect the underlying layer and to ensure proper drainage, the spreading of the sub-base shall begin along the centreline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

3.5 MATERIALS ACCEPTABLE IN EXISTING CONDITION

- A. When material is secured in a uniform and satisfactory condition, such approved material may be moved directly to the spreading equipment for placing.
- B. The materials from these sources shall meet the requirements for gradation, quality and consistency.
- C. The moisture content of the material shall be brought up to approximately that percentage required to obtain maximum density. Any deficiency or excess of moisture may be corrected by surface sprinkling or by aeration.
- D. In such instances, mixing or manipulation may be required, immediately preceding the rolling, to obtain the required moisture content.

3.6 PLANT MIXING

- A. When materials from several sources are to be blended and mixed, these materials shall be processed in a central or travelling mixing plant. The material, together with any blended material, shall be thoroughly mixed with the required amount of water.
- B. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of the moisture content.

3.7 MIXED IN PLACE

- A. When materials from different sources are to be proportioned and mixed or blended in place, the relative proportions of the components of the mixture shall be in accordance with Clause 2.2 of this section.
- B. The sub-base material shall be deposited and spread evenly to a uniform thickness and width.

- C. Then the binder, filler, or other material shall be deposited and spread evenly over the first layer.
- D. There shall be as many layers of materials added as the Engineer may direct to obtain the required sub-base mixture.
- E. When the required amount of materials have been placed, they shall be thoroughly mixed and blended by means of approved graders, disc harrows, rotary tillers, supplemented by other suitable equipment if necessary.
- F. The mixing shall continue until the mixture is uniform throughout.
- G. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough re-mixing.
- H. Water in the amount and as directed by the Engineer shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its required moisture content.
- I. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness, grade and levels.

3.8 PLACING

- A. The sub-base course shall be constructed in layers. Any layer shall be not less than 75 mm nor more than 200 mm of compacted thickness.
- B. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials.
- C. The sub-base, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square metres in advance of the rolling. Any necessary sprinkling shall be kept within this limit.
- D. No material shall be placed on a soft or muddy course.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of sub-grade, or foreign material in the sub-base course mixture.

3.9 FINISHING AND COMPACTING

- A. After spreading or mixing, the material shall be thoroughly compacted by rolling and sprinkling, when necessary.
- B. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the course. Rolling shall progress gradually from the sides to the centre of the lane under construction, or from one side towards previously placed material, by lapping uniformly each preceding track by at least 300 mm.
- C. The rolling shall continue until the material is thoroughly set and stable, and the course has been compacted to not less than 95% of maximum modified dry density at optimum moisture as determined by ASTM D 1557, Procedure 'C'.

- D. Tests for field density shall be made in at least one location for every 500 square metres of each compacted layer in accordance with ASTM D 1556, or with a nuclear density meter in accordance with ASTM D 2922.
- E. Blading and rolling shall be done alternatively, as required or directed, to obtain a smooth, even and uniformly compacted course.
- F. The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the underlying course or sub-base course.
- G. Water shall not be added in such a manner or quantity that free water will reach the underlying layer and cause it to become soft.
- H. Along places inaccessible to rollers, the material shall be tamped thoroughly with mechanical tampers.

3.10 SURFACE FINISH TESTS - SMOOTHNESS

- A. After the course is completely compacted, the surface shall be tested for smoothness and accuracy of grade and level; any portion found to lack the required smoothness or to fail in accuracy of grade or level shall be scarified, reshaped, re-compacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy are obtained.
- B. The finished surface shall not vary more than 10 mm when tested with a 3 metre straight edge applied parallel with and at right angles to the centre line.

3.11 THICKNESS AND FINISHED LEVELS

- A. The thickness of the completed course may be checked by depth tests or cores taken at intervals, so that each test shall represent no more than 500 square metres.
- B. Deficiencies in thickness are allowed between the tolerances for elevation of the underlying layer and the top of the constructed course.
- C. The elevations of the finished surface shall not vary more than +10/-20 mm from the design elevations.
- D. The levelling of the finished course shall be performed by the Contractor in a grid as indicated by the Engineer on a lot basis of 2000 m².
- E. The Contractor shall submit all levels in due time to the Engineer for checking and approval.
- F. Any deviation of the finished elevations from the design elevations outside the tolerances, shall be corrected by the Contractor by scarifying, removing and/or adding material, sprinkling, rolling, reshaping, and finishing in accordance with these specifications.
- G. The Contractor shall replace at his expense the material when borings are taken for test purposes.

3.12 FREQUENCY OF PRODUCTION CONTROL

A. The Contractor shall perform regularly the tests as per Table 3.

Test Description		Frequency of Tests
1	Grading	Daily
3	Liquid Limit	each 2,500 tons
4	Plasticity Index	each 2,500 tons
5	Laboratory CBR (soaked	each 5,000 tons
6	Field Density	each 500 m2
7	Thickness	each 500 m2
8	Level	each 500 m2
9	Smoothness	each 500 m2

Table 3: Routine Testing Requirements

3.13 PROTECTION

A. Work on the sub-base course shall not be conducted when the sub-grade is too wet.

3.14 MAINTENANCE

A. Following the final shaping of the material, the sub-base shall be maintained by the use of graders and rollers and watering, whenever required until, in the judgement of the Engineer, the sub-base meets all requirements and is acceptable for the construction of the next course.

END OF SECTION

SECTION 32 11 16.19 SELECTED FILL & DRAINAGE LAYER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of selected fill and drainage layer composed of soil and granular materials, obtained from specified excavations or borrow areas, or manufactured and constructed in accordance with these specification requirements and in conformity with the dimensions and typical cross sections shown on the drawings or as instructed by the Engineer.

1.2 REFERENCES

A. Testing Requirements:

- | | |
|------------|--|
| ASTMC 117 | Materials finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by washing |
| ASTMC 136 | Sieve Analysis of Fine and Course Aggregates |
| ASTMD 1556 | Density and Unit Weight of Soil in Place by Sand Cone Method |
| ASTMD 1557 | Laboratory Compaction Characteristics of Soil (Moisture-Density Relations, Method C) |
| ASTMD 1883 | CBR (California Bearing Ratio) of Laboratory-Compacted Soils |
| ASTMD 2922 | Density of Soil and Soil-Aggregate in Place by Nuclear Method |
| ASTMD 4318 | Liquid Limit, Plastic Limit and Plasticity Index of Soils. |

1.3 RELATED SECTION

Not Applicable

34 PART 2 - PRODUCTS

2.1 SELECTED FILL

- A. Selected fill material shall be approved soil and granular material and shall consist of durable particles of gravel, sand or other approved granular material.
- B. If necessary, it shall be blended with sand or other approved fine screenings to provide the

required gradation.

- C. The material shall be free from vegetable matter, lumps or excessive amounts of clay and other objectionable substances.
- D. The gradation shall be within the limits as per Table 1 when tested in accordance with ASTM C 136 and C 117 (wet sieving).

ASTM Sieve Size		Percentage by Weight Passing Sieve
4 inch	(100 mm)	100
No. 4	(4.75 mm)	30 – 100
No. 16	(1.18 mm)	15 - 50
No. 50	(300 µm)	5 – 30
No. 200	(75 µm)	0 – 10

Table 1: Aggregate Grading Selected Fill

- E. The CBR of a laboratory-compacted sample shall not be less than 20%. Samples are to be prepared and tested in accordance with ASTM D 1883 and are to be soaked for four (4) days.
- F. The swelling shall be less than 1.0%.
- G. The material passing the 0.420 mm (No. 40) sieve shall have a Liquid Limit of not more than 25% and the Plasticity Index shall not exceed 5% when tested in accordance with ASTM D 4318.

2.2 DRAINAGE LAYER

- A. The drainage layer shall be from crushed rock, gravel or natural borrow material which fulfills the gradation requirements as per Table 2

ASTM Sieve Size		Percentage by Weight Passing Sieve
¾ inch	(19 mm)	100
½ inch	(12.5 mm)	70 – 100
3/8 inch	(9.5 mm)	40 – 65
No. 4	(4.75 mm)	20 – 45
No. 8	(2.36 mm)	17 – 30
No. 200	(75 µm)	0 – 3

Table 2: Aggregate Grading Drainage Layer

- B. The permeability tested using a constant head permeability apparatus shall be at least 300 m day.
- C. Coefficient of uniformity > 3.5 and non plastic ($C_u = D_{60} / D_{10}$).

PART 3 - EXECUTION

3.1 OPERATIONS IN BORROW AREAS

- A. All work involved in clearing and stripping of borrow areas, including handling unsuitable material encountered, shall be performed by the Contractor at his own expense.
- B. The material shall be obtained from pits or sources that have been approved by the Engineer before the borrow excavation starts.
- C. The material in the pits shall be excavated and handled in such a manner that a uniform and satisfactory product can be secured.
- D. Unless otherwise directed, pits shall be adequately drained and shall be left in a neat and presentable condition to the discretion of the Engineer, with all slopes uniformly dressed.

3.2 PREPARING UNDERLYING COURSE

- A. The underlying course shall be prepared and conditioned as specified under the Section for Earthworks before any selected fill or drainage layer material is placed.
- B. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started.
- C. Work on the selected fill shall not be conducted when the underlying course is too wet.

3.3 PLACING

- A. The selected fill course and the drainage layer shall be constructed in layers. Any layer shall not be less than 75 mm nor more than 250 mm of compacted thickness.
- B. The material as spread, shall be of uniform gradation with no pockets of fine or coarse material.

3.4 FINISHING AND COMPACTING

- A. After spreading, the material shall be thoroughly compacted by rolling, and moistured by means of sprinkling when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the course. Rolling shall progress gradually from the side to the centre of the lane under construction or from one side towards the previously constructed lane, by overlapping uniformly each preceding lane by at least 0.3 m. The rolling shall continue until the material is thoroughly set and stable, and the course

has been compacted to specified dry density at optimum moisture content as determined by ASTM D 1557.

- B. Tests for field density shall be made in accordance with ASTM D 1556 or with nuclear density test equipment in accordance with ASTM D 2922, in at least one location for every 1,000 square metres of each compacted layer.

Nuclear density tests are only allowed when a satisfactory laboratory calibration can be made and when the Contractor is authorised to operate the nuclear equipment.

- C. Blading and rolling shall be done alternatively as required or directed to obtain a smooth, even and uniformly compacted course.
- D. Water shall not be added in such a manner or quantity that free water will reach the underlying course and cause it to become soft.
- E. Along places inaccessible to rollers, the material shall be tamped thoroughly with mechanical tampers.

3.5 SURFACE TOLERANCES

- A. Surface tolerances shall conform to the requirements as per Table 3.
- B. Level deviation in excess of tolerances: to be corrected by loosening, removing or adding materials, spreading and re-compacting by sprinkling and rolling.
- C. The thickness of the completed course shall not be as per the specified the design thickness. The thickness shall be determined by levelling the underlying course and the finished surface of the selected fill or drainage layer and calculating the difference. However the deficiencies in thickness are allowed between the tolerances of elevations of the underlying course and finished surface of the constructed course and calculating the difference.
- D. Any deviations in excess of the specified variation shall be corrected.

3.6 COMPACTION REQUIREMENTS AND SURFACE TOLERANCES

- A Field densities shall conform to the requirements of Table 3.

	Minimum test area per layer (m2)	Field Density	Design Level Tolerance (mm)
Selected Fill	1,000	98%	-15/+15
Drainage Layer	1,000	95%	-15/+15

Table 3: Field Density and Design Level Tolerances

END OF SECTION

SECTION 32 11 33.13 SOIL CEMENT BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of furnishing, mixing, spreading, shaping, and compacting soil, cement, and water in accordance with the requirements of this specification and shall conform to the dimensions and typical cross section shown on the drawings and to the lines and grades established by the Engineer.
- B. The soil cement base course shall be built in a series of parallel lanes using mechanical spreading equipment.

1.2 REFERENCES

A. Testing Requirements

ASTM C136	sieve analyses
ASTM C496	split tensile test
ASTM 423 D	liquid limit
ASTM 424 D	plastic limit and plasticity index of soils
ASTM 558 D	Moisture Density Relations of Soil Cement Mixtures
ASTM 559 D	Wetting and Drying Tests of Compacted Soil Cement Mixtures
ASTM 560 D	Freezing and Thawing Tests of Compacted Soil Cement Mixtures
ASTM 1556 D	density of soil in place
ASTM 1557 D	moisture-density relation (Method C)
ASTM 1633 D	compressive strength cylinders

- B. Material Specification Requirement ASTM C 150 Portland Cement

ASTM C 595 Blended Hydraulic Cements

FAA P301 Soil Cement Base Course (FAA ref AC 150/5370-10B)

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 32 05 53.13 Construction Water

PART 2 - PRODUCTS

2.1 SOIL

A. **The soil shall consist of an approved selected soil. The soil shall be free of roots, sod, weeds, and shall not contain gravel or stone retained on a 1-inch (25 mm) sieve or more than 45% retained on a No. 4 sieve, as determined by ASTM C 136.**

2.2 PORTLAND CEMENT

A. Portland cement shall be a standard brand and shall conform to the latest standard requirements of ASTM C 150 for the type I cement. Cement with pozzolanic additives are also allowed, in which case the pozzolanic content shall be up to a maximum of 30 percent by weight (ASTM C595).

2.3 WATER

A. Water shall be in accordance with section "Construction Water".

PART 3 - EXECUTION

3.1 CEMENT CONTENT

A. The minimum cement content shall be 3% by weight of dry aggregate.

3.2 COMPOSITION

- A. Prior to base course construction, laboratory tests of soils shall be made to determine the quantity of cement required in the mix.
- B. Test specimens containing various amounts of cement are to be compacted in accordance with ASTM D 558, and the optimum moisture for each amount of cement is to be determined. Samples at the optimum moisture shall be subjected to the wet-dry and the freeze-thaw test in accordance with ASTM D 559 and D 560, respectively.

- C. The specified cement content for construction shall be that at which the weight loss of the specimens subjected to 12 cycles of either the wet-dry or the freeze- thaw is not more than 14% for granular soils, 10% for the more plastic granular and silty soils, and 7% for clay soils.
- D. The compressive strength of soaked specimens should increase both with age and with increase in cement content.

3.3 WEATHER LIMITATIONS

- A. The soil cement base course shall not be placed when the weather is rainy.

3.4 OPERATIONS IN PITS AND QUARRIES

- A. The material shall be obtained from borrow pits, quarries or recycled that have been approved. The material shall be excavated and handled in such a manner that a uniform and satisfactory product can be secured.

3.5 EQUIPMENT

- A. All equipment necessary for the proper construction of this work shall be in good working condition, and shall have been approved by the Engineer before construction is permitted to start.
- B. Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design.
- C. The processing equipment shall be designed, constructed, and operated and shall have sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a soil cement base course of the gradation and consistency as required.

3.6 PREPARING UNDERLYING COURSE

- A. The area to be paved shall be graded and shaped to conform to the grades and typical cross section shown on the plans. Any soft or yielding areas in the subgrade shall be removed and replaced with acceptable soil and compacted as specified.
- B. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.
- C. Grade control between the edges of the pavement shall be by means of grade stakes, steel pins, or forms placed in lanes parallel to the centreline of the pavement and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.
- D. To protect the underlying layer and to ensure proper drainage, the spreading of the cement treated base course shall begin along the centreline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

3.7 CEMENT APPLICATION, MIXING AND SPREADING

- A. Mixing of the soil, cement, and water shall be accomplished either by the mixed- in-place or the central-plant-mixed method.
- B. The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations, and it shall not exceed the specified optimum moisture content for the soil-cement mixture.
- C. **Method A – Mixed-in-place.** The specified quantity of cement shall be spread uniformly on the soil.

Cement that has been displaced shall be replaced before mixing is started. After the cement has been applied, it shall be mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied.

Immediately after the soil and cement have been mixed, water shall be incorporated into the mixture. Excessive concentrations of water on or near the surface shall be avoided. A water supply and pressure distributing equipment shall be provided that will assure the application within 3 hours of all mixing water on the section being processed. After all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, cement, and water has been obtained.

- D. **Method B – Central plant mixed.** The soil, cement, and water shall be mixed in a pugmill, either of the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices that will add the soil, cement, and water into the mixer in the specified quantities. Soil and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform and intimate mixture of soil, cement, and water is obtained.

The mixture shall be hauled to the project in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader(s). Not more than 30 minutes shall elapse between the placement of soil-cement in adjacent lanes.

The layer of soil-cement shall be uniform in thickness and surface contour and of such quantity that the completed base will conform to the required grade and cross section. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

Not more than 60 minutes shall elapse between the start of moist mixing and the start of compaction of soil-cement.

3.8 COMPACTION

- A. Immediately upon completion of the spreading operations, the mixture shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.
- B. The field density of the compacted mixture shall be at least 98 percent of the maximum

density of laboratory specimens prepared from samples of the cement- treated base material taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D 558. The in-place field density shall be determined in accordance with ASTM D 1556. Any mixture that has not been compacted shall not be left undisturbed for more than 30 minutes. The moisture content of the mixture at the start of compaction shall not be below nor more than 2 percentage points above the optimum moisture content. The optimum moisture content shall be determined in accordance with ASTM D 558 and shall be less than that amount which will cause the mixture to become unstable during compaction and finishing.

3.9 FINISHING

- A. Finishing operations shall be completed during daylight hours, and the completed base course shall conform to the required lines, grades, and cross section. If necessary, the surface shall be lightly scarified to eliminate any imprints made by the compacting or shaping equipment. The surface shall then be recompacted to the required density.

3.10 CONSTRUCTION JOINTS

- A. At the end of each day's run, a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true vertical face free of loose material.
- B. The protection provided for construction joints shall permit the placing, spreading, and compacting of base material without injury to the work previously laid. Where it is necessary to operate or turn any equipment on the completed base course, sufficient protection and cover shall be provided to prevent damage to the finished surface. A supply of mats or wooden planks shall be maintained and used as approved and directed by the Engineer.
- C. Care shall be exercised to ensure thorough compaction of the base material immediately adjacent to all construction joints. When spreading or compacting base material adjacent to a previously constructed lane, care shall be taken to prevent injury to the work already constructed.

3.11 PROTECTION AND CURING

- A. After the base course has been finished to grade and compacted as specified herein, it shall be protected against drying for a period of 7 days by the application of bituminous material or other acceptable methods. The curing method shall begin as soon as possible, but no later than 24 hours after the completion of finishing operations. The finished base course shall be kept moist continuously until the curing material is placed.
- B. The bituminous material specified shall be uniformly applied to the surface of the completed base course at the rate of approximately 0.2 gallon per square yard (0.92 liter/square meter) with approved heating and distributing equipment. The exact rate and temperature of

application to give complete coverage without excessive runoff shall be as specified.

- C. At the time the bituminous material is applied, the surface shall be dense, free of all loose and extraneous material, and shall contain sufficient moisture to prevent penetration of the bituminous material. Water shall be applied in sufficient quantity to fill the surface voids immediately before the bituminous curing material is applied.
- D. The curing material shall be maintained and applied as needed by the Contractor during the 7-day protection period so that all of the soil-cement will be covered effectively during this period.
- E. Finished portions of soil-cement that are used by equipment in constructing an adjoining section shall be protected to prevent equipment from marring or damaging the completed work.
- F. When the air temperature may be expected to reach the freezing point, sufficient protection from freezing shall be given the soil-cement for 7 days after its construction and until it has hardened.
- G. Other curing materials such as moist straw or hay may be used if approved.

3.12 CONSTRUCTION LIMITATIONS

- A. When any of the operations after the application of cement are interrupted for more than 30 minutes or when the uncompacted soil-cement mixture is wetted by rain so that the moisture content is exceeded by a small amount, the decision to reconstruct the portion affected shall rest with the Engineer. In the event the uncompacted, rain-wetted mixture exceeds the specified moisture content tolerance, the Contractor shall reconstruct at his/her expense the portion affected. All material along the longitudinal or transverse construction joints not properly compacted shall be removed and replaced, at the Contractor's expense, with properly moistened and mixed soil-cement compacted to specified density.

3.13 SURFACE TESTS

- A. The finished surface shall not vary more than 9 mm when tested with a 4.8 m straightedge applied parallel with, or at right angles to, the longitudinal axis of the pavement. Any variations in excess of this tolerance shall be corrected by the Contractor, at his/her own expense, and in a manner satisfactory to the Engineer.

3.14 THICKNESS

- A. The thickness of the soil-cement base course shall be determined from measurements of cores drilled from the finished base or from thickness measurements at holes drilled in the base at intervals so that each test shall represent no more than 250 square meters. The average thickness of the base constructed during one day shall be within 12 mm of the thickness shown on the drawings, except that the thickness of any one point may be within 13 mm of that shown on the plans. Where the average thickness shown by the measurements made in one day's construction is not within the tolerance given, the Engineer shall evaluate the

area and determine if, in his/her opinion, it shall be reconstructed at the Contractor's expense or the deficiency deducted from the total material in place.

3.15 MAINTENANCE

- A. The Contractor shall be required to maintain, at his/her own expense, the entire base course within the limits of his/her contract in a condition satisfactory to the Engineer from the time he starts work until all the work has been completed. Maintenance shall include immediate repairs of any defects that may occur either before or after the cement is applied. The work shall be done by the Contractor at his/her own expense and repeated as often as necessary to keep the area intact at all times. Repairs shall be made in a manner that will insure restoration of a uniform surface and the durability of the part repaired. Faulty work must be replaced for the full depth of treatment. Any low areas shall be remedied by replacing the material for the full depth of treatment rather than by adding a thin layer of soil-cement to the completed work.

END OF SECTION

SECTION 32 11 23.33 CRUSHED AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of a base course composed of crushed aggregate, constructed on a prepared underlying course in accordance with this specification and in conformity with the dimensions and lines and grades as shown on the drawings or as instructed by the Engineer.

1.2 REFERENCES

A. Testing Requirements:

ASTMC 88	Soundness of Aggregates
ASTMC 117	Materials finer than 75 micron (No. 200) Sieve in Mineral Aggregates by washing
ASTMC 127	Specific Gravity and Absorption of Coarse Aggregate
ASTMC 128	Specific Gravity and Absorption of Fine Aggregate
ASTMC 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the L.A. Machine
ASTMC 136	Sieve Analysis of Fine and Course Aggregates
ASTMC 142	Clay Lumps and Friable Particles in Aggregates
ASTMD 75	Sampling Aggregates
ASTMD 1556	Density and Unit Weight of Soil in Place by Sand Cone Method
ASTMD 1557	Laboratory Compaction Characteristics of Soil (Moisture-Density Relations, 'Procedure C')
ASTMD 1883	CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTMD 2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTMD 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Method
ASTMD 3017	Water Content of Soils and Rock in Place by Nuclear Method

ASTMD 3665 (Practice for) Random Sampling of Construction Materials

ASTMD 4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils.

B. Material Specification Requirements:

ASTM C 693 Crushed Aggregate for Macadam Pavement BS 812 Testing of Aggregates

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 32 05 43.13 Construction Water

PART 2 - PRODUCTS

2.1 AGGREGATE

- A. Aggregate shall consist of clean, sound, durable particles of crushed rock or crushed stone and shall be free from coatings of clay, silt, vegetable matter and other objectionable matter and shall not contain clay balls.
- B. Fine aggregate passing the No. 4 sieve (4.75 mm) shall consist of fines from the operation of crushing the coarse aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone that meet the requirements for wear and soundness specified for coarse aggregate.

C. The aggregate shall comply with the requirements as shown in Table 1.

Test	Size	Requirement	Reference
Grading	all	Table 2	
Shape			
- two or more fractured faces	> 4.75 mm	> = 85 % (w/w)	
- one or more fractured faces	> 4.75 mm	> = 90 % (w/w)	
- flat and elongated pieces	> 9.5 mm	< 15 % (w/w)	ASTM D 693
Water Absorption	coarse	< 3 %	ASTM C 127
	fine	< 3 %	ASTM C 128
Sand Equivalent	fine	> 40 %	ASTM D 2419
Aggregate Impact Value (SSD)	10 - 14 mm	< 30 %	BS 812 / EN
Ten Percent Fines Value (SSD)	10 - 14 mm	> 100 kN	BS 812 / EN
Wear (Los Angeles Abrasion Value)	coarse	< 45 %	ASTM C 131
Sodium Sulphate Soundness Loss	coarse	< 12 %	ASTM C 88
Liquid limit	< 0.450 mm	< 25 %	ASTM D 4318
Plasticity Index	< 0.450 mm	< 4 %	ASTM D 4318

Table 1: Aggregate Requirements

2.2 JOB MIX

- A. The gradation (Job Mix) of the final mixture shall fall within the design range indicated in Table 2, when tested in accordance with ASTM C117 and C136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

ASTM Sieve Size		Percentage Passing by Weight
2 inch	50 mm	100
1 ½ inch	37 mm	95 – 100
1 inch	25 mm	70 – 95
¾ inch	19 mm	55 – 85
No. 4	4.75 mm	30 – 60
No. 30	0.60 mm	12 – 30
No. 200	0.075 mm	0 – 8

Table 2: Aggregate Grading Requirements

- B. The job mix tolerances in Table 2 shall be applied to the job mix gradation to establish a job control grading band. The full tolerance will still apply if application of the tolerances results in a job control grading band outside the design range.

2.3 STRENGTH REQUIREMENT

- A. The laboratory California Bearing Ratio (CBR) defined in accordance with ASTM D 1883 shall be at least 100%, under soaked condition, after compaction as per ASTM D 1557, procedure 'C'.

2.4 WATER

- A. Water and aggregates shall be in accordance with the Section for Construction Water.

PART 3 - EXECUTION

3.1 OPERATIONS IN PITS AND QUARRIES

- A. The material shall be obtained from pits or quarries that have been approved. The material shall be excavated and handled in such a manner that a uniform and satisfactory product can be secured.

3.2 EQUIPMENT

- A. All equipment necessary for the proper construction of this work shall be in first- class working condition, and shall have been approved by the Engineer before construction is permitted to start. Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design to ensure uniform application.

- B. The processing equipment shall be designed, constructed, and operated and shall have sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a crushed aggregate base course of the gradation and consistency as required.

3.3 PREPARING UNDERLYING COURSE

- A. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations may start. Any ruts or soft yielding places that appear by reason of improper drainage conditions, or hauling, or from any other cause, shall be corrected and rolled to the required compaction before the base course is placed thereon.

3.4 PLANT MIX

- A. The base course material shall be uniformly blended during crushing operations or mixed in an approved blending plant. The type of plant shall be a central proportioning and mixing plant.
- B. The plant shall blend and mix the materials to meet this specification and to secure the proper moisture content for compaction.

3.5 PLACING AND SPREADING

A. Central Plant

1. The aggregate base course material which is correctly proportioned in a crushing and screening plant, or has been processed in a central blending plant, shall be placed on the prepared moistened underlying course and compacted in layers of the required thickness.
2. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer will have the required thickness. The base course aggregate shall preferably be spread by the use of mechanical pavers which shall spread the aggregate in the required amount so as to avoid or minimize the need for hand manipulation.
3. Dumping from vehicles in piles which will require re-handling shall not be done unless the Engineer's permission is obtained. Hauling over the uncompacted base course shall not be permitted.

B. Method of Placing

1. The base course shall be constructed in layers of not less than 75 mm nor more than 200 mm of compacted thickness. The aggregate as spread shall be of uniform grading with no segregation or pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square metres in advance of the rolling. The base material shall be at a satisfactory moisture content when rolling is started. The preferred method of placing is by a suitable paver.

2. There shall be no reworking of the base course material in place to obtain the specified gradation.
3. The Contractor shall make tests to determine the field density and the proper moisture content of the base course material.
4. Any minor variation shall be corrected by sprinkling or by aeration if necessary.
5. During the placing and spreading process, sufficient caution shall be exercised to prevent the incorporation of sub-grade, subbase, or shoulder material in the base course mixture.

3.6 COMPACTING, FINISHING AND TESTING

- A. After spreading the crushed aggregate shall be thoroughly compacted by rolling and sprinkling when necessary. Sufficient rollers shall be furnished to adequately handle the compaction of the material that has been placed and spread as specified above.

Rolling shall progress gradually from the sides to the centre of the lane under construction or from one side towards previously placed material by lapping uniformly each preceding rear wheel track by one-half the width of such track, and shall continue until the entire area of the course has been rolled by the rear wheels.

The rolling shall continue until the stone is thoroughly set, the interstices of the material reduced to a minimum, and creeping of the stone ahead of the roller no longer visible.

- B. Rolling shall continue until the base material has been compacted to not less than 100% of the modified density as determined by ASTM D 1557 'Procedure C'.
- C. Blading and rolling shall be done alternately as required or directed to obtain a smooth, even, and uniformly compacted base. When the rolling develops irregularities that exceed the tolerances stated in clause 3.7, the irregular surface shall be loosened, then refilled with the same kind of material as that used in constructing the course, and again rolled as required.
- D. Along places inaccessible to rollers, the base course material shall be tamped thoroughly with mechanical tampers.

3.7 SURFACE FINISH TESTS – COMPACTION AND SMOOTHNESS

- A. Tests for field density shall be made in at least one location for every 500 square metre of each compacted layer.
- B. After the course is completely compacted, the surface shall be tested for smoothness and accuracy of grade and level; any portion found to lack the required smoothness or to fail in accuracy of grade or level shall be scarified, reshaped, re-compacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy are obtained.
- C. The finished surface shall not vary more than 10 mm when tested with a 3 metre straightedge applied parallel with and at right angles to the centre line.

3.8 THICKNESS AND FINISHED LEVELS

- A. The thickness of the completed base course may be checked by depth tests.
- B. Deficiencies in thickness are allowed between the tolerances for elevation of the underlaying layer and the top of the constructed course.
- C. The elevations of the finished surface shall not vary more than +10/-15 mm from the design elevations.
- D. The levelling of the finished course shall be performed by the Contractor in a grid as indicated by the Engineer. The Contractor shall submit all levels in due time to the Engineer for checking and approval. Any deviation of the finished elevations from the design elevations outside the tolerances, shall be corrected by the Contractor by scarifying, removing and/or adding material, sprinkling, rolling, reshaping, and finishing in accordance with this specification.
- E. The Contractor shall replace the material when excavation/borings are taken for test purposes.

3.9 PROTECTION

- A. Work on the base course shall not be carried out when the sub-grade is too wet.
- B. Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction.
- C. The Engineer shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his opinion, such hauling is causing damage.
- D. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his own expense.

3.10 MAINTENANCE

- A. Following the completion of the base course the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times.
- B. If cleaning is necessary or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.
- C. Before the preparations for the application of a surface treatment or for a surface course have started, the base course shall be allowed to partially dry until the average moisture content of the full depth of base is less than 80% of the optimum moisture content of the base mixture. The drying shall not continue to the extent that the surface of the base course becomes dusty with consequent loss of binder. If the surface of the base course dries too fast, it shall be kept moist by sprinkling until such time as the prime coat shall be applied.

3.11 FREQUENCY OF PRODUCTION CONTROL

A. The Contractor shall perform on a regular basis the tests as per Table 3.

Test Description	Reference	Requirement	Frequency of Test
Gradation	ASTM C 117	Table 2	daily
	ASTM C 136	Table 2	daily
Flat and Elongated Pieces	ASTM D 693		each 5,000 tons
Fractured Faces	Table 1	>85% one face >90% two faces	each 5,000 tons
Abrasion	ASTM C 131	< 45%	each 5,000 tons
Water Absorption	ASTM C 127	< 3%	each 5,000 tons
Sodium Sulphate Soundness Loss	ASTM C 88	< 12%	each 5,000 tons
Sand Equivalent	ASTM D 2419	> 40%	each 5,000 tons
Liquid Limit	ASTM D 4318	< 25%	each 5,000 tons
Plasticity Limit	ASTM D 4318	< 4%	each 5,000 tons
Lab CBR	ASTM D 1883	> 100	each 2,500 tons
Field Density	ASTM D 1557	> 100%	each 500 m2

Thickness		each 500 m2
Elevation		each 500 m2
Smoothness		each 500 m2

Table 3: Frequency of Tests

END OF SECTION

SECTION 32 11 33.13 PORTLAND CEMENT-STABILIZED BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of furnishing, mixing, spreading, shaping, and compacting mineral aggregate, cement, and water in accordance with the requirements of this specification and shall conform to the dimensions and typical cross section shown on the drawings and to the lines and grades established by the Engineer.
- B. The cement treated base course shall be built in a series of parallel lanes using mechanical spreading equipment.

1.2 REFERENCES

A. Testing Requirements

- ASTM C136 sieve analyses
- ASTM C496 split tensile test
- ASTM 423 liquid limit
D
- ASTM 424 plastic limit and plasticity index of soils
D
- ASTM 1556 density of soil in place
D
- ASTM 1557 moisture-density relation (Method C)
D
- ASTM 1633 compressive strength cylinders
D

B. Material Specification Requirement ASTM C 150 Portland Cement

ASTM C 595 Blended Hydraulic Cements

1.3 RELATED SECTION

A. Sections to be referred to:

- 1. Section 32 05 53.13 Construction Water

PART 2 - PRODUCTS

2.1 AGGREGATE

- A. The aggregate may be manufactured from crushed stone or gravel, recycled concrete, bricks or asphalt concrete or a combination of all. The fine aggregate shall be that naturally contained in the base crushed material.
- B. The excavated material from the demolition of existing pavements, granular base and structures shall be recycled for use.
- C. In addition, natural or crushed sand may be added to achieve the required grading.
- D. The base material for aggregate shall be of acceptable quality, crushed to specified sizes, and free from an excess of flat, elongated, soft or disintegrated pieces, dirt, or other unsuitable matter.
- E. Recycled asphalt pavements from the demolitions (if used) shall be restricted to a maximum of 25 percent of the total mix by weight. The percentage of aggregate from recycled bricks shall not be more than 15 percent of the total mix by weight.
- F. The method used in the production of crushed material shall be such that the finished product shall be as consistent as practicable. If necessary, to meet this requirement or to eliminate an excess of fine particles, the crushed material shall be screened.
- G. All material passing the No. 4 mesh sieve produced in the crushing operation of either the stone, gravel, or during recycling, shall be incorporated in the base material to the extent permitted by the gradation requirement.
- H. The gradation shall be within the limits as per Table 1 when tested in accordance with ASTM C 136. The gradations of the table represent the limits which shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be well graded from coarse to fine size.

ASTM Sieve		Percentage by Weight Passing Sieves	
Size		A	B
1½"	(37.5 mm)	100	--
1"	(25.0 mm)	55 – 95	100
¾"	(19.0 mm)	45 – 80	70 – 100
No. 4	(4.75 mm)	30 – 60	35 – 65
No. 40	(0.425 mm)	10 – 35	15 – 30
No. 200	(0.150 mm)	0 – 15	0 – 15

Table 1: Aggregate Grading Requirements

- I. The portion of the base aggregate, including any blended material, passing the No. 40 sieve

shall have a liquid limit of not more than 25% and a plasticity index of not more than 4% when tested in accordance with ASTM D 423 and D 424.

- J. Unsuitable material like roots, sod, weeds, wood particles and plastic shall be removed from the base aggregate.

2.2 PORTLAND CEMENT

- A. Portland cement shall be a standard brand and shall conform to the latest standard requirements of ASTM C 150 for the type I cement. Cement with pozzolanic additives are also allowed, in which case the pozzolanic content shall be up to a maximum of 30 percent by weight (ASTM C595).

2.3 WATER

- A. Water shall be in accordance with section "Construction Water".

PART 3 - EXECUTION

3.1 CEMENT CONTENT

- A. The minimum cement content shall be 4% by weight of dry aggregate.

3.2 COMPOSITION

- A. Prior to construction, laboratory tests on specimen of aggregate, cement and water shall be conducted to determine the job mix formula.
- B. Test specimens containing various amounts of cement shall be compacted in accordance with ASTM D 1557 (Method C) and the optimum moisture content for each amount of cement shall be determined.
- C. Samples compacted at OMC shall be subjected to the compressive and split tensile strength tests after a period of 28 day moist curing and 4 hours soaking. The number of test specimens for each cement content shall be as per clause 3.2E.
- D. Test specimens containing various amounts of cement shall be compacted at OMC and tested to meet the strength as per Table 2.

	Characteristic Strength	Compressive	Characteristic Strength	Flexural
7 days	> 7.5 MPa		N/A	
28 days	> 10.0 MPa			> 2.0 MPa

Table 2: Laboratory Strength Requirements

- E. Characteristic strength shall be calculated as the average minus one (1) standard deviation as calculated for a minimum of six (6) test.
- F. The flexural strength may be computed from the split tensile tests as per ASTM C-496 on specimens prepared as per Clause 3.2B. The flexural strength is (split tensile strength x 1.5) in N/mm².
- G. The test results for the compressive strength shall be tested as per ASTM D 1633. No correction for the L/D ratio is required.
- H. A relation between 7 days and 28 days strength of the selected cement content which satisfies 28 day strength may be used for field control.
- I. Specimens shall be tested after moist curing for 7 days or 28 days as applicable and 4 hours of soaking.
- J. Of the accepted laboratory mix, the average laboratory dry density (based on 6 specimens) shall be determined in accordance with ASTM D 1557, Method C.

3.3 WEATHER LIMITATIONS

- A. The cement treated base shall not be placed when the weather is rainy.

3.4 OPERATIONS IN PITS AND QUARRIES

- A. The material shall be obtained from borrow pits, quarries or recycled that have been approved. The material shall be excavated and handled in such a manner that a uniform and satisfactory product can be secured.

3.5 EQUIPMENT

- A. All equipment necessary for the proper construction of this work shall be in good working condition, and shall have been approved by the Engineer before construction is permitted to start.
- B. Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design.
- C. The processing equipment shall be designed, constructed, and operated and shall have sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a cement treated base course of the gradation and consistency as required.

3.6 FORMS AND SPREADING

- A. The preferred method of laying of the Cement Treated Base shall be by using a spreading equipment without side forms.

- B. In order to achieve proper level and grade control, the topmost layer of the cement treated base shall be laid by a mechanical paver.
- C. The layers below the topmost layer can be laid by using a self-propelled motor grader, a power shovel or similar equipment.
- D. The spreading equipment and supply of base mixture shall permit a continuous and satisfactory spreading of material and compaction to the proper thickness and grade.

3.7 PREPARING UNDERLYING COURSE

- A. Before any cement treated base course material is placed, the underlying course shall be prepared and conditioned as specified.
- B. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.
- C. Grade control between the edges of the pavement shall be by means of grade stakes, steel pins, or forms placed in lanes parallel to the centreline of the pavement and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.
- D. To protect the underlying layer and to ensure proper drainage, the spreading of the cement treated base course shall begin along the centreline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

3.8 MIXING

- A. Cement-treated base shall be mixed at a central mixing plant by either batch or continuous mixing. The aggregates and cement may be proportioned either by weight or by volume.
- B. Aggregates for the cement-treated base shall be separated into at least two sizes and each size shall be stored separately. One storage bin shall contain aggregate retained on a No. 4 sieve.

The second storage bin shall contain aggregate finer than a No. 4 sieve.

- C. In all plant, water shall be proportioned by weight or volume, and there shall be means by which the Engineer may readily verify the amount of water per batch or the rate of flow for continuous mixing. The discharge of the water into the mixer shall not be started before part of the aggregate is placed into the mixer.
- D. The inside of the mixer shall be kept free from any hardened mix.
- E. In all plant, cement shall be added in such a manner that it is uniformly distributed throughout the aggregates during the mixing operation.
- F. The charge in a batch mixer, or the rate of feed into a continuous mixer shall not exceed that which will permit complete mixing of all the material.
- G. The mixing time in a continuous mix plant shall be not less than 50 seconds, except that the time may be reduced when tests indicate that the requirement for cement content and

compressive strength can be consistently met.

- H. When the mix is hauled in non-agitating trucks, no more than 45 minutes shall elapse from the time water is added to the mix, until it is deposited in place at the job site.

3.9 PLACING AND COMPACTING

A. Placing

1. The use of mixers having a chute delivery shall be permitted if chutes, baffle plates, etc., shall ensure the placing of the cement-treated base without segregation.
2. The prepared underlying course shall be free of all ruts or soft yielding places. The surface, if dry, shall be moistened but not to the extent of producing a muddy condition at the time the base mixture is placed.
3. Trucks for transporting the mixed base material shall be provided with protective covers. The truck shall have a minimum payload capacity of 10 tons.
4. The material shall be spread on the prepared underlying course to such depth that, when thoroughly compacted, it will conform to the grade and dimensions shown on the plans.
5. Cement Treated Base shall be laid in layers, not exceeding a compacted thickness of 250 mm. This limitation can be waived by the engineer, if the contractor can demonstrate adequate compaction for thicker layers. The minimum single layer compacted thickness is 150 mm.
6. When the construction of CTB involves more than one layer, the lower layer shall be rough finished using hand rakes. This is to encourage bonding between the layers. The second and the subsequent layer of CTB can be laid and compacted, 24 hours after laying the lower layer. The lower layers shall be moistened before applying the subsequent layer to encourage bonding between the layers.
7. Not more than 30 minutes shall elapse between the time the base material is mixed and the time it is deposited in place. This requirement may be adjusted based on site conditions, rate of hardening of the mix and subsequent strength development with the prior approval of the engineer.
8. The equipment and methods employed in spreading the base material shall ensure accuracy and uniformity of depth and width.

B. Compacting

1. Immediately upon completion of the spreading operations, the base material shall be thoroughly compacted and not more than 45 minutes shall elapse between the time of spreading and the completion of the final rolling to obtain maximum density.
2. Rollers, in sufficient number, size, and type shall be provided to obtain the specified results.

3. Care shall be exercised in routing construction equipment to avoid the formation of unnecessary ridges due to wheel tracks or tractor treads.
4. If necessary, the base material after compaction shall be trimmed by means of a self-propelled motor grader to the grade and section shown on the drawings. All material loosened in this operation shall be swept from the surface before any further rolling.
5. Finishing operations shall continue until the surface is true to the specified cross section with a tolerance of 10 mm above or below the design levels and until the surface shows no variations of more than 6 mm from a 3 metre straightedge laid in any location parallel with, or at right angles to, the longitudinal axis of the pavement.
6. The thickness tolerance is - 10 mm/+ 10 mm.
7. Field compaction tests shall be determined for at least one location for every 500 m² of cement treated base course. The minimum compaction requirement is 98% of the laboratory density at optimum moisture content.
8. Field densities shall be determined in accordance with ASTM D 1556. Calibrated nuclear density apparatus can also be used for field density determination.
9. No equipment or traffic which, in the opinion of the Engineer, will damage the cement treated base course or the curing material shall be permitted on the finished base course during the first 24-hour of the curing period.

3.10 PRE-CRACKING

- A. Pre-cracking into small panels prevents uncontrolled shrinkage cracks and limits thermal movements due to temperature changes.
- B. Each layer of the Cement Treated Base shall be pre-cracked to a panel size not exceeding 3.5 x 3.5 m for flexible pavement. For rigid pavement (PCC), pre-cracking should match approximately (\pm 50 mm) the joint pattern of the PCC slabs. Any of the following methods can be employed by the Contractor:
 1. forming the crack in green CTB by using vibrating plates with a cutting plate.
 2. by cutting the joint in the green CTB by a cutting wheel.
- C. The created joint either by the vibrating plate or by the cutting wheel shall be sprayed with bitumen emulsion to prevent the re-welding of the cut joint due to compaction or any other reason.
- D. The depth of the pre-crack shall be at least one third (1/3) the thickness of the layer compacted.
- E. Precracking may be done after partial compaction or full compaction.

3.11 CONSTRUCTION JOINTS

- A. At the end of each day's run a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true transverse vertical face.

- B. These faces shall be protected by banking damp earth against them or by other approved suitable methods.
- C. The protection provided for construction joints shall permit the placing, spreading, and compacting of base material without injury to the work previously laid.
- D. When a longitudinal construction joint is required in part-width construction, side forms shall be used or it shall be formed by cutting back into the compacted material to form a true vertical edge.
- E. Care shall be exercised to ensure thorough compaction of the base material immediately adjacent to all construction joints.
- F. Before depositing new material against consolidated material, the surface of the joint shall be cleaned, and wetted.

3.12 PROTECTION AND CURING

- A. After the cement treated base course has been finished as specified herein, it shall be protected against drying for a period of 7 days by wetting with water. Moisture retaining mats or woven jute fabric shall be used during the curing period.
- B. The curing shall begin as soon as possible, but no later than 4 hours after the completion of finishing operations. In any event the freshly laid surface shall not be allowed to become dry.

3.13 FREQUENCY OF PRODUCTION CONTROL

- A. Samples of aggregate, filler and binder shall be furnished and tested by the Contractor, as indicated in Table 3, prior to delivery at the job site and prior to the start of and at intervals during production.

Test Description		Frequency of Tests
1.	Grading	Daily
2.	Liquid Limit / Plasticity Index	each 5,000 m3
3.	Compressive Strength 7 days	4 per day
	28 days	2 per day
4.	Layer Thickness	4 tests per lot
5.	Field Compressive Strength (7 days)	3 tests per lot
6.	Field Compaction	4 tests per lot

Table 3: Schedule for Quality Control Testing

3.14 FIELD ACCEPTANCE

- A. The Contractor shall cut at least 4 cores of 150 mm dia. out of every 2,000 m² (defined as a lot) of completed cement treated base course after 7 days curing, for the determination of compressive strength. The location of the cores shall be decided by the Engineer.
- B. The routine acceptance of the CTB shall be per lot and shall be based on the following twin criteria:
 - 1. The laboratory characteristic strength shall be equal to or exceed the requirements of Table 2.
 - 2. The field compaction shall be as specified in Clause 3.9B.7
- C. If the routine acceptance criteria at clause 3.14B are not met, then the field cores, extracted per lot, shall be tested for compressive strength as per ASTM D 1633. The cores to have a ratio $L/D = 1$.
- D. If the average core compressive strength is equal to or more than the laboratory average compressive strength and the strength of the individual cores shall be at least 90 percent of the laboratory characteristic strength, then the lot will be accepted. The laboratory average compressive strength is equal to the specified 7 days characteristic strength + 1 x standard deviation as determined in the laboratory.
- E. When the core test results of a lot do not meet the requirements of Clause 3.14D, then the area shall be replaced at the Contractor's expense. Additional cores may be drilled to isolate the extent of the CTB to be removed, subject to the approval of the Engineer.
- F. In addition to the above, the routine production control tests as specified in Clause 3.13A shall also be met.

- G. Finishing and level tolerances shall comply with Clause 3.9B.

END OF SECTION

SECTION 32 11 33.23 RECYCLED BASE COURSE

PART 1 – GENERAL

1.1 Description

- A This Section covers the requirements for the construction of a (sub)base course from in situ pavement layerworks by in-situ recycling, constructed on an underlying course in accordance with this specification and in conformity with the dimensions shown on the drawings.
- B The recycled (sub)base material shall only be used as pavement structural layers for runway, taxiway and apron shoulders, blast pad & overruns, and lightly trafficked roads at locations shown on the drawings.

1.2 Standard Test Methods

- A. The following testing requirements apply:

Test Short title

ASTM C 136 Sieve analysis

ASTM D 1556 Density of soil in place

ASTM D 1557 Moisture-density relations (method C) ASTM D 1883 California Bearing Ratio (CBR) ASTM D 2922 Nuclear testing of in situ density ASTM D 4318 Liquid limit, Plastic limit

and Plasticity Index

PART 2 – PRODUCTS

2.1 Materials

- A. The base material shall consist of in situ pavement layerworks, or milled and crushed material from asphalt pavements, recycled granular bases and granular aggregates or a combination of the above.
- B. Milled or crushed material from asphalt pavement when used as aggregate for manufacturing the base course shall be restricted to 40 percent of the combined aggregate.
- C. The base material may be mixed or blended with fine sand, stone dust, or other similar binding or filler material produced from approved sources.
- D. The base material shall also be stabilised with a minimum of 3% cement by mixing or blending or in-situ recycling (by recycler).
- E. The specified cement content for construction shall be that at which the weight loss of either the wet-dry or the freeze-thaw is not more than 14% for granular soils, 10% for granular and silty soils, and 7% for clay soils.

2.2 General

- A. The recycled base course shall be placed where designated on the drawings. The material shall be shaped and thoroughly compacted within the tolerances specified.
- B. The method of placing and compacting shall not produce segregation of material. Any areas of segregation shall be removed and replaced.

2.3 Equipment

- A. All equipment necessary for the proper construction of this work shall be in good working condition, and shall have been approved by the Engineer before construction is permitted to start.
- B. Milling equipment when used for in place mixing shall be of sufficient capacity and good working condition and shall have been approved by the engineer.
- C. Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design to ensure uniform application.
- D. The equipment shall have sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a base course of the gradation and consistency as required.

2.4 Preparing Underlying Course

- A. When recycled base material is manufactured in a plant, transported and placed, the underlying course shall be prepared and conditioned as specified. The course shall be approved by the Engineer before placing and spreading operations are started.
- B. Grade control between the edges of the pavement shall be by means of grade stakes and steel pins placed in lanes parallel to the centreline of the pavement and at intervals which will permit string lines to be placed properly.

2.5 Plant Mixing

- A. When materials from several sources are to be blended and mixed, these materials shall be processed in a central or travelling mixing plant. The material shall be thoroughly mixed with the required amount of water.
- B. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of the moisture content.

2.6 Milling and Mixed in Place

- A. Existing pavement may be recycled in place by milling to the depth required and mixing the milled material in place.
- B. If necessary, a layer of new granular material may be placed on the pavement prior to milling, to achieve a better grading or raise the level of the finished base course.
- C. In any case the milled material together with any new granular material shall be thoroughly mixed in place by suitable equipment.
- D. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough remixing.
- E. Water shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its optimum moisture content.
- F. When the mixing has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness, grade and levels.

2.7 Placing

- A. The base course shall be constructed in layers. Any layer shall not be less than 75 mm nor more than 300 mm of compacted thickness.
- B. The base, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square metres in advance of the rolling. Any necessary sprinkling of water shall be kept within this limit.
- C. During the milling, mixing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, or objectional material in the base course mixture.

2.8 Finishing and Compacting

- A. After spreading or mixing, the material shall be thoroughly compacted by rolling and sprinkling, when necessary.
- B. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the course. Rolling shall progress gradually from the sides to the centre of the lane under construction, or from one side towards previously placed material, by lapping uniformly each preceding track by at least 300 mm.
- C. The rolling shall continue until the material is thoroughly set and stable, and the course has been compacted to not less than 100% of maximum dry density at optimum moisture as determined by ASTM D 1557, Method C.
- D. Tests for field density shall be made in accordance with ASTM D 1556. Nuclear density determination in accordance with ASTM D 2922 can be used to supplement the field control, if it is properly correlated with actual field densities.
- E. Blading and rolling shall be done alternately, as required or directed, to obtain a Smooth, even, and uniformly compacted course.
- F. The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the underlying course.
- G. Water shall not be added in such a manner or quantity that free water will reach the underlying layer and cause it to become soft.
- H. Along places inaccessible to rollers, the material shall be tamped thoroughly with mechanical tampers.

2.9 Surface Finish Tests

- A. After the course is completely compacted, the surface shall be tested for smoothness and accuracy of grade and level; any portion found to lack the required smoothness or to fail in accuracy of grade or level shall be scarified, reshaped, recompacted, and otherwise

manipulated until the required smoothness and accuracy are obtained.

- B. The finished surface shall not vary more than 10 mm when tested with a 3 metre straightedge applied parallel with and at right angles to the centre line at a uniform slope. The straight edge at right angle to the centre line shall be laid at least 1 m away from the crown of the pavement.

2.10 Thickness and Finished Levels

- A. The thickness of the completed base course shall be checked by depth tests.
- B. Deficiencies in thickness are allowed between the tolerances for elevation of the underlying layer and the top of the constructed course.
- C. The elevations of the finished surface shall not vary more than 10 mm from the design elevations.
- D. The levelling of the finished course shall be performed by the Contractor in a grid as agreed with the Engineer.
- E. The Contractor shall submit all levels in due time to the Engineer for checking and approval.
- F. Any deviation of the finished elevations from the design elevations outside the tolerances, shall be corrected by the Contractor by scarifying, removing and/or adding material, sprinkling, rolling, reshaping, and finishing in accordance with these specifications.
- G. The Contractor shall replace the material when excavations are made for test purposes.

2.11 Schedule of Tests and Frequencies for Subbase

A

Test Description	Designation	Requirement	Frequency
Grading	ASTM C 136 envelope	once daily	
Field compaction	ASTM D 1556 ASTM D 2922	min. 100% min. 100%	each 500 m ² each 250 m ²
Liquid Limit Plasticity index	ASTM D 4318 ASTM D 4318	max. 25% max. 6%	each 2,500 m ³ each 2,500 m ³

CBR, laboratory Soaked	ASTM D 1883	min. 80%	once daily
Layer thickness	-	-	each 500 m ²

B Quality testing of recycled base material shall be done well in advance before supply to the job site (plant mixing) or before full scale commencement of milling and mixing in place.

The Contractor shall produce a schedule so that the materials can be tested and results approved without causing undue delay to the works.

2.12 Protection

A. Work on the base course shall not be conducted when the layer below is too wet. This shall be defined by the Engineer

2.13 Maintenance

A. Following the final shaping of the material, the base shall be maintained by the use of graders and rollers until the base meets all requirements and is acceptable for the construction of the next course. This shall be approved by the Engineer.

END OF SECTION

SECTION 32 12 13.16 BITUMINOUS TACK COAT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material, in order to ensure a bond between this surface and the overlying course, in accordance with this specification or as directed by the Engineer.

1.2 REFERENCES

- A. Standard Material Specifications:

ASTM D 946 Penetration Graded Asphalt Cement for Use in Pavement Construction

ASTM D 977 Emulsified Asphalt

ASTM D 2028 Cutback Asphalt (Rapid-Curing Type) ASTM D 2397 Cationic Emulsified Asphalt

1.3 RELATED SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

- A. The type, grade, controlling specification, and application temperature of bituminous material to be used shall conform to the requirements of Table 1.

Type and Grade	Specification	Application Temperature (deg. C)
Emulsified Asphalt		
SS-1, SS-1h	ASTM D 977	25 – 55
CSS-1, CSS-1h	ASTM D 2397	25 – 55
Cutback Asphalt		
RC-70 (RC-1)	ASTM D 2028	50 – 75
RC-250 (RC-2)	ASTM D 2028	65 – 95
Straight Bitumen		

PEN 60-70	ASTM D 946	> 100
PEN 85-100	ASTM D 946	

Table 1: Bituminous Material

2.2 CONTRACTOR'S RESPONSIBILITY FOR BITUMINOUS MATERIAL

- A. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approval obtained before use of such material begins.
- B. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the Contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.
- C. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material.
- D. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.
- E. The Manufacturer's Certificate of Guarantee shall be submitted.

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 15 degree celcius.
- B. The temperature requirement may be waived, but only when so directed by the Engineer.

3.2 EQUIPMENT

- A. The equipment used by the Contractor shall include a power broom and/or blower, a distributor and equipment for heating bituminous material.
- B. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent.
- C. Distributor equipment shall include a tachometer, pressure gauges, volume- measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents.
- D. The distributor shall be self-powered and shall be equipped with a power unit for the pump

and full circulation spray bars adjustable laterally and vertically.

3.3 APPLICATION AND QUANTITY OF BITUMINOUS MATERIAL

- A. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or airblast, supplemented by hand brooms, if necessary, to remove all loose dirt and other objectionable material.
- B. After removing the dust and all other objectionable material, and prior to the application of the bituminous material, an inspection shall be made of the course to determine its fitness to receive the bituminous material. That portion of the surface of the course proposed for immediate treatment must be dry and in satisfactory condition.
- C. Emulsified and cutback asphalt shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.
- D. If penetration grade bitumen is used as tack coat, curing period is not necessary.
- E. The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate specified per unit area.
- F. In order to determine the exact amount necessary, the Engineer may order trial areas. The application rate shall be between 0.2 and 0.7 kg/m², depending on the condition of the existing surface.
- G. The type of bituminous material and application rate shall be approved by the Engineer prior to application.
- H. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer.
- I. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

END OF SECTION

SECTION 32 12 13.23 BITUMINOUS PRIME COAT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of an application of bituminous material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

1.2 REFERENCES

A. Standard Material Specifications: ASTM D 977 Emulsified Asphalt
ASTM D 2027 Cutback Asphalt (Medium-Curing Type) ASTM D 2028 Cutback Asphalt
(Rapid-Curing Type) ASTM D 2397 Cationic Emulsified Asphalt

1.3 RELATED SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

- A. The type, grade, controlling specification, and application temperature of bituminous material to be used shall conform to the requirements of **Error! Reference source not found.**

Type and Grade	Specification	Application Temperature (deg. C)
Emulsified Asphalt		
SS-1, SS-1h	ASTM D 977	20 – 70
MS-2, HFMS-1	ASTM D 977	20 – 70
CSS-1, CSS-1h	ASTM D 2397	20 – 70
CMS-2	ASTM D 2397	20 – 70
Cutback Asphalt		
MC-30	ASTM D 2027	30 – 55
MC-70	ASTM D 2027	50 – 75
RC-30	ASTM D 2028	> 30
RC-70 (RC-1)	ASTM D 2028	> 50
RC-250 (RC-2)	ASTM D 2028	> 75

Table 1: Bituminous Material

2.2 CONTRACTOR'S RESPONSIBILITY FOR BITUMINOUS MATERIAL

- A. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approval obtained before use of such material begins.
- B. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the Contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.
- C. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material.
- D. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.
- E. The Manufacturer's Certificate of Guarantee shall be submitted.

PART 3 - EXECUTION

3.1 WEATHER CONDITIONS

- A. The prime coat shall be applied only when the average moisture content of the full depth of the base is less than 80% of the optimum moisture content, but contains sufficient moisture to ensure uniform distribution of the bituminous material, when the atmospheric temperature is above 15 deg C, when the weather is not foggy or rainy, or when there is a dust storm.
- B. The temperature requirement may be waived, but only when so directed by the Engineer.

3.2 REQUIRED EQUIPMENT

- A. The equipment used by the Contractor shall include a power broom and/or blower, a distributor and equipment for heating bituminous material.
- B. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent.
- C. Distributor equipment shall include a tachometer, pressure gauges, volume- measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents.
- D. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

3.3 APPLICATION

- A. Immediately before applying the prime coat, all loose dirt and other objectionable material shall be removed from the surface, with a power broom and/or blower as required.
- B. If the surface of the base has dried to the extent that it is dusty, it shall be lightly sprinkled with water before the prime coat is sprayed.
- C. The bituminous material shall be applied by means of a distributor of a rate and at a temperature within the range specified herein.
- D. Following the application, the primed surface shall be allowed to dry for a period of not less than 48 hours without being disturbed, or for such additional time as may be necessary to permit the drying out of the prime coat until it will not be picked up by traffic or equipment. This period will be determined by the Engineer.
- E. The surface shall then be maintained by the Contractor until the surfacing has been placed.
- F. Appropriate precautions shall be taken by the Contractor to protect the primed surface against damage during this period, including supplying and spreading any sand necessary to blot up excess bituminous material.
- G. The appropriate amount of bituminous material for the prime coat shall be 1.0 to 1.5 kg/m². The exact amount shall be specified by the Engineer. In order to determine the exact amount necessary, the Engineer may order trial areas.

END OF SECTION

SECTION 32 12 16.13 ASPHALT CONCRETE SURFACE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of a course composed of mineral aggregate, filler and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with this specification.
- B. Each course shall be constructed to the depth, typical section or elevation required by the drawings or as indicated by the Engineer and shall be rolled, finished and approved before the laying of the next course.

1.2 REFERENCES

A. Testing Requirements

ASTM C 29 Unit Weight and Voids in Aggregate ASTM C 88 Soundness of Aggregates
ASTM C 117 Materials finer than 75-m (No. 200) Sieve in Mineral Aggregates by washing
ASTM C 127 Specific Gravity and Absorption of Coarse Aggregate ASTM C 128 Specific Gravity and Absorption of Fine Aggregate
ASTM C 131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the L.A. Machine
ASTM C 136 Sieve Analysis of Fine and Coarse Aggregates ASTM C 142 Clay Lumps and Friable Particles in Aggregates ASTM C 183 Practice for) Sampling and the Amount of Testing of Hydraulic Cement ASTM D 75 Sampling Aggregates
ASTM D 792 Density and Specific Gravity of Plastics by Displacement ASTM D 1188 Bulk Specific Gravity of Compacted Bituminous Mixtures using Paraffin-Coated Specimens
ASTM D 1559 Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus
ASTM D 1664 Coating and Stripping of Bitumen-Aggregate Mixtures ASTM D 2041 Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
ASTM D 2172 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419 Sand Equivalent Value of Soils and Fine Aggregate ASTM D 2726 Bulk Specific Gravity of Compacted Bituminous Mixtures

using Saturated Surface-dry Specimens

ASTM D 2950 Density of Bituminous Concrete in Place by Nuclear Method ASTM D 3203
Percent Air Voids in Compacted Dense and Open

Bituminous Paving Mixtures

ASTM D 3549 Thickness or height of compacted bituminous paving mixture.

ASTM D 3625 Effect of Water on Bituminous-Coated Aggregate

ASTM D 4123 Indirect Tension Test for Resilient Modulus of Bituminous Mixtures

ASTM D 4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils. ASTM D 4867 Effect
of Moisture on Asphalt Concrete Paving Mixtures.

AASHTO T 30 Mechanical Analysis of Extracted Aggregate EN 933-9 Methylene Blue Test
The Asphalt Institute's Manual Series No. 2 (MS-2)

B. Material Specification Requirement

ASTM D 242 Mineral Filler for Bituminous Paving Mixtures

ASTM C 946 Penetration-Graded Asphalt Cement for Use in Pavement Construction

C. Plant Requirements

ASTM D 995 - Requirements for Mixing Plants

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 32 12 73.13 Hot to Cold Joint Preparation
2. Section 01 71 13-13 Mobilisation Demobilisation

PART 2 - PRODUCTS

2.1 AGGREGATE

A. General

1. Aggregate shall consist of crushed stone or crushed gravel. Natural sand can be blended if allowed by these specifications.

2. The definition of the various portions of material is as follows:

- a) Coarse aggregate: material retained on the No. 8 sieve (size > 2.4 mm);
- b) Fine aggregate: material passing the No. 8 sieve and retained on the No. 200 sieve (0.075 mm < size < 2.4 mm);
- c) Mineral filler: material passing the No. 200 sieve (size < 0.075 mm).

B. Coarse Aggregate

1. Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances.
2. The aggregate shall comply with the requirements as shown in Table 1.

C. Fine Aggregate

1. Fine aggregate shall consist of clean, sound, durable, angular particles produced by crushing stone or gravel.
2. To obtain the required gradation of aggregate blend or to improve the workability, natural sand may be used. The amount of sand to be added shall be adjusted to produce mixtures conforming to the requirements of this Section. If it is necessary to add natural sand, the percentage shall be kept below 15% (calculated by weight of total mixture).
3. The aggregate shall comply with the requirements as shown in Table 1.

D. Filler

1. The Contractor shall be aware that the mineral filler, naturally present in the crushed aggregate shall comply with the requirements in Table 1. In case of non-compliance, the natural filler shall be completely discarded from the blended aggregate and replaced with manufactured filler.
2. Manufactured filler shall be from limestone and shall comply with the requirements in Table 1.

E. Summary of Aggregate Requirements

Test	Size	Requirement	Reference
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Grading	combined	Table 4	
	filler	ASTM D 242	ASTM D 242
Shape			
- Two or more fractured faces	coarse	> 95% (w/w)	ASTM D 5821
- One or more fractured faces	coarse	>100% (w/w)	ASTM D 5821
- Flat and elongated pieces ratio 3:1	coarse	< 15% (w/w)	ASTM D 4791
Water Absorption	coarse	< 3%	ASTM C 127
	fine	< 3%	ASTM C 128
Sand Equivalent	fine	> 65%	ASTM D 2419
Angularity	fine	> 45%	ASTM C 1252
Aggregate Impact Value	10-14 mm	< 30%	EN 13043
Ten Percent Fines Value	10-14 mm	> 150 kN	EN 13043
Wear (Los Angeles Abrasion Value)	coarse	< 35%	ASTM C 131
Sodium Sulphate Soundness Loss ⁽¹⁾	coarse	< 9%	ASTM C 88
Magnesium Sulphate Soundness Loss ⁽¹⁾	coarse	< 12%	ASTM C 88
Clay/friable particles	fine	< 3%	ASTM C 142
Plasticity Index	filler	< 4	ASTM D 4318
Harmful fines by Methylene Blue	filler	< 1.9 MEQ/	EN 933-9
(1) only one of these tests needs to be conducted. Tests to be conducted at five cycles. Tests are not applicable to high carbonate aggregates			
(CaCo3 > 65%) MEQ= milli-equivalents absorbed by 100 g of filler.			

Table 1: Aggregate Requirements

F. Preliminary Material Acceptance

1. Sources of aggregate shall be selected well in advance of the time the materials are required on site. An inspection of the producer's operation may be made by the Engineer.
2. Prior to delivery of materials to the site, the Contractor shall submit test reports to the Engineer for the following materials:
 - a) Coarse Aggregate

- 1) Percent of Wear
- 2) Soundness
- 3) Water Absorption
- b) Fine Aggregate
 - 1) Angularity
 - 2) Sand Equivalent
 - 3) Clay/Friable Particles
- c) Filler
 - 1) Plasticity Index
 - 2) Swelling Potential
3. Preliminary acceptance of the aggregates by the Engineer does not relieve the Contractor from the obligation to supply aggregates to the site in full compliance with the requirements in this specification.
4. Failure to obtain preliminary acceptance from the Engineer shall mean that the Contractor shall identify another source of aggregates.

2.2 ANTI-STRIPPING AGENT

- A. Anti-stripping agent shall be added, if necessary, to meet the requirements of the Job Mix Formula (JMF).
- B. If ordinary Portland cement is used as an anti-stripping agent, it shall be restricted to a maximum of 1% by weight of the combined aggregate.

2.3 BITUMINOUS MATERIAL

- A. The type, grades and controlling specifications for the unmodified bituminous base material shall be as follows:
 1. Penetration grade: 60-70
 2. Specification: ASTM D 946
- B. Additional field tests may be required by the Engineer before acceptance of:
 1. Penetration;
 2. Softening Point;

2.4 COMPOSITION

A. Mixtures

1. The asphalt mix shall be composed of a mixture of aggregate, filler and bituminous material.
2. The several aggregate fractions shall be combined in such proportions that the resulting mixture meets the grading requirements of the following:
 - a) Laboratory Trial Mix Formula (LTMF);
 - b) Field Job Mix Formula (FJMF).

B. Laboratory Trial Mix Formula

1. No asphalt mixture for pavement shall be produced until a Laboratory Job Mix Formula (LJMF) has been approved by the Engineer. Details of the JMF shall be submitted at least 15 days prior to first trials.
2. The LTMF shall be based on volumetric mix design.

C. Volumetric Mixture Design

1. The bituminous mixture shall be designed using testing methods and procedures contained in Chapters 2, 3, 4 and 5, Marshall Method of Mix Design, The Asphalt Institute's Manual Series No. 2 (MS-2), current edition.
2. The Contractor shall prepare a series of test specimens for a range of different asphalt contents, so that the test data show a well-defined curve. To provide adequate data, triplicate test specimens shall be prepared for each asphalt content to be used.
3. The requirements of Table 3 and Table 4 shall be met for this stage. The requirements of Table 3 and Table 4 are target values necessary to meet the acceptance requirements contained in Clause 3.6.
4. The gradations in Table 4 represent the limits that shall determine the suitability of aggregate for use in the source of supply. The selection of the maximum aggregate size shall be as indicated in Table 2.

Layer Thickness	Maximum Aggregate Size
< 50 mm	12.5 mm
>50 mm	19 mm

Table 2: Maximum Aggregate Size

Criterion	Requirement
Number of Blows	2 x 75

Stability, in Newton	> 8,000
Flow, in mm	3 – 6
Air Voids, percent	3 – 5
Marshall Quotient, N/mm (= Stability/Flow)	2,000 – 3,000
Percent Voids in Mineral Aggregate (VMA)	see Table 5

Table 3: Marshall Criteria

ASTM		Percentage by Weight Passing Sieves			
Sieve Size		25 mm max	19 mm max	16 mm max	12.5 mm max
1 1/4"	(32.0 mm)	--	--	--	--
1"	(25.0 mm)	100	--	--	--
3/4"	(19.0 mm)	76 - 98	100	--	--
5/8"	(16.0 mm)	--	90 –100	100	--
1/2"	(12.5 mm)	66 – 86	78 – 98	79 – 99	100

3/8"	(9.5 mm)	55 – 77	68 – 88	70 – 90	78 – 98
No. 4	(4.75 mm)	40 – 60	48 – 68	55 – 75	58 – 78
No. 8	(2.36 mm)	26 – 46	33 – 53	35 – 55	39 – 59
No. 16	(1.18 mm)	17 – 37	20 – 40	20 – 40	26 – 46
No. 30	(0.60 mm)	11 – 27	14 – 30	16 – 30	19 – 35
No. 50	(0.30 mm)	7 – 19	9 – 21	10 – 22	12 – 24
No. 100	(0.15 mm)	6 – 16	6 – 16	7 – 16	7 – 17
No. 200	(0.075 mm)	3 – 6	3 – 6	3 – 5	3 – 6
Bitumen Content		4.5 – 7.0	5.0 – 7.5	5.5 – 7.5	5.5 – 8.0
VMA %		> 13	> 13	> 13	> 14

Table 4: Aggregate Grading Requirements

5. Bitumen content shall be calculated by weight of total mixture, excluding absorption.
6. The percentages in Table 4 are based on dry sieving. When the aggregate contains much fine dust, or clay, which might cling to the coarser aggregate particles, washed sieve analysis may be used. The percentages shown in Table 4 shall be adjusted for wet sieving, tested as per ASTM C 117.
7. The Loss of Stability shall not be more than 25 percent determined as follows:
 - a) Submerge tablets in water at 60 °C for 30 minutes and determine Marshal Stability - result (a);
 - b) Submerge tablets in water at 60 °C for 24 hours - result (b);
 - c) Loss of Stability calculated as (a-b)/a x 100%.

D. Mix Tolerances

1. The tolerances shown in Table 5 shall be applied to the FJMF to establish a job control-limits.

Material	Tolerance
Aggregate passing No. 4 sieve or larger	± 7%
Aggregate passing Nos. 8, 16, 30 and 50 sieves	± 4%
Aggregate passing Nos. 100 and 200 sieves	± 1%

Bitumen content	$\pm 0.3\%$
Temperature	$\pm 10\text{ }^{\circ}\text{C}$

Table 5: Job Mix Tolerances

PART 3 - EXECUTION

3.1 TEST SECTION

- A. Prior to full production, the Contractor shall prepare a quantity of bituminous mixture according to the LTMF, sufficient to construct a test section at least 30 m long and 5 m wide and shall be of the same depth specified for the construction of the course which it represents.
- B. The trial mixtures shall be laid at a location selected by the Engineer with the spreading and compacting equipment the Contractor proposes to use.
- C. The test section shall determine the appropriate method of spreading, compacting and finishing the bituminous mixture to comply with the specifications.
- D. If the test results should prove to be unsatisfactory, the necessary adjustments to the mix design, plant operation and work procedures shall be made till the plant can produce a mix as per the LJMF and within the tolerances as per Table 5. This mix shall be the FJMF (Filed Job Mix Formula) subject to approval by the Engineer. Full production shall not start prior to approval by the Engineer of the FJMF.
- E. When test sections do not conform to specification requirements, the layer(s) shall be removed and replaced at the Contractor's expense.
- F. The trials during the test section shall establish the following:
 - 1. Maximum mixing temperature in the plant for both aggregate and modified binder. (Guideline: not more than 175°C);
 - 2. Minimum temperature of the mixture behind the paver. (Guideline: not less than 150°C);
 - 3. Preferred temperature to achieve maximum compaction. (Guideline: 140 – 160°C);
 - 4. Layer temperature for finishing compaction using steel wheel rollers and PTR, without causing damage. (Guideline: 100 – 120°C);
- G. If the test sections are successful, establish a correlation between nuclear method of density determination and core density with at least 12 separate tests.

3.2 WORK PROCEDURE AND QUALITY ASSURANCE PLAN

- A. After the approval of the test section, the Contractor shall prepare and submit to the Engineer a detailed Work Procedure and a Quality Assurance Plan.
- B. The contents shall include as a minimum:
 - 1. Description of work;
 - 2. Work organization and responsibilities;
 - 3. Method of testing and reporting;

4. Method, sequence and authority for correction measures based on laboratory & field tests (job mix, mixing plant and working methods);
 5. Remedial measures in case of non-acceptance.
- C. Full production shall not begin without the approval of the Engineer of the Work Procedure and Quality Assurance Plan.

3.3 WEATHER LIMITATIONS

- A. The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than 5 deg. C.

3.4 EQUIPMENT

A. Bituminous Mixing Plant

1. Mixing shall be in batch mixing plant(s) in accordance with the requirements of ASTM D 995. The mixing plant shall have provision to separately weigh the filler to be added to the aggregate.
2. The Engineer or his authorized representative shall have access, at all times, to all parts of the mixing plants for checking the adequacy of equipment, verifying weights, proportions and material properties and checking the temperatures maintained in the preparation of the mixtures.
3. The plant calibration shall be checked and reported as follows:
 - a) At the beginning before the trial section is laid (Alternatively: Recent Proof of Certification for calibration from a recognized agency);
 - b) Every 100,000 tons of mix produced and incorporated in the works.
4. The emission of the plant shall comply with the national standards.

B. Hauling Equipment

1. Trucks used for hauling bituminous mixtures shall have tight, clean and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material.
2. Each truck shall have a suitable cover and tailgate to protect the mixture from adverse weather. When necessary, to ensure that the mix will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.
3. The preferred payload of the trucks shall be at least 20 metric tons. This is to prevent rapid cooling. This requirement may be waived by the Engineer if the Contractor can prove to deliver asphalt mix on site at a temperature not less than required in Clause

3.1F.

C. Asphalt Pavers

1. Bituminous pavers shall be well maintained, self-contained, power- propelled units with an activated screed or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of bituminous plant-mix material which will meet the specified thickness, smoothness, and grade.
2. The paving width capacity of the paving equipment shall be as specified in Clause 3.1A and easily adjustable in width.

D. Rollers

1. Rollers shall be a combination of the steel wheel (with and without vibration), and pneumatic-tired (PTR) type. They shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the bituminous mixture.
2. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density. Both steel wheel rollers and PTR's are necessary to achieve the required compaction and finishing standards.

E. Prior to the start and during the length of each night shift the Contractor shall have available on site:

- minimum 120 tons of hot asphalt in storage;
- a lifting crane, suitable to remove the heaviest piece of equipment from the runway area.

3.5 PREPARATION OF MATERIAL

A. Bituminous Material

1. The bituminous material shall be heated to the specified temperature in a manner, which will avoid local overheating and provide a continuous supply to the mixer at a uniform temperature.
2. The temperature of the bituminous binder delivered to the mixer shall have a suitable viscosity for adequate coating of the aggregate particles (see Clause 3.1F) and not be more than 5° C above the temperature of the aggregate.

B. Mineral Aggregate

1. The aggregate for the mixture shall be dried and heated to the temperature designated by the Field Job Mix Formula within the job mix tolerance specified. The moisture content of the stockpiled aggregate shall not be more than 4%.

2. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregate.

C. Preparation of Bituminous Mixture

1. The aggregate and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the FJMF.
2. The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured.
3. Wet mixing time shall be the shortest time that will produce a satisfactory mix without excessive plant aging and shall be approved by the Engineer.

D. Transporting, Spreading and Finishing

1. Transporting and deliveries shall be scheduled to match the spreading and rolling for one day's run during daylight or under proper artificial lighting.
2. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.
3. Immediately before placing the bituminous mixture, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms as directed.
4. The mix shall be placed and compacted at a temperature as determined in Clause 3.1F.
5. Moisture content of the mix shall not exceed 1%. Mixture shall be rejected if delivered on site at a temperature less than the placing temperature.
6. Upon arrival, the mixture shall be spread to the full width by an approved bituminous paver.
7. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and shall conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat.

8. Unless otherwise directed, placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one- way slope. The mixture shall be placed in consecutive adjacent lanes having a minimum width as specified in Clause 3.1A, except where edge lanes require a lesser width to complete the area.
9. As far as practical the paving shall continue without stopping. Start-stop procedures shall be avoided.
10. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 0.3 m (preferably 0.5 m).
11. Transverse joints in one layer shall be offset by at least 0.6 m from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of 3 m.
12. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

E. Grade and Slope Control

1. Grade control shall be based on string line or by mobile reference (ski or shoe).
2. Slope control shall be based on Electronic Slope Sensors, compatible with the paver equipment.
3. The preferred method of grade control for the base layers of the asphalt pavement is by string line. The spacing of the support brackets for the string line shall not exceed 5.0 m at straight portions and 3.5 m in curves.
4. The preferred method of grade control for the middle layers is by ski. The length of the ski shall be at least 6 m.
5. Ski or string line shall not be used for the final layer. Instead, only a shoe grade follower shall be used.
6. No asphalt pavement shall be placed prior to approval by the Engineer of the grade and slope control measures. Refer also to Clause 3.6 hereof.

F. Compaction of Mixture

1. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hairline cracking.
2. Sufficient rollers shall be furnished to handle the output of the plant.
3. Rolling shall continue until the surface is of uniform texture and true to grade and cross section, and the required field density is achieved. It is recommended to

compact at the highest practical temperature (see 3.1F).

4. To prevent adhesion of the mixture to the steel wheel roller, the wheels shall be kept properly (but not excessively) moistened.
5. When pneumatic tire rollers are used after the steel wheel roller, they shall not be allowed to start rolling until the surface is completely dry (hot and dry rolling).
6. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the roller or from any other cause shall be corrected at once by raking and applying fresh mixture.
7. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.
8. Any mixture, which becomes loose and broken, mixed with dirt, or in any way defective, shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. Skin patching and hand working shall not be allowed.

G. Joints

1. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture and smoothness as other sections of the course.
2. When a new lane is to be placed adjacent to a cold lane, the longitudinal joint between the lanes shall be constructed as specified in the Section for Hot-to-Cold Joint Preparation (Section 32 12 73.13).
3. A cold lane is defined as such when the surface temperature of the already laid asphalt mix is less than 80°C.

H. Shaping Edges

1. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment.

3.6 MATERIAL ACCEPTANCE

A. Sampling and Testing

1. All sampling and testing of plant produced and field placed material necessary to determine conformance with the requirements specified in this Section will be on a lot basis unless indicated differently. Each lot shall consist of a one-day production or 6,000 m², whichever is less as agreed with the Engineer. Each lot shall be subdivided into 4 approximately equal sub-lots for random sampling.
2. All sampling and testing shall be executed by the Contractor. Random sampling shall be as agreed with the Engineer.

3. The Engineer reserves the right to increase or decrease the frequency of sampling and testing at any moment during production.
4. ASTM D 75 shall be followed in sampling coarse and fine aggregate, ASTM C 183 shall be followed in sampling mineral filler.

B. Routine Tests on Materials during Production

1. The Contractor shall perform all quality control procedures described below to control the production and construction process applicable to these specifications.
2. Samples of aggregate, filler and binder shall be furnished and tested by the Contractor, as indicated in Table 6, prior to delivery at the job site and prior to the start of and at intervals during production.

Test Description		Frequency of Tests
1	Grading	Daily
2	Shape: a. two/one fractured faces	each 5,000 tons
	b. flat and elongated pieces	each 5,000 tons
3	Water absorption	each 5,000 tons
4	Sand equivalent	each 2,000 tons
5	Wear	each 5,000 tons
6	Sodium/Magnesium sulphate soundness loss	each 2,000 tons
7	Clay / friable particles	each 5,000 tons
8	Plasticity index and grading filler	each 100 tons
9	Bitumen	each bulk delivery

Table 6: Schedule for Quality Control Testing

C. Routine Tests on Plant Produced Material

1. One sample of sufficient plant produced material shall be taken on a random basis at the start of production for every two sub-lots for conducting all test described hereafter.
2. The theoretical maximum specific gravity of the uncompacted mixture (Gmm) shall be determined in accordance with ASTM D 2041.
3. One set of four (4) Marshall specimens shall be prepared from each sample at the required number of blows.
4. Prior to testing, for each specimen the bulk specific gravity (Gmb) shall be

- determined in accordance with ASTM D 2726, the percent air voids shall be determined in accordance with ASTM D 3203 and the VMA and VFA shall be determined in accordance with Asphalt Institute MS-2.
5. Three specimens per set shall be tested to determine Marshall stability and flow in accordance with ASTM D 1559.
 6. One Marshall specimen shall be retained for record purposes.
 7. Every three days a sample of sufficient material shall be taken to prepare one additional set of three Marshall specimens. The specimens shall be tested to determine the Loss of Stability as per 2.4C.7.
 8. One extraction test shall be performed per sample in accordance with ASTM D 2172 for determination of asphalt content and aggregate gradation in accordance with ASTM C 136 and ASTM C 117. The results of these test shall be submitted to the Engineer within 2 hours after sampling.
 9. Conduct one test per day of softening point (Tr&b) as per ASTM D 36 and Penetration as per ASTM D 5 on the binder.
 10. The Contractor shall maintain and keep current, linear control charts indicating the approved target, warning lines at one, two and three times the calculated standard deviation on either side of the target and the individual measurements of the data obtained. As a minimum, control charts shall be established for the test parameters indicated in Table 7.

Test Parameter for Control Charts	Standard Deviation (σ)
Bitumen Content	to be determined during the field trials and continuously updated as the work progresses
Percentage passing No. 4 Sieve	
Percentage passing No. 30 Sieve	
Percentage passing No. 200 Sieve	

Table 7: Linear Control Charts

11. The control charts shall be used as part of the process control, for identifying potential problems before they occur. Adjustments to the process shall be deemed necessary when:
 - a) One (1) individual result outside the $3 \times \sigma$ lines;
 - b) Two (2) consecutive results outside the $2 \times \sigma$ lines;
 - c) Three (3) consecutive results outside the $1 \times \sigma$ warning line;
 - d) Eleven (11) consecutive results at one side of the target.

12. The Contractor shall maintain and keep current linear trend charts of the average lot results for:
 - a) Softening Point;
 - b) Penetration;
 - c) Gmb and Gmm;
 - d) Air Voids, VMA and VFA;
 - e) Marshall Stability;
 - f) Flow;
 - g) Loss of Stability.

These charts shall be used to determine compliance with the requirements and to identify significant changes in the overall mix properties. Non-compliance of the results may result in suspension of production by the Engineer until the reason for non-compliance is determined and corrective action is taken. The charts are the basis for adjustments to the approved mix, as instructed by the Engineer.

D. Routine Tests on Field Placed Materials

1. Establish an initial statistical correlation between nuclear density (NDT) and field cores by conducting tests on trial sections. The correlation shall be continuously updated, as additional data are available with the progress of work.
2. Perform continuous and random temperature control of the mix and check density of the mat using nuclear apparatus during laying and compacting. This is a work control and need not be formally reported. However, effort shall be made to achieve a work density, using a nuclear density test device of at least 98% of the Job Mix Density.
3. The Contractor shall make tests for conformity with the specified level and grade immediately after initial compaction.
4. Any variation shall be corrected by the removal of materials and by continuous rolling.
5. After the completion of final rolling, the smoothness of the course shall again be tested. Humps or depressions exceeding the specified tolerances shall be immediately corrected by removing the defective work and replacing with new material, as directed by the Engineer. This shall be done at the Contractor's expense.
6. Skin patching will not be permitted.

E. Acceptance Tests

1. One core and three nuclear density tests of compacted material shall be taken per sub-

lot to determine the layer thickness, mat density and air voids. The cores shall be at least 100 mm in diameter and shall be taken at random locations not closer than 300 mm from any joint. Additional density measurements using nuclear measuring equipment (ASTM D 2950) may be used to supplement the core results for a better statistical analysis, if local regulations permit the use of such devices. However, the use of nuclear density measurements will only be allowed if a correlation has been established with field core density values and approved by the Engineer.

2. The total length of joint in each lot shall be divided into four equal sub-lots. One core and three nuclear density tests of compacted material shall be taken per sub-lot to determine the joint density. The cores shall be at least 100 mm in diameter and shall be taken at random locations at a distance of 150 mm from the joint.
3. Cores shall be neatly cut with an approved core drill. The thickness of each core shall be measured and the bulk specific gravity of each cored sample shall be determined in accordance with ASTM D 2726. Additional cores may be required in case of deficiencies in thickness exceeding the tolerances.

F. Acceptance Criteria

1. Acceptance of plant produced and field placed material shall be based on:
 - a) Mat density;
 - b) Joint Density;
 - c) Thickness;
 - d) Smoothness;
 - e) Grade.
2. Results of air voids should be routinely used for timely adjustment of FJMF.
3. For acceptance criteria which are to be determined on a statistical basis per lot, using the Quality Index (Q_i) concept, reference is made to Clause 3.6G for the calculation of Q_i . The lot is defined in par.3.6A.1.

G. Quality Index Concept

1. The Quality Index Concept shall be used for the acceptance of mat density and joint density.
2. When using the Quality Index Concept, comparison is made between the calculated Quality Index ($Q_{i,calc}$) and the required Quality Index ($Q_{i,req}$).
3. The required Quality Index ($Q_{i,req}$) shall be determined from Table 8 at the applicable confidence level (CL) and the number of test results as indicated in the respective Clauses.

CL	Positive Value of Qi								
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 10	n = 16	n > 16
90%	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2600	1.2740	1.2817
85%	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0370	1.0367	1.0365

Table 8: Quality Index

- The calculated Quality Index ($Q_{i,calc}$) shall be calculated as follows:

$$Q_{i,calc} = \frac{\bar{x} - L}{S_n}$$

where:

\bar{x} = Average of the number (n) of test results
 L = Lower limit of the acceptance criteria

S_n = Standard deviation of test results (calculated on "Random" basis)

- A lot will be accepted if the calculated Quality Index is higher than the required Quality Index, i.e.: $Q_{i,calc} > Q_{i,req}$.

H. Mat Density

- Acceptance of each lot of asphalt concrete surface course for mat density shall be based on a 90% confidence level (CL).
- The lower limit (L) for mat density is 97% of the Job Mix Density. Additionally, air voids of cores shall not be lower than 3 percent nor exceed 5 percent, based on ASTM D 2041 & D 2726.
- Failure to meet the Q_i requirements shall result in a retest of the sub-lot(s), which is (are) the reason for failure. The sub-lot(s) shall be divided into four sub-sub-lots and checked for the Q_i requirements in accordance with the same procedure followed for a whole lot.
- If the $Q_{i,calc}$ for the sub-lot is higher than $Q_{i,req}$, the sub-lot will be accepted. If the $Q_{i,calc}$ is less than $Q_{i,req}$, the failing parts shall be removed and replaced at the Contractor's expense.
- Alternative procedure:

In case a nuclear density testing (ASTM D 2950) at site is not possible due to governmental restrictions, then from each lot four cores shall be taken (one per sub-lot) at random. Each lot of compacted pavement will be accepted with respect to density, when the average mat density is equal to or greater than 98.5% of the Job Mix and when no individual core density is less than the average mat density - 1.5%.

I. Joint Density

1. Acceptance of each lot of asphalt concrete surface course for joint density shall be based on a 90% confidence level (CL).
2. The lower limit (L) for joint density is 96% of the Job Mix Density.
3. Failure to meet the Qi requirements shall result in determination of the cause and evaluation of the jointing procedure.
4. Good joint adhesion at hot-cold joints is required, based on cores and visual inspection.
5. Alternative procedure:

In case a nuclear density testing (ASTM D 2950) at site is not possible due to governmental restrictions, then from each lot four cores shall be taken (one per sub-lot) at random. Each lot of the compacted pavement layer will be accepted with respect to density, when the average density is equal to or greater than 97.5% of the Job Mix and when no individual core density is less than the average field density - 1.5%.

J. Thickness

1. The lot will be accepted for surface layer thickness if the average of all sub-lot core measurements of the total thickness asphalt concrete is not less than the specified thickness minus 5 mm.
2. Thickness of cores shall be measured as per ASTM D 3549.
3. When a lot fails to meet the acceptance criteria for thickness, deficient areas shall be removed and replaced with new material.
4. Sufficient material shall be removed to allow at least 40 mm of asphalt concrete to be placed. Skin patching will not be permitted.

K. Smoothness and Grade

1. Smoothness measurements shall be made on the finished course with a 3- meter straightedge parallel and perpendicular to the centerline at intervals not exceeding 10 meter. The measurements perpendicular to the centerline shall be at least 1 meter away from the crown of the pavement.
2. Each lot will be accepted for smoothness as follows:
 - a) For lower layers of the asphalt concrete surface course, if not more than 5 percent of all measurements in the lot exceed 5 mm.
 - b) For the final layer of the surface course:
 - 1) No measurement parallel with the center line in the lot exceeding 3 mm;

- 2) No measurement at right angle to the center line in the lot exceeding 4 mm;
 - 3) No measurement at shoulders exceeding 5 mm.
3. A lot will be accepted for grade if not more than 5 percent of all the measurements in the lot exceed a tolerance of plus or minus 10 mm from the design elevations.
4. When a lot fails to meet the acceptance criteria for smoothness and grade, deficient areas shall be removed to the full depth and replaced with new material.
5. Skin patching for correction of low areas will not be permitted. High points may be ground off (allowed only in the lower layer).
6. Grade measurements shall be made on the finished lower course at intervals not exceeding 10 meter longitudinally and transversely to determine the elevations.

END OF SECTION

SECTION 32 12 19.19 POROUS FRICTION COURSE (PFC)

PART 1 - GENERAL

1.1 Description

- A This item shall consist of an open-graded, bituminous surface course composed of mineral aggregate and bituminous material, mixed in a central mixing plant, and placed on an existing runway pavement in accordance with these specifications and shall conform to the dimensions shown on the plans.
- B The Porous Friction Course (PFC) is designed as a free-draining, wearing surface of uniform thickness which will provide a skid resistant and hydroplane resistant surface for aircraft landing and takeoff operations.
- C Measurement of Skid Resistance of a trial section and the finished PFC as per specifications.

1.2 Reference

The following testing and material requirements apply: A Standard Test Methods

Test	Short Title
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AASHTO T30	Aggregate Grading
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ASTM C 29	Unit weight of aggregates
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ASTM C 88	Soundness of aggregates
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ASTM C 127	Specific gravity and absorption of coarse aggregate
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ASTM C 128	Specific gravity and absorption of fine aggregate
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ASTM C 142	Clay lumps and friable particles
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ASTM C 131	Resistance to abrasion
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ASTM C 136	Sieve or screen analysis (dry)
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ASTM C 566	Moisture content of Aggregate
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ASTM D 75	Sampling Aggregates
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ASTM D 693	Flat and Elongated Particles
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ASTM D 1188	Bulk specific gravity of compacted bituminous mixtures using paraffin-coated specimens
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ASTM D 1664	Coating and stripping of Bitumen Aggregate Mixtures
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ASTM D 2419	Sand equivalent value
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ASTM D 2172	Bitumen extraction
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The Asphalt Mix design methods for asphalt concrete Institute's Manual
No. 2 (MS-2) Latest Edition

1.2.A Standard Material Specifications

ASTM D 242 Mineral filler for bituminous paving mixtures

ASTM D 946 Asphalt cement for use in pavement construction C Plant Requirements

ASTM D 995 Requirements for mixing plants

1.3 Related Sections

Section 02 22 33.13 Pavement Skid Resistance Testing.

PART 2 - PRODUCTS

2.1 Aggregate

2.1.1 General

A Aggregates shall consist of crushed stone without natural sand.

B. The definition of the various portions of the aggregate is as follows:

C. Coarse aggregate: material retained on the No. 8 sieve (size > 2.4 mm)

D. Fine aggregate: material passing the No. 8 sieve and retained on the No.
200 sieve (size > 2.4 mm & < 0.075 mm)

E. Natural filler: material passing the No. 200 sieve
(size < 0.075 mm)

F. Coarse Aggregate

- Coarse aggregate shall consist of sound, tough, durable particles, free from adherent coatings of clay, organic matter, and other deleterious substances.
- The crushed pieces of coarse aggregate shall show fractured faces.

To count as a fractured face, the area of each face shall be equal to at least 75% of the smallest midsectional area of the piece. When two fractures are continuous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.

- The aggregate shall comply with the requirements of Table 1.
- Natural filler from the crushed aggregate shall be non plastic and amount restricted to 2 percent in the total mix.

G. Fine Aggregate

- Fine aggregate shall consist of clean, sound, durable, angular particles produced by crushing stone or gravel and shall comply with the requirements of Table 1.

H. Mineral Filler

- Mineral filler shall comply with the requirements of ASTM D 242 and shall be from lime stone and non plastic.

I. Sources of Aggregates

- All sources of aggregates shall be selected at least 30 days in advance of the time the materials are required in the work. An inspection of the producer's operation will be made by the Engineer.
- Approval of the source of aggregate does not relieve the Contractor in any way of the responsibility for delivery at the job site of aggregates which meet the specified requirements.

J. Sampling and Testing for Initial Aggregate Selection

- All aggregate samples and tests required as per this section shall be furnished by the Contractor.
- The aggregates from each source shall be separately tested and shall meet the requirements described in Table 1.

TABLE 1: AGGREGATE REQUIREMENTS

	Required Value	Test Designation
Physical Properties		
Grading	sec. 2.3.1	ASTM D 75, ASHTO T30
Shape		
- one fractured face/ two fractured face	100 / 90%	-
- flat and elongated particles - 3 to 1	< 10%	ASTM D 4791
- 5 to 1	< 5%	ASTM D 4791
Water absorption	< 2%	ASTM C 127 & C 128
Sand equivalent	> 60%	ASTM D 2419
-Aggregate Impact value	< 30%	BS 812
-10 percent fines value (SSD)	100 kN	BS 812
-Aggregate Abrasion value	< 20%	ASTM C 131
Sodium sulphate soundness loss	< 9%	ASTM C 88
Clay/friable particles	< 1%	ASTM C142

K. Aggregate Testing during Production

- The Contractor shall furnish and regularly carry out tests on aggregates at the job site.

The schedule for intervals of testing shall be as designated in clause 3.12.

- The samples and test results will be the basis of approval of specific lots of aggregates for the quality requirements of this section.

L. Coating of Aggregate

- The crushed aggregate portion passing the 3/4-inch (19.0 mm) sieve and retained on ASTM No.4 (4.75 mm) sieve shall have an estimated coated area “above 95 percent” ASTM D 2489. If coated area is “below 95 percent”, the bitumen shall be treated with an antistripping agent. The amount of antistripping agent used shall be sufficient to produce a coated area “above 95 percent”.

2.2 Bituminous Material

A The types, grades, and controlling specifications and maximum mixing temperatures for the bituminous materials are given as follows:

Penetration grade: 60-70

Specification ASTM: D 946

B The Contractor shall furnish the vendor's certified test reports for each load of bitumen delivered to the project. The report shall be delivered to the Engineer before permission is granted for use of the material.

2.3 Stabilizer Additive

A A fiber stabilizer, either cellulose or mineral fiber is to be utilised to prevent rapid drain down. Dosage rates shall be 0.25 to 0.4 percent by weight of total mix. The type of fiber chosen shall have been successfully used in preventing drain down of bitumen mixes.

2.4 Composition of Mixture

A The hot mix shall be composed of a mixture of aggregate, bituminous material, mineral filler and stabilizer additive. Limestone based mineral fillers shall have preference over other type of fillers. Antistripping agent shall be used if required.

2.4.1 Design Requirements and Job Mix Formula (JMF)

- A The mix design requirements are: within the master range of aggregate gradation choose a blend, which shall be compacted at various binder contents within the range indicated in Table 2. The mixing temperature of aggregates and bitumen shall be as per Asphalt Institute Manual MS-2, sec. 5.05 latest edition. The job mix formula is the binder content which satisfies the aggregate gradation requirement of Table 2, achieve a uniform full coating of all aggregate particles and at bitumen content as specified at clause 2.3.1.H.
- B The chosen mix should also satisfy the resistance to abrasion, on unaged and aged Marshall specimens from “Contabro” test ASTM C 131 as per clause 2.4.2.
- C The formula with all the supporting details shall be submitted in writing to the Engineer at least 15 days prior to the start of paving operations.

- D No mixture for pavement shall be produced until a formula has been approved by the Engineer.
- E The approved job mix formula with permitted deviations shall be in effect until modified in writing by the Engineer.
- F Should a change in sources of materials be made, a new JMF shall be established before the new material is used.
- G The field laboratory to be used, shall be capable of performing all the tests required by this section.
- H The aggregate gradation, bitumen content and mix requirements shall be as specified in Table 2.

TABLE 2

AGGREGATE – POROUS FRICTION COURSE

Sieve Size	Percentage by Weight Passing Sieves	
	¾ in. maximum	½ in. maximum
¾ in. (19.0 mm)	100	-- 100
½ in. (12.5 mm)	70 – 100	80 – 100
¾ in. (9.5 mm)	45 – 75	20 – 40
No. 4 (4.75 mm)	20 – 40	12 – 20
No. 8 (2.36 mm)	12 – 20	8 – 14
No. 30 (600 micro-m)	8 – 14	3 – 5
No. 200 (75 micro-m)	3 – 5	
Compacted Thickness (average)	2 in. (50 mm)	1.2 in. (30 mm)
Bituminous content	5 percent minimum based on weight of total mix	
Drain down percent ¹	0.3 max. (1 hour reaction) ASTM D 6491	
Air Voids	Minimum 18% at 2 x 50 blows using Marshall compaction as per ASTM D 1559	

Note 1 : The drain down test shall be an loose mix at a temperature 15 degrees centigrade higher than the anticipated production temperature.

I The bituminous content of PFC shall be expressed as a percentage of the total mix by weight.

The bituminous content estimated by the Contractor shall be within plus or minus 1 percent of the value obtained from the formula:

$$2 K_c + 4.0$$

Where K_c is the surface constant for that part of the total dry aggregate that will pass a $\frac{3}{4}$ -inch (19.0 mm) sieve and be retained on the No. 4 (4.75 mm) sieve. Procedures for determining K_c are contained in Chapter 6 of the Asphalt Institute's Manual Series No. 2 (MS-2) latest edition. The bituminous content so estimated is the percentage by weight of the total dry aggregates and must be converted to the percent by weight of the total mix in the approved job mix formula.

J Job mix tolerance shall be as per Table 3.

TABLE 3

JOB MIX TOLERANCE

- Aggregate passing on 4 sieve or larger	$\pm 7\%$
- Aggregate passing no. 8 and no. 30 sieves	$\pm 4\%$
- Bitumen	$\pm 0.3\%$
- Temperature of mix	$\pm 10^\circ\text{C}$

2.4.2 Resistance to Abrasion

The resistance to abrasion shall be performed on unaged and aged Marshall specimens using "Contabro" test as described in **Appendix-1** to this section. The abrasion loss shall not exceed the values as described below:

Un-aged Specimen

The average of abrasion losses obtained on 5 (five) un-aged Marshall specimens, shall not exceed 20 percent while no individual result should exceed 30 percent.

Aged Specimen

The average of abrasion losses obtained on 5 (five) aged Marshall specimens shall not exceed 30 percent, while no individual result should exceed 45 percent. Accelerated ageing shall be as described in **Appendix-1**.

2.4.3 Test Section

- A Prior to full production, the Contractor shall prepare a quantity of bituminous mixture according to the job mix formula, sufficient to construct a test section of at least 60 m long and 6 m wide comprising one longitudinal joint and shall be at the same thickness as shown on the plans.
- B The trial mix shall be laid at a location selected by the Engineer with the spreading and compacting equipment the Contractor proposes to use. The location chosen shall be such, that there is at least 150 m length of paved surface on either side of the test section, to facilitate the skid resistance measurements as per clause 2.4.4. The PFC layer shall be ramped at both ends using a sand asphalt mix, to enable the friction testing equipment to transit smoothly.
- C The test section shall determine the appropriate method of spreading, compacting, finishing the bituminous mixture to comply with the specifications. In addition, the test section of PFC shall also tested for skid resistance as per clause 2.4.4.
- D If the test section results should prove to be unsatisfactory, the necessary adjustments to the mix design, plant operation, work procedures shall be made.
- E When test sections do not conform to specification requirements, the layer(s) shall be removed and replaced at the Contractor's expense.
- F The trial section can be located on the runway at the discretion of the Engineer.

(The specification requirements are as follows:

- Skid resistance as. as per requirements in **Section 02 22 33.13**
- Measured texture depth using the Sand Patch Method should exceed 1mm

for each of at least 3 random tests to be performed for each trial section;

- No fat spots or loss of stone (FOD) should be visible, all joints should be

sound and no water ponding should be visible.

- Unevenness less than 3mm under a 3m straightedge.
- Layer thickness – 90% of all the measurements shall be equal to or thicker

than the specified thickness less 5mm. The average thickness of all cores shall be within 5 % of specified thickness

The applicability of the product will also be assessed in terms of the speed of application. It would be required that the product can be opened to operational traffic within 1 hour after having completed the paving operation (or within such time as would be indicated by the contractor as a reasonable time).

2.4.4 Testing for Skid Resistance

The test section shall be tested for Skid Resistance as per **Section 02 22 33.13** and shall comply with the requirements there in.

PFC to be tested shall be cured for at least 7 days after placing.

2.4.5 Work Plan

After the approval of the test section, the contractor will prepare and submit to the Engineer a work plan which addresses at least the following:

- Description of Work
- Work organisation
- Quality plan and field control

Full production and placing of PFC shall not begin without approval of the Engineer of the work plan.

PART 3 - EXECUTION

3.1 Weather Limitations

The Porous Friction Course (PFC) shall be placed only when the surface is dry and the atmospheric temperature is 10 deg. and rising and when the weather is not foggy or rainy.

3.2 Bituminous Mixing Plant

Mixing plant shall be batch mixing type of sufficient capacity, complying with the specifications as laid down in ASTM D 995. The plant shall have facility to separately weigh the filler before adding to the mixer.

The Engineer or his authorized representative shall have access, at all times, to all parts of the mixing plant for checking the adequacy of equipment, for the preparation of the mixtures.

3.4 Hauling Equipment

A Trucks used for hauling bituminous mixtures shall have suitably treated beds to prevent the mixture from adhering to them. When necessary the mixture shall be protected to ensure delivery to the site at the specified temperature.

3.4 Bituminous Pavers

- A Bituminous pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of bituminous plant-mix material which will meet the specified thickness, smoothness and grade.
- B The paver shall be capable of applying the tack coat ahead of the screed, such that the wheel tracks of the paver do not run over the freshly applied tack coat.

3.4 Rollers

- A Rollers shall be 4-10 ton, steel wheel, tandem or equivalent. The use of equipment which results in excessive crushing of aggregate will not be permitted.

3.5 Preparation of Bituminous Material

- A The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed the applicable maximum temperature as determined in clause 2.4.1 and 2.4.3.

3.7 Preparation of Mineral Aggregate

- A. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. When introduced into the mixer, the combined aggregate moisture content shall be less than 0.50 percent determined as per ASTM C127 and C128.

The weight of the aggregate sample for determining the moisture content shall be at least 500 grams.

3.8 Preparation of Bituminous Mixture

- A. The aggregate, filler and the bituminous material shall be weighed separately and introduced into the mixer in the amount determined by the job mix formula.
- B. The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured. Wet mixing time shall be as short as practically feasible to prevent excessive ageing in the plant.
- C. The temperature of the aggregate shall not be more than 5°C above the temperature of the bituminous material.

3.9 Transporting, Spreading, and Finishing

- A. Immediately before placing the bituminous mixture, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms as directed. Where indicated on the plans, a tack coat as per specifications shall be applied

well in advance of placing the PFC.

- B. Deliveries shall be so scheduled so that it is compatible with the speed of spreading and rolling.
- C. The mix shall be placed at a temperature of not less than 135°C. Prior to the beginning of the compaction the temperature shall not be less than 110°C. These temperature are indicative and should be modified based on tests as per clause 2.4.3.
- D. Hauling over freshly placed PFC course shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature for at least 12 hours. In extreme hot weather conditions, (Maximum Daily Temperatures exceeding 40°C), the cooling time shall be increased to 24 hours.

3.10 Compaction of Mixture

- A. Compaction of the mixture shall begin soon after spreading. The number of passes of the roller shall be based on trials as determined during the trial sections as per clause 2.4.3.
- B. Overcompaction shall be avoided.
- C. Skin patching shall not be allowed.

3.11 Joints

- A. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course and achieve a uniform texture.

3.12 Routine Laboratory Tests on Aggregates and Mixture

- A. Samples of aggregate, bitumen and mixture shall be furnished and tested by the Contractor at the start of production and at intervals during production, as indicated in Table 4.

TABLE 4
SCHEDULE OF FREQUENCIES AND TESTS

Test Description	Test Designation	Requirement	Frequency of Test
Aggregates			
- Shape			

- one fractured/two fractured faces	--	100 / 90%	each 2,000 tons
- flat and elongated particles	ASTM D 4791		
- 3 to 1		< 10%	each 2,000 tons
- 5 to 1		< 5%	each 2,000 tons
- Abrasion Test	ASTM C 131	< 20%	each 2,000 tons
- Sand equivalent	ASTM D 2419	> 60%	each 2,000 tons
- Water absorption	ASTM C 127, 128	< 2%	each 2,000 tons
Bitumen	-	as per clause 2.2A	Each bulk delivery
Mixture production tests			
- Aggregate grading	AASHTO T 30	JMF JMF	once daily once daily
- Bitumen content	ASTM D 2172		

B. The result of each analysis shall be submitted to the Engineer within 24 hours of sampling and any adjustments shown to be required shall be made, with his agreement, immediately.

C. Until the adjustments have been made and a certificate to this effect has been submitted by the Engineer, no further deliveries of mixed materials shall be made from the mixing plant in question.

3.13 Surface Finish Tests

A. After completion of the final rolling, the finished surface shall be tested with a 5 m straightedge and shall not vary more than 6 mm. The 5 m straightedge shall be applied parallel with and at right angles to the runway centreline in a pattern that includes longitudinal and transverse joints. The straightedge shall be advanced approximately ½ its length in the line of measurement. Measurements perpendicular to the runway centreline, shall be made at intervals not exceeding 10m.

B. Areas of the porous friction course exceeding the specified tolerances shall be corrected at the Contractor's expense by removing the defective work and replacing it with new material. Skin patching or hand working will not be permitted.

3.14 Field Sampling and Testing

- A. A minimum of 3 cores (100 mm diameter) per lot shall be obtained at random locations as directed by the engineer. These cores shall be tested for thickness. A lot is defined as 900 m x width of the paving lane.
- B. When the measurement of any core is more than the maximum or less than the minimum allowable thickness, as shown in Table 5, additional cores shall be taken at 6 metre intervals (parallel to and at right angles to the runway centreline) until the completed PFC is within such maximum or minimum thickness for the subunit being tested. If, in the Engineer's judgement, such out of tolerance areas warrant removal, the PFC shall be removed and the underlying course shall be cleaned (ready for reconstruction), all at the Contractor's expense.

TABLE 5
ALLOWABLE FINISHED PFC THICKNESS

	Nominal		Maximum		Minimum	
	in.	mm	in.	mm	in.	mm
¾ in. aggregate	1.0	25	1.50	37	0.75	19
½ in. aggregate	0.75	19	1.25	32	0.50	12.5

3.15 Acceptance

- A. Completed PFC shall be determined "acceptable" or "unacceptable" on the basis of visual inspection by the Engineer, skid resistance testing, thickness measurement (3.14B) and smoothness (3.13B) . The Engineer shall immediately notify the Contractor of visual defects such as nonuniform texture roller marks, bleeding of bituminous material, cracking and shoving of the mixture, and evidence of aggregate crushing during the roller operations, or non-conformance to the requirements at clause 3.13 and clause 3.14 B.
- B. Final acceptance is based on testing for skid resistance and meet the specification requirements as per **Section 02 22 33.13** "Pavement Skid Resistance Testing".
- C. "Unacceptable" PFC shall be removed, leaving a vertical face at the remaining PFC. The underlying surface shall be cleaned and a tack coat applied prior to replacing the PFC. All work shall be at the Contractor's expense.

END OF SECTION

APPENDIX-1 Section 32 12 19.19

Resistance to Abrasion

The resistance of compacted PFC specimens to abrasion loss to be analysed by means of the Cantabro test. This is an abrasion and impact test carried out in the Los Angeles abrasion machine (ASTM Method C131).

35 Un-aged test

In this test, an PFC Marshall specimen compacted with 50 blows on each side is used. The mass of the specimen is determined to the nearest 0.1 gram, and is recorded as P_1 . The test specimen (not later than 24 hours) is then placed in the Los Angeles Rattler without the charge of steel balls. The operating temperature is 25 deg. The machine is operated for 300 revolutions at a speed of 30 to 33 rpm. The test specimen is then removed and its mass determined to the nearest 0.1 gram (P_2). The percentage abrasion loss (P) is calculated according to the following formula:

$$P = \frac{P_1 - P_2}{P_1} \times 100$$

The average of the abrasion losses obtained on 5 un-aged specimens should not exceed 20 percent, while no individual result should exceed 30 percent.

Test on Aged Specimens

Aging is to be accomplished by placing five Marshall specimens compacted with 50 blows in a forced draft oven set at 60 deg. for 168 hours (7 days). The specimens are then cooled to 25 deg. and stored for 4 hours prior to Cantabro abrasion test. The average of the abrasion losses obtained on 5 aged specimens should not exceed 30 percent, while no individual result should exceed 45 percent.

SECTION 32 13.26 PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section consists of requirements for producing and placing or pouring Portland Cement Concrete Pavement, comprising:

1. Structural Cement Concrete, for the civil works, with or without reinforcement, including:
 - a) tie bars and dowels for load transfer
 - b) construction and expansion/contraction joints with joint sealer
2. prepared and constructed in accordance with these specification requirements at the locations and to the forms, dimensions and details as shown on the drawings or as instructed by the Engineer.

1.2 REFERENCES

A. Testing Requirements:

ASTM C 31 Making and Curing Concrete Test Specimens in the Field
ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40 Organic Impurities in Fine Aggregates for Concrete

ASTMC 42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTMC 78	Flexural Strength of Concrete
ASTMC 88	Soundness of Aggregates
ASTMC 109	Compressive Strength of Hydraulic Cement Mortars
ASTMC 117	Material finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTMC 125	Terminology Relating to Concrete and Concrete Aggregates
ASTMC 127	Specific Gravity and Absorption of Coarse Aggregate
ASTMC 128	Specific Gravity and Absorption of Fine Aggregate
ASTMC 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the L.A. Machine
ASTMC 136	Sieve Analysis of Fine and Coarse Aggregates

ASTMC 138 Unit Weight, Yield and Air Content of Concrete
ASTMC 143 Slump of Hydraulic Cement Concrete
ASTMC 174 Measuring Length of Drilled Concrete Cores
ASTMC 192 Making and Curing Concrete Test Specimens in the
Laboratory

B. Material Specification Requirements:

ASTM A 185 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement ASTM A 615
Deformed and Plain Billet-Steel Bars for Concrete
Reinforcement (reinforcing steel & tie bars) ASTM A 617 Axle-Steel Deformed and Plain Bars for
Concrete
Reinforcement (steel dowels) AASHTO M 254 Coated Dowels
ASTM C 33 Concrete Aggregates
ASTM C 87 Effect of organic impurities on strength ASTM C 94 Ready-Mixed Concrete
ASTM C 150 Portland Cement

ASTMC 171	Sheet Materials for Curing Concrete
ASTMC 172	Sampling Fresh Concrete
ASTMC 260	Air-Entraining Admixtures for Concrete
ASTMC 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTMC 494	Chemical Admixtures for Concrete
ASTMC 618	Coal Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in PCC
ASTMC 666	Test for Rapid Freezing and Thawing
ASTMC 881	Epoxy-Resin-Base Bonding Systems for Concrete
ASTMD 98	Calcium Chloride
ASTMD 994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTMD 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTMD 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

EN 196-1 Method of Testing Cement

EN 197-1 Cement – part 1: Composition, specifications and conformity criteria for common cements.

1.3 RELATED SECTION

A. Sections to be referred to:

1. Section 32 13 73.13 Fuel-Resistant Concrete Paving Joint Sealant
2. Section 32 05 43.13 Construction Water

1.4 SUBMITTALS

- A. Product: Portland Cement.
- B. Compliance: ASTM C 150, BS 12 or BS 4027.
- C. Product Data: Submit product data, including manufacturer's product specification sheet of specified products.
- D. Samples: Submit selection and verification samples for final approval by Engineer.
- E. Quality Assurance Submittals:
 - 1. Test Reports: Certified test reports showing compliance with specified physical requirements, or;
 - 2. Certificates: Product certificates signed by manufacturer stating, that materials comply with specified physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: In bulk, or deliver materials to site in manufacturer's original, undamaged, unopened bags with identification labels intact.
- C. Storage and Protection:
 - 1. store materials at temperature conditions recommended by manufacturer and protect same from extended UV exposure and against moisture;
 - 2. consignments stored for more than 2 months from date of manufacture: not be used, to be discarded and removed from site.

PART 2 - PRODUCTS

2.1 AGGREGATE

- A. General
 - 1. Aggregates shall consist of tough, hard, durable and non-coated crushed rock. The Contractor shall be responsible for satisfactorily processing this material to meet the specified requirements.
 - 2. Before starting work, the contractor shall advise the Engineer of the sources of aggregates to be used and to permit samples to be taken in the presence of a representative of the Engineer at the site.
 - 3. Aggregate, which has become segregated or contaminated with foreign matter during storage or handling, shall be rejected and shall be removed and reprocessed, or

replaced with material of acceptable quality at the Contractor's expense. The amount of deleterious substances shall not exceed the requirements contained in ASTM C 33 for class 45.

4. Prior to approval of mixture design, the Contractor shall submit written certification that the aggregate does not have a history of D-cracking. If the aggregate is not approved by the State Agency, the aggregates may be approved provided the aggregate is tested in accordance with ASTM C 666 and receives a durability factor of 95 percent or greater.
5. Aggregates shall be stored in sufficient quantity to ensure that there is no interruption of concrete work at any time.
6. Approval of aggregate quality and/or gradation shall not waive the responsibility of the Contractor to produce concrete of the strength specified.

B. Coarse Aggregate

1. Coarse aggregate for concrete shall conform to the requirements of ASTM C 33.
2. Coarse aggregate shall be furnished in two separate sizes as shown in Table 1.

ASTM Sieve Size		Percentage by Weight Passing Sieves	
		38.0 mm – 9.5 mm	19.0 mm – 2.36 mm
2"	(50.0 mm)	100	--
1½"	(38.0 mm)	90 – 100	--
1"	(25.0 mm)	25 – 55	100
¾"	(19.0 mm)	0 – 15	95 – 100
3/8"	(9.5 mm)	0 – 5	20 – 55
No. 4	(4.75 mm)	--	0 – 10
No. 8	(2.36 mm)	--	0 – 5

Table 1: Coarse Aggregate Gradation

3. The percentage of wear shall be no more than 40% when tested in accordance with ASTM C 131.
4. Sodium Sulphate soundness loss shall be no more than 12% when tested in accordance with ASTM C 88.

C. Fine Aggregate

1. Fine aggregate for concrete shall conform to the requirements of ASTM C 33.
2. It shall meet the gradation requirements of Table 2.

ASTM Sieve Size		Percentage by Weight Passing Sieve
3/8"	(9.5 mm)	100
No. 4	(4.75 mm)	90 – 100
No. 8	(2.36 mm)	65 – 95
No. 16	(1.2 mm)	45 – 75
No. 30	(600 µm)	25 – 55
No. 50	(300 µm)	10 – 30
No. 100	(150 µm)	2 – 10
No. 200	(75 µm)	0 – 5

Table 2: Fine Aggregate Gradation

3. The percentage of wear shall be no more than 40% when tested in accordance with ASTM C 131.
4. The Fineness Modulus shall not be less than 2.3 and not more than 3.1.
5. Dry sieving is usually satisfactory for routine testing. When accurate determination of the amount of fines is necessary, then testing in accordance with ASTM C 117 – Washing will be required.

2.2 CEMENT

A. Ordinary Portland Cement

1. Ordinary Portland Cement (OPC) shall conform to the requirements of ASTM C150, Type I.
2. Equivalent Cement as per EN 197-1 is also acceptable.

B. Sulphate Resisting Portland Cement

1. Sulphate resisting Portland cement shall comply with ASTM C 150, Type V.
2. Equivalent Cement as per EN 197-1 is also acceptable.

C. Moderate Sulphate Resistant Portland Cement

1. Moderate Sulphate Resistant Portland Cement (MSRPC) complying with ASTM

C150, Type II, with the following amendments. In either case the cement shall not contain more than 2.7% proportion by weight of sulphur trioxide.

- a) the acid soluble alkali level measured as (NA2 O+0.658 K2 O) shall not exceed 0.6% by weight determined by test method described in EN-196, Part 21;

D. Manufacture and Storage

1. Cement used shall have been manufactured at least 15 days prior to use.
2. Stale cement or cement reclaimed from cleaning bags shall not be used.
3. All cement shall be stored in watertight sheds on a floor sufficiently raised above ground, or in watertight silos.
4. Each consignment, brand and type of cement shall be kept separate in the sheds.
5. Cement which for any reason has become partially set or contains lumps or caked cement shall be rejected.
6. Any consignment not used within 2 months from the date of manufacture shall not be allowed to be used in the works.
7. Whenever tests of factory or field samples, subsequent to the original approved test show that the cement does not comply with the specifications, the consignment form which the sample was taken shall be rejected and the Contractor shall remove it forthwith from the site at his own expense and replace it with cement of satisfactory quality.

2.3 JOINT MATERIAL

- 2.3.1 Pre-molded joint filler for expansion joints shall conform to the requirements of ASTM D 994 or D 1751. Cork based joint filler shall conform to ASTM D 1752.
- 2.3.2 The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise instructed.
- 2.3.3 When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Engineer.
- 2.3.4 The joint sealer for the joints in the concrete pavement shall meet the requirements of Section for "Joints Sealants".

2.4 STEEL

- 2.4.1 Reinforcement Steel
- 2.4.2 Reinforcing shall consist of welded steel wire fabric in accordance with the requirements of ASTM A 185, or of plain or deformed bars of structural steel (grade 40), or intermediate billet steel (grade 60), meeting ASTM A 615.
- 2.4.3 Dowel and Tie Bars
- 2.4.4 Tie bars shall be deformed steel bars and conform to the requirements of ASTM A 615 except

- that steel bars, grade 50 or 60, shall not be used for tie bars, which are to be bent or re-straightened during construction.
- 2.4.5 Tie bars designated as grade 40 in ASTM A 615 can be used for construction requiring bent bars.
 - 2.4.6 Dowel bars shall be plain steel bars conforming to ASTM A 615 or A 617, Grade 40 or more and shall be free from burring or other deformation restricting slippage in the concrete.
 - 2.4.7 Before delivery to the construction site, a minimum of two-thirds of the length of each dowel bar shall be painted with one coat of lead paint.
 - 2.4.8 If plastic or epoxy-coated steel dowels are used, no lead paint coating is required, except when specified for a particular situation on the drawings. Coated dowels shall be in accordance with the requirements given in AASHTO M 254.
 - 2.4.9 The sleeves for dowel bars used in expansion joints shall be metal or plastic, of an approved design to cover 50 - 80 mm of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 25 mm from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

2.5. WATER

- 2.5.1 Water shall be in accordance with Section for "Construction Water".

2.6. ADMIXTURES

- 2.6.1 The use of any material added to the concrete mix shall be approved by the Engineer.
- 2.6.2 The Contractor shall submit certificates indicating that the material to be furnished meets the requirements.
- 2.6.3 The Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications.
- 2.6.4 Subsequent tests shall be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.
- 2.6.5 Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolans meeting the requirements of ASTM C 618 with the exception of loss of ignition, where the maximum should be less than 6 percent.
- 2.6.6 Air-entraining admixtures shall meet the requirements of ASTM C 260 and shall be added to the mixer in the amount necessary to produce the specified air content.
- 2.6.7 The air-entrainment agent and the water reducer admixture shall be compatible.
- 2.6.8 Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding.

- 2.6.9** Water-reducing admixtures shall be added at the mixer separately from air- entraining admixtures in accordance with the manufacturer's printed instructions.

2.7. CURING MATERIAL

- 2.7.1** Wet burlap for curing concrete is preferred. If white polyethylene film, or white burlap polyethylene sheeting is used it shall be in accordance with ASTM C 171.
- 2.7.2** Liquid membrane - forming compounds for curing concrete-shall be in accordance with ASTM C 309, Type 2 (all resin base).

2.8. PORTLAND CEMENT CONCRETE REQUIREMENTS

- 2.8.1** Mix Design
- 2.8.2** After the materials provided by the Contractor have been accepted for the particular work, the actual proportions of cement, water, fine aggregate, and the two sizes of coarse aggregate that will produce concrete with the specified strength requirements, required plasticity and workability shall be determined by trial mixes.
- 2.8.3** The proportions of the trial mixes shall be within the requirements of Table 3.

Cement Content	minimum 350 kg/m ³
Water / Cement Ratio	maximum 0.45
Ratio Fine Aggregate to Total Aggregate	38 – 43%
Ratio either Coarse Aggregate Size to Total Coarse Aggregate	40 – 60%

Table 3: Proportions of the Trial Mix

- 2.8.4** For mix design purposes the overall grading of these sizes of aggregate shall be within the limits of Table 4.

ASTM		Percentage Passing by Weight	
Sieve Size		Crushed	Gravel
2"	(50.0 mm)	100	100
1 ½ "	(38.0 mm)	96 – 100	96 – 100
1"	(25.4 mm)	70 – 90	66 – 89
¾ "	(19.0 mm)	60 – 80	58 – 79
3/8 "	(9.5 mm)	45 – 63	39 – 60
No. 4	(4.75 mm)	34 – 50	30 – 45
No. 8	(2.36 mm)	25 – 40	22 – 38
No. 16	(1.20 mm)	16 – 30	15 – 29
No. 30	(600 µm)	10 – 22	8 – 21
No. 50	(300 µm)	4 – 14	3.5 – 11.5
No. 100	(150 µm)	0.8 – 5	0.7 – 4
No. 200	(75 µm)	0 – 2.5	0 - 2

Table 4: Overall Grading of Aggregate

- 2.8.5** The variations between the limits of Table 3 and 4 are to produce concrete with a dense and uniform gradation of the desired plasticity and strength.
- 2.8.6** Water shall be maintained at the minimum amount necessary for satisfactory workability.
- 2.8.7** The trial mixes shall be expressed in dry weight of fine and coarse aggregate, exclusive of free water.
- 2.8.8** The finally selected mix is the concrete mix that will give the strength at 28 days and plasticity within the specification and has a satisfactory workability without exceeding the maximum water/cement ratio and with a cement content not less than the minimum content specified and not more than strictly necessary.
- 2.8.9** Test Specimen
- 2.8.10** From each trial mix, one slump test and six cylinders for compressive strength test shall be carried out, and six beams for flexural strength test shall be made in accordance with ASTM C 39 and C 78.
- 2.8.11** Several trial mixes shall be prepared and tested simultaneously.
- 2.8.12** The six specimen of each group are to be tested at the end of 28 days. The average strength and the standard deviation of the six specimen is to be calculated for each group. The test results are to be compared with the requirements given hereafter.
- 2.8.13** Trial mixes are to be continued until a design mix can be selected that fulfills the requirements.
- 2.8.14** Additional specimen may be made and tested to obtain the 7 days strength results. These results may be used as an indication of the 28 days strengths. The 7 days strength shall not be less than 65% of the required 28 days strength.

2.8.15 Compressive Strength

2.8.16 The required characteristic compressive design strength of the group of six test cylinders at 28 days shall be at least 45 N/mm² (ASTM C39).

2.8.17 Characteristic Compressive Strength is defined as: $x_{C6} - K.Sd_6$, in which:

x_{C6} = average of six test cylinders

Sd_6 = standard deviation based on 6 test cylinders

K = constant = 1

Flexural Strength

2.8.18 The required characteristic flexural strength of the group of six test beams at 28 days shall be at least 5 N/mm² (ASTM C78).

2.8.19 Characteristic Flexural Strength is defined as: $x_{B6} - K.Sd_6$, in which:

x_{B6} = average of six beams

Sd_6 = standard deviation based on 6 beams

K = constant = 1

2.8.20 Chloride and Sulphate Content

2.8.21 The chloride and sulphate levels in the concrete mix shall comply with the following requirements.

2.8.22 Maximum limits of acid and soluble chloride and sulphate content as a percentage by weight of cement in the mix (including cement, water & aggregates) are specified in Table 5.

Type of Concrete	Max. Chloride (Cl) Content (% by weight of cement)	Max. Sulphate (SO ₃) Content (% by weight of cement)
Reinforced concrete made with Portland cement type V containing less than about 4% C3A (e.g. sulphate resisting Portland cement)	0.15	In all cases 4.0, including the sulphate in the cement
Reinforced concrete made with Portland cement containing more than 4% C3A	0.30	
Unreinforced concrete pavements	0.60	

Table 5: Maximum Chloride and Sulphate Levels

2.8.23 Slump Test

2.8.24 For each trial mix, one slump test is to be carried out in accordance with ASTM C 143.

2.8.25 Slump test results shall range between 15 - 40 mm for machine laid concrete, with full-width vibration of slabs, and shall range between 25 - 50 mm for hand-laid concrete.

PART 3 - EXECUTION

3.1 TEST SECTION

- A. The test section to be made of the approved concrete mix, to be laid by concrete train or by hand, shall be regarded as the trial bays and shall include joints. They shall be laid along the outer edges of the pavement area.
- B. At least 4 cores shall be cut in order to prove the degree of compaction. These cores shall be cut when the concrete is not less than 7 days old.
- C. Should any of the cores show honey-combing in the concrete, the trial bays shall be cut out and further use of the spreading and compacting unit shall not be permitted until further trials have shown that the modifications made have resulted in the required compaction.

3.2 ADJUSTMENT DURING PROGRESS OF WORK

- A. After the design proportions have been designated they shall not be changed during the progress of the work, except as follows:
 1. If it is found impossible to obtain concrete of the desired workability with the proportions originally determined, the Engineer will allow such changes in aggregate

weights as he may deem necessary, provided that in no case the amount of cement originally designated shall be changed except as provided hereafter.

2. If the cement content of the concrete, determined by means of the yield test ASTM C 138, varies more than 2% from the designated value, the proportions shall be adjusted so as to maintain a cement content which does not vary more than 2% from the designated value.
 3. If it is found impossible to produce concrete fulfilling the strength requirements, the cement content may be increased with the approval of the Engineer.
- B. No change in the source or character of the materials shall be made without due notice to the Engineer and no new materials shall be used until the Engineer has accepted such materials and new proportions based on tests on trial mixes, have been determined.

3.3 EQUIPMENT

A. General

1. Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition.
2. The equipment shall be at the job site sufficiently before the start of construction operations for examination and approval.

B. Batching Plant and Equipment

1. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate and cement.
2. The batching plant shall be equipped with necessary controls to ensure a consistent quality mix as required by this specification.

C. Mixers

1. Concrete shall be mixed at the construction site, at a central point.
2. A device, accurate within 3%, shall be provided at the mixer for determining the amount of air-entraining agent or other admixture if required to be added.
3. Mixers shall be examined daily for the accumulation of hard concrete or mortar and the wear of blades.

D. Finishing Equipment

1. The finishing machine shall be equipped with at least two oscillating type transverse screeds.
2. Vibrators, for full width vibration of concrete paving slabs, may be either the surface pan type or the internal type with either immersed tube or multiple spuds. They may be attached to the spreader or the finishing machine, or they may be mounted on a

separate carriage. They shall not come in contact with the joint, load transfer devices, sub-grade, or side forms. The frequency of the vibrators shall be adequate to attain the required compaction and homogeneity.

3. Hand vibrators shall be used to consolidate the concrete along forms and other isolated areas.

E. Sawing Equipment

1. When sawing of joints is elected or specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations.
2. The Contractor shall provide adequate artificial lighting facilities for night sawing.

3.4 FORMWORK

A. Side Forms

1. Straight side forms shall be made of metal having a thickness of not less than 5 mm and shall be furnished in sections not less than 3 meter in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 30 meter radius or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than two thirds the height of the form. Forms with battered top surfaces, and bent, twisted or broken forms shall be removed from the work.
2. Repaired forms shall not be used until inspected and approved.
3. Built-up forms shall not be used, except as approved by the Engineer.
4. The top face of the form shall not vary from a true plane more than 3 mm in 3 m, and the upstanding leg shall not vary more than 6 mm.
5. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting.

B. Form Setting and Recesses

1. Forms shall be set sufficiently in advance of the concrete placement to ensure continuous paving operation.
2. Forms shall be supported on thoroughly compacted material over their entire length.
3. Shimming with loose earth or pebbles, etc, will not be permitted.

4. If a form does not have satisfactory bearing for its full length, it shall be removed, the bearing area shall be reshaped and compacted and the form shall be replaced.
5. Forms shall be staked into place with not less than 3 pins for each 3-meter section. A pin shall be placed at each side of every joint.
6. Form sections shall be tightly locked and shall be free from play or movement in any direction.
7. The forms shall not deviate from true line by more than 3 mm at any joint.
8. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment.
9. Forms shall be cleaned and oiled prior to the placing of concrete.
10. The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete.
11. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.
12. Forms shall not be removed until 12 hours after the concrete has been placed.
13. Exact sizes for recesses or holes in concrete pavement slabs, necessary for pits or gullies, etc. have to be determined and provided by the Contractor.
14. Inserts or boxes as required are to be placed in correct position before placing concrete.

3.5 PREPARATION OF UNDERLYING COURSE

- A. If no separation layer is indicated on the drawings or additionally instructed, the prepared grade shall be well moistened with water, without saturating, immediately ahead of concrete placement, to prevent rapid loss of moisture from the concrete.
- B. Ruts or depressions in the underlying course caused by hauling or usage of other equipment shall be filled, as they develop, with suitable material (not with concrete or concrete aggregates) and thoroughly compacted by rolling.
- C. If damage occurs to a stabilized sub-base, it shall be corrected full depth by the Contractor.
- D. A multiple pin template weighing not less than 500 kg (per 6 m machine) or other approved template shall be provided and operated on the forms immediately in advance of the placing of the concrete. The template shall be propelled only by hand and not attached to the mixer, tractor, or other power unit. Templates shall be adjustable so that they may be set and maintained at the correct contour of the underlying course. The adjustment and operation of the template shall be such as to provide an accurate retest of the grade before placing the concrete thereon.
- E. All excess material shall be removed.

- F. If the grade is found to be below the true elevation, the depressions shall be filled with approved material and thoroughly compacted to the proper cross section by rolling or tamping with a hand tamper.
- G. The template shall be maintained in accurate adjustment, at all times by the Contractor, and should be checked daily.
- H. The work described under the foregoing paragraphs does not constitute a regular sub-grading operation, but rather a final accurate check of the underlying course.

3.6 SEPARATION LAYER

- A. A separation layer shall be laid on the foundation course under concrete pavements and buried slabs, if shown on the drawings.
- B. Separation layers shall be formed with polyethylene film of a thickness not less than 0.075 mm (75 micron).
- C. The sheet shall be laid flat, immediately prior to spreading the concrete surfacing, with laps of 80 mm longitudinally and 150 mm transversely. They shall be butt against the side forms or adjacent lanes on either side without gaps.
- D. Material which is torn, damaged, or stocky shall not be used and precautions shall be taken to prevent tearing or damage after laying.

3.7 HANDLING AND BATCHING OF MATERIALS

- A. Concrete materials shall be so stored and handled as to prevent contamination, segregation, and mixture with foreign materials. Coarse and fine aggregate stockpiles shall be sufficiently separated to prevent intermixing.
- B. The mixing water for each batch shall be measured either by volume or by weight and the batch quantity shall be measured to within one-half (½) percent of the specified batch quantity.

3.8 HANDLING AND PLACING REINFORCEMENT

- A. All metal reinforcement shall be protected as far as practicable from mechanical injury or surface deterioration, from rusting or other causes from time of shipment until it is placed. Reinforcement stored at the site shall be laid on sills suitably spaced.
- B. Where bent reinforced bars are required, they shall be bent to their required shape and dimensions before placing in the form.
- C. Reinforcing steel shall be free from dirt, mill scale, grease, injurious rust, or other foreign substances. All loose scale shall be removed.
- D. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck-

off to such a length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck-off and finished off.

- E. Any portion of the bottom layer of concrete which has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense.
- F. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

3.9 MIXING CONCRETE

- A. The concrete shall be mixed at the work site in a central mixing plant.
- B. Re-tempering concrete by adding water or by other means shall not be permitted, except if accomplished within 45 minutes after the initial mixing operation.
- C. Concrete that is not within the specified slump limits at time of placement shall be discarded.
- D. Mixed concrete shall be transported in truck mixers, truck agitators or non- agitating trucks having special bodies.

3.10 WORKING CONDITIONS

A. Sufficient Light

- 1. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

B. Cold Weather

- 1. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 5°C and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 2° C.
- 2. When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer.
- 3. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might injure the materials.
- 4. Unless otherwise authorized, the temperature of the mixed concrete shall not be less than 10°C at the time of placement in the forms.
- 5. If the air temperature is 2°C or less at the time of placing concrete, the Engineer may

require the water and/or the aggregates to be heated to not less than 20°C nor more than 65°C.

C. Hot Weather

1. The Contractor is required to take special precautions to prevent the formation of plastic shrinkage cracks. Plastic shrinkage cracks are due to increased rate of evaporation of water from the surface, due to the effects of wind, temperature and humidity. Precautionary measures against plastic shrinkage shall be taken when the rate of evaporation exceeds 0.75 kg/m²/hr determined as per ACI committee report 305 - 1977.
2. The concrete shall be placed at the coolest temperature practicable, and in no case when the temperature of the fresh concrete is higher than 32°C.
3. Concrete temperatures are to be reduced by the following methods:
 - a) By shading aggregate and cement stockpiles from direct rays of the sun.
 - b) By cooling of mixing water which can be achieved by ice or by burying, insulating, shading or white-painting the pipe line and water storage tanks. Tank cars used for transporting water should be insulated or painted white.
 - c) By sprinkling forms and sub-grade with cool water just prior to placing.
4. When temperature conditions are critical, concrete placement shall be restricted to the evening or night. Daily records shall be maintained for air temperature, concrete placing temperature, humidity and wind speed.
5. A copy of weather data shall be included in the permanent records of the job.

3.11 LAYING OF CONCRETE

A. Machine Laid Concrete

1. All concrete pavements, except as provided under clause 3.11.2, shall be carried out by a self- propelled concrete train consisting of at least a concrete spreader, a compactor-finisher, a diagonal leveling finisher and a spray curing machine. Dowel bar placers and joint vibrators are optional.
2. The mixed concrete shall be placed and distributed evenly over the base by means of spreaders. The mix shall not be deposited direct on the base by lorry, skip, or by hand or in any way which might cause uneven compaction or segregation of the mix.
3. The striking and finishing off shall conform to the cross sections indicated and shall be performed at an elevation sufficiently above the required final surface level to ensure that when properly compacted and finished, the surface of the concrete shall be the required level and cross section.
4. The first lane of concrete shall be laid and compacted between 2 forms.
5. Metal wheels shall not be allowed to run on concrete surfacing. Alternative methods may be used providing they do not cause damage to the concrete surfacing.
6. The slab shall not be subjected to the weight of any plant until at least 7 days after laying, when, if the Contractor is satisfied that it is sufficiently strong to carry the loads, he may use the slab at his own risk.

B. Hand Laid Concrete

1. Concrete to be laid in areas which are of narrow width or of irregular dimensions or inaccessible to self-propelled machines, shall be placed as described below.
2. Should the Contractor wish to place pavement concrete by the hand method for any substantial part of the Works, he shall state so at the time of tendering, and this will only be permitted after specific approval of the Engineer.
3. Hand laid concrete shall be placed and distributed evenly over the base by means which will ensure uniformity and continuity of spread and shall not cause uneven compaction or segregation of the mix.
4. Concrete shall be compacted with approved hand manipulated vibrating tampers.
5. Where it is necessary to lay the pavement over an area which has a group of manholes closely placed, the entire area for the full width of the lane, may, with the approval of the Engineer, be laid by hand.
6. If it is necessary to adjust the mix slightly to give an increased slump within the limits specified any addition of water shall be accompanied by a corresponding increase in the cement content in order to maintain a water/cement ratio not exceeding that specified.

7. The distance apart of the forms shall be such as to enable tamping beams of manageable size to be used. Generally 4.50 m shall be the maximum for this purpose.
8. The tampers shall not be slid along the forms but shall be lifted and dropped on the surface with each forward movement and the surcharge shall be sufficient to ensure proper compaction of the concrete. Tamping beams shall be designed for the width of bay being laid and should a narrow bay be formed, the use of a tamping beam designed for a wider bay shall not be allowed.

C. Work at Joints

1. Concrete adjacent to expansion and construction joints, including longitudinal construction joints against adjacent lanes and against side forms, shall normally be compacted with poker vibrators inserted into the concrete.
2. The vibrators shall not come into contact with the joint filler, dowels, tie bars, reinforcement, or the base.
3. As soon as the side forms are removed any minor surface cavities shall be filled in with mortar composed of one part of cement to two parts of fine aggregate.
4. Concrete with honey-combing of the vertical faces, indicating poor compaction, shall not be accepted.

3.12 JOINTS

A. General

1. Longitudinal and transverse joints shall be constructed as indicated on the drawings and in accordance with these requirements.
2. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement.
3. Joints shall not vary more than 5 mm from a true line or from their designated position.
4. The vertical surface of the pavements adjacent to all expansion joints shall be finished to a true plane and edged to a radius of 5 mm, or as shown on the drawings. The edges of the other joints shall be finished with an edging tool or grooving tool.
5. The surface across the joints shall be tested with a 3 meter straightedge as the joints are finished, and any irregularities in excess of 5 mm shall be corrected before the concrete has hardened.
6. Key joints shall be accurately formed with template of metal or wood. The gauge or thickness of the material in the template shall be such that the full key joint, as specified, shall be formed and is in the correct location.
7. Transverse joints shall be at right angles to the centre-line of the pavement and shall extend the full width of the slab. The transverse joints in succeeding lanes shall be

placed in line with similar joints in the first lane. In the case of widening existing pavements, transverse joints shall be placed in line with similar joints in the existing pavement.

8. All joints shall be so prepared, finished, or cut to provide a groove of sufficient width and depth to receive and effectively retain joint-sealing material.
9. The Contractor shall timely submit for approval his complete proposal for the construction of the joints.

B. Tie Bars

1. Tie bars consist of deformed bars of 16 mm (5/8") and shall be installed where shown on the drawings.
2. Tie bars shall be placed at right angles to the centre-line of the concrete slab and shall be held in position parallel to the pavement surface and midway between the surfaces of the slab.
3. When tie bars extend into an unpaved lane, they may be bent at right angles against the form of longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, coated with asphalt, or enclosed in sleeves.

C. Dowel Bars

1. Dowel bars or other load-transfer units of an approved type shall be placed across transverse or other joints in the manner as shown on the drawings.
2. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place.
3. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position.
4. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the drawings. The caps shall fit the dowel bar tightly and the closed end shall be watertight.
5. The portion of each dowel painted with rust preventive paint shall be thoroughly coated with asphalt MC-70 to ASTM D 2027, to prevent the concrete from binding to that portion of the dowel.
6. If free-sliding plastic-coated or epoxy-coated steel dowels are used, a lubrication bond breaker shall be used, except when approved pullout tests indicate it is not necessary.
7. In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by a mechanical device approved by the Engineer.

8. Drilling holes for installing dowel bars in existing concrete slabs shall be done by an approved core drilling device. The holes in the vertical exposed faces of the slab shall be parallel to the surface and sides of the slab. The diameter of the holes shall be the minimum that is necessary to accommodate the dowel bar.
9. The dowels shall be fixed in the drill hole by an epoxy-based adhesive. The adhesive shall conform to ASTM C 881. Manufacturer's instructions shall be strictly followed.
10. Before inserting new dowel bars in drilled holes, the holes shall be cleaned out using oil free compressed air. When in a dry state, prime and plug the drilled holes with resin based adhesive and insert the new dowel bars accurately aligned parallel to the surface and sides of the slab.

D. Installation of Joint Material

1. All joint materials required shall be put in place on the completed and accepted grade.
2. The materials and joint position shall be either at right angles or parallel to the centre-line of the pavement except for fillets or irregular sections.
3. The top of an assembled joint device shall be set at the proper distance below the pavement surface and the elevation shall be checked. Such devices shall be set to the required position and line and shall be securely held in place by stakes or other means during the pouring and finishing of the concrete.
4. The pre-molded joint material shall be placed and held in a vertical position. If constructed in sections, there shall be no offsets between adjacent units.
5. Dowel bars shall be checked for exact position and alignment as soon as the joint device is staked in place and the device shall be tested to determine whether it is firmly supported.
6. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical shall not exceed 2% or 6 mm per 0.30 m of a dowel bar. The most effective way to obtain proper alignment is with well- fabricated dowel baskets and dowel assemblies.
7. When joints in concrete pavements are sawed, the joints shall be cut at the time and in the manner approved by the Engineer. The circular cutter shall be capable of cutting a groove in a straight line. The circular cutter shall produce a slot at least 3 mm wide and to the depth shown on the drawings.
8. When shown on the drawings or if required the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved bevelling to provide adequate space for joint sealers.
9. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing.
10. Sawing shall be carried out both during the day and night as required.

11. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

E. Longitudinal Construction Joints

1. Longitudinal construction joints necessary for lane construction shall be formed against suitable side forms.
2. The edges of the joint shall be finished with a bevelling tool or edging tool and a space or slot shall be formed along the joint of the dimensions as indicated, to receive the sealing material.
3. Provisions shall be made for the installation of dowel bars as noted on the drawings.

F. Longitudinal Expansion Joints

1. Longitudinal expansion joints shall be installed where designated on the drawings.
2. These shall be of a butt-type without load-transfer devices and shall include a pre-molded expansion material.
3. The thickness of the concrete at these joints shall be increased by at least 25% of the normal pavement thickness. This increase shall slope to normal thickness in not less than 3 m from the joint or to the nearest joint such as a groove joint.
4. The premoulded filler of the thickness as shown on the drawings shall extend for the full depth and width of the slab at the joint, except for space for the sealant at the top of the slab.
5. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A metal or wooden cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished.
6. After the concrete has been placed and struck-off, the cap shall be carefully withdrawn leaving the space over the pre-molded filler.
7. The edges of the joint shall be finished and tooled while the concrete is still plastic.

G. Transverse Contraction Joints

1. Transverse contraction joints shall be installed at the locations and spacing as shown on the drawings.
2. These joints will be installed by sawing a groove into the concrete surface after the concrete has hardened.
3. The sawed groove shall be straight and of uniform width and depth.
4. The saw-cut shall be clean cut so that spalling will be avoided at intersections with

transverse joints.

H. Sealing Joints

1. The joints in the pavement shall be sealed in accordance with section Joint Sealants, and to the details shown on the drawings.

3.13 FINISHING

A. Finishing Methods

1. Immediately following the compacting operations and also after the construction of joints where these are formed in the plastic concrete, minor irregularities and score marks remaining in the pavement surface shall be eliminated by removing surplus material or by adding freshly mixed concrete.
2. It shall be further smoothed, trued and consolidated by means of long- handled floats and scraping straight-edges or by mechanical self propelled articulated finisher forming part of the paving train.
3. The finishing shall be done in such time sequence as to ensure the removal of water or laitance from the surface and within 60 minutes from the time of mixing.
4. The finishing shall conform to the surface requirements specified hereafter.

B. Surface Texture

1. All concrete surfacing shall be slightly roughened or textured.
2. A suitable finish can be obtained by drawing a broom lightly across the pavements at right angles to the side forms, after the foregoing operations but whilst the concrete is still soft enough to take an impression.
3. The brooming operation shall be so executed that the corrugations produced in the surface shall be uniform in appearance and approximately 2 mm in depth.

C. Test for Surface Accuracy

1. The finished surface level of the pavement shall conform to the levels and contours indicated.
2. The surface shall be free from honey-combing and local protuberances.
3. Except across the crown of a camber and across drainage channels, the surface shall be such that when tested with a 3 m long straightedge the gap between the bottom of the straightedge and the surface of the pavement shall not be greater than:
 - a) 5 mm for aprons, measured in any direction;
 - b) 5 mm for runways and taxiways, measured in transverse direction;
 - c) 3 mm for runways and taxiways, measured in longitudinal direction.

4. No variation from the true surface will be permitted across any joint in the pavements.
5. Isolated high spots in the final pavement not exceeding 2 square metre each, which do not comply with the straightedge test above, shall be ground down, if the total area to be ground does not exceed 10 square metre in any 1,000 square metre section of concrete surfacing.
6. When corrections in the final pavement in excess of this allowance shall be necessary to bring the surface accuracy within these specified limits, the concrete shall be removed and replaced by the Contractor at his own expense.

3.14 CURING OF CONCRETE SURFACES

- A. The concrete surfaces shall be thoroughly cured.
- B. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. Curing compound shall be applied by mechanical sprayers under pressure at the rate of spread as specified by the Manufacturer.
- C. The curing compound shall not be applied during rainfall.
- D. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout. During application the compound shall be stirred continuously.
- E. The liquid shall be applied by a mechanical sprayer, which shall be arranged to traverse the concrete lanes both longitudinally and transversely. In order to prevent wind blown losses, the nozzles shall be as close to the surface of the concrete as is convenient to ensure even coverage. Where such machines cannot operate due to irregular bay sizes, suitable hand operated sprayers shall be used.
- F. Approved standby facilities for curing concrete pavements shall be provided at a readily accessible location at the site of this work.
- G. Curing compound shall not be applied to the inside faces of joints to be sealed.
- H. The curing compound shall be of such character that the film will harden within 30 minutes after application.
- I. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound.
- J. Immediately after spraying with curing compound the concrete shall be protected for a period of not less than 8 hours by movable frames covered with an approved opaque light coloured material which shall control the temperature at the surface of the concrete, so arranged that the covering is not less than 75 mm nor more than 150 mm above the surface of the concrete except at the sides and ends which shall be closed to prevent a through current of air. The covering shall give continuous coverage over the concrete and if absorbent shall be kept well damped during the entire period of curing.

- K. Immediately the frames are removed, additional curing shall be carried out by placing pervious mats made from hessian, cotton or similar on the concrete and kept moist and in position for at least 7 days from the placing of the concrete.
- L. On removal of the forms, vertical faces of the concrete shall be coated with Rapid Curing bituminous cutback material.

3.15 PROTECTION OF PAVEMENT

- A. The Contractor shall protect the pavement and its appurtenances against traffic.
- B. Any damage to the pavement occurring prior to Provisional Hand-over shall be repaired or the pavement replaced at the Contractor's expense.
- C. In order that the concrete be properly protected against the affects of rain before the concrete is sufficiently hardened, the Contractor shall be required to have available at all time materials for the protection of the edges and surfaces of the unhardened concrete.
- D. Such protective materials shall consist of rolled polyethylene sheeting at least 0.075 mm thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface.
- E. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

3.16 OPENING TO TRAFFIC

- A. The Engineer shall decide when the pavement shall be opened to traffic.
- B. The pavement shall not be opened to traffic (including the Contractor's vehicles) until test specimens molded and cured in accordance with ASTM C 31 have attained a flexural strength of 3.5 N/mm², when tested in accordance with ASTM C 78.
- C. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed.
- D. Prior to opening to traffic, the joints shall be sealed in accordance with section Joints Sealants and the pavement shall be cleaned.
- E. Opening to traffic shall not constitute a final acceptance of the pavement.

3.17 TOLERANCES IN COURSE THICKNESS

- A. To achieve the proper thickness the following instructions shall be strictly adhered to.
 - 1. When formwork method is used clauses B, C & D shall be applicable.

2. When slipform method is used clause E shall be applicable.
- B. When the underlying layer is a prepared base, the top of this layer shall be within a tolerance of 5 mm above design level and 10 mm under design level and under a straight-edge of 3 metres the maximum deviation shall be less than 10 mm.
- C. The top of the formwork has a maximum allowable deviation from design level of 3 mm.
- D. Forms shall be placed in such a way, that the required concrete thickness can be placed over the full width of the lane. This shall be checked with string lines and depth tests or with boards placed across the lane.
- E. When a slipform paver is used, the tolerance in design level is plus/minus 5 mm and the thickness tolerance is plus/minus 10 mm.

3.18 SLUMP TESTS

- A. Slump tests are to be taken at each mixer in the presence of the Engineer in accordance with ASTM C 143 at a rate of 1 per truckload for four truckloads and then at least one in every 50 batches mixed.
- B. Any batch with a slump not complying with the value agreed by the Engineer under clause 3.2, will be condemned and is to be removed from the site.
- C. A slump test is also to be carried out on the concrete of all batches from which test cylinders and beams are made.

3.19 FIELD TESTS DURING PRODUCTION

A. Tests on Materials

1. Samples of aggregate cement and water shall be routinely tested as per schedule of frequency indicated in Table 6.

-	Grading of Aggregate (ASTM C 33)	Daily
-	Moisture Absorption (ASTM C 128)	each 5,000 tons
-	Water Quality	At start of trials and when service is changed
-	Cement Quality	each bulk delivery

Table 6: Schedule for Testing Aggregates, Cement and Water

B. Cylinder and Beam Test Specimens

1. Six specimen for compressive strength test cylinders and six for flexural strength test beams shall be made, each day that the concrete is placed, as long as total daily production is less than 200 m³. For daily productions over 200 m³, one additional

test cylinder and one test beam is to be made for each 50 m³ or part thereof, over 200 m³.

2. One group of three cylinders and beams is to be made during the first half of each shift, a second group of three cylinders and beams is to be made during the last portion of the shift.
3. Each group of test specimen shall be molded from the same batch of concrete and prepared in accordance with ASTM C 31.
4. Additional groups of specimens may be required by the Engineer at the start of the paving operations and when the aggregate source or characteristics, or the mix design is changed.
5. The above mentioned number of test specimens shall be used for the 28- days test and additional test specimen may be prepared for the 7-days test.
6. When a satisfactory relationship between the 7-day and the 28-day strength has been established and approved, the 7-day test results may be used as an indication of the 28-day strength. The 7-day test results will not replace the results of the 28-day tests if the 28-day results fall below the requirement.
7. Specimens which are obviously defective shall not be considered in the determination of the strength.

C. Field-Compressive Strength Requirements

1. The characteristic compressive strength of the field laboratory test specimens made during a days run and tested at the end of 28 days shall be at least 45 N/mm².

D. Field-Flexural Strength Requirements

1. The characteristic flexural strength of the field test laboratory specimens made during a days run and tested at the end of 28 days shall have an average of at least 5.0 N/mm².

E. Routine Cores

1. The Contractor shall also cut not less than one routine core from each 250 m² concrete approx. 28 days old for visual inspection and strength tests. The position of the cores will be decided by the Engineer.
2. The coreholes shall be filled with non-shrink and non-metallic mortar.

3.20 ACCEPTANCE OF WORK

A. Cores are to be tested conform to ASTM C 42.

B. The concrete area will be acceptable if:

1. the average strength of the three cores is at least 45 N/mm², and
2. the strength of each of the three cores is at least 40 N/mm², and
3. none of the cores shows considerable honeycombing.

- C. The average compressive strength after correction for length of these three cores together with their thickness and the presence of honeycombing will be the basis by which the Engineer will determine, whether or not the concrete is to be condemned.
- D. Further cores shall be drilled by the Contractor as directed by the Engineer to ascertain the extent of unsatisfactory concrete.
- E. Condemned areas shall be removed and replaced by the Contractor at his own expense.

3.21 MARKING PCC SLABS

- A. Completed PCC slabs shall be marked for future identification and maintenance management purposes. The markings shall be alpha-numeric in nature to be agreed by the engineer.
- B. Height and width of letters and numbers shall be 110 x 70 mm.
- C. The identification marks may be either imprinted on fresh concrete or stencilled on hardened concrete with black/yellow paint. The markings shall also be reflected in the as-built drawings.

END OF SECTION

SECTION 32 13 73.13 FUEL-RESISTANT CONCRETE PAVING JOINT SEALANT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of providing and installing a resilient and adhesive joint sealant capable of effectively sealing joints and cracks in pavements and structures.

1.2 REFERENCES

- A. Testing Requirements:

ASTM D412 Tests for Rubber Properties in Tension ASTM D1644 Tests for Non-volatile Content of Varnishes

1.3 RELATED SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATIONS

- A. Joint sealing materials shall meet the requirements of one or more of the following specifications:

- B. For Concrete and Asphalt Pavements

ASTM D 3405 Joint Sealants, Hot Poured.

US Fed. Spec. SS-S-200 Sealing Compounds, Two-Component, Elastomeric, Polymer Type (Polysulfide resin minimum 40%), Jet-Fuel, de-icing and chemical resistant.

- C. For Concrete Pavements

ASTM D 3406 Joint sealants, Hot-Poured, Elastomeric-Type.

ASTM D 3569 Joint Sealant, Hot-Poured, Elastomeric Type, Jet-Fuel- Resistant.

ASTM D 2628 Preformed Polychloroprene Elastomeric Joint Seals. US Fed. Spec. SS-S-200 Sealing Compounds, Two-Component,

Elastomeric, Polymer Type (Polysulfide resin minimum 40%), Jet-Fuel, de-icing and chemical resistant. Cold applied.

2.2 OTHER REQUIREMENTS

- A. The grade shall be suitable for warm to hot climatic conditions. (-400 C until + 1200 C)
- B. Where recommended by the manufacturer of the sealer, a primer supplied by him shall be used to improve adhesion.
- C. If the preformed joint sealer is used, the manufacturer shall certify that the preformed seal will exert a minimum pressure of 21 KPa, when compressed to 80 percent of nominal width and a maximum of 172 KPa, when compressed to 50 percent of nominal width.
- D. Back-up materials and bond breakers shall be a closed cell material, shall be compatible with the sealant, shall not adhere to the sealant, shall be compressible without extruding the sealant and shall recover to maintain contact with the joint faces, when the joint is open.
- E. Each lot or batch of sealing compound shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and safe heating temperature and shall be accompanied by the manufacturer's certification stating that the compounds meets the requirements of this specification.
- F. Each lot of preformed joint sealer delivered to the jobsite shall be accompanied by the manufacturer's certification stating that it meets the requirements of this specification.

2.3 LUBRICANT ADHESIVE

- A. Lubricant for installation of preformed joint seal shall be a one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-oxidants and acid acceptors in aromatic hydrocarbon solvent mixture and shall meet the following requirements:
 - 1. Average weight per litre, kg: 0.93
 - 2. Solids content, percent by weight: 22-28 as per ASTM D1644, Method A
 - 3. Film Strength, MPa 15 min. as per ASTM D412
 - 4. Elongation, percent 750 min. as per ASTM D412
- B. Each shipment of lubricant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the date of the manufacturer and shall be accompanied by the manufacturer's certification stating that the lubricant meets the requirements of the specification.
- C. This lubricant shall be stored at a temperature between 10 degrees C and 27degrees C and shall be used within 270 days of its manufacture.

PART 3 - EXECUTION

3.1 TIME OF APPLICATION

- A. The joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment.
- B. The pavement temperature at the time of installation shall be above 50 degrees C for the poured joint sealing material and 30 C above dewpoint and 5 degrees C for preformed seal.
- C. If the pavement is opened to traffic prior to placement of the sealant, and subject to the approval of the Engineer, the Contractor shall temporarily fill the joint with a cotton jute or nylon rope immediately after the joint is sawed.

The rope should be slightly larger than the joint and should be forced into the joint so that the top of the rope is 3 mm below the pavement surface. The rope shall be removed immediately prior to cleaning and sealing.

3.2 PREPARATION OF JOINTS

- A. Immediately before sealing, the joints shall be thoroughly cleaned of all laitance, curing compound, protrusions of hardened concrete, dirt, dust or other objectionable material. Cleaning shall be accomplished by sandblasting or wire brushing. Upon completion of cleaning, the joints shall be blown out with compressed air. The joint faces shall be surface dry when the seal is applied.
- B. Prior to resealing joints, the existing joint material shall be removed to the depth as shown on the drawings. If joint sealer other than that originally used is specified, all existing joint sealer shall be removed.

3.3 INSTALLATION OF SEALANTS

- A. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed.
- B. Sealants shall be installed in accordance with the following requirements.
 - 1. Hot Poured Sealants
 - a) The joint sealant shall be applied, uniformly solid from bottom to top and shall be filled without formation of entrapped air or voids.
 - b) The heating kettle shall be an indirect heating type, constructed as a double boiler, with a space between the inner and the outer shells filled with oil, or other material for heat transfer, in order to avoid local overheating.
 - c) A positive temperature control and mechanical agitation shall be provided. The sealant shall not be heated to more than 11 degrees Celsius below the safe heating temperature. The safe heating temperature can be obtained from the manufacturer's shipping container. A direct connecting pressure type extruding device with nozzles shaped for insertion into the joint shall be provided.
 - d) A backing material shall be placed as shown on the drawings and shall be

nonadhesive to the concrete or the sealant material.

- e) Any sealant spilled on the surface of the pavement shall be removed immediately.
2. Cold Applied Sealants
- a) Cold applied joint sealing compound shall be applied by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement.
 - b) Sealant which does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition shall be rejected and be replaced by the Contractor at no additional cost.
 - c) A backing material shall be placed as shown on the drawings and shall be non-adhesive to the concrete or the sealing material.
3. Preformed Compression Sealants
- a) The Engineer and Contractor will jointly conduct a survey to determine the average widths of the sawed joints at the time of joint sealing.
 - b) The widths of the seal insert and the joint to be sealed shall be selected in relation to the slab size and manufacturer's recommendations so that, in principle, the estimated maximum width of joint opening shall not be more than 60 percent of the original (uncompressed) width of the seal.
 - c) Based on the measurements the preformed inserts shall be selected according to the requirements in Table 1.

Joint Width incl. Shrinkage	Original Compression Seal	
	min. width	height
less than 7 mm	10 mm	18 mm
7 – 10 mm	14 mm	21 mm
expansion joints 25 – 38 mm	45 mm	31-51 mm

Table 1: Dimension of Joint Seal Insert

- d) Compression seals shall be inserted into the grooves without prior extension or rotation, with a lubricant adhesive which is compatible with the seal and the concrete. The adhesive may be applied to the joint faces or to the seal, or both and shall cover both sides of the seal and joint. The seal shall be positioned with its axis perpendicular to the concrete surface and with the top corners of the seal

in even contact with the joint faces, between 3 mm and 6 mm below the concrete surface or as recommended by the manufacturer. Excess adhesive on top of the seal shall be removed to prevent adhesion of the top faces of the seal under compression. The seal shall be in one piece for at least each full lane width of the transverse joint.

- e) If the longitudinal joint is sawn and a compression seal used it shall be laid in continuous lengths. Seals subsequently inserted into transverse joints should be butted and fixed to the longitudinal seals with additional adhesive.
- f) It is most important that compression seals remain in compression at all times.

3.4 FIELD TEST

- A. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing, mixing and placing the sealants will provide a satisfactory joint sealing.
- B. The demonstration shall include the preparation of at least two small batches and the application of the resulting material.

END OF SECTION

SECTION 32 14 13.13 INTERLOCKING CONCRETE BLOCK PAVEMENT

PART 1 - GENERAL

1.1 Description

- A. This item shall consist of interlocking concrete blocks of the type and dimension indicated on the drawings, furnished and placed at the locations and areas as shown on the drawings or required by the Engineer, in accordance with this specification.

1.2 Reference

- A Standard Test Method

ASTM C 33 Standards for Concrete Aggregates BS 1881 Method of Testing Concrete - Part 4

PART 2 - PRODUCTS

2.1 Concrete Blocks

- A. The concrete blocks shall be hydraulically pressed in accordance with the cement and concrete association specifications for precast concrete paving blocks. The aggregates used shall conform to ASTM C-33 or equivalent.
- B. The blocks shall have a chamfered edge and shall be of the type, dimensions and colour as shown on the applicable drawings.
- C. Laying pattern of the blocks shall be as shown on the drawings including the use of starter and half paving blocks.

2.2 Bedding Sand

- A. Sand for bedding below shall be well graded. Not more than 10%, consisting of sharp sand or crushed rock shall retain on ASTM sieve No.4 (4.75 mm).
- B. Clay, silt and fine dust content shall be not more than 3% by mass. Sand shall be free from deleterious salts and contaminants.
- C. The following grading has been found to give satisfactory results.

ASTM Sieve	% Passing
No. 4 (4.75 mm)	90 – 100
No. 8 (2.36 mm)	75 – 100
No. 16 (1.18 mm)	55 - 90
No. 50 (.30 mm)	8 - 30
No.100 (.15 mm)	0 - 10

C Sand for joints must be clean and dry, 100% passing ASTM sieve no. 16 and not more than 10% passing ASTM sieve no. 200.

2.3 Testing

- A Before delivery 10 blocks of each lot of 5000 blocks shall be tested.
- B The mean compressive strength of the blocks shall be not less than 45 N/mm², no single value shall be less than 40 N/mm². Testing shall comply with BS 1881.

The compressive strength is: 1.18 x max. applied load (N)
plan area, including chamfers (mm²)

- C Prior to testing the blocks shall be stored in water at a temperature of 20°C ± 5°C for at least 24 hours.
- D Load increase of stress during test shall be 15 N/mm² per minute. Blocks shall be packed in 4 mm thick plywood.
- E Water absorption, when tested according BS 1881 shall be not more than: 2% absorption after 10 minutes;

5% absorption after 24 hours.

- F Maximum permissible variations in dimensions are as follows: length: ±2 mm of the nominal specified length

width: ±2 mm of the nominal specified width thickness: ±3 mm of the nominal specified thickness.

PART 3 - EXECUTION

3.1 Construction Method

- A The blocks shall be laid and embedded on approved and compacted sandfill to the correct level, grade and crossfall, so that when tested with a 3 metre straight edge, placed in any direction of the paving, the maximum deviation shall not exceed 10 mm. The difference in level between two adjacent blocks shall not exceed 2 mm.
- B Deviation from the specified level shall not exceed 6 mm.
- C Deviation from the specified level of the top of the granular subbase shall not exceed 20 mm.

- D Edge restraints must be complete, adequately bedded and haunched and must be to the required level.

Hunching to gullies, manholes and the inside face of edge restraints must be vertical so that pavings do not "ride-up" when compacted.

- E The first part of the bedding shall consist of a compacted layer with a thickness of approximately 35 mm. The second part shall be a uniformly loose layer with sufficient surcharge to give the required finished levels and an overall bedding thickness of 50 mm.

Subject to approval of accuracy and regularity of the finished paving, the bedding may be laid in a single layer.

- F Bedding sand must not be delivered to the working area over the uncompacted paving. Pedestrian or wheeled traffic is not allowed over the bedding course.
- G Stockpiled bedding material must be protected against saturation by heavy rainfall.
- H Starting from an edge restraint blocks must be laid handtight with a joint width of 2-5 mm, mechanical force to obtain tight joints is not allowed. Blocks must be placed squarely with a minimum disturbance to the bedding.
- I Blocks must be supplied at least 1 metre back from the laying face. Plant is not allowed to traverse areas of uncompacted paving.
- J The alignment of pavers must be checked continually with string lines to ensure maintenance of an accurate bond.
- K Wherever the type of bond and angle of edging permit, small infill pieces at edges must be avoided by breaking bond on the next course on from the edge using cut blocks not less than 1/3 full size.
- L Non-compacted areas of paving must be protected from heavy rainfall.
- M Paving must be thoroughly compacted with a vibrating plate compactor as laying proceeds but after infilling of edges. Complete area except 1 m of any unrestrained edge must be compacted at the end of a working day.
- N Vibrating compactor to be used: Plate area: 0.35 to 0.5 m²;

Force range: 75 to 100 kN/m²;

Frequency range: 75 to 100 Hz.

- O Paving must be checked after compacting the first few metres and at regular intervals to ensure that surface levels are as specified, if not, pavers must be lifted and relaid.
- P Sand for joints must be brushed-in, and surface must be revibrated until joint is completely filled.

END OF SECTION

SECTION 32 16 CONCRETE KERBS AND GUTTERS

PART 1 - GENERAL

1.1 Summary

Section covers requirements for supplying and placing: **Concrete Kerbs and Gutters**.

- made of structural concrete;
- on cement mortar bed with haunch supports of blinding concrete;
- at locations and in accordance with the lines, grades, dimensions and details as shown on the drawings or as instructed by the Engineer.

1.2 Related Sections

Section to be referred to, related to this Section:

- **Structural Cement Concrete and Blinding Concrete**, section

31 13.13.

1.3 References

ASTM C 109M Compressive Strength of Hydraulic Cement Mortars

ASTM C 293 Flexural Strength of Concrete (using Simple Beam with Centre-Point Loading)

Refer to the **Section** for **Structural Concrete for Civil Works**.

B Material Specification Requirements:

ASTM C 33 Concrete Aggregates ASTM C 91 Masonry Cement

ASTM C 144 Aggregate for Masonry Mortar ASTM C 150 Portland Cement

ASTM C 270 Mortar for Unit Masonry

Refer to the **Section** for **Structural Concrete for Civil Works**.

PART 2 - PRODUCTS

2.1 Materials

2.1.1 Kerbs and Gutters

A Manufacture: recast, in steel moulds;

- with tongue and groove ends.

B Portland Cement, Type I or Type V ASTM C 150.

C Physical Requirement:

- concrete quality
- average flexural strength: $> 5.0 \text{ N/cm}^2$ (according ASTM C 293);

number and frequency of testing: **5** stones per each lot of **500**;

- straight precast stone length for:

- straight sections/curved sections with radius $R > 30 \text{ m}$:

0.50 - 1.00 m;

- curved sections with radius $7.5 < R < 30 \text{ m}$:

0.25 - 0.50 m;

- dimension tolerance:
 - length: $\pm 1 \%$ of nominal specified length;
 - width: $\pm 2 \text{ mm}$ of nominal specified width;
 - height: $\pm 3 \text{ mm}$ of nominal specified height.

2.1.2 Cement Mortar

A Portland Cement, Type: refer to par. 2.1.1.

B Aggregate: Natural sand or Manufactured sand, obtained from crushing stone or gravel;

- Grading: according to par. 4.1 of ASTM C 144.

C Composition of Mortar: **1** (one) part cement : **2.5 - 3.0** parts of sand by weight.

D Physical Requirement:

- average compressive strength (3 cubes) according to ASTM C 109M: after **7** days: $> 3.5 \text{ Mpa}$ (reference ASTM C 91 and C 270, Type N).

2.1.3 Blinding Concrete

A Physical Requirement:

- concrete quality: **C 15** (refer to the **Section 03 31 13.13**).

PART 3 - EXECUTION

3.1 Preparing and Placing

- A After the base course of the pavement construction has been compacted and approved, a groove shall be carefully cut in the base course to the dimensions required for placing the kerbs.
- B The kerbstone is to be set on a layer of cement mortar and carefully tamped in place to the exact lines, grades and elevations.
- C The border stone shall be set on a layer of cement mortar. The topside of the border stone shall be 5 mm below the surface of the adjacent paving tiles.

3.2 Cleaning and Restoration of Site

- A After the placing of the kerbs or gutters are completed the Contractor shall remove all tools, surplus material, dirt and rubbish from the site.

END OF SECTION

SECTION 32 17 23.13 PAVEMENT MARKING

PART 1 - GENERAL

DESCRIPTION

A. Section consists of requirements for the supply and application of temporary and permanent markings on:

1. Airfield pavements and/or road pavements;
2. Including solid glass beads to the marking paint or its surface to provide for the reflective feature, where specified;
3. At locations and to the extent and details as shown on the drawings or as instructed by the Supervisor.

B. The following types and colours for the markings are applicable:

1. Runway markings shall be reflective white;
2. Taxiways, taxi track and apron markings shall be non-reflective yellow;
3. Road markings shall be white;
4. Temporary markings shall be white or yellow, as indicated;
5. Markings on concrete pavements shall be outlined in black, wide 100 mm.

C. In addition, Section consists of requirements for: Removal of Pavement Markings,

i.e. permanent and/or temporary markings from:

1. Airfield pavements and/or road pavements;
2. Including clean-up of surface and disposal of materials;
3. At locations and to the extend and details as shown on the drawings or as instructed by the Supervisor.

1.2 RELATED SECTIONS

Not Applicable.

1.3 REFERENCES

A. Material Specification Requirements:

EN 1436:1997 Road Marking Materials – Road Marking Performance EN 1871:2000 Road Marking Materials – Physical properties

BS 6088 Solid Glass Beads

B. Definitions

Paint: A liquid product containing solids suspended in an organic solvent or in water, applied by brush, roller or spray using appropriate mechanical applicator.

Thermoplastics: A solvent – free marking substance supplied in block, granular or powder forms, heated to a molten state and then applied with an appropriate mechanical applicator.

1.4 SUBMITTALS

A. Product Data:

1. Submit product data, including manufacturer's product specification sheet(s) of specified product(s).

B. Samples:

1. Submit selection and verification samples for final approval by Supervisor.

C. Quality Assurance Submittals as follows:

1. Test Reports: Certified test reports showing compliance with all specified physical requirements, or;
2. Certificates: Product certificates signed by manufacturer stating, that materials comply with all specified physical requirements.

1.5 DELIVERY STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver to site in original, undamaged, sealed containers with identification labels intact, showing manufacturer's name, batch or lot number and safe heating temperature (only for hot-applied).

C. Storage and Protection: Store materials in covered areas at temperature conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 COLOUR, LUMINANCE AND SKID RESISTANCE

A. The chromaticity and luminance factors of pavement marking after application and curing shall be within the boundaries of the C.I.E. colour diagram as indicated in Table 1.

B. The chromaticity and luminance factors of marking shall be determined as per EN-1436:1997 and EN-1871:2000.

- C. The skid resistance value expressed in SRT units shall be at least equal to or greater than 65 and measured as per EN-1436:1997, Annex-D.

Colour	Boundary	CIE Equations
Non-Reflective Markings		
White	Purple Blue Green Yellow Luminance Factor	$Y = 0.010 + X$ $Y = 0.610 - X$ $Y = 0.030 + X$ $Y = 0.710 - X$ $\beta = 0.75$ (minimum)
Yellow	Orange White Green Luminance Factor	$Y = 0.108 + 0.707 X$ $Y = 0.910 - X$ $Y = 1.35 X$ $Y = 0.093$ $\beta = 0.45$ (minimum)
Red	Purple White Orange Luminance Factor	$Y = 0.345 - 0.051 X$ $Y = 0.910 - X$ $Y = 0.314 + 0.047 X$ $\beta = 0.07$ (minimum)
Black	Purple Blue Green Yellow Luminance Factor	$Y = X - 0.030$ $Y = 0.570 - X$ $Y = 0.050 + X$ $Y = 0.740 - X$ $\beta = 0.03$ (maximum)
Reflective Marking		
White	Purple Blue Green Yellow Luminance Factor	$Y = X$ $Y = 0.610 - X$ $Y = 0.040 + X$ $Y = 0.710 - X$ $\beta = 0.27$ (minimum)

Table 1: Chromaticity and Luminance Factors for Pavement Markings

2.2 REFLECTIVE MEDIA – GLASS BEADS

- A. Glass beads incorporated in the paint and/or sprinkled on the surface shall be in accordance with BS 6088 Class B or equivalent. Consumption up to 12 kg per 20 litres of paint or as per manufacturer's instructions. Pyramidal shape glass beads as per EN 1436 is preferred over spherical shape beads.

2.3 SILICA SAND

- A. Silica sand shall be foundry grade silica sand composed of at least 99.5 percent silicon dioxide when tested in accordance with ASTM C-146. The gradation of the silica sand shall meet the paint manufacturer's recommendations and shall approximate a 50/60 graded sand when tested in accordance with ASTM C-136. It shall also meet skid resistance standards as specified at Clause 2.1 C. Alternately calcined aluminium oxide grit will be acceptable.

2.4 PRODUCT SUBMISSIONS

- A. Product submittal shall accompany with all the test reports and technical details. The product will not be applied without approval of the Supervisor.

2.5 THERMOPLASTIC MARKING PAINT

A. Individual Constituent Specification

1. The material used shall conform to EN 1871:2010 for Road Marking Materials (superimposed type).
2. The chromacity coordinates and luminance factor shall be as per Table 1 clause 2.1.
3. The softening point shall exceed 85°C when tested as per EN 1871:2000, Annex F.
4. The material shall meet the requirement of cold impact – class 3, EN 1871:2000.
5. The ultra violet ageing (UV) tested as per EN 1871:2000, shall be such that the difference in luminance factor ($\Delta\beta$) for colours white and yellow shall be

< 0.05 ($\Delta\beta$).

6. Heat stability of the product tested as per EN 1871: 2010, Annex G and the tests after the heat stability tests such as chromacity coordinates, luminance factor and softening point shall comply with EN 1871:2000.
7. Containers shall conform to the requirements of EN 1871:2000 and shall be made of a material which will protect the contents from contamination. The capacity shall not be less than 25 kg. Each container shall be clearly marked with the manufacturer's name, batch number and date of manufacture.

B. Composition and Thickness

1. The composition of the thermoplastic marking material shall generally comply with the requirements of Table 2.
2. The grading of the various ingredients shall be such that the final product, when in a molten state, can be sprayed on the surface at approximately 1/16" (1.5 mm) thickness.
3. The compound shall have an open flash point exceeding 230° C. Temperature up to 220° C may be used for mixing. At this temperature the material shall not discolour

in the time required for its use.

4. The composition shall possess an approximate specific gravity of 2.0 kg/litre.
5. The material shall be adjusted for tropical conditions.
6. The final material shall consist of light coloured aggregate, pigment and extender, bound together with hard wearing resins, plasticised with oil as necessary.

Proportion of Constituents	Percentage by Weight	
	Non- Reflective	Reflective
Binder	18 – 22	20
Aggregate	60	40
Pigment and Extender	18 – 22	20
Solid Glass Beads	-	20
Grading of Combined Material	Percent Passing	
No. 14	100	
No. 25	75 - 95	

Table 2: Composition of Thermoplastic Marking

C. Performance Tests

1. The material shall possess adequate properties over the required tropical temperature range. It must conform to the performance tests described in EN 1871:2000.
2. The softening point of the binder shall be used as a guide to quality control, and the behaviour of the spray shall be judged from the performance test.

2.6 MARKING PAINT

A. Individual Constituent Specification

1. The material used shall conform to EN 1436:1997 and EN 1871:2000 for Pavement Marking Paints.
2. Solid glass beads incorporated in the mixture and/or sprinkled on the surface shall be in accordance with Clause 2.2.
3. The paint shall be organic solvent based. The solvent used shall be compatible with the pavement surface.

B. Composition and Thickness

1. The grading of the various ingredients shall be such that the final product can be sprayed on the surface at approximately **350 microns** wet and **200 microns** dry film thickness.
2. The composition shall possess a minimum specific gravity of 1.4 kg/litre.

PART 3 - EXECUTION

3.1 WEATHER CONDITIONS

A. At the time of preparation and application, weather conditions to be:

1. dry;
2. atmospheric temperature: $> 5^{\circ}\text{C}$;
3. wind speed: use formula: $[T] \text{ (atm. temp. in }^{\circ}\text{C)} - [Vw] \text{ (wind velocity in m/sec)} > 0$

B. In addition, application of marking paint:

1. on a dry pavement surface;
2. actual surface temperature of pavement: $> 5^{\circ}\text{C}$

3.2 EQUIPMENT

- A. All equipment for the work shall be approved by the Supervisor and shall include everything necessary to clean the existing surface; a mechanical marking machine and such auxiliary hand painting equipment as is necessary.
- B. The mechanical marker shall be an approved atomising spray- or screed type marking machine suitable for application of traffic paint.
- C. The machine shall produce an even and uniform film at the required spreading rate and shall be designed so as to apply markings of uniform cross section and clear-cut edges without running or spattering and within the limits for straightness as set forth herein.

- D. When required, a sphere dispenser properly designed for attachment to the mechanical marker and suitable for dispensing the required quantity of spheres shall be furnished.
- E. Suitable adjustments or additional equipment capable of painting the shapes and dimensions required shall be provided.

3.3 PREPARATION OF PAVEMENT SURFACE

- A. Immediately before application of the paint, the surface shall be dry and entirely free from dirt, grease, oil, acids, laitance, or other foreign matter, which could reduce the bond between the coat of paint and the pavement.
- B. The area to be painted shall be thoroughly cleaned by sweeping and blowing and scrubbing with water as required to remove all dirt, laitance and loose material.
- C. Areas, which cannot be satisfactorily cleaned by brooming and blowing, shall be scrubbed as directed with a water solution of tri-sodium phosphate (10% Na₃PO₄ by weight) or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to painting.
- D. On new concrete surfaces any laitance and/or curing compound shall be removed by wire brushing or other approved means before applying the markings.
- E. If specified by the paint manufacturer a tack coat shall be provided on old and/or new concrete surfaces.
- F. For cement concrete pavements, no paint shall be applied until the surface in the area to be painted is clean of curing compound.
- G. Sand blasting or high-pressure water shall be used to remove curing compound. When necessary a special thinner as recommended by the manufacturer shall be applied for concrete surfaces.

3.4 TEST SECTION

- A. Contractor to prepare a marking test section of at least 50 m, demonstrating that equipment and procedures for preparing and applying the paint material shall provide a satisfactory pavement marking.

3.5 APPLICATION

A. General

1. Compliance: Contractor to comply with manufacturer's instructions for application.
2. When retro-reflective markings are applied, the additional surface application of the glass beads shall be immediately distributed to the surface of the pigmented binder and embedded at the rate as required to provide adhesion and reflection.
3. A time interval as recommended by the paint manufacturer shall elapse from the laying time of the bituminous surface course and the cement concrete to the time of marking the pavement.
4. The paint shall not curl or discolour when applied to bituminous surfaces.

B. Thermoplastic Marking Paint

1. Application shall be by mobile sprayer, either hand- propelled or self- propelled.
2. Where necessary to use tack coat, this shall be a rubberised type recommended by the manufacturers of the plastic.
3. In addition to the glass beads included in the mix, an additional quantity of glass beads shall be sprayed on to the hot spray plastic line at the time of application when.
4. The rate of application shall be about 460 – 610 g per square meter.
5. The material shall be laid in intermittent lines or continuous lines of 1.5 mm thick, using an approved pressure spray unit.
6. The finished lines shall be free from “raggedness” on sides and ends and be in true plane with the general alignment of the pavement.
7. The upper surface of the lines shall be level, uniform and free from streaks.
8. Material not conforming to the specification or work performed of inferior quality shall be considered as defective and shall be replaced or made satisfactory, at the expense of the Contractor.

C. Marking Paint

1. Rate of application shall be at least such that resulting film shall have film thickness dry of at least **200 microns**.
2. If the paint material is applied by brush, the surface shall receive two coats. The first coat shall be thoroughly dry before the second coat is applied.

D. Temporary Marking Paint

1. Temporary markings shall consist of markings placed on runways, taxiways, taxi tracks, aprons and roads as temporary markings for traffic guidance or as temporarily closed markings, and shall be placed by the Contractor at the locations as shown on the drawings or as directed by the Supervisor.
2. The markings shall be of the type and colour as specified on the drawings or as instructed. When not specified otherwise, temporary markings for traffic guidance shall have the same colours as the permanent markings. Low durability water based paint will be acceptable. The minimum duration of use as temporary marking shall be at least 3 months.
3. Rate of application shall result in a dry film thickness of at least **60 microns**.
4. When areas are temporarily closed off, a material other than a paint may be used, such as heavy fabric, plywood or whitewash.
5. The “closed” markings on the runway shall preferably be painted with whitewash and be maintained during the time the runway is closed to air traffic.

6. All temporary markings shall be placed and maintained to the satisfaction of the Supervisor.
7. Temporary markings that are to be abandoned shall be removed, obliterated or obscured by the best method suited for the purpose and to the satisfaction of the Supervisor. (see Clause 3.7.B).

3.6 PROTECTION

- A. After application of the paint, all markings shall be protected from damage until the paint is dry.
- B. The fresh paint shall be protected from all traffic, both vehicular and pedestrian, and from injury or damage of any kind.
- C. The Contractor shall be responsible and shall erect or place suitable warning signs, flags, and/or barricades, protective screens, or coverings as required.
- D. All surfaces shall be protected from spatter, splashes, spillage, drippings, etc. of paint or other materials.

3.7 REMOVAL OF EXISTING PAVEMENT MARKINGS

A. General

1. Existing marking of stripes which are to be abandoned or removed because of changes in the pattern or in the operating procedures, or because the thickness of the layers is excessive, shall be obliterated by the best method suited for the purpose, as decided by the Supervisor.

B. Method of Removal

1. Obscuring of existing markings will not be applied except as a temporary measure.
2. Sandblasting is the recommended method as it is effective and does little damage to the pavement surface. The sand deposited on the pavement shall be removed.
3. Grinding, milling shall not be used on asphalt concrete pavements.
4. When chemicals are used for paint removal, a large and continuous source of water shall be used to reduce damage to pavements and to dilute the chemicals washed into drains or channels.
5. Burners using butane, propane or mixtures of liquid petroleum gases shall not be used.
6. Burners using propane and pure oxygen, which produces much hotter flames, are to be used when burning is selected. An excess of oxygen rapidly oxidizes the paint and transfers less heat to the underlying pavement. More than one pass may be required.
7. After the paint is oxidized, the residue is to be removed from the pavement surface by wire brushing, hydro-brooming or hand scraping or light sand blasting.

END OF SECTION

SECTION 32 31 13.53 HIGH-SECURITY CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item covers the requirements for furnishing materials and constructing fences and gates in accordance with the details included herein and shown on the drawings.
- B. The type of fence to be erected shall be chain-link fencing as shown on the applicable drawing.
- C. The contractor shall include all supplementary parts necessary or required for a complete and satisfactory installation within the true meaning and intent of the drawings.
- D. All runs of the fence shall present the same general appearance and the product of one manufacturer only will be accepted, except for items which do not influence the appearance of the completed fence.
- E. No used, rerolled, or open seam steel shall be permitted.
- F. The posts and supports shall be constructed in accordance with the details included herein and/or as shown on the drawings or as directed by the Engineer.
- G. Included in the item are connections to buildings or existing fences and the provision of electrical grounds.

1.2 REFERENCES

A. Material Requirements:

ASTM A 121 Metallic-Coated Carbon Steel Barbed Wire

ASTM A 153 Zinc Coating (hot-dip) on Iron and Steel hardware ASTM B 117 Practice for Operating Salt-Spray Apparatus

ASTM F 1043 Strength and Protective Coating on Steel Industrial Chain Link Fence Frame Work

ASTM F 1083 Pipe, Steel Hot-Dipped Zinc-Coated Welded for Fence Structures

ASTM G 152 Operating Open Flame Carbon Arc Light Apparatus for Exposure of Non-Metallic Materials

ASTM G 153 Operating Enclosed Carbon Arc Light Apparatus for Exposure of Non-Metallic Materials

ASTM G 154 Operating Fluorescent Light Apparatus for UV Exposure of Non-Metallic Materials

ASTM G 155 Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Fed. Spec. RR-F-191/3 Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)

B. RELATED SECTION

C. Sections to be referred to:

1. Section 03 31 13.13 Structural Concrete and Blinding Concrete

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The fabric shall be a woven with a 9-gauge PVC-coated steel wire in a 50 mm mesh and shall meet the requirements of ASTM F 1043, Class 2b.
- B. Barbed wire shall be 2-strand twisted 2.5 mm thick zinc-coated steel wire with 4- point barbs of 2 mm zinc-coated steel wire and shall conform to the requirements of ASTM A 121, Class 3, Chain Link Fence Grade. The barbs shall be spaced approximately 120 mm. The minimum weight of zinc-coating shall be 150 gram per square metre. The wires shall be spaced as shown on the drawings or as directed by the Engineer.
- C. Wirefabric ties and wire ties shall be 3 mm galvanized steel wire and PVC coated. Tension wire shall be 4 mm galvanized steel wire and PVC coated.
- D. Line posts, rails and braces shall conform to the requirements of ASTM F 1043 or ASTM F 1083 as follows:
1. Galvanized tubular steel pipe shall conform to the requirements of Group IA, (Schedule 40) coatings conforming to Type A, or Group IC (High Strength Pipe), External coating Type B, and internal coating Type B or D.
 2. Roll Formed Steel Shapes (C-Sections) shall conform to the requirements of Group IIA, and be galvanized in accordance with the requirements of F 1043, Type A.
 3. Hot-Rolled Shapes (H Beams) shall meet the requirements of Group III, and be galvanized in accordance with the requirements of F 1043, Type A.
 4. Aluminium Pipe shall conform to the requirements of Group IB.
 5. Aluminium Shapes shall conform to the requirements of Group IIB.
 6. Vinyl or polyester coated steel shall conform to the requirements of ASTM F 1043, Paragraph 7.3 Optional Supplemental Colour Coating.
 7. Composite posts shall conform to the strength requirements of ASTM F 1043 or ASTM F 1083. The strength loss of composite posts shall not exceed 10 percent when subjected to 3,600 hours of exposure to light and water in accordance with ASTM G 152, ASTM G 153, ASTM G 154, and ASTM G-155.
- E. Posts, rails, and braces furnished for use in conjunction with aluminium alloy fabric shall be aluminium alloy or composite.
- F. Posts, rails, and braces, with the exception of galvanized steel conforming to F 1043 or ASTM F 1083, Group 1A, Type A, or aluminium alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B 117 as follows:

1. External: 1,000 hours with a maximum of 5% red rust.
 2. Internal: 650 hours with a maximum of 5% red rust.
- G. The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Fed. Spec. RR-F-191/3.
- H. Gate frames shall consist of galvanized steel pipe and shall conform to the specifications for the same material under Clause 2.1D. Gates may be filled with security mesh fence welded to the pipes or consist of top and bottom rails with vertical bars. The fabric shall be of the same type material as used in the fence.
- I. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A 153. Barbed wire support arms shall withstand a load of 250 pounds (113 kg) applied vertically to the outermost end of the arm.
- J. Zinc-coating on gates, gate posts, supports, fittings and other structural steelware shall be of a minimum weight of 450 gram per square metre.
- K. Concrete shall be in accordance with Section Structural Concrete and Blinding Concrete, using 25 mm maximum coarse aggregate.

PART 3 - EXECUTION

3.1 GENERAL

- A. The fence shall be constructed in accordance with the requirements of the Engineer and as specified herein, with new materials and all work shall be performed in a workmanlike manner satisfactory to the Engineer.
- B. Prior to the beginning of the work, the Contractor shall locate the position of the work by establishing and marking the fence line. At locations of small natural or drainage ditches where it is not practical for the fence to conform to the general contour of the ground surface, the Contractor, when directed, shall use longer posts and strands of barbed wire stretched thereon to span the opening below the fence, vertical clearance between wire shall not be more than 0.15 m.
- C. The new fence shall be permanently tied to the terminating points or existing fences whenever required by the Engineer.
- D. The finished fence shall be plumb, taut, true to line, and ground contour, and complete in every detail.
- E. When directed, the Contractor shall be required to stake down the chain-link fence at several points between the posts.

- F. To keep stock on adjoining property enclosed at all times, the Contractor shall arrange the work so that construction of the new fence will immediately follow removal of existing fence.
- G. The unfenced section shall be of such length that the livestock can be kept in the proper field. The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence.
- H. Openings in the fence shall be guarded when livestock is in the adjoining property.

3.2 CLEARING FENCE LINE

- A. The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground.
- B. The fence line shall be cleared to minimum width of 1 metre on each side of the centre line of the fence.
- C. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. The clearing must be within the airport boundaries.
- D. Stumps within the cleared areas of the fence line shall be grubbed or excavated.
- E. The bottom of the fence shall be placed at a uniform distance above the ground as specified by the Engineer.
- F. As directed by the Engineer, existing fences which coincide with, or are in a position to interfere with the new fence location shall be removed by the Contractor as a part of the construction work
- G. All holes remaining after stump and post removal shall be refilled with suitable soil, gravel, or other material subject to the acceptance of the Engineer and shall be properly compacted with tampers.
- H. The work shall include the handling and disposal of all material cleared, excavated or removed, regardless of the type, character, composition, or condition of such material encountered.
- I. Performance of the work under this clause shall be considered as a subsidiary obligation of the Contractor covered under the item "Chain-Link Fence".
- J. Grading operation exceeding fill or excavation layers of 0.15 m thickness shall not be considered as normal grading.
- K. If so ordered by the Engineer, fill or excavation exceeding the 0.15 m shall be carried out by the Contractor.

3.3 INSTALLING POSTS AND SUPPORTS

- A. All posts shall be spaced as shown on the drawings.
- B. Line and corner posts and supports shall be set in concrete bases as shown on the drawings.
The top of the base shall be slightly above the ground surface, trowel finished, and sloped to drain.
- C. Holes of full depth and size for the concrete bases for posts shall be provided.
- D. the concrete bases shall be allowed to cure for 7 days before top rails, tension wire and fabric are installed.
- E. Should rock be encountered at a depth less than the planned footing depth, a hole 50 mm larger than the greatest dimension of the posts shall be drilled to a depth of 300 mm.
- F. After the posts are set, the remainder of the drilled hole shall be filled with grout, at Contractor's expense.
- G. If top rails are required, an expansion coupling shall be placed at approximately 30 metres intervals to take care of expansion and contraction of the rail.
- H. All corner and support posts etc. shall be braced as shown on the drawings.
- I. Support posts shall be set at approx. 100 metres intervals and braced as shown on the drawings.

3.4 INSTALLING BARBED WIRE AND TENSION WIRE

- A. All barbed wire and tension wire shall be placed on the side of the posts away from the airport or as directed by the Engineer, at the height indicated on the plan.
- B. The wire shall be carefully stretched and hung without sag and with true alignment. Care shall be taken not to stretch the wire so tightly that it will pull up corner, support and gate posts.
- C. All wires shall be fastened securely to each post by fasteners or clips designed for use with the posts furnished.
- D. The wires shall be wrapped around end, corner and gate posts, and the ends of all horizontal wires shall be tied with snug, tight twists.
- E. The wires shall be secured to each post to prevent slipping out of line or becoming loose.
- F. Splices in barbed and tension wire shall be permitted if made with an approved galvanized bolt-clamp splice.
- G. The bottom tension wire shall clear the ground by not more than 0.1 m at any place.

3.5 ELECTRICAL GROUNDS

- A. Where a power line/cable passes over or under the fence, electrical grounds shall be

constructed.

- B. The electrical grounds shall be installed 10 m before and 10 m after the point of crossing.
- C. The electrical grounds shall be accomplished with a copperclad rod 2.4 m long and a minimum of 15 mm in diameter driven vertically until the top is 150 mm below the ground surface.
- D. A solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded.
- E. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction.

3.6 INSTALLING FABRIC

- A. The chain link fabric shall be installed by a method as recommended by the supplier.
- B. Standard chain-link fence stretching equipment shall be provided for stretching the fabric before tying it to the wire or rails and posts.
- C. Stretching operations shall be repeated about every 30 metres.

3.7 INSTALLING GATES

- A. The gates shall be hung on gate fittings to match the existing. They shall be attached in such a manner that the gate cannot be lifted off the hinges.
- B. Gates shall be so erected as to swing in the direction indicated or as directed by the Engineer and shall be provided with gate stops.
- C. All hardware shall be thoroughly secured, properly adjusted, and left in perfect working order.
- D. Hinges and diagonal bracing in gates shall be adjusted so that the gates will hang level.

3.8 CONNECTION WITH EXISTING FENCE

- A. Wherever the new fence joins an existing fence, either at a corner or at the intersection of straight fence lines, a corner post with a brace post shall be set at the junction and braced the same as shown on the drawings.
- B. If the connection is made at other than the corner of the new fence (e.g. to a building), the last span of the old fence shall contain a brace span.

3.9 CLEANING-UP SITE

- A. The Contractor shall remove from the vicinity of the completed work all tools, equipment, etc. belonging to him or used under his direction during the construction.

END OF SECTION

SECTION 32 91 19.13 TOPSOIL PLACEMENT AND GRADING

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies sources and requirements for topsoil material and construction methods for the topsoil works, such as obtaining topsoil material, stockpiling, preparing the ground surface for topsoil application and spreading topsoil material on prepared areas and at the locations shown on the drawings or as directed by the Supervisor.

1.2 DEFINITIONS

- A. Topsoil. Topsoil is the surface soil with a mineral base suitable for plant growth.
- B. Subsoil. Subsoil is the undisturbed strata lying immediately below the topsoil.
- C. Plastic Limit. The plastic limit of the soil is water content at which the soil consistency changes from being brittle to plastic.
- D. Organic matter. Decomposed remains of plants or animals no longer distinguishable.

1.2 STANDARD TEST METHODS

- A. The following test methods apply:

ASTM D 1140 Test Method for Amount of Material in Soil Finer Than 75-mm (No. 200) Sieve
ASTM D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat
and Other Organic Soils ASTM D 4972 Test Method for pH of Soils
ASTM D 5268 Specification for Topsoil Used for Landscaping Purposes

PART 2 - PRODUCTS

2.1 MATERIAL SOURCES

- A. Naturally occurring topsoil, upper layer of an *in situ* soil profile, usually darker in colour, more fertile than that below (subsoil) and which is a product of natural biological and environmental processes.
- B. The selected subsoil, deposits of mixture of soils and organic matter suitable for plant growth, located in deeper layers of the soil profile.
- C. All top soil shall be obtained from sources within the limits of the construction site, unless specifically approved by the Supervisor.

2.2 GENERAL MATERIAL REQUIREMENTS

- A. Topsoil shall be a layer with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stone (50 mm or more in diameter), clay lumps or similar objects.
- B. Brush or other vegetation which will not be incorporated with the soil during handling operations shall be cut and removed.
- C. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations.
- D. The topsoil or soil mixture obtained from sources off site, unless otherwise specified or approved, shall have a pH range of approximately 5 pH to 7 pH (ASTM D 4972).
- E. The organic matter content shall be neither less than 2% nor more than 20% (ASTM D 2974).
- F. There shall be 20–60% sand content and 35–70% silt and clay content (ASTM D 1140).
- G. The topsoil material may be ended by the Contractor with approved materials and methods to meet the above specifications.

2.3 INSPECTIONS AND TESTS

- A. The Supervisor shall be notified in due time of the source of topsoil to be furnished by the Contractor.
- B. The topsoil material shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth and the extend to which stripping and/or excavation will be permitted.
- C. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed depths, for testing purposes as specified.

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. Suitable equipment necessary for proper preparation and treatment of ground surface, stripping of topsoil, and for the spreading of all required materials shall be available, in good condition, and approved by the Supervisor before the various operations are started.

3.2 OBTAINING TOPSOIL MATERIAL

- A. When suitable topsoil material is available on the site, the Contractor shall remove this material from the designated areas and to the depth as instructed by the Supervisor.
- B. When suitable topsoil material is secured off the airport site, the Contractor shall locate and

obtain the supply, subject to the approval of the Supervisor. The Contractor shall notify the Supervisor sufficiently in advance of operations in order that necessary measurements and tests can be made.

- C. Sites should be surveyed prior to stripping so that depths and distribution of topsoil material can be identified.
- D. Prior to the stripping of naturally occurring topsoil from designated areas, any vegetation, briars, stumps, and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Supervisor. Heavy sod or other cover, which cannot be incorporated into the topsoil by disking or other means shall be removed.
- E. Topsoil should never be stripped or laid when it is wetter than the Plastic Limit (PL), and preferably not when the moisture content is wetter than the PL less 3%. The PL can be assessed in the field as the minimum moisture content at which the soil can be rolled and moulded into thin thread approximately 3mm in diameter without breaking or cracking.
- F. Topsoil should not be stripped during, or shortly after, heavy rain.
- G. The selected subsoil excavation, as another source of topsoil material, shall meet the requirements of Section "Earthworks" of these Specifications.

3.3 STOCKPILING

- A. Ideally, topsoil material should not be stockpiled but, if this is unavoidable, topsoil heaps should be as low and as narrow as possible, maximum heap height 1 m.
- B. Topsoil material should be loosely dumped and stockpiles should be shaped to shed water and sited to avoid potentially water-logged areas.
- C. The areas adjacent to stockpile which have been disturbed by the Contractor shall be graded and put into condition acceptable for seeding or planting, if required.
- D. If topsoil material has to be stored for more than 6 months, it is advisable to seed the stockpile with a deep rooting grass legume seed mixture to maintain structure and aeration, to minimize weed colonization and to stabilize the stockpile.

3.4 PREPARING THE GROUND SURFACE

- A. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Supervisor, to a minimum depth of 50 mm to facilitate bonding of the topsoil to the covered subsoil.
- B. The surface of the area to be topsoiled shall be cleared of all stones larger than 50 mm in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting.
- C. Areas, which are too compact to respond to these operations shall receive special scarification.

- D. Grades on the area to be topsoiled as shown on the drawings, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and properly compacted condition to prevent, insofar as practical, the formation of low places or pockets where water will stand.
- E. The physical and chemical characteristics of all material within the rooting depth should be such that plant roots will thrive in it.

3.5 SPREADING TOPSOIL MATERIAL

- A. The topsoil shall be evenly spread on the prepared areas, already tilled and smooth-graded, to a depth as indicated on the drawings. Spreading shall not be done when the ground or topsoil is excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turving operations can proceed with a minimum of soil preparation or tilling.
- B. After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (50 mm or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor.
- C. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cult packer or by other means approved by the Supervisor.
- D. The compacted topsoil surface shall conform to the required lines, grades, and cross sections.
- E. Any topsoil or dirt falling upon roads or other pavements as a result of hauling or handling and placing of topsoil shall be promptly removed.

END OF SECTION

SECTION 32 92 19.19 GRASSING

PART 1 - GENERAL

1.1 Description

A This item shall consist of sowing seed or planting grass on the areas shown on the drawings or as directed by the Engineer, in accordance with this specification.

B These areas have usually been provided with topsoil.

1.2 References

NOT APPLICABLE

PART 2 - PRODUCTS

2.1 Grass Type

A The seed or grass used for sowing or planting shall be Dhub grass (*Cynoden Dactylon*) or Bahama grass or as instructed by the Engineer.

B Tall, quick growing or Tussock grasses shall not be used without the consent of the Engineer.

PART 3 - EXECUTION

3.1 General

A The Contractor shall as far as practical arrange his operations in such a manner, that grassing of the areas as described can take place in the proper season.

3.2 Seeding

A After grading of the areas to be grassed has been completed, the top shall be loosened and worked to a depth of 50 mm.

B Grass seed shall be sown at such a rate as is necessary to ensure that the grass will form a thick and homogeneous mat.

C The seed shall be raked and properly covered.

D After the seed has been properly covered, the seed bed shall be immediately compacted by means of an approved lawn roller, weighing 60 - 100 kg/m width for clay soils (or any soil having a tendency to pack) and weighing 225 -300 kg/m width for sandy or light soils.

E Contractor may propose alternate methods of seeding such as Hydro- seeding.

3.3 Planting

A Individual planting shall be at max 0.25 m centres measured parallel and at right angles

to the edge of the pavement or at such distances as is necessary to ensure that the grass will form a thick and homogeneous mat.

- B If the soil is not moist when the grass is being set, water shall be applied until the soil is moist and in workable condition.

3.4 Maintenance of Grassed Areas

- A The Contractor shall protect grassed areas against traffic or other use and he shall mow and water as necessary and otherwise maintain grassed areas in a satisfactory condition until provisional hand-over of the areas or until such time as specified.
- B Surfaces gullied or otherwise damaged following seeding or planting shall be repaired by regrading and reseeding or replanting.
- C It shall be the Contractor's responsibility to ensure that the seed is sown at the necessary rate, that watering is sufficient for the grass to take root, and that a good stand of grass is established, uniform in colour and density to the satisfaction of the Engineer.
- D If at the time of the completion of the works it is not possible to make an adequate determination of the colour, density and uniformity of the grassed areas, acceptance and payment for the unaccepted portions shall be withheld until such time as these requirements have been met.

END OF SECTION

SECTION 33 15400 PLUMBING WORKS

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SECTION 33 15400 PLUMBING WORKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General Condition, Conditions of Particular Application and Division-33 Utilities Specification sections, apply to work of this section.

In particular, Drawings of the series KIS-DD-WA-01 to 08 apply to work of this section.

1.2 DESCRIPTION OF WORK

This section covers the work of water supply, sewers and drainage systems as required by the Contract.

1.1.1 Domestic Water Supply Systems

- Provide water meters with, connection to site main include pipe work there from to inside the buildings.
- Provide cold and hot water supply piping including valves, hangers and supports, expansion joints/loops, regulating valves, automatic air vents, drain valves, insulation, wrapping, excavation, dewatering, and backfill.
- Provide hot water system, including pipework, controls, electrical water heaters, and safety devices.
- Provide system testing, disinfections, and commissioning.

1.1.2 Drainage System

- Provide domestic soil and waste, and vent drainage system to collect soil borne wastewater from sanitary fixtures, wastewater from wet areas and equipment.
- Provide above ground and underground piping, hangers and supports, floor drains, cleanouts, roof drains, trap primer, vacuum breakers, plumbing fixtures and fittings, excavation, dewatering, pipe bedding and surroundings and backfill.
- Provide sand trap, oil interceptor, sump and sewage ejector pumps.
- Provide storm water system to collect rain water on the roof and freely discharged on the grade surrounding.
- Provide system testing and commissioning.

1.2 REFERENCE STANDARDS AND CODES

Comply with the stipulations of the latest Edition of the applicable Kenian Standard Specifications and with National Standard Plumbing Code (USA), or other equivalent International Standards, by-laws and regulations of all statutory authorities concerned.

British Standard Specifications BS No.

- 1387 Seamless Black/Galvanized Mild Steel Pipe and Fitting
- 4504 Flanges and Bolting for Pipes, Valves and Fittings. Metric Series
- 4772 Ductile iron pipe for pressure pipelines
- 5154 Copper alloy globe, stop and check valves for general purposes.

1.3 RELATED SECTIONS

The following sections include requirements which relate to this section: 31 11 00.13 Clearing, Grubbing and Demolition

31 22 23.13 Area Grading

31 23 16.33 Excavation and Fill

31 23 33.13 Trenching and Backfill

33 42 13.23 Pipes for Storm Sewers and Foul Water Lines 33 49 13.23 Manholes, Inlets, Pits, etc.

1.3 SUBMITTALS

Submit in accordance with the requirements of Specification 01 33 00-13 Submittal Procedures the following:

- A. **Product Data:** Submit manufacturer's technical product data for materials and products.
- B. **Shop Drawings:** Submit (1:20, 1:50 and 1:100) scaled layout drawings of plumbing pipes and fittings including, but not necessarily limited to, pipe sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations and connections. Show interface and spatial relationship between piping and proximate equipment. Obtain Engineer's approval prior to the commencement of work. Alterations in shop drawings from Contract Drawings, whether due to coordination or otherwise, shall be carried out by the Contractor.
- C. **Coordination Drawings:** Drawn accurately to 1:50 scale and coordinating penetrations and system requirements with other trades.
- D. **Record Drawings:** At project close-out, submit record drawings of installed systems in

accordance with requirements of Division 1.

- E. **Maintenance Data:** Submit maintenance data and parts lists for plumbing systems, materials and products. Include this data, product data, shop drawings and record drawings in operation and maintenance manual.
- F. **Samples:** Submit samples for the Engineer's approval.

1.4 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of plumbing systems products of types, materials and sizes required and whose products have been in satisfactory use in similar service for not less than 15 years.
- B. **Contractor Engineer's Qualifications:** Graduated mechanical engineer with experience of not less than 10 years in the plumbing fields for projects of similar nature and size.

1.5 NOMINAL PIPE SIZES (NPS)

Pipe diameters indicated on the Drawings are nominal. Exact pipe diameters are understood to be the exact pipe diameters as per the applicable specified standard for each pipe material.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing systems with the following minimum working pressure ratings, except where indicated otherwise.

Working Pressure				Test Pressure	
Domestic	Water	Supply Systems	kPa	850	1 200

Soil, Waste & Vent Systems water head 2 3
(m)
Fire Protection kPa 1 200 1 800
Drainage Pressure Mains kPa 680 1 000

PART 2 PRODUCTS

2.1 MATERIALS AND PRODUCTS

Provide equipment, piping materials and factory-fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection to comply with installation requirements. Provide sizes and types matching piping and equipment connections. Provide fittings of materials which match pipe materials used in plumbing systems. Where more than one type of materials or products are indicated, obtain Engineer's clarification prior the procurement of materials.

2.2 BASIC IDENTIFICATION

Provide identification in accordance with the following listing:

- Valves: White plastic identification labels with black letters indicating valve type, number and service.
- Above Ground Piping: Plastic pipe markers/colour coded paint.
- Underground Piping: Underground-type plastic pipe markers.

Comply with ASME A13.1 for colour coding.

2.3 PLUMBING PIPING

Pipes and fittings are specified in different sections of Division-15. The listing for the utilization of the various materials for plumbing works are indicated on the table attached to the end of this section.

2.4 INTERIOR AUTOMATIC-AIR VENTS

Float type hot pressed brass MS 58 consists of two halves screwed together and fitted with O-ring seal, with rubber valve seal, plastic float, vacuum breaker complete with automatic self-sealing spring-loaded brass check valve, stainless steel spring and catch ring rated for 1 000 kPa working pressure as model Hy-vent Type 20-5072/5236 manufactured by Taco Armatoran AG, Switzerland or approved equal.

2.5 PROTECTIVE WRAPPINGS

Non-woven fabric carrier free from chemical impurities, fully impregnated and coated on both sides with neutral compound based on saturated petroleum hydrocarbons with inert siliceous filter tape as manufactured by Winn & Coales (Denso) Ltd., U.K., or approved equal.

2.6 WATER METER

Register in cubic meter, AWWA C 700, displacement (disc) type, with bronze main case, complete with isolating valves, check valve, strainer and cabinet.

2.7 WATER METER CABINETS

Stainless steel cabinet, 2 mm thick with continuous type hinge 3 mm thick stainless steel door with identifying letters engraved to door "Water Meter". Size the cabinet to house inlet pipe connection, strainer, valves, meter and outlet pipe connection. Include door operating hardware in stainless steel with cam-action latch. Cabinet shall be manufactured with corners mitred, welded and ground smooth.

2.8 INTERIOR WALL PIPE SLEEVES

Standard weight galvanized steel pipe sleeve of size to pass pipe and insulation.

2.9 EXTERIOR WALL PIPE SLEEVES

Standard weight galvanized steel pipe sleeve with sealing and anchoring collar poured in place.

2.10 ROCKER PIPE

Two adjacent flexible pipe joints, one is located at a distance of 150 mm from the external face of the structure and the second is located at a maximum distance of 300 mm.

Provide the two flexible joints at each side of the building boundary and at expansion joints.

2.11 ANGLE STOP VALVES

Chrome plated, zinc free bronze angle stop valves and escutcheon, marked red for hot water and blue for cold water as model 22 950 with handle model Florida 100-45180 manufactured by Frederich Grohe, Germany, or approved equal.

2.12 GROUP VALVES

2.12.1 **Embedded Valves:** Bronze body with pre-assembled head part 15 mm short spindle model 29 800 with chrome plated handle assembly, screw flange with wall sealing, Florida handle Model 100-415 180 marking blue or red all as model 19 862 manufactured by Frederich Grohe, Germany, or approved equal.

2.12.2 **Concealed Valves:** Bronze gate valves as specified in section 15100.

2.13 PAINTING

Comply with Health Authorities Regulations and the requirements.

PART 3 - EXECUTION

3.1 INSPECTION

Examine substrates and conditions under which soil and waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 INSTALLATION OF BASIC IDENTIFICATIONS

Install identification for surfaces requiring painting, insulation or other covering finish, including valve tags, after completion of covering and painting. Install identification prior to the installation of acoustical ceilings and similar removable concealment.

Apply colour coding paint for piping and equipment.

Install plastic pipe marker on each system indicated to receive identification and include for arrows to show normal direction of flow.

Install, during backfilling of each exterior underground piping system, continuous underground type plastic line marker located directly over buried line at 150 to 200 mm below finished grade.

Provide valve tag on every valve, cock and control device in each piping system. Exclude check valves, valves within factory fabricated equipment, hose bibs and shut-off valves at plumbing fixtures. List each tagged valve in valve schedule for each piping system.

3.3 INSTALLATION OF ABOVE GROUND PIPING

Drawings indicate general location and arrangements of piping systems, Install piping, as far as practical, as indicated taking into consideration pipe sizing and friction loss, expansion, equipment sizing, other trades and other design requirements.

Ream ends of pipes and remove burrs. Bevel plain ends of pipe. Remove scale, slag, dirt and debris for both inside and outside of piping and fittings before assembly.

Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings and below grade or floors unless indicated otherwise.

Install piping free from sags or bends and with ample space between piping to permit proper insulation.

Install piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated on Drawings.

Locate groups of pipes parallel to each other and spaced to permit applying full insulation and servicing of valves.

Install drains at low points in mains, risers, and branch lines consisting of tee fittings, 15 mm ball valve and short 15 mm threaded nipple and cap.

Seal pipe penetrations through exterior walls using sleeves or puddle connections.

Install unions adjacent to each valve and at final connection to each piece of equipment and plumbing fixtures having 50 mm and smaller.

Install flanges in piping 65 mm and larger, where indicated, every 12 meter, adjacent to each valve and at each of the final connection to each piece of equipment.

Carry out, where applicable, pipework as building proceeds as soon as possible to minimize cutting away and repairing.

Mark out correctly the positions of necessary holes in walls, floors, ceilings, etc., for pipes and pipe supports.

3.4 INSTALLATION OF UNDERGROUND PIPING

Install underground piping as indicated and in accordance with National Standard Plumbing Code. Lay underground piping beginning at low point of systems and true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops. Terminate underground piping at 600 mm above finish floor, coordinate those termination locations to be coordinated with aboveground stacks, plumbing fixtures, etc..

Apply two layers, overlapped 50%, of approved tape as recommended by pipe manufacturer to be compatible with pipe material. Use minimum 500 microns thick and 100 mm wide inner layer. Use 750 microns thick and 100 mm wide outer layer.

3.5 EXCAVATION AND BACKFILL

- A. **Excavation**: Make pipe trench true and even to falls, trim and ram trench bottom to correct level. Refer to Section 02300 "Earthwork".
- B. **Dewatering**: Provide necessary equipment for dewatering while erecting, testing underground piping.
- C. **Planking and Strutting**: Provide adequate shuttering by skilled carpenters. Remove timber as backfilling proceed.
- D. **Backfill**: Use only approved backfill as specified in Section 02300 "Earthwork"

Do not carry out backfill prior the approval of pipe testing. Apply backfill in compacted layers of no more than 300 mm thick. Compact each layer to 97% of maximum dry density as specified in Section 02300 "Earthwork"

3.6 INSTALLATION OF HANGERS AND SUPPORTS

Install hangers, supports, clamps and attachments to support piping properly from building structure and arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-

duty trapeze hangers where possible. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Install hangers and supports to provide piping slopes.

3.7 INSTALLATION OF DRAINAGE PRODUCTS

- A. **Cleanouts:** Install in piping as indicated, as required by National Standard Plumbing Code; and at each change in direction of piping greater than 45°; at maximum intervals of 15 m for piping 100 mm and smaller and 30 m for larger piping; and at base of each vertical soil or waste stack located 150 mm above the Flood Rim of the lowest fixture on the lowest floor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- B. **Flashing Flanges:** Install flashing flange and clamping device with each stack, floor drain, and cleanout passing through waterproof membranes.
- C. **Vent Flashing Sleeves:** Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

4 EQUIPMENT CONNECTIONS

Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by National Standard Plumbing Code.

5 FINAL ELECTRICAL CONNECTIONS

Provide main isolators in control panels of each equipment.

Carry out electrical connection to control panel isolators, between control panel and equipment including control wiring. Carry out earthing for electrical equipment. Comply with the requirements of Division-16

6 PIPE SLEEVES

Install sleeves in connection with piping passing through slabs, partitions or the other building construction.

Set sleeves in new concrete construction before pouring.

Provide sleeves for vertical pipes in open chases or shafts, where allowances for expansion are required or where chases or shafts are to be grouted in after work is installed.

For interior wall sleeves terminate sleeve flush with wall.

Seal sleeves through walls with tightly packed mineral fiber. Special consideration shall be given to the sealing of fire walls.

Use escutcheons flush against finished walls for piping exposed to view. For exterior wall sleeves coat exterior surface of pipe and sleeve with waterproofing material. Seal sleeve through wall with tightly packed waterproofing material. Coat exterior surfaces with tar compound.

Provide fire stopping to sleeves passing through floors, fire protected shaft walls and fire rated walls. Provide fire stopping for the complete sleeve length.

3.8 FIELD QUALITY CONTROL

Test piping systems in the presence of the Engineer in accordance with requirements of National Standard Plumbing Code and as specified. Correct defects appearing under test and repeat until no defects are disclosed. Replace defective work with new work without extra charges to the Employer.

Apply hydraulic leakage test for gravity drainage pipes both in its entirety and in sections after rough piping installation. When applied to entire system, close tightly openings in the piping except highest opening and fill the system with water to point of overflow. When tested in sections, plug tightly pipe openings except the highest opening of the section under test. Fill each section with water but no section shall be tested with less than 3 meters head of water. In testing successive sections, test at least the upper 3 meters of the next to preceding section. Keep the water in the system or in the portion under test for at least 15 minutes before inspection starts, the system shall be tight closed at all points.

Apply hydraulic pressure test for other piping, as the work proceeds, of no less than 1 ½ times the working pressure of the system. Maintain the pressure for one hour. Apply hydraulic pressure test of twice the working pressure for underground pipelines.

Test the whole piping systems of each service immediately prior the completion of work.

Test all fixtures for soundness, stability of support and satisfactory operation.

Test each piece of sanitary ware as follows:

- Flush water closets twice and check for leaks and defects.
- Fill lavatories and sinks to the over flow level, and after running the water through the overflow for a minimum of 30 seconds, remove the plug. Check for leaks and defects.

Repair any defects or leaks. Replace cracked or chipped fixtures.

3.9 CLEANING, FLUSHING AND DISINFECTION

Clean, flush and disinfect entire water supply system, including tanks, equipment, etc., using either calcium or sodium hypochlorite solution. The following process shall be followed:

- Flush thoroughly piping with clean potable water to remove dirt and other contaminants. Remove screens of taps before flushing and reinstall them after completion of disinfection.
- Inject disinfecting agent by means of proportioning pump at an even rate.
- Open sectional valves and ensure that each outlet shall be opened at least twice during disinfection. Check residual with ortholidin solution.
- Close and secure all outlets when the chlorine residual concentration, at all outlets, indicates no less than 50 ppm calculated on the volume of water contained in piping.
- Retain the residual chlorine in the piping system for a period of no less than 24 hours. Ensure that the residual, after retention period is not less than 5 ppm. If not, repeat the process.
- If found satisfactory, flush the piping with clean potable water until residual chlorine

at outlets are not greater than the incoming water supply.

- Employ approved applicators or qualified personnel with chemical and laboratory experience to perform and certify the process.

Indicate, in the certificate of performance, the following:

- Name and location of the job and date of disinfection performance
- Material used for disinfection and its concentration
- Retention period of disinfection in piping system
- ppm chlorine during retention
- ppm chlorine after flushing
- Statement of compliance with the specification
- Signature and address of company/person performing disinfection
- Under no circumstances permit the use of any portion of the water supply piping till the completion of proper and certified disinfection and flushing is terminated.

3.10 PROTECTION

Protect piping during remainder of construction period to avoid clogging with construction materials and debris and to prevent damage from traffic and construction work.

PIPING MATERIAL

System	Pipe Size	Internal Works		Site Works
		Above Ground	Underground	
Drainage	Soil, Waste and Vent Piping			
	50 mm and smaller	MUPVC	MUPVC, gravel bed and sand surroundings	MUPVC, gravel bed, sand bed and surroundings
	80 mm and larger	UPVC	UPVC, gravel bed and sand surroundings	UPVc, gravel bed and sand surrounding
	40 mm and larger	Cast iron painted	Cast iron, heavy duty, concrete bed and surroundings	Cast iron, heavy duty, concrete bed and surroundings
	Pressure Main			

	All	UPVC Schedule 80,	UPVC Schedule 80, sand bed and surroundings	UPVC Schedule 80, sand bed and surroundings with thrust blocks
Domestic Cold Water	All	Galvanized steel	Galvanized steel, wrapped, sand bed and surroundings	Galvanized steel, wrapped, sand bed and surroundings with thrust blocks
Domestic Hot Water	All	Galvanized steel	Galvanized steel, wrapped, sand bed and surroundings	Galvanized steel, wrapped, sand bed and surroundings with thrust blocks
Fire Protection	65 mm and smaller	Black steel, seamless, painted	Galvanized steel, wrapped, sand bed and surroundings	Galvanized steel, wrapped, sand bed and surroundings with thrust blocks
	80 mm and larger	Black steel, seamless painted	Ductile iron, wrapped, sand bed and surroundings	Ductile iron, wrapped, sand bed and surroundings with thrust blocks
Fuel Oil	All	Black steel, painted	Black steel, Protective coating, wrapped, sand bed and surroundings	Black steel, Protective coating, wrapped, sand bed and surroundings

⁽¹⁾Unless otherwise indicated on drawings.

END OF SECTION 33 15400

SECTION 33 42 13.23 PIPES FOR STORM SEWERS AND FOUL WATER LINES

PART 1 - GENERAL

1.1 Description

- A This item shall consist of pipes of the types and sizes as indicated, either for direct burial or encased in reinforced concrete on a working apron of blinding concrete, constructed in accordance with this specification at the specified locations and in accordance with the lines, grades, and dimensions shown on the drawings or as required by the Engineer.
- B The item shall include common excavation, backfill and disposing of surplus excavation, furnishing and installing all trench bracing, shoring and sheathing, grading, pumping and temporary stream diversion required for the installation of the pipe, and all treatment, materials and fittings required to complete the pipe, as shown on the drawings, and the material for and the making of all joints including all connection to existing drainage pipes and structures.
- C The construction of **headwalls, inlet and outlet structures, pits etc., are not included in this scope.**
- D The construction of **concrete culverts** are not included in this scope.

1.2 Standard Test Methods

ASTM C 497 Testing Concrete Pipe.

1.3 Standard Material Specifications

Reference to clause 2 (Materials)

PART 2 - PRODUCTS

2.1 Materials

- A Concrete pipe used in the pipe system shall be of tongue and groove type, or as approved by the Engineer.
- B Concrete pipe for **direct burial** shall be un-reinforced and in accordance with ASTM C 14 m – 95, class 3.
- C Concrete pipe **for encasing with reinforced concrete** shall be in accordance with ASTM C 14 m – Class 1.

- D PVC pipe shall be in accordance with the requirements of ASTM D 3034 - series SDR-41 for **encased** pipes
- E PVC pipe for direct burial of non-pressure systems shall be in accordance with the requirements of ASTM S 3034 – SDR-35.
- F PVC pipe for direct burial pressure systems shall be in accordance with ASTM D 1785, type II.
- G Polypropylene (PP) pipe for direct burial for **non-pressure systems** shall be in accordance with EN 1852-1 and ring stiffness > 8 kN/m².
- H. Polypropylene (PP) pipe for direct burial for **pressurised system** shall be in accordance with EN (to be filled) and ring stiffness (to be filled).
- I Solvent cement for PVC or PP pipe and fittings shall be compatible and in accordance with the requirements of the supplier of pipes.
- J Concrete for encasement shall be structural cement concrete and for working aprons shall be blinding concrete in accordance with specification **Section 03 31 13.13**, Structural Concrete and Blinding Concrete.
- K Reinforcement shall be in accordance with the relevant specification **Section 03 31 13.13**, Structural Concrete and Blinding Concrete.
- L Portland cement for mortar shall be in accordance with the requirement of ASTM C 150, type I. Sand for mortar shall be in accordance with the requirements of ASTM C 144.
- M Rubber gaskets for concrete pipes shall be in accordance with the requirements of ASTM C 443.
- N Bituminous treatment material shall be RC 250 or MC 250 as per ASTM D 2027.

PART 3 - EXECUTION

2.1 Equipment

- A All equipment necessary and required for the proper construction of storm sewers and sewage lines shall be on the project in first class working condition and shall have been approved by the Engineer before construction is permitted to start.
- B The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the subgrade and backfill as specified.
- C The Contractor shall provide appropriate hoisting equipment to handle the pipe while unloading and placing it in its final position, without damage to the pipe.

2.2 Excavation

- A The width of the pit or trench for the structure shall be sufficient to permit satisfactory jointing of the pipe and/or pouring of concrete and thorough tamping of the bedding material under and around the structure, but it shall not be less than the external diameter of the pipe or structure plus 0.15 m on each side.
- B Trench or pit walls shall be approximately vertical.
- C Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 0.15 m.
- D The excavation below grade shall be backfilled with selected fine compressive material, such as silty clay or loam, and lightly compacted in layers not over 0.15 m in uncompacted depth, to form an uniform but yielding foundation.
- E Where a firm foundation is not encountered at the design grade, due to unsuitable material, this soil shall be removed and replaced with approved fill material for the full trench width. The Engineer shall determine the depth of removal. The fill material shall be compacted to provide adequate support for the pipe.
- F The excavation for pipe lines that are placed in an embankment shall not be made until the embankment has been completed to a height of 0.3 metre above the top of the pipe or culvert.
- G The Contractor shall do such trench or pit bracing, sheating, or shoring necessary to perform and protect the excavation and the structure as required for safety and conforming governing laws, and perform all grading and pumping, if necessary, to prevent water running into the trench and to keep the trench dry.
- H The bracing, sheating or shoring shall be removed by the Contractor after placing at the structure. Removal shall be done in such a way that it will not disturb the structure.
- I In order to work under dry conditions, it may be necessary to divert streams temporarily. Contractor shall carry out all such excavation and backfill operations as may be necessary in accordance with the specification.

2.3 Placing Pipe

A. General

- 2.3.A.1 Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a bed which is uniformly firm throughout its entire length.
- 2.3.A.2 Any pipe which is not in true alignment, or which shows any undue settlement after being laid, or is damaged, shall be taken up and re-laid or replaced without extra compensation.
- 2.3.A.3 The laying of the pipe in the finished trench shall be started at the lowest point and laid upgrade.
- 2.3.A.4 The bed of the pipe shall be such, that at least the lower quarter of the pipe shall be in continuous contact with the bed.

B. Concrete Pipe

- 2.3.B.1 The Engineer shall inspect all pipes before they are laid, and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe.
- 2.3.B.2 When bell and spigot pipe is used, the bell shall be laid upgrade.
- 2.3.B.3 If tongue and groove pipe is used, the grooved end shall be laid upgrade.
- 2.3.B.4 The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform.
- 2.3.B.5 The pipe shall be protected from water during placing and until the mortar in the joints has thoroughly set.
- 2.3.B.6 When bell and spigot pipes are used, spaces for the pipe bells shall be provided in the base/subgrade to accommodate the bells. These spaces shall be deep enough to ensure that the bells do not bear the load of the pipe. They shall not be excessively wide in relation to the longitudinal direction of the trench.
- 2.3.B.7 When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant-shaped bedding throughout its full length, exclusive of the bell, to support the entire load of the pipe.

C. PVC Pipe

- 2.3.C.1 The pipe shall be laid in accordance with the recommendations of ASTM D 2321.
- 2.3.C.2 Between the ends of the pipes and the joints, some play shall be maintained to allow for expansion.

2.4 Placing Concrete and Reinforcement

- A The structural cement concrete for the encasement of the pipe shall be in accordance with the specification **Section 03311**.
- B Reinforcement shall be in accordance with the specification **Section 03311** and placed as indicated on the applicable drawings and shall be approved by the Engineer before concrete is poured.
- C Provisions shall be made to keep the pipes, reinforcement and shuttering firmly in place and for the proper bonding of previously and newly poured concrete, all to the satisfaction of the Engineer.
- D The work shall be so arranged that a section begun on any day shall be finished during daylight of the same day. Sections may be between contraction joints.

2.5 Pipe Joints

A. Concrete Pipe Joints

- 2.5.A.1 Joints for concrete pipe may be of the bell and spigot type or the tongue and groove type, unless one type is specifically instructed by the Engineer.
- 2.5.A.2 Cement mortar joints shall be thoroughly cleaned before placing of the pipe and be filled with mortar by an approved method.

The mortar shall be of the desired consistency for filling joints without outside support.

The inner side of the joints filler shall be flush with the pipe wall. The outside of the pipe shall be wrapped with approved bituminous bandage at the joints.

- 2.5.A.3 Rubber gasket joints shall be installed in accordance with the manufacturer's instructions.

B. Pipe Joints

- 2.5.B.1 Joints for PVC pipes shall be made in accordance with the recommendations of ASTM D 2855 or D 3212.
- 2.5.B.2 Joints for polypropylene (PP) pipes shall be in accordance with EN 1852-1.

C. Concrete Encased Pipe Joints

2.5.C.1 Concrete encasement of pipes shall be constructed in sections not longer than 15 metres.

2.5.C.2 Joints shall be made with tongue and groove for load transfer and with a prefabricated rubber water stop as gasket.

2.6 Protection of Concrete Pipe

- A The surfaces of concrete encasement and concrete pipes which will come in permanent contact with soil shall be given two coatings with an approved bituminous material (see Clause 2.1.N).

The first coating shall not be applied before a 7 day curing period of the concrete has elapsed and the second coat at least 24 hours after the first coat.

2.7 Backfilling

- A All trenches and excavations shall be backfilled in a reasonable time after the pipes are installed.

No back-fill shall be placed until the Engineer has approved the structure or pipe.

- B The backfill material shall be approved fill material.
- C Backfill material used under or at the sides of the pipe or until the fill over the top of the pipe exceeds 0.3 m, shall contain no particles larger than 6 mm. The remainder of the backfill shall not contain particles larger than 30 mm.
- D The backfill shall be placed in loose layers not exceeding 0.2 m in depth around and over the pipe.

Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Engineer, until the trench is completely filled and brought to the elevation as directed.

- E Backfilling shall be placed on both sides of the pipe at approximately the same time and same height in order to avoid side pressures on the pipe.
- F In embankments and for other areas outside of pavements, the fill shall be compacted at each side of the pipe for a lateral distance equal to twice the outside diameter or 3.50 metres whichever is the greater and carried up to an elevation at least 0.3 m above the top of the pipe.

Great care shall be used to obtain thorough compaction under the haunches and along the pipe.

- G The backfill shall be compacted to the density as specified for embankments in unpaved areas and paved areas, whichever is applicable.

- H Movement of construction machinery over a pipe drain shall be at the Contractor's risk. Any pipe damaged thereby shall be replaced at the expense of the Contractor.
- I Backfill shall not be placed against any structure until permission is given by the Engineer.

2.8 Connection to Existing Structure

- A Where the drawings call for connections to existing or proposed structures, these connections shall be watertight and so made that a smooth uniform flow line will be obtained throughout the system.
- B PVC pipe connections to pits, etc. shall be made through an extra coupling at both sides of the pit to allow for some play.

2.9 Cleaning and Restoration of Site

- A After the backfill is completed the Contractor shall remove all tools, surplus material, dirt and rubbish from the site.
- B For paved areas, the Contractor shall restore all disturbed areas to their original condition.

2.10 Inspection

- A Prior to final approval of the drainage system, the Engineer accompanied by the Contractor's Representative, shall make a through inspection. Any indication of defects in material or workmanship, or obstruction to flow in the system, shall be further investigated and corrected.
- B Defects due to the contractor's negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

END OF SECTION

SECTION 33 42 16.13 PRECAST CONCRETE PIPE CULVERTS

PART 1 - GENERAL

1.1 Description

- A This item shall consist of reinforced concrete pipe, for direct burial of the types, classes, and dimensions required on the drawings, furnished and installed at locations designated on the drawings and profiles, in accordance with this specification.
- B The item shall include common excavation, backfill and disposing of surplus excavation, furnishing and installing all trench bracing, shoring and sheathing, grading, pumping and temporary stream diversion required for the installation of the reinforced concrete pipe and all treatment and fittings required to complete the pipe culvert as shown on the drawings, and the material for and the making of bedding, of all joints, including all connections to existing drainage pipes and structures.
- C The construction of **headwalls, inlets and outlet structures**, pits etc. **are not included** in this scope.

1.2 Test Methods and Specifications

The following testing and material requirements apply.

- A Standard Test Methods

ASTM C 497 Testing concrete pipes B Standard Material Specifications

Reference to clause 2 (Materials).

PART 2 - PRODUCTS

2.1 Materials

The pipe shall meet the requirements shown on the drawings and specified below:

- A Reinforced concrete pipe shall be in accordance with the requirements of ASTM C 76, Class V - Wall B, to meet the D-crack load of 140 N/M/mm diameter, accompanied by a factory certificate, tested as per ASTM C 497.

- B Rubber gaskets for concrete pipes shall be in accordance with the requirements of ASTM C 443.
- C Portland cement for mortar shall be in accordance with the requirements of ASTM C 150, type I.
- D Sand for mortar shall be in accordance with the requirements of ASTM C 144.
- E Bituminous material for treatment shall be RC 250 or MC 250, to ASTM D 2028 or ASTM D 2027 respectively.
- F Structural concrete for pipe bedding/cradle and blinding concrete shall be as per

Section 03 31 13.13, Structural Concrete and Blinding Concrete.

PART 3 - EXECUTION

3.1 Equipment

- A All equipment necessary and required for the proper construction of culverts and drains shall be on the project in first class working condition and shall have been approved by the Engineer before construction is permitted to start.
- B The Contractor shall provide poker vibrators and hand tampers and pneumatic tampers to obtain the required compaction of the pipe concrete bedding/cradle material and the subgrade/backfill material, as specified.
- C The Contractor shall provide appropriate hoisting equipment to handle the pipe while unloading and placing it in its final position without damage to the pipe or disturbance to the trench.

3.2 Excavation

- A The width of the pit or trench for the structure shall be sufficient to permit satisfactory jointing of the pipe and/or pouring of concrete and thorough compaction of the concrete bedding material under and around the structure, but it shall not be less than the external diameter of the pipe or structure plus 0.25 m on each side.
- B Trench or pit walls shall be approximately vertical.
- C Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 0.15 m.
- D The excavation for pipe lines or culverts that are placed in embankment fill shall not be made until the embankment has been completed to a height of 0.3 metre above the top

of the pipe or culvert.

- E The Contractor shall do such trench or pit bracing, sheeting, or shoring necessary to perform and protect the excavation and the structure as required for safety and conforming governing laws, and perform all grading and pumping, if necessary, to prevent water running into the trench and to keep the trench dry.
- F The bracing, sheathing, or shoring shall be removed by the Contractor after placing of the structure. Removal shall be done in such a way that it will not disturb the structure.
- G In order to work under dry conditions, it may be necessary to divert streams temporarily. Contractor shall carry out all such excavation and backfill operations as may be necessary in accordance with the specification.

3.3 Placing Pipe

3.3.1 General

- 3.3.1.1 Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a structural concrete bed which is uniformly firm throughout its entire length.
- 3.3.1.2 Any pipe which is not in true alignment, or which shows any undue settlement after being laid, or is damaged, shall be taken up and relaid or replaced without extra compensation.
- 3.3.1.3 The laying of the pipe in the finished trench shall be started at the lowest point and laid upgrade.
- 3.3.1.4 The bed of the pipe shall be such, that at least the lower quarter of the pipe shall be in continuous contact with the bed.

3.3.2 Concrete Pipes

- 3.3.2.1 The Engineer shall inspect all pipes before they are laid, and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe. In any case, the pipes shall be accompanied by a load test certificate from the pipe manufacturer as per ASTM C 497. If necessary, the engineer may ask for a new load test of pipe specimens at contractors expense.
- 3.3.2.2 When bell and spigot pipe is used, the bell shall be laid upgrade.
- 3.3.2.3 If tongue and groove pipe is used, the grooved end shall be laid upgrade.
- 3.3.2.4 The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform.
- 3.3.2.5 When bell and spigot pipes are used, spaces for the pipe bells shall be dug in the pipe

subgrade to accommodate the bells. These spaces shall be deep enough to ensure the same depth of concrete bedding is provided under the bells and that the bells do not bear the load of the pipe. They shall not be excessively wide in relation to the longitudinal direction of the trench.

3.3.2.6 When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant-shaped bedding throughout its full length, exclusive of the bell, to support the entire load of the pipe.

3.4 Pipe Joints

- A Pipe joints may be of the bell and spigot type or the tongue and groove type. The pipe shall be gasket jointed.
- B The gasket shall be rubber to the requirement of ASTM C 443M, installed in accordance with the manufacturer's instructions.

3.5 Protection of Concrete Pipe

- A Before concrete pipes are laid the surfaces of the pipes which will come in permanent contact with soil shall be given two coatings with an approved bituminous material, depending upon the ambient temperature. The first coating shall not be applied before a 7 day curing period of the concrete has elapsed and the second coat at least 24 hours after the first coat.
- B In case no shuttering is used and concrete is poured directly in the excavated trench or pit, plastic sheets shall be used as protection between the concrete and the soil.

3.6 Backfilling

- A All trenches and excavations shall be backfilled in a reasonable time after the pipes are installed.

No back-fill shall be placed until the Engineer has approved the structure or pipe and until the cradle concrete has reached 65% of the specified 28 days strength.

- B The backfill material shall be approved fill material, preferably non-plastic sandy soil.
- C Backfill material used above the concrete cradle, and above and at the sides of the pipe shall not contain particles larger than 25 mm.
- D The backfill shall be placed in loose layers not exceeding 0.2 m in depth around and over the pipe. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Engineer, until the trench is completely filled and

brought to the elevation as directed.

- E Backfilling shall be placed on both sides of the pipe at approximately the same time and same height in order to avoid side pressures on the pipe.
- F In embankments and for other areas outside of pavements, the fill shall be compacted at each side of the pipe for a lateral distance equal to twice the outside diameter or 3.50 metres whichever is the greater and carried up to an elevation at least 0.3 m above the top of the pipe. Great care shall be used to obtain thorough compaction under the haunches and along the pipe.
- G The backfill shall be compacted to the density as specified for embankments in unpaved areas and paved areas, whichever is applicable.
- H Movement of construction machinery over a pipe drain shall be at the Contractor's risk. Any pipe damaged thereby shall be replaced at the expense of the Contractor.

3.7 Connection to Existing Structure

A Where the drawings call for connections to existing or proposed structures, these connections shall be watertight and so made that a smooth uniform flow line will be obtained throughout the system.

3.8 Cleaning and Restoration of Site

- A After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site.
- B For paved areas, the Contractor shall restore all disturbed areas to their original condition.

3.9 Inspection

- A Prior to final approval of the drainage system, the Engineer accompanied by the Contractor's Representative, shall make a thorough inspection. Any indication of defects in material or workmanship, or obstruction to flow, or poorly constructed joints in the system, shall be further investigated and corrected.
- B Defects due to Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

END OF SECTION

SECTION 33 44 19.19 TREATMENT OF RAIN AND DRAINAGE WATER (OIL SEPARATOR)

PART 1 – GENERAL

1.1 Description

- A This item consists of the supply and installation water treatment plants consisting of flow regulators, high efficiency oil interceptors, absorbing oil filters, and submersible pumps, installed at location as shown on the drawings and in accordance with the requirements of the specification.
- B The contractor shall guarantee the treatment plants and all component equipment therein against any defect due to materials, or workmanship, for a period of two years from the date of the Certificate of Acceptance. This guarantee shall require the immediate on-site replacement and installation of any defective component equipment at no cost to the Employer.

1.2 References

DIN 1229 - Manhole covers and gratings DIN 1999 - Oil water separators

PART 2 - PRODUCTS

- A The treatment plants shall meet the requirements as specified below and shall be based on the principle that all the storm water effluent from the areas of which the run-off should be treated, as given on the drainage plans, must pass the separator system, either directly or pumped via a retention pond.
- B Based on an influent with a kerosene, aviation fuel and oil the maximum concentration of slop oil in the treated water shall be not more than 10 mg/ltr.
- C The regulators, oil filters, oil interceptors and pumps will be installed on site in cast in situ concrete pits in accordance with the requirements as given in sections 33 49 13.23 and 03 31 13.13 of the specifications. Frames, covers and gratings shall withstand a minimal static load of 400 KN, class D in accordance with German standard DIN 1229. The supplier will furnish the requirements, details and dimensions of the concrete pits.
- D The supplier of the treatment plants will furnish a complete hydraulic design, details and shop drawings, based on the technical characteristics as given in **Part 3** of this section.
- E Flow regulators shall include float based diaphragm shutter flow regulator, nominal capacity as specified in Clause 2.2A, B & C with a maximum deviation of +/-5% within

a regulation range to a maximum of 2050 mm head of water. Material shall be stainless steel SS 304, water and oil resistant bearings, fixing and sealing materials.

- F High efficiency oil interceptor with integrated sludge trap and absorbing oil filter shall include:
- Interceptors with a nominal capacity as specified in Clause 2.2A, B & C, with a guaranteed efficiency for < 1 mg/l free hydrocarbons residue in the effluent under DIN 1999 test running conditions.
 - Honeycomb structure lamellae package offering sufficient hydraulic surface charge conditions (4.4 m/h) as well as coalescence efficiency, preventing flow blocking, material polypropylene, protected and supported in galvanised frames, with fixing and sealing materials;
 - Automatic float shutter (obturation) devices, material stainless steel SS 304 with NBR rubber packing, integrated in a galvanised cage and outlet construction.

The treatment plants shall include service stairs, bar screens and alarm devices.

2.1 Characteristics of the Plants

Treatment Plant Nr. 1 (for run-off from aircraft parking aprons)

Location: adjacent to the concrete apron;

Capacity treatment plant max: 100 Itr/sec;

Run off discharge: 860 Itr/sec;

PART 3 - EXECUTION

- A. The contractor shall finish all plant, labour, material, equipment and services necessary to install the treatment plants complete and in operative condition.

The work shall include, but not be limited to: preparation of shop drawings, fabrication, transportation, assembly and installation of the modules, electrical wiring, power connections and control devices; testing, adjustments, provision of operating and maintenance manuals and supply of initial spares.

- B. All work shall be performed in accordance with this specification and drawings, to the full satisfaction of the Engineer.
- C. During the installation the Contractor shall make appropriate mobile crane assistance available.
- D. Within two weeks after the last plant has been accepted, the Contractor shall clean up the area used for storage and erection.

- E. The Supplier shall have a supervisor at the site during the time installation is in progress. The Supervisor will be the Suppliers representative at the installation on site and responsible for all the work done for the installation of the plants.
- F. Ten (10) maintenance instruction manuals of the treatment plants, in the English language, shall be supplied to the Engineer on hand-over of the first plant.
- G. After completion of the installation of the plants, the Supplier shall supply one transparency and three prints of each of the approved "as built" drawings.
- H. The treatment plants and associate equipment shall be designed for normal maintenance suitable for inclusion in a systematic planned maintenance scheme.
- I. All electrical, mechanical and hydraulic equipment, which requires periodical maintenance, shall be easy accessible.

END OF SECTION

SECTION 33 46 26.13 FRENCH DRAIN

PART 1 - GENERAL

1.1 Scope

- A. This item shall consist of a drainage layer of clean dust free crushed aggregate, perforated pvc pipes or other material approved by the Engineer and a filter.
- B. This item shall include any type of excavation and disposing of surplus excavation, grading, cleaning and restoration of site required for the installations of the french drain.

1.2 Materials

A. Drainage Layer

The drainage layer shall be from crushed rock sources that fulfil the gradation requirements as per 1

ASTM Sieve Size		Percentage by Weight Passing Sieve
¾ inch	(19 mm)	100
½ inch	(12.5 mm)	70 – 100
3/8 inch	(9.5 mm)	40 – 65
No. 4	(4.75 mm)	20 – 45
No. 8	(2.36 mm)	17 – 30
No. 200	(75 µm)	0 – 3

Table 1: Aggregate Grading Drainage Layer

The permeability tested using a constant head permeability apparatus shall be at least 300 m day.

Coefficient of uniformity > 3.5 and non plastic ($C_u = D_{60} / D_{10}$).

B. Pipes

The pipes shall be perforated pvc pipe diam. min. 0.150 m or equal material up to the approval of the Engineer.

Perforated pvc pipe shall conform to the requirement of ASTM D1785, schedule 80. Fittings for pvc pipe shall conform to the requirement of ASTM D2467.

C.Filter

The filter shall be constructed of woven polypropylene mat or nonwoven sheet of continuous filaments of spunbonded polypropylene.

The filter shall not be affected by bacteria, natural acids, salts or alkali or by ultra- violet light after exposure to direct sunlight during one month. It shall have good resistance to rot, moisture, mildew and insects and show no wet shrinkage or stretching. The size of the openings in the mat or sheet shall be determined on the basis of the subsoil that should be prevented to pass.

The filter shall have the following characteristics:

$\frac{EOS}{D(15)} < 1$, in which D(15)

EOS = equivalent opening size. In a sieve test shall be determined, what grain size of a standard sand will be allowed to pass the filter. The equivalent opening size is equivalent to the grain size of which 5 per cent in weight of the material is able to pass the filter.

D(15) = grain size from the distribution curve of the subsoil material for which 5 per cent in weight of the grains have a smaller diameter than D(15).

The filter shall have a permeability that is greater than the permeability of the subsoil in the final situation.

Filters made of other materials, such as polyamide, or polyester may be used, provided the filter characteristics are the same as for the polypropylene filter.

The filter material shall be supplied to the site on rolls, properly protected during transport and storage against ultra violet light.

The permeability of the various subsoils shall be tested in the laboratory in accordance with ASTM D653. The permeability of the filter shall be tested in the field laboratory or by the manufacturer. Certificates provided by the manufacturer, indicating amongst other things the permeability of the filter, will be acceptable, but the Engineer has the right to required tests at the site.

END OF SECTION

SECTION 33 47 13.23 GROUTED STONE PITCHING

1.1 Description

A Section covers the requirements for constructing: **Grouted Stone Pitching**,

- consisting of a layer of stones or crushed rock, grouted with cement mortar; on a prepared sub-grade at inlets and outlets of culverts or at
slopes and bottom in ditches, gutters, etc.;
- at locations and in accordance with the lines, grades, dimensions and
details as shown on the drawings or as instructed by the Engineer;
- including excavation, provisions for temporary stream diversion and pumping for keeping working areas dry, grading, compaction, disposal of
surplus material and restoring ground surface to its original state.

1.2 Related Sections

A Sections to be referred to, related to this Section:

- Construction Water
- Earthworks

1.3 References

A Testing Requirements:

ASTM C 109 - Compressive Strength of Hydraulic Cement Mortars

B Material Specification Requirements:

ASTM C 91 - Masonry Cement

ASTM C 144 - Aggregate for Masonry Mortar

ASTM C 150 - Portland Cement

ASTM C 270 - Mortar for Unit Masonry

1.4 Submittals

A.Product: **Cement**.

B.Compliance: ASTM C 150.

C.Product Data: Submit product data, including manufacturer's product specification sheet of specified product.

D.Samples: Submit selection and verification samples for final approval by Engineer.

E. Quality Assurance Submittals: Submit the following:

- Test Reports: Certified test reports showing compliance with specified physical requirements, **or**;
- Certificates: Product certificates signed by manufacturer stating, that materials comply with specified physical requirements.

1.5 Delivery, Storage and Handling

A Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B Delivery: In bulk, or;
deliver materials to site in manufacturer's original, undamaged, unopened bags with identification labels intact.

C Storage and Protection:

- store materials at temperature conditions recommended by manufacturer and protect same from extended UV exposure and against moisture;
- consignments stored for more than 2 months from date of manufacture:
not to be used, to be discarded and removed from site.

PART 2 - PRODUCTS

2.1 Materials

2.1.1 Pitch Stone

A Pitch Stone to be sound, hard and durable natural stone or crushed rock with at least one flat surface with:

- minimum square size of: **100 mm**;
- maximum square size of: **200 mm**;
- thickness of: **100 - 250 mm**, or not more than the thickness of the grouted stone pitching

layer, whichever is less.

2.1.2 Cement Mortar

A Portland Cement, Type: I

B Aggregate:

- Natural sand or Manufactured sand, obtained from crushing stone or gravel;
- Grading: according to par. 4.1 of ASTM C 144.
- C Composition of Mortar: **1** (one) part cement : **2.5 - 3.0** parts of sand by weight.
- D Physical Requirement: average compressive strength (3 cubes) according to ASTM C 109/C 109M:

after **7** days:> **3.5** Mpa (reference ASTM C 91 and C 270, Type N).

PART 3 – EXECUTION

3.1 Preparing Sub-grade

A Excavation shall be made to the required width and depth, and the sub-grade upon which the item is to be built shall be compacted to a firm uniform grade.

B All soft and unsuitable material shall be removed and replaced with suitable approved material.

C The Contractor shall perform all grading and pumping to prevent water running in and to keep the excavated pits dry.

D When indicated on the drawings or instructed by the Engineer a layer of subbase material, having a compacted thickness of 100 mm, shall be placed to form a sub-grade.

E The underlying course shall be checked and accepted by the Engineer before placing operations are started.

F Performance of works under this item such as excavation, removing unsuitable material and replacing with suitable approved material, pumping and compacting sub-grade, shall be considered as a subsidiary obligation of the Contractor, covered under the item Grouted Stone Pitching.

1.3 Placing

A The stones shall be bedded in the foundation in straight rows with each stone perpendicular to the finished surface. The stones shall be set in close contact, their flat surfaces up and their longest dimension at right angles to the centre- line of the gutter and ditch.

B The pattern of the stones shall break joints satisfactorily, so that no continuous joints are formed. There shall be no interstices exceeding 30 mm in width.

C The stones shall be rammed thoroughly until the surface is firm and conforms to the finished surface in grade, alignment, and cross section.

D Any sections having an irregular or uneven surface shall be taken up and relaid satisfactorily. Rejected material shall be removed from the work.

3.3 Grouting

A After the stones have been rammed into place and the surface is satisfactory, the spaces or voids between and around the stones shall be filled with grout.

B The grout shall be poured and broomed into the spaces between the stones, this operation being continued until the grout remains flush with the top of the stones.

C The grout shall be of such consistency that it will flow readily in to the spaces between the stones, but it must not be so wet that the solid matter separates from the water.

3.4 Weep Holes

A Weep holes shall be constructed as shown on the drawings or indicated by the Engineer.

3.5 Backfill

A After the grout has set sufficiently, the spaces adjacent to the structure shall be backfilled to the required elevation with approved fill material and compacted by mechanical equipment to at least 90% of the MDD at OMC, as determined by ASTM D 1557, Procedure 'C'.

3.6 Cleaning and Restoring of Site

A After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site.

END OF SECTION

SECTION 33 47 13.26 CONCRETE LINING

PART 1 - GENERAL

1.1 Description

- A This item shall consist of Portland cement concrete ditches, on a prepared bed constructed in accordance with this specification at the specified locations and in accordance with the dimensions, lines and grades as shown on the drawings or as required by the Engineer.
- B The item shall include common excavation, backfill, disposing of surplus excavation, grading, reinforcement, jointing, pumping and cleaning and restoration of site required for the installation of the concrete lining.

1.2 Reference

- A ASTMD 1557 - Laboratory Compaction – Modified effort

36 PART 2 - PRODUCTS

- A Concrete, reinforcement, joint filler and premoulded joint material shall be in accordance with the requirements of sections Structural Cement Concrete and Joint Sealants.
- B Sub-base material shall be in accordance with the requirements of the relevant section.

PART 3 - EXECUTION

3.1 Construction Methods

3.1.1 Preparing Sub-grade

- A. Excavation shall be made to the required width and depth, and the sub-grade upon which the item is to be built shall be compacted to a firm uniform grade.
- B. All soft and unsuitable material shall be removed and replaced with suitable approved material.
- C. The Contractor shall perform all grading and pumping to prevent water running in and to keep the excavated pits dry.
- D. When indicated on the drawings, a layer of subbase material, having a compacted thickness of

100 mm, shall be placed to form a sub-grade.

- E. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations of the blinding concrete are started.
- F. Performance of the work under this item, such as excavation, removing unsuitable material and replacing with suitable approved material, pumping and compacting subgrade, shall be considered as a subsidiary obligation of the Contractor.

3.1.2Placing

- A. The forms for and the mixing, placing, finishing, and curing of concrete shall be in accordance with the relevant section.
- B. The concrete shall be tamped and spaded until it is consolidated and laitance entirely covers and forms the top surface. The surface of the concrete shall be floated smooth.
- C. Before the concrete is given the final finishing, the surface shall be tested with a 3 metre straightedge, and any irregularities of more than 6 mm in 3 metres shall be eliminated.
- D. The concrete lining shall be reinforced with welded wire fabric of 6 mm diameter at 200 mm centres in both directions.
- E. The concrete shall be placed with dummy grooved joints not more than 7.5 metres apart, except where shorter lengths are necessary for closures, but no section shall be less than 1.20 metres long.
- F. Expansion joints of the type called for in the drawings shall be constructed to replace a dummy groove at spacings of approximately 30 metres.
- G. When the lined ditch is placed next to concrete pavement,
expansion joints in the lined ditch shall be located opposite expansion joints in the pavement.
- H. When a lined ditch abuts a pavement or other structure, an expansion joint shall be placed between the lining and the pavement or other structure.
- I. Weep holes shall be constructed as shown on the drawings or indicated by the Engineer.
- J. Forms shall not be removed within 24 hours after the concrete has been placed.
- K. Minor defects shall be repaired with mortar containing 1 part cement and 2 parts fine aggregate.
- L. The operations of depositing, compacting and finishing the item shall be conducted so as to build a satisfactory structure.

M. If any section of concrete is found to be porous, other than minor defects which may be plastered or is otherwise defective, it shall be removed and replaced by the Contractor without additional compensation.

3.1.3 Backfilling

After the concrete has set sufficiently, the spaces adjacent to the structure shall be backfilled to the required elevation with approved fill material and compacted to at least 90% of the MDD at OMC, as determined by ASTM D 1557, method D.

3.1.4 Cleaning and Restoration of Site

After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site.

END OF SECTION

SECTION 33 49 13.23 BOX CULVERTS, HEADWALLS AND WINGWALLS

PART 1 - GENERAL

1.1 Description

- A This item shall consist of reinforced concrete box culverts, headwalls and wingwalls on a working apron of blinding concrete, constructed in accordance with this specification at the specified locations and conforming to the lines, grades, and dimensions shown on the drawings or as instructed by the Engineer.
- B The item shall include common excavation, backfill, and disposing of surplus material, furnishing and installing all trench bracing, shoring and sheeting, grading, pumping and temporary stream diversion required for the installation and all treatment materials and fittings required to complete the structure as shown on the drawings, and the material for and the making of all joints, all connections to existing drainage and structures and cleaning and restoration of site.

1.2 References

- A **Test Methods and Specifications**

The standards referred to in PART 2 (Products) shall apply.

PART 2 - PRODUCTS

- A Concrete for structures shall be structural cement concrete and for working aprons shall be blinding concrete in accordance with the requirements of the specification **section 03 31 13.13**
- B Reinforcement steel shall be in accordance with the requirements of the specification **section 03 31 13.13**
- C Rubber gaskets for joints shall be of the type as specified on the drawings and shall conform to ASTM C443 M.
- D Bituminous material for treatment shall be RC 250 or MC 250.

PART 3 - EXECUTION

3.1 Equipment

- 3.1.1 All equipment necessary and required for the proper construction of the structure shall be on the project in first class working condition and shall have been approved by the Engineer before construction is permitted to start.

- 3.1.2 The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the subgrade and the backfill as specified.

3.2 Excavation

- 3.2.1 The width of the pit or trench for the structure shall be sufficient to permit satisfactory placing of the structure and/or pouring of concrete and thorough tamping of the bedding material under and around the structure.
- 3.2.2 Excavated material not required or not acceptable for backfill shall be disposed of.
- 3.2.3 Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 0.15 m.
- 3.2.4 Where a firm foundation is not encountered at the design grade, due to unsuitable material, this soil shall be removed and replaced with approved fill material for the full trench width. The Engineer shall determine the depth of removal. The fill material shall be compacted to provide adequate support.
- 3.2.5 The Contractor shall do such trench or pit bracing, sheeting, or shoring necessary to perform and protect the excavation and the structure as required for safety and conforming governing laws, and perform all grading and pumping, if necessary, to prevent water running into the trench and to keep the trench dry. The bracing, sheeting, or shoring shall be removed by the Contractor after placing the structure. Removal shall be done in such a way that it will not disturb the structure.
- 3.2.6 In order to work under dry conditions, it may be necessary to divert streams temporarily. Contractor shall carry out all such excavation and backfill operations as may be necessary.

3.3 Placing Concrete and Reinforcement

- 3.3.1 The reinforced structural cement concrete for the structure shall be in accordance with the relevant specification.
- 3.3.2 Where indicated on the drawings a working apron of blinding concrete shall be made of minimum 50 mm thickness.
- 3.3.3 Reinforcement shall be placed as indicated on the applicable drawings and shall be approved before concrete is poured.
- 3.3.4 Provision shall be made to keep the reinforcement and shuttering firmly in place and for the proper bonding of previously and newly poured concrete.
- 3.3.5 The work shall be arranged so that a section commenced on any day shall be finished during daylight of the same day. Sections may be between contraction joints.

3.4 Protection

- 3.4.1 The surfaces of reinforced concrete which will come in contact with soil shall be given two coatings with an approved bituminous material, depending on the ambient temperature.
- 3.4.2 The first coating shall not be applied before a 7 day curing period of the concrete has elapsed and the second coat at least 24 hours after the first coat.
- 3.4.3 In case no shuttering is used and concrete is poured directly in the excavated trench or pit, plastic sheets shall be used as protection between the concrete and the soil.

3.5 Backfilling

- 3.5.1 After a structure has been completed, the areas around it shall be filled with approved material, in horizontal layers not to exceed 0.2 m in loose depth, and compacted to the density as required for fill in unpaved areas and paved areas, as per section 02321, Earthworks.
- 3.5.2 Backfill shall not be placed against any structure until permission is given.

3.6 Connections

- 3.6.1 Where the drawings call for connections to existing or proposed structures, these connections shall be watertight and so made that a smooth uniform flow line will be obtained throughout the system.

3.7 Weep Holes

- 3.7.1 Weep holes shall be constructed where shown on the drawings.

3.8 Cleaning and Restoration of Site

- 3.8.1 After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site.
- 3.8.2 For paved areas, the Contractor shall restore all disturbed areas to their original condition.

3.9 Inspection

- 3.9.1 Prior to final approval, a thorough inspection shall be performed.
- 3.9.2 Any indication of defects in material or workmanship, or obstruction to flow in the system, shall be further investigated and corrected.

3.9.3 Defects due to the Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed.

END OF SECTION

SECTION 33 49 13.23 MANHOLES, INLETS, PITS, ETC.

PART 1 - GENERAL

Description

- A. This item shall consist of manholes, catch basins, inlets, gullies, inspection pits, collection pits, pump-pits and connection pits, septic tanks, soak-away pits, oil and grease separators, drainage channels, frames, fittings and animal screens, perforated drainage pipes etc., in accordance with this specification, at the specified location and in accordance with the lines, grades, and dimensions shown on the drawings or required by the Engineer.
- B. The item shall include common excavation, backfill and disposing of surplus excavation, the furnishing and installation of all bracing, shoring and sheathing, grading and pumping required for the installation of the structure, all treatment and fittings required to complete the structure, as shown on the drawings, including all connections and cleaning and restoration of site.

1.2 Reference

- A ASTM, AASHTO and other standards as specified in part 2 of this section,

PART 2 - PRODUCTS

2.1 Manholes, Inlets, Pits etc

- A. Concrete Brick shall be in accordance with the requirements of ASTM C 55, Type II, Grade S.
- B. Mortar grout and similar work shall be composed of 1 part of Portland cement and 2 parts of mortar sand, by volume. Portland cement shall be in accordance with the requirements of ASTM C 150, Type I.
- C. Sand shall be in accordance with the requirements of ASTM C 144. Water shall be in accordance with section Construction Water.
- D. Plain and reinforced concrete used in structures, connection of pipes with structures, and the support of structures or frames shall be in accordance with the requirements of the relevant section.
- E. Oil and grease separators shall be made either of concrete/cast iron combination, steel or glass fibre reinforced polyester. This depending on type, size and manufacturer. Covers of separators shall be gas tight.
- F. The casting of frames, covers, grates and screens shall comply with one of the following requirements:
 - a) Gray iron castings shall meet the requirements of AASHTO M 105.
 - b) Malleable iron castings shall meet the requirements of AASHTO M 106.

- c) Steel castings shall meet the requirements of AASHTO M 103.
 - d) Structural steel for grates and frames shall meet the requirements of AASHTO M 94.
 - e) Cast iron frames, covers and grates shall be capable of withstanding the following minimum static loads:
 - 900 KN, class F according to German standard DIN 1229, when installed in pavements subjected to aircraft load.
 - 600 KN, class E according to German standard DIN 1229, when installed in pavements subjected to vehicle load.
 - 250 KN, class C according to German standard DIN 1229, when installed in side walks and other areas not subjected to significant load.
 - f) Adequate bolts shall be used for locking. The grating shall be suitably seated by means of gaskets attached into the frame.
- F Castings or structural steel units shall be to the dimensions shown on the drawings and shall be designed to support the loads specified.

Each frame and cover or grate shall be provided with fastening members to prevent it from being dislodged by traffic but which allow easy access to the structure.

All castings shall be thoroughly cleaned and given two coats of approved bituminous paint.

All structural steel units shall be galvanized after fabrication to meet the requirements of AASHTO M 111.

- G Steps or ladder bars shall be galvanized steel and shall meet the requirements of AASHTO M 111.

The steps shall be of the size, length, and shape as shown on the drawings. H Rubber gaskets shall be in accordance with the requirements of ASTM C 443. I Bituminous treatment material shall be RC 250, MC 250 or equivalent.

3.2 Perforated Pipe for Drainage

- A Perforated pipe for sub-surface drainage shall be manufactured from polypropylene as per DIN 4262-1 or Equivalent EURONORM. The perforated pipes shall be corrugated and surrounded by polypropylene fibres. The T-joints and connections shall be of the same material.
- B The perforated pipe shall meet the requirements of DIN 4262-1/ EURONORM
- C The surrounding fibres shall meet the requirements of DIN 4262-1/ EURONORM
- D The diameter of the pipe and connections shall be as shown on the applicable drawings.

PART 3 - EXECUTION

3.1 Equipment

All equipment necessary and required for the proper construction of the structures shall be on the project in first class working condition and shall have been approved by the Engineer before construction is permitted to start.

The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the subgrade and the backfill as specified.

3.2 Excavation

- A. The Contractor shall do all excavation of sufficient size to permit the placing of the structure.
- B. Excavated material not required or acceptable for backfill shall be disposed of.
- C. Common excavation shall not be done below the required depth. When this is done, the trench or pit shall be backfilled with approved material and compacted to the specified density, at the Contractor's expense.
- D. Boulders, logs, or any other objectionable material encountered in excavation shall be removed.
- E. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Supervisor. Seams or crevices shall be cleaned out and grouted. Loose and disintegrated rock and thin strata shall be removed.
- F. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation.
- G. Excavation to final grade shall not be made until just before the concrete or reinforcing steel is to be placed.
- H. Where a firm foundation is not encountered at the design grade, due to unstable soil, this soil shall be removed and replaced with sand or with approved granular material. The Engineer shall determine the depth of removal of unstable soil and the amount of backfill necessary. The backfill shall be compacted and shaped to a firm but slightly yielding condition to form the bed for the structure.
- I. The foundation of the structure shall be controlled and compacted to the depth and density specified by the Engineer.
- J. Where indicated on the drawings, working floors of blinding concrete thick 50 mm shall be made.
- K. The Contractor shall do such trench or pit bracing, sheating, or shoring necessary to perform and protect the excavation and the structure as required
- L. for safety and conforming governing laws, and perform all grading and
- M. pumping, if necessary, to prevent water running into the trench and to keep the trench dry.
- N. The bracing, sheating, or shoring shall be removed by the Contractor after placing at the structure.
- O. Removal shall be done in such a way that it will not disturb the structure.
- P. In order to work under dry conditions, it may be necessary to divert streams temporarily. Contractor shall carry out all such excavation and backfill operations as may be necessary.

3.3 Brick Structures

3.3.1 Foundations

- A A prepared foundation shall be constructed for all brick structures after the excavation is completed and accepted.
- B The base shall consist of reinforced concrete in accordance with the relevant specification.
- C The foundation shall be built to the correct elevation and shall be finished to reduce possible resistance to flowing water.

3.3.2 Laying Bricks

- A All bricks shall be clean and thoroughly wetted before laying so that they will not absorb any appreciable amount of additional water at the time they are laid.
- B All bricks shall be laid in freshly made mortar.
- C Mortar that is not used within 45 minutes after water has been added shall be discarded.

Retempering of mortar shall not be permitted.

- D An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it which can be readily closed by the laying of the brick.
- E All bed and head joints shall be filled with solid mortar.
- F End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint.
- G Bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and relaid with fresh mortar.
- H No broken or chipped bricks shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges.
- I Full bricks shall be placed at ends or corners and the bats shall be used in the interior of the course.
- J In making closures, no piece of brick shorter than the width of a whole brick shall be used and wherever practicable, whole brick shall be used and laid as headers.

3.3.3 Joints

- K Joints shall not be less than 6 mm nor more than 12 mm and whatever width is adopted shall be maintained uniform throughout the work.
- L All joints shall be finished properly as the laying of the brick progresses.
- M When nails or line pins are used, the holes shall be immediately plugged with mortar when the nail or pin is removed.

3.3.4 Finishing

- N Upon completion of the bricklaying the walls shall be plastered inside and outside.
- O The plaster shall be not less than 12 mm thick, trowelled to a smooth dense surface so as to provide a continuous unbroken shield.
- P The plaster shall be cured with a curing compound applied at the rate of spread as specified by the manufacturer.

3.4 Concrete Structures

- A Concrete structures shall be built on prepared foundations, in accordance with the dimensions and forms indicated on the drawings.
- B The concrete construction shall be in accordance with the requirements of the relevant specification.
- C The reinforcement shall be placed as indicated on the drawings and shall be approved by the Engineer before the concrete is poured.
- D All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flowing water.

The interior bottom shall be sloped downward towards the outlet.

3.5 Inlet and Outlet Pipes

- A Inlet and outlet pipes shall extend through the walls of the structures for a sufficient distance beyond the outside surface to allow for connections but shall be cut off flush with the wall on the inside surface, unless otherwise directed.
- B For concrete structures, the mortar shall be placed around these pipes so as to form a tight, neat connection.

3.6 Placing and Treatment of Castings, Frames, Fittings and Screens

- A Castings, frames, fittings and screens shall be fixed in the positions indicated on the drawings or as directed by the Engineer, and shall be set true to line and to correct elevation.
- B If frame or fittings are to be set in concrete or cement mortar, all anchor or bolts shall be in place and positioned before concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.
- C The Contractor shall make allowances for the placing of frames, anchor bolts, brackets and other embedded items in the concrete or brickwork.
- D When frames or fittings are to be fixed upon previously constructed masonry, the

bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the drawings or as directed and approved by the Engineer.

- E All units shall be set firm and secure.

3.7 Installation of Steps

- A The steps shall be installed as indicated on the drawings.
- B The steps shall be set in concrete and shall be fixed and secured in position before the concrete is poured.
- C When the steps are installed in brick masonry they shall be fixed as the masonry is being built.
- D The steps shall not be disturbed or used until the concrete or mortar has hardened for at least 7 days. After this period has elapsed, the steps shall be cleaned.

3.8 Protection of Surfaces

- A The surface of the structures which will come in permanent contact with soil shall be given two coatings with an approved bituminous material, depending on the ambient temperature.
- B The first coating shall not be applied before a 7 day curing period of the concrete or plaster has lapsed and the second coat at least 24 hours after the first coat.
- C In case no shuttering is used and concrete is poured directly in the excavated trench or pit, plastic sheets shall be used as protection between the concrete and the soil.

3.9 Backfilling

- A After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed 0,2 m in loose depth and compacted to the density as required for embankments in unpaved areas and paved areas.
- B Backfill shall not be placed against any structure until permission is given by the Engineer.
- C The backfill shall be placed on all sides of the structure at the same time and to approximately the same elevation.

3.10 Connection to Existing Structure

- A Where the drawings call for connections to existing or proposed structures, these connections shall be

watertight and so made that a smooth uniform flow line will be obtained throughout the system.

3.11 Installation of Perforated Pipes

- A The perforated pipe shall be installed in the pervious drainage layer at locations and elevations as shown on the applicable drawings. The perforated pipes shall be provided with T-junctions and other accessories and connected to the drainage structures, or outfalls as indicated on the applicable drawings and as directed by the Engineer.
- B The perforated pipes shall be carefully backfilled with the drainage layer material . Precaution shall be taken to prevent damage or collapse of the pipe before the backfill is completed.

3.12 Cleaning and Restoration of Site

- A After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site.
- B For paved areas, the Contractor shall restore all disturbed areas to their original condition.

3.13 Inspection

- A Prior to final approval of the drainage system, a thorough inspection shall be performed.
- B Any indication of defects in material or workmanship, or obstruction to flow, or poorly constructed joints in the system, shall be further investigated and corrected.
- C Defects due to the Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed.

END OF SECTION

SECTION 33 49 33.13 CONCRETE SURFACE DRAIN WITH GRATINGS

PART 1 - GENERAL

1.1 Description

A Section covers the requirements for constructing: **Concrete Surface Drain with Gratings,**

- to be made of reinforced cement concrete, including frame and grating, construction joints with water stops and joint sealant;
- including inspection/collection pits with frames and covers;
- on a working bed of blinding concrete;
- at locations and in accordance with the lines, grades, dimensions and details as shown on the drawings or as instructed by the Engineer;
- including connection to inspection/collection pits, culverts and other drainage structures;
- including:
 - excavation, provisions for bracing and shoring of trenches and pumping for keeping working areas dry;
 - formwork;
 - supply and application of protective bituminous coatings to concrete surfaces in contact with soil or polyethylene sheeting;
 - backfill, compaction and disposal of unsuitable and surplus material.

1.2 Related Sections

A Sections to be referred to, related to this Section:

- **Construction Water, section 32 05 53.13**
- **Earthworks, section 31 23 33.13**
- **Structural Concrete and Blinding Concrete, section 03 31 13.13**
- **Manholes Inlets, Pits, etc. , section 33 49 13.23**
- **Joint Sealants, section 32 13 73.13**

1.3 References

A Testing Requirements: Refer to the **Section** for **Structural Concrete and Blinding Concrete**.

EN 124, European Norm: Gully Tops, Manhole Tops, Design

Requirements and Type Testing B Material Specification Requirements:

Refer to the **Section** for **Structural Concrete and Blinding Concrete**.

1.4 Submittals

A Products: **Gratings, Covers and Bearing Rails; Cement.**

B Compliance: European Norm EN 124;

ASTM C 150.

C Product Data: Submit product data, including manufacturer's product specification sheets of specified products.

D Samples: Submit selection and verification samples for final approval by Engineer.

E Quality Assurance Submittals: Submit the following:

- Test Reports: Certified test reports showing compliance with specified physical requirements, **or**;
- Certificates: Product test load certificates signed by manufacturer stating, that materials comply with specified physical requirements.

1.5 Delivery, Storage and Handling

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials to site in manufacturer's original, undamaged,
a. unopened crates or packages with identification labels intact.

C. Storage and Protection of Cement:

- store materials at temperature conditions recommended by manufacturer
and protect same from extended UV exposure and against moisture;
- consignments stored for more than 2 months from date of manufacture:
not to be used, to be discarded and removed from site.

PART 2 - PRODUCTS

2.1 Materials

2.1.1 Structural Concrete

A. Portland Cement, Type: I

Physical Requirement:

- concrete quality: (refer to the Section for Structural Concrete for Civil Works).

2.1.2 Reinforcing Steel

A Physical Requirement: steel quality:

Grade 60. (refer to the **Section** for **Structural and Blinding Concrete**)

2.1.3 Blinding Concrete

A Portland Cement, Type: refer to par. 2.1.1.

B Physical Requirement:

- concrete quality: **C 15** (refer to the **Section** for **Structural and Blinding Concrete**).

2.1.4 Inspection/Collection Pits with Frames and Covers

C Refer to the **Section** for **Manholes, Inlets, Pits, etc.**

2.1.5 Joint Sealant

D Refer to the **Section** for **Joint Sealant**.

2.1.6 Gratings

E Gratings and Covers: Cast Iron, Ductile Iron or Steel (EN 124)

F Bearing Rail: Integrally cast with preformed frame, manufactured from:

- polymer concrete;
- galvanised steel or similar; to be securely anchored into the structural concrete surround.

G Test load requirements are shown in **Table 1**.

TABLE 1

Test Load Requirements - Gratings and Covers

Material	Clear Opening CO in mm	Service Test Load (minimum)	Ultimate Strength Test Load (minimum)	Test Method	Size of Test Block EN 124, Table 7	Requirement at Service Test

Grey Iron (BS 1452 or equivalent)	300 mm	320 KN	950 KN	EN 124	250 x 150 mm	No deflection and no cracks
Ductile Iron (BS 2789 or equivalent)	300 mm	320 KN	800 KN	EN 124	250 x 150 mm	CO/250, (max.) elastic deflection
Cast Structural Steel (BS 3100/ BS 5950 or equivalent)	300 mm	320 KN	650 KN	EN 124	250 x 150 mm	CO/250 (max.) elastic deflection

H Each grating and cover:

- to be provided with locking bolts to prevent dislodging by traffic, but allowing easy access for maintenance purposes.

2.2 Product Submissions

A Substitutions: If Contractor wishes to propose an alternative standard design of a certain manufacturer, he shall be required to submit his substitution in accordance with the Conditions of Contract.

2.3 Source Quality

A Source Quality: Obtain specified product from a single manufacturer.

PART 3 - EXECUTION

3.1 Excavation

- A Excavation shall be of sufficient size to permit the placing of the full width and length of the drain structure including the foundation.
- B The excavation shall be braced and shored if necessary.
- C The bottom of the excavation shall be compacted and levelled up to the depth as indicated on the drawings. All loose material shall be removed prior to placing the blinding concrete.

3.2 Concrete Structure

- A The concrete structure shall be built on the prepared foundation conforming to dimensions and form indicated on the drawings.
- B Prior to pouring of the concrete, the reinforcement placed and the cast-in elements shall be approved by the engineer.
- C All invert channels shall be constructed and shaped accurately so as to be smooth, uniform and cause minimum resistance to flowing water.
- D Where the concrete structure has to be connected to inspection pits, junction pits, manholes or other drainage structures, the connections shall be structurally sound and neat.
- E The surfaces of the structure which will come in permanent contact with soil, shall be given two coatings of an approved bituminous material or an equivalent protection to protect the surfaces from effects of soil chemicals.

3.3 Placement of Gratings

- A Castings for frames and fittings shall be placed in the positions indicated on the drawings.
- B Grating and covers shall be placed and fastened in the frames and fittings before pouring the concrete and shall not be disturbed until the concrete has set.
- C Grating openings and bolt holes shall be sufficiently protected during pouring of the concrete.

3.4 Inspection

- A Prior to final approval of the drain a thorough inspection shall be performed.
- B Any defects in materials and workmanship, or obstruction to flow, or poorly installed elements shall be corrected.
- C Defects due to the contractor's negligence shall be corrected.

3.5 Backfilling

- A After a structure has been completed, the area around it shall be backfilled with approved material in layers not exceeding 200 mm and well compacted with suitable equipment.
- B Backfilling shall not be placed without the permission of the engineer.
- C Where indicated on the drawings, the top portion of the backfill shall be finished with soil cement, pavement layers or turfing, constructed as per applicable sections of the specifications.

3.6 Cleaning and Restoration of Site

- A After the backfill is completed, the contractor shall restore the site; as directed by the engineer, leaving the site clear and in good condition.
- B Covers shall be thoroughly cleaned and cast iron or ductile iron surfaces shall receive a bituminous coating upon handing over of the project.

END OF SECTION

SECTION VII - BILLS OF QUANTITIES

I. Preamble

- I. The Bills of Quantities shall be read in conjunction with the Instructions to Tenderers, General and Particular Conditions of Contract, Technical Specifications, and Drawings.
- II. The quantities given in the Bills of Quantities are estimated and provisional, and are given to provide a common basis for tendering. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tender in the priced Bills of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
- III. The rates and prices tender in the priced Bills of Quantities shall, except in so far as it is otherwise provided under the Contract, include all Constructional Plant, labor, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.
- IV. A rate or price shall be entered against each item in the priced Bills of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bills of Quantities.
- V. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bills of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
- VI. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bills of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bills of Quantities.
- VII. Provisional Sums included and so designated in the Bills of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub-Clause 13.5 and Clause 13.6 of the General Conditions.
- VIII. The method of measurement of completed work for payment shall be in accordance with [insert the name of a standard reference guide, or full details of the methods to be used] 6.

2. Work Items

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

BILL OF QUANTITIES

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT	
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025	
Bill of Quantities		Page: 14
Summary		
Item No.	Description	Amount (Kshs.)
1	PRELIMINARIES	
4	SITE CLEARANCE	
5	EARTHWORKS	
8	CULVERT AND DRAINAGE WORKS	
12	NATURAL MATERIAL SUBBASE	
15	BITUMINOUS SURFACE TREATMENT AND SURFACE DRESSING	
16	BITUMINOUS MIXES	
20	ROAD FURNITURE	
22	DAYWORKS	
ELC 1	ELECTRICAL WORKS	
	Sub Total 1	
	Add 5% of Sub-Total 1 of Bills as Provisional Sum for contingencies to be expended in the whole or part or deleted by the Engineer	
	Sub Total 2	
	Add 16% of Sub-Total 2 for Value Added Tax (VAT)	
	Grand Total Carried to page on the form of Tender	

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 1
Bill No.1	Preliminaries		BOQ		
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount KSh
1.01	Allow a Prime Cost Sum of Kshs. 500,000/= for materials testing including equipment whose ownership shall revert to employer at end of contract.	Item	1	500,000.00	500,000.00
1.02	Include percentage of P.C Sum in item 1.01 for contractor's overheads and profit.	%			
1.03	Allow a prime cost Sum of Ksh. 300,000 for Engineer's miscellaneous account.	Item	1	300,000.00	300,000.00
1.04	Include percentage of P.C sum in item 1.03 for contractor's overheads and profit.	%	300,000		
1.05	Provide with driver, fuel, service and maintain, insure 1No. new clean 4WD Double cab pick up vehicle, diesel engine capacity 2800-3000 cc for exclusive use of the Engineer inclusive of the first 5,000 km per vehicle month to Engineer's approval. Vehicle to revert back to the contractor.	Veh. Month	4		
1.06	Extra over item 1.05 for mileage over 5,000km per vehicle month inclusive of of all fuels, lubricants, servicing and maintenance insurances and driver.	Km	5,000		
1.07	Provide project signboard being 1200mm x 600mm Gauge 14 (1.99mm thick) mild steel plate welded onto 50mm x 50mm x 3mm square hollow sections frame, 2.5m frame with 0.5m fixed below ground, and painted approved colours for the duration of the project including the defects liability period	No	1		
Total of Bill Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
ITEM	DESCRIPTION	UNIT	QTY	RAT E	AMOUNT
ELC 1	Runway Edge Lights				
1.01	Taking coordinates for the above Light fittings before the runway works commence and re-using the coordinates to establish the light positions during re-installation.	NO	10		
1.02	Disconnection and removal of existing Elevated runway edge light fitting complete with its secondary cable and transformer before the earth works commence.	NO	10		
1.03	Installation of 32mm HDPE Conduit after the earth works have been done but before asphalt is laid, including excavation, placing of soilcrete and compaction.	LM	150		
1.04	Supply of 32mm HDPE Conduit complete with its accessories, eg bends and couplers.	LM	200		
1.05	Excavate and cast in situ 500x500x200mm Concrete base for runway edge light.	NO	10		
1.06	Re-installation of the Elevated Runway edge light fitting complete with its secondary cable and transformer after asphalt has been laid on the shoulders.	NO	10		
1.07	10X100mm Rawl bolts for mounting the above fittings	NO	60		
1.08	Plug and receptacle connector kits for secondary circuits as per FAA.	Pairs	10		
1.09	Plug and receptacle connector kits for primary circuits as per FAA L-823 (AC 150/5345-26B).	Pairs	10		

1.10	Series Primary cable, 5kV 6mm ² XLPE as AC 150/5345-7D (L-824)for reinstating damaged sections- <i>surplus to be handed over to the station for maintenance.</i>	LM	1000			
1.11	Secondary AGL cable, 4mm ² copper core, XLPE insulated as per AC 150/5345-7D (L-824)	LM	200			
1.12	4mm sq Bare copper wire to earth the fittings.	LM	200			
1.13	Airfield ground lighting halogen lamps 6.6 A Lamps, 150 W, average longlife 1500h - <i>leads of lamps to be compatible with the fittings (surplus lamps to be handed over to the station for maintenance).</i>	NO	50			
	Total for AGL Works					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 2
Bill No. 4	SITE CLEARANCE AND TOP SOIL STRIPPING				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KSh)
No separate payment shall be made for the overhaul material and the cost of such haulage shall be included in the rate and /or prices.					
4.01	Clear site including removal of hedges, bushes, trees including uprooting of trees stumps (except those designated to remain by the engineer) and other vegetation and objectionable materials in accordance with the specifications	Ha	0.5		
4.02	Removal of topsoil to spoil. Depth not exceeding 200mm.	m ³	1,080.0		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 3
Bill No.5	EARTH WORKS				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
No separate payment shall be made for the overhaul material and the cost of such haulage shall be included in the rate and /or prices. It is the contractor's responsibility to identify quarries, borrow pits and spoil areas.					
5.01	Cut to Spoil and cart to waste in soft material	m ³	2,550		
5.02	Spoil in hard material	m ³	100		
5.03	Provide, lay and compact in 200mm layers approved rock fill as directed by Engineer.	Tonne	3,375		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities				Page: 4	
Bill No. 8	CULVERT AND DRAINAGE WORKS				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
No separate payment shall be made for the haulage of surplus or unsuitable excavated material and the cost of such haulage shall be included in the rates/prices.					
8.01	Excavate for inlet, outfall, mitre and catch water drains in soft material.	m ³	2,300		
8.02	Extra over item 8.01 for excavation in hard material.	m ³	10		
8.03	Provide and install Type 1 geo synthetic filter fabric GSM 200	m ²	6,950		
8.04	Provide and install 150mm perforated Class D PVC Pipe to subsoil drains	m	1,275.00		
8.05	40mm/50mm Aggregates	m ³	2,300		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 6
Bill No.12	NATURAL MATERIAL BASE AND SUBBASE				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
No overhaul will be paid separately under this item and the cost for haulage will be deemed to have been included in the rates (METHOD B).					
12.01	Provide, lay, and compact hand packed stone material for subbase including filling of voids with stone dust	m ³	900		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 7
Bill No.13	GRADED CRUSHED STONE SUBBASE AND BASE				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
No overhaul will be paid separately under this item and the cost for haulage will be deemed to have been included in the rates.					
13.01	Provide, place, spread and compact class A Graded crushed stone mixed with 1-3% cement, thickness not exceeding 150mm with an average dry density not less than 98% MDD.	m ³	912		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 9
Bill No.15	BITUMINOUS SURFACE TREATMENT AND SURFACE DRESSING				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
15.01	Prepare the surface of runway and runway shoulders, and provide and spray MC-70 as a prime coat cutback bitumen at a rate of 0.8 -1.2 lt/m ² as a prime coat.	Lts	4,320		
15.02	Prepare primed surfaces, provide and spray K1-70 bitumen emulsion as tack coat at a spray rate of 0.8 - 1.0 lt/m ² as directed by the Engineer.	Lts	7,200		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 10
Bill No.16	BITUMINOUS MIXES				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
16.01	Provide , place and compact 50mm asphalt concrete Type 1 With 5-6% nominal bitumen content by weight to total mix as wearing Course on Runway as directed by the Engineer	m ³	180		
16.02	Pothole cutting and cleaning	m ³	125		
16.03	Pothole patching - hot mix asphalt type I	m ³	125		
16.04	cut and trim to a maximum depth of 50mm and prepare leaving the surface of the cracks dry and free of loose material and seal with hot applied slurry seal material or cold applied rubberised crack filler or similar approved	m	2,000		
16.05	Supply and install closed cell polythene backer rod -3/8"	m	3,000		
16.06	EO 16.05 but 5/8"	m	2,000		
16.07	EO 16.06 but 7/8"	m	1,500		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 11
Bill No.20	ROAD FURNITURE				
Item No.	Description	Units	Quantity	Unit Rate(Kshs)	Amount (KShs.)
20.01	Prepare surface and apply 2 (two) coats of approved white reflectorised road marking paint at a nominal rate of 0.45L/sqm for pavement marking as directed by the Engineer	m ²	1,800		
20.02	Prepare surface and apply 2 (two) coats of approved yellow reflectorised road marking paint at a nominal rate of 0.45L/sqm for pavement marking as directed by the Engineer	m ²	500		
20.03	Prepare surface and paint with approved temporary white and yellow road marking paints for pavement marking as directed by the Engineer.	m ²	500		
Total Carried Forward to Summary Sheet					

Project	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT				
Contract No.	TENDER No. KAA/OT/KIA/0090/2024-2025				
Bill of Quantities					Page: 12
Bill No.22	DAYWORKS (RATES ONLY)				
Item No.	Description	Units	Quantity	Unit Rate (Kshs)	Amount (KSh)
	<u>LABOUR</u>				
	All items for labour must be priced. Only the actual time engaged in the work will be paid for. NOTE: The rate inserted herein shall include all costs of labour as well as overtime, traveling, time and cost of accommodation, social security, contributions, use and maintenance of small tools of trade, supervision, insurance, overheads, profits, and any other cost allowance.				
22.01	Unskilled Labour	Hrs	40		
22.02	Skilled Labour	Hrs	40		
	<u>MATERIALS</u>				
	All materials should comply with the specifications. The rates inserted herein are to include delivery to the site, storage, handling, overheads, and profit				
22.03	Ordinary Portland Cement	Tonne	1		
22.04	Hydrated Lime	Tonne	1		
22.05	Aggregates for Concrete				
	a) Sand	m ³	1		
	b) Coarse aggregate (12mm)	m ³	1		
	c) Coarse aggregate (20mm)	m ³	1		
22.06	Shuttering Timber				
	Class F1 finish	m ²	1		
	Class F3 finish	m ²	1		

22.07	Bitumen					
	a) 80/100 Penetration Grade Bitumen	Litre	5			
	b) MC 30 Cutback Bitumen	Litre	5			
	c) MC 3000 Cutback Bitumen	Litre	5			
	d) K 1-70 Bitumen Emulsion	Litre	5			
	e) Kerosene	Litre	5			
22.08	Asphalt Concrete Type 1					
	a) 0/14mm grading	m ³	0.5			
	b) 0/20mm grading	m ³	0.5			
22.09	Approved quarry waste	Tonne	1			
22.10	Hard-core	Tonne	1			
22.11	Gravel					
	a) Natural Base or sub-base (Minimum CBR-30%)	m ³	2			
22.12	Barbed Wire heavy gauze	Lm	2			
22.13	Ordinary steel nails (All sizes)	Kg	2			
22.14	Treated wooden fencing post 100mm diameter by 1000mm long	No.	4			
22.15	250x125mm half-battered kerbs	Lm	5			
22.16	125x100mm precast concrete channel	Lm	5			
	<u>PLANT & EQUIPMENT</u>					
	Where items of major plant listed in the schedule of Day works are specified by type (e.g. Cat D7, Cat 120H) the power rating of such plant is that manufactured within the two years prior to the date of tender. Any plant employed upon day works which have power rating lower than that stated above shall be paid for at rates lower than those schedule of day works. The deduction in the payable rates shall be in proportion to the power rating below the specified above plant.					

22.17	Cat D6 bull dozer or equivalent with Dozer/ Ripper attachment.	Hr	1			
22.18	Cat 140H motor grader or equivalent complete with scarifier.	Hr	1			
22.19	Vibrating roller (10 tonnes).	Hr	1			
22.20	Hand propelled vibrating roller.	Hr	1			
22.21	Cat 950G wheel loader or equivalent.	Hr	1			
22.22	15 tonne tipper lorry.	Hr	1			
22.23	10 tonne tipper lorry.	Hr	1			
22.24	Concrete mixer 0.3 - 0.7 m ³	Hr	1			
22.25	Pneumatic self-propelled roller 15 tonne.	Hrs	1			
22.26	Smooth wheel roller - 16-18 tonnes .	Hrs	1			
22.27	As item 22.26 but 10 tonne.	Hrs	1			
22.28	One ton hand-propelled vibrating roller.	Hrs	1			
22.29	Hand held rammer compactor or equivalent.	Hrs	1			
22.30	One to one & a half tonne capacity pick-up truck.	Hrs	1			
22.31	Compressor 250 c.f.m. complete with all tools, hoses, steels etc.	Hrs	1			
22.32	Concrete poker vibrator	Hrs	1			
22.33	Self-propelled water tanker - 6,000-10,000 litre minimum capacity with pick-up pump.	Hrs	1			
22.34	Mechanical broom	Hrs	1			
22.35	Pressure bitumen distributor 4500-8000 litres capacity.	Hrs	1			
Total Carried Forward to Summary Sheet						

PART III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

SECTION VIII - GENERAL CONDITIONS OF CONTRACT

I. GENERAL PROVISIONS

1.1 Definitions

In the Conditions of Contract (“these Conditions”), which include Particular Conditions, Parts A and B, and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1 The Contract

“Bills of Quantities”, “Day work Schedule” and “Schedule of Payment Currencies” mean the documents so named (if any) which are comprised in the Schedules.

“Contract Agreement” means the contract agreement referred to in Sub-Clause 1.6 [Contract Agreement].

“Contract” means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.

“Drawings” means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) Procuring Entity in accordance with the Contract.

“Laws” means all national legislation, statutes, ordinances, and regulations and by-laws of any legally constituted public authority.

“Letter of Acceptance” means the letter of formal acceptance, signed by the Contractor and Procuring Entity, including any annexed memoranda comprising agreements between and signed by both Parties.

“Letter of Tender” means the document entitled letter of tender or letter of tender, which was completed by the Contractor and includes the signed offer to Procuring Entity for the Works.

a) **“SCC” means the Special Conditions of Contract completed by Procuring Entity which modify the General Conditions of Contract.**

“Schedules” means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bills of Quantities, data, lists, and schedules of rates and/or prices.

“Specification” means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.

“Tender” means the Letter of Tender and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.

1.1.2 Parties and Persons

“Contractor's Personnel” means the Contractor's Representative and all personnel whom the Contractor utilizes on Site, who may include the staff, labor and other employees of the Contractor and of each Sub-contractor; and any other personnel assisting the Contractor in the execution of the Works.

“Contractor's Representative” means the person named by the Contract or in the Contractor appointed from time to time by the Contractor under Sub-Clause 4.3 [Contractor's Representative], who acts on behalf of the Contractor.

“Contractor” means the person(s) named as Contractor in the Letter of Tender accepted by Procuring Entity and the legal successors in title to this person(s).

“Engineer” means the person appointed by Procuring Entity to act as the Engineer for the purposes of the Contract and named in the SCC, or other person appointed from time to time by Procuring Entity and notified to the Contractor under Sub-Clause 3.4 [Replacement of the Engineer].

“Party” means Procuring Entity or the Contractor, as the context requires.

“Procuring Entity” means the Entity named in the Special Conditions of Contract.

“Procuring Entity's Personnel” means the Engineer, the assistants referred to in Sub-Clause 3.2 [Delegation by the Engineer] and all other staff, labor and other employees of the Engineer and of Procuring Entity; and any other personnel notified to the Contractor, by Procuring Entity or the Engineer, as Procuring Entity's Personnel.

“Procuring Entity” means the person named as Procuring Entity in the SCC and the legal successors in title to this person.

“Sub-contractor” means any person named in the Contract as a Sub-contractor, or any person appointed as a Sub-contractor, for a part of the Works; and the legal successors in title to each of these persons.

1.1.3 Dates, Tests, Periods and Completion

“Base Date” means a date 30 day prior to the submission of tenders.

“Commencement Date” means the date notified under Sub-Clause 8.1 [Commencement of Works]. **“Completion Certificate”** means the certificate issued under Sub-Clause 11.9 [Performance Certificate].

“Day” means a calendar day and “year” means 365 days.

“Defects Notification Period” means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], which extends over 365 days

except if otherwise stated in the **SCC** (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1[Taking Over of the Works and Sections].

“Taking-Over Certificate” means a certificate issued under Clause 10 [Procuring Entity's Taking Over].

“Tests after Completion” means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by Procuring Entity.

“Tests on Completion” means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by Procuring Entity.

“Time for Completion” means the time for completing the Works or a Section (as the case may be) under Sub- Clause 8.2 [Time for Completion], as stated in the **SCC** (with any extension under Sub-Clause 8.4 [Extension of Time for Completion]), calculated from the Commencement Date.

1.1.4 Money and Payments

“Accepted Contract Amount” means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

“Contract Price” means the price defined in Sub-Clause 14.1 [The Contract Price] and includes adjustments in accordance with the Contract.

“Cost” means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

“Final Payment Certificate” means the payment certificate issued under Sub-Clause 14.13 [Issue of Final Payment Certificate].

“Final Statement” means the statement defined in Sub-Clause 14.11 [Application for Final Payment

Certificate].

“Foreign Currency” means a currency in which part (oral) of the Contract Price is payable, but not the Local Currency.

“Interim Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment], other than the Final Payment Certificate.

“Local Currency” means the currency of the Country.

“Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment].

“Provisional Sum” means a sum (if any) which is specified in the Contract as a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [Provisional Sums].

“Retention Money” means the accumulated retention moneys which Procuring Entity retains under Sub-Clause 14.3 [Application for Interim Payment Certificates] and pays under Sub-Clause 14.9 [Payment of Retention Money].

“Statement” means a statement submitted by the Contractor as part of an application, under Clause 14 [Contract Price and Payment], for a payment certificate.

1.1.5 Works and Goods

“Contractor's Equipment” means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Procuring Entity's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

“Goods” means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

“Materials” means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

“Permanent Works” means the permanent works to be executed by the Contractor under the Contract.

“Plant” means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works, including vehicles purchased for Procuring Entity and relating to the construction or operation of the Works.

“Section” means a part of the Works specified in the SCC as a Section (if any).

“Temporary Works” means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

“Works” mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.6 Other Definitions

“Contractor's Documents” means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.

“Country” means Kenya as the country in which the Site is located, where the Permanent Works are to be executed.

“Force Majeure” is defined in Clause 19 [Force Majeure].

“Laws” means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.

“Notice of Dissatisfaction” means the notice given by either Party to the other under Sub-Clause 20.4 indicating its dissatisfaction and intention to commence arbitration.

“Performance Security” means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].

“Procuring Entity's Equipment” means the apparatus, machinery and vehicles (if any) made available by Procuring Entity for the use of the Contractor in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by Procuring Entity.

“Site” means the places where the Permanent Works are to be executed, including storage and working areas, and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

“Unforeseeable” means not reasonably foreseeable by an experienced Contractor by the Base Date.

“Variation” means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

12 Interpretation

In the Contract, except where the context requires otherwise:

- a) Words indicating one gender include all genders;
- b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- c) provisions including the word “agree”, “agreed” or “agreement” require the agreement to be recorded in writing;
- d) “written” or “in writing” means hand-written, type-written, printed or electronically made, and resulting in a permanent record; and
- e) the word “tender” is synonymous with “tender” and “tenderer” with “Tenderer” and the words “tender documents” with “tendering documents.”

13 Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

- a) In writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the **SCC**; and
- b) Delivered, sent or transmitted to the address for the recipient's communications as stated in the **SCC**. However:
 - i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
 - ii) if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be.

14 Law and Language

- 1.4.1 The Contract shall be governed by the **laws of Kenya**.
- 1.4.2 The ruling language of the Contract shall be the **English Language**.

15 Priority of Documents

- 1.5.1 The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:
 - a) The Contract Agreement,

- b) Letter of Acceptance
- c) Form of Tender
- d) Particular Conditions–Part A,
- e) Particular Conditions–Part B
- f) General Conditions of Contract
- g) Specifications and Bills of Quantities
- h) Drawings, and
- i) Schedules and any other documents forming part of the Contract.

1.5.2 If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall enter into a Contract Agreement within 14 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by Procuring Entity.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

- a) May assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and
- b) May, as security in favor of a Procuring Entity or financial institution, assign its right to any moneys due, or to become due, under the Contract.

1.8 Care and Supply of Documents

- 1.8.1 The Specification and Drawings shall be in the custody and care of Procuring Entity. Unless otherwise stated in the Contract, two copies of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.
- 1.8.2 Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by Procuring Entity. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer
- 1.8.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. Procuring Entity's Personnel shall have the right of access to all these documents at all reasonable times.
- 1.8.4 If a Party becomes aware of an error or defect in a document which was prepared

for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9 Delayed Drawings or Instructions

- 1.9.1 The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

- 1.9.2 After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

- 1.9.3 However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

1.10 Procuring Entity's Use of Contractor's Documents

- 1.10.1 As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor. The Contractor shall be deemed (by signing the Contract) to give to Procuring Entity a non-terminable transferable non-exclusive royalty-free license to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This license shall:

- a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
- b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
- c) in the case of Contractor's Documents which are in the form of computer

programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

- 1.10.2 The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) Procuring Entity for purposes other than those permitted under this Sub-Clause.

1.11 Contractor's Use of Procuring Entity's Documents

As between the Parties, Procuring Entity shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) Procuring Entity. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without Procuring Entity's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidential Details

The Contractor's and Procuring Entity's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation.

1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

- a) Procuring Entity shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by Procuring Entity; and Procuring Entity shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and
- b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licenses and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold Procuring Entity harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture, consortium or other unincorporated grouping of two or more persons:

- a) These persons shall be deemed to be jointly and severally liable to Procuring Entity

- for the performance of the Contract;
- b) these persons shall notify Procuring Entity of their leader who shall have authority to bind the Contractor and each of these persons; and
 - c) the Contractor shall not alter its composition or legal status without the prior consent of Procuring Entity.

1.15 Inspections and Audit by Procuring Entity

Pursuant to paragraph 2.2 e. of Appendix B to the General Conditions, the Contractor shall permit and shall cause its Sub - contractor and sub-consultants to permit, Procuring Entity and/or persons appointed by Procuring Entity to inspect the Site and/or the accounts and records relating to the procurement process, selection and/or contract execution, and to have such accounts and records audited by auditors appointed by Procuring Entity. The Contractor's and its Sub - contractor' and sub- consultants' attention is drawn to Sub-Clause 15.6 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of Procuring Entity's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to Procuring Entity's prevailing sanctions procedures).

2. PROCURING ENTITY

2.1 Right of Access to the Site

Procuring Entity shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the **SCC**. The right and possession may not be exclusive to the Contractor. If, under the Contract, Procuring Entity is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, Procuring Entity shall do so in the time and manner stated in the Specification. However, Procuring Entity may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the **SCC**, Procuring Entity shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the program submitted under Sub-Clause 8.3 [Program].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by Procuring Entity to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that Procuring Entity's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

1.2. Permits, Licenses or Approvals

Procuring Entity shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

- a) Copies of the Laws of the Country which are relevant to the Contract but are not readily available, and
- b) Any permits, licenses or approvals required by the Laws of the Country:
 - i. Which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws],
 - ii. For the delivery of Goods, including clearance through customs, and
 - iii. For the export of Contractor's Equipment when it is removed from the Site.

1.3. Procuring Entity's Personnel

Procuring Entity shall be responsible for ensuring that Procuring Entity's Personnel and other Contractors on the Site:

- a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation], and
- b) take actions similar to those which the Contractor is required to take under sub-paragraphs (a), (b) and (c) of Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.18 [Protection of the Environment].

1.4. Procuring Entity's Financial Arrangement

Procuring Entity shall submit, before the Commencement Date and there after within 30 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable Procuring Entity to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [Contract Price and Payment]. Before Procuring Entity makes any material change to his financial arrangements, Procuring Entity shall give notice to the Contractor with detailed particulars.

In addition, if Procuring Entity has notified to the Contractor that Procuring Entity has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, Procuring Entity shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the 2.4.3 Engineer, within 7 days of Procuring Entity having received the suspension notification from Procuring Entity.

If alternative funds will be available in appropriate currencies to Procuring Entity to continue making payments to the Contractor beyond a date 60 day after the date of Procuring Entity notification of the suspension, Procuring Entity shall provide reasonable evidence in his notice of the extent to which such funds will be available.

1.5. Procuring Entity's Claims

If Procuring Entity considers itself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, Procuring Entity or they shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Procuring Entity's Equipment and Free-Issue Materials], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 30 days after Procuring Entity became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim and shall include substantiation of the amount and/or extension to which Procuring Entity considers itself to be

entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which Procuring Entity is entitled to be paid by the Contractor, and/or(ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

3. THE ENGINEER

3.1. Engineer's Duties and Authority

Procuring Entity shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties. The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of Procuring Entity before exercising a specified authority, the requirements shall be as stated in the Particular Conditions.

Procuring Entity shall promptly inform the Contractor of any change to the authority attributed to the Engineer. However, whenever the Engineer exercises a specified authority for which Procuring Entity's approval is required, then (for the purposes of the Contract) Procuring Entity shall be deemed to have given approval. Except as otherwise stated in these Conditions:

- a) Whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for Procuring Entity; the Engineer has no authority to relieve either Party of any duties, obligations or
- b) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances; and
- c) any act by the Engineer in response to a Contractor's request except as otherwise expressly specified shall be notified in writing to the Contractor within 14 days of receipt.

The following provisions shall apply; The Engineer shall obtain the specific approval of Procuring Entity before taking action under the-following Sub-Clauses of these Conditions:

- a) Sub-Clause 4.12: agreeing or determining an extension of time and/or additional cost.
- b) Sub-Clause13.1: instructing a Variation, except;
 - i) In an emergency situation as determined by the Engineer, or
 - ii) If such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the **SCC**.
- c) Sub-Clause13.3: Approving a proposal for Variation submitted by the Contractor in

accordance with Sub Clause 13.1 or 13.2.

- d) Sub-Clause 13.4: Specifying the amount payable in each of the applicable currencies.

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 responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk.

The Contractor shall forthwith comply, despite the absence of approval of Procuring Entity, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to Procuring Entity.

3.2. Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Engineer shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [Determinations].

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

- a) Any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials;
- b) If the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

3.3. Instructions of The Engineer

The Engineer may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments]

shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer or a delegated assistant:

- a) Gives an oral instruction,
- b) Receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and
- c) Does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation, then the confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be).

3.4. Replacement of The Engineer

If Procuring Entity intends to replace the Engineer, Procuring Entity shall, not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer. If the Contractor considers the intended replacement Engineer to be unsuitable, he has the right to raise objection against him by notice to Procuring Entity, with supporting particulars, and Procuring Entity shall give full and fair consideration to this objection.

3.5. Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavor to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars, within 30 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

4. THE CONTRACTOR

4.1. Contractor's General Obligations

The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Engineer's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by Procuring Entity.

The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer.

The Contractor shall not commence any Works, including mobilization and/or pre-construction activities (e.g., limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits), unless the Engineer is satisfied that appropriate measures are in place to address environmental, social, health and safety risks and impacts.

If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Particular Conditions:

- a) The Contractor shall submit to the Engineer the Contractor's Documents for this part in accordance with the procedures specified in the Contract;
- b) These Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language], and shall include additional information required by the Engineer to add to the Drawings for co-ordination of each Party's designs;
- c) The Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the

- Contract; and
- d) Prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer the “as- built” documents and, if applicable, operation and maintenance manuals in accordance with the Specification and insufficient detail for Procuring Entity to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer.

4.2. Performance Security

Performance security shall not be required for contracts estimated to cost less than Kenya shillings five million shillings.

The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount stated in the **SCC** and denominated in the currency (ies) of the Contractor in a freely convertible currency acceptable to Procuring Entity. If an amount is not stated in the **SCC**, this Sub-Clause shall not apply.

The Contractor shall deliver the Performance Security to Procuring Entity within 14 days after receiving the Letter of Acceptance and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable Procuring Entity or financial institution selected by the Contractor and shall be in the form annexed to the Particular Conditions, as stipulated by Procuring Entity in the **SCC**, or in another form approved by Procuring Entity.

The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 30 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

Procuring Entity shall not make a claim under the Performance Security, except for amounts to which Procuring Entity is entitled under the Contract.

Procuring Entity shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which Procuring Entity was not entitled to make the claim.

Procuring Entity shall return the Performance Security to the Contractor within 21 days after receiving a copy of the Performance Certificate.

Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer determines an addition or deduction to the Contract Price as a result of a change in cost and/or

legislation, or as a result of a Variation, amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.

4.3. Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract. Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of Sub-Clause 6.9 [Contractor's Personnel], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer's prior consent, and the Engineer shall be notified accordingly.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

4.4. Sub - contractor

The Contractor shall not subcontract the whole of the Works.

The Contractor shall be responsible for the acts or defaults of any Sub-contractor, his agents

or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

- a) The Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Sub-contractor is named in the Contract;
- b) The prior consent of the Engineer shall be obtained to other proposed Sub Contractors;
- c) the Contractor shall give Procuring Entity not less than 14 days' notice of the intended date of the commencement of each Sub-contractor's work, and of the commencement of such work on the Site; and
- d) each subcontract shall include provisions which would entitle Procuring Entity to require the subcontract to be assigned to Procuring Entity under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Procuring Entity].

The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidential Details] apply equally to each Sub-contractor.

Where practicable, the Contractor shall give fair and reasonable opportunity for Contractors from the Country to be appointed as Sub - contractors.

4.5. Assignment of Benefit of Subcontract

If a Sub-contractor's obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to Procuring Entity, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to Procuring Entity for the work carried out by the Sub-contractor after the assignment takes effect.

4.6. Co-operation

The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

- a) Procuring Entity's Personnel,
- b) Any other Contractors employed by Procuring Entity, and
- c) The personnel of any legally constituted public authorities, who may be employed in the execution on or near the Site of any work not included in the Contract.

Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other Contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

If, under the Contract, Procuring Entity is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such documents to the Engineer in the time and manner stated in

the Specification.

4.7. Setting Out of the Works

The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contractor notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

Procuring Entity shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced Contractor could not reasonably have discovered such error and avoided this delay and/or Cost, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to these.

4.8. Safety Procedures

The Contractor shall:

- a) Comply with all applicable safety regulations,
- b) Take care for the safety of all persons entitled to be on the Site,
- c) Use reasonable efforts to keep the Site and Works clear of unnecessary obstructions as to avoid danger to these persons,
- d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Procuring Entity's Taking Over], and
- e) Provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

4.9. Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the

Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor itself shall be apparent on the document itself. Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

4.10. Site Data

Procuring Entity shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in Procuring Entity's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. Procuring Entity shall similarly make available to the Contractor all such data which come into Procuring Entity's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

- a) The form and nature of the Site, including sub-surface conditions,
- b) The hydrological and climatic conditions,
- c) The extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,
- d) The Laws, procedures and labor practices of the Country, and
- e) The Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

4.11. Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

- a) Have satisfied itself as to the correctness and sufficiency of the Accepted Contract Amount, and
- b) Have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].

Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the

remedying of any defects.

4.12. Unforeseeable Physical Conditions

In this Sub-Clause, “physical conditions” means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable. This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [Contractor's Claims] to:

- a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) Payment of any such Cost, which shall be included in the Contract Price.

Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favorable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favorable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in any reduction in the Contract Price.

The Engineer shall take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which shall be made available by the Contractor, but

shall not be bound by the Contractor's interpretation of any such evidence.

4.13. Rights of Way and Facilities

Unless otherwise specified in the Contract Procuring Entity shall provide effective access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works.

4.14. Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

- a) The convenience of the public, or
- b) The access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of Procuring Entity or of others.

The Contractor shall indemnify and hold Procuring Entity harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

4.15. Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

- a) The Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;
- b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;
- c) Procuring Entity shall not be responsible for any claims which may arise from the use or otherwise of any access route;
- d) Procuring Entity does not guarantee the suitability or availability of particular access routes; and
- e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16. Transport of Goods

Unless otherwise stated in the Particular Conditions:

- a) The Contractor shall give the Engineer not less than 21 days' notice of the date on which

- any Plant or a major item of other Goods will be delivered to the Site;
- b) The Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and
 - c) The Contractor shall indemnify and hold Procuring Entity harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17. Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought onto the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.

4.18. Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

The Contractor shall ensure that emissions, surfaced is charges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

4.19. Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specification. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to Procuring Entity.

4.20. Procuring Entity's Equipment and Free-Issue Materials

Procuring Entity shall make Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

Procuring Entity shall be responsible for Equipment, except that The Contractor shall be responsible for each item of Procuring Entity's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it or in possession or control of it.

The appropriate quantities and the amounts due (at such stated prices) for the use of Procuring Entity's Equipment shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to Procuring Entity. Procuring Entity shall supply, free of charge, the "free-issue materials" (if any) in accordance with the details stated in the Specification. Procuring Entity shall, at his risk and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them and shall promptly give notice to the Engineer of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, Procuring Entity shall immediately rectify the notified shortage, defect or default.

After this visual inspection, the free-issue materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody and control shall not relieve Procuring Entity of liability for any shortage, defect or default not apparent from a visual inspection.

4.21. Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

- i. charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Sub-contractor (as defined in Clause 5 [Nominated Sub - contractor]),
- ii. photographs showing the status of manufacture and of progress on the Site;
- iii. for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:
 - commencement of manufacture,
 - Contractor's inspections, tests, and
 - shipment and arrival at the Site;
 - the details described in Sub-Clause 6.10 [Records of Contractor's

- Personnel and Equipment];
- copies of quality assurance documents, test results and certificates of Materials;
- list of notices given under Sub-Clause 2.5 [Procuring Entity's Claims] and notices given under Sub-Clause
- 20.1 [Contractor's Claims];
- safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

The Contractor shall provide immediate notification to the Engineer of incidents in the following categories.

- Full details of such incidents shall be provided to the Engineer within the time frame agreed with the Engineer.
- confirmed or likely violation of any law or international agreement;
- any fatality or serious injury;
- significant adverse effects or damage to private property (e.g., vehicle accident, damage from fly rock, working beyond the boundary);
- major pollution of drinking water aquifer or damage or destruction of rare or endangered habitat (including protected areas) or species; or
- any allegation of sexual harassment or sexual misbehavior, child abuse, defilement, or other violations involving children.

4.22. Security of the Site

Unless otherwise stated in the Particular Conditions:

- a) The Contractor shall be responsible for keeping unauthorized persons off the Site, and
- b) Authorized persons shall be limited to the Contractor's Personnel and Procuring Entity's Personnel; and to any other personnel notified to the Contractor, by Procuring Entity or the Engineer, as authorized personnel of Procuring Entity's other Contractors on the Site.

4.23. Contractor's Operations on Site

The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working areas. The

Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required.

Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

4.24. Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of Procuring Entity. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
 - b) payment of any such Cost, which shall be included in the Contract Price.
- After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

5. NOMINATED SUB CONTRACTORS

5.1. Definition of “Nominated Sub-contractor

In the Contract, “nominated Sub-contractor” means a Sub-contractor:

- a) Who is stated in the Contract as being a nominated Sub-contractor, or
- b) Whom the Engineer, under Clause 13 [Variations and Adjustments], instructs the Contractor to employ as a Sub-contractor subject to Sub-Clause 5.2 [Objection to Notification].

5.2. Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Sub-contractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless Procuring Entity agrees in writing to indemnify the Contractor against and from the consequences of the matter:

- a) there are reasons to believe that the Sub-contractor does not have sufficient competence, resources or financial strength;
- b) the nominated Subcontract or does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Sub-contractor, his agents and employees; or
- c) the nominated Sub-contractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontract or shall:
 - i. undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge his obligations and liabilities under the Contract;
 - ii. indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Sub-contractor to perform these obligations or to fulfil these liabilities, and
 - iii. be paid only if and when the Contractor has received from Procuring Entity payments for sums due under the Subcontract referred to under Sub-Clause 5.3 [Payment to nominated Sub - contractor].

5.3. Payments to nominated Sub - contractor

The Contractor shall pay to the nominated Sub-contractor the amounts shown on the nominated Sub - contractor's invoices approved by the Contractor which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-Clause 13.5 [Provisional Sums], except as stated in Sub-Clause 5.4 [Evidence of Payments].

5.4. Evidence of Payments

Before issuing a Payment Certificate which includes an amount payable to a nominated Sub-contractor, the Engineer may request the Contractor to supply reasonable evidence that the

nominated Sub-contractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

- a) Submits this reasonable evidence to the Engineer, or
- b) Satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
- c) Submits to the Engineer reasonable evidence that the nominated Sub-contractor has been notified of the Contractor's entitlement, then Procuring Entity may (at his sole discretion) pay, direct to the nominated Sub-contractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Sub-contractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to Procuring Entity, the amount which the nominated Sub-contractor was directly paid by Procuring Entity.

6. STAFF AND LABOR

6.1. Engagement of Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, feeding, transport, and, when appropriate, housing. The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor with appropriate qualifications and experience from sources within the Country.

6.2. Rates of Wages and Conditions of Labor

The Contractor shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by Procuring Entity's whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in Kenya in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of Kenya for the time being in force, and the Contractor shall perform such duties in regard to such deductions there of as may be imposed on him by such Laws.

6.3. Persons in the Service of Procuring Entity

The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst Procuring Entity's Personnel.

6.4. Labor Laws

The Contractor shall comply with all the relevant labor Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

6.5. Working Hours

No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours stated in the SCC, unless:

- a) Otherwise stated in the Contract,
- b) The Engineer gives consent, or
- c) The work is unavoidable, or necessary for the protection of life or property or for the

safety of the Works, in which case the Contractor shall immediately advise the Engineer.

6.6. Facilities for Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for Procuring Entity's Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

6.7. Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Procuring Entity's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

HIV-AIDS Prevention. The Contractor shall conduct an HIV-AIDS awareness program via an approved service provider and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

6.8. Contractor's Superintendence

Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.

Superintendence shall be given by a sufficient number of persons having adequate knowledge

of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9. Contractor's Personnel

The Contractor's Personnel specified in the SCC shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

- a) Persists in any misconduct or lack of care,
- b) Carries out duties incompetently or negligently,
- c) Fails to conform with any provisions of the Contract,
- d) Persists in any conduct which is prejudicial to safety, health, or the protection of the environment, or
- e) Based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution of the Works.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.10. Records of Contractor's Personnel and Equipment

The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

6.11. Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12. Foreign Personnel

The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. Procuring Entity will, if requested by the Contractor, use his Lowest endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

6.13. Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

6.14. Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

6.15. Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

6.16. Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereof by Contractor's Personnel.

6.17. Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

6.18. Festivals and Religious Customs

The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.

6.19. Funeral Arrangements

The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.

6.20. Prohibition of Forced or Compulsory Labor

The Contractor shall not employ forced labor, which consists of any work or service, not

voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

6.21. Prohibition of Harmful Child Labor

The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labor laws of the Country have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.

6.22. Employment Records of Workers

The Contractor shall keep complete and accurate records of the employment of labor at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

6.23. Workers' Organizations

The Contractor shall comply with laws on workers' rights to form and to join workers' organizations without interference and to bargain collectively.

6.24. Non-Discrimination and Equal Opportunity

The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline.

7. PLANT, MATERIALS AND WORKMANSHIP

7.1. Manner of Execution

The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:

- a) In the manner (if any) specified in the Contract,
- b) In a proper workman like and careful manner, in accordance with recognized good practice, and
- c) With properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

7.2. Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:

- a) manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and
- b) additional samples instructed by the Engineer as a Variation. Each sample shall be labeled as to origin and intended use in the Works.

7.3. Inspection

Procuring Entity's Personnel shall at all reasonable times:

- a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and
- b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

The Contractor shall give Procuring Entity's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

7.4. Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables,

instruments, labor, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours' notice of the Engineer's intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which Procuring Entity is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

7.5. Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Engineer requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause Procuring Entity to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay these costs to Procuring Entity.

7.6. Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor

to remove from the Site and replace any Plant or Materials which is not in accordance with the Contract, remove and re-execute any other work which is not in accordance with the Contract, and execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under subparagraph (c).

If the Contractor fails to comply with the instruction, Procuring Entity shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay to Procuring Entity all costs arising from this failure.

7.7. Ownership of Plant and Materials

Except as otherwise provided in the Contract, each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of Procuring Entity at whichever is the earlier of the following times, free from liens and other encumbrances:

- a) When it is incorporated in the Works;
- b) When the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [Payment for Plant and Materials in Event of Suspension].

7.8. Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

- a) Natural Materials obtained from outside the Site, and
- b) The disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8. COMMENCEMENT, DELAYS AND SUSPENSION

8.1. Commencement of Works

Except as otherwise specified in the Special Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer's notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor:

- a) Contract by relevant authorities of the Country;
- b) delivery to the Contractor of reasonable evidence of Procuring Entity's financial arrangements (under Sub-Clause 2.4 [Procuring Entity's Financial Arrangements]);
- c) signature of the Contract Agreement by both Parties, and if required, approval of the except if otherwise specified in the **SCC**, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works
- d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding Procuring Entity guarantee has been delivered by the Contractor.

If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [Termination by Contractor].

The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date and shall then proceed with the Works with due expedition and without delay.

8.2. Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

- a) achieving the passing of the Tests on Completion, and
- b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3. Program

The Contractor shall submit a detailed time program to the Engineer within 14 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works]. The Contractor shall also submit a revised program whenever the previous program is inconsistent with actual progress or with the Contractor's obligations. Each program shall include:

- a) The order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,

- b) Each of these stages for work by each nominated Sub-contractor (as defined in Clause 5 [Nominated Sub - contractor]),
- c) The sequence and timing of inspections and tests specified in the Contract, and
- d) A supporting report which includes:
 - i. a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and
 - ii. details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

Unless the Engineer, within 14 days after receiving a program, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the program, subject to his other obligations under the Contract. Procuring Entity's Personnel shall be entitled to rely upon the program when planning their activities.

The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [Variation Procedure].

If, at any time, the Engineer gives notice to the Contractor that a program fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised program to the Engineer in accordance with this Sub-Clause.

8.4. Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:

- a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract,
- b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,
- c) exceptionally adverse climatic conditions,
- d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or
- e) Any delay, impediment or prevention caused by or attributable to Procuring Entity, Procuring Entity's Personnel, or Procuring Entity's other Contractors.

If the Contractor considers itself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.5. Delays Caused by Authorities

If the following conditions apply, namely:

- a) The Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country,
- b) These authorities delay or disrupt the Contractor's work, and
- c) The delay or disruption was Unforeseeable, then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.4 [Extension of Time for Completion].

8.6. Rate of Progress

If, at any time:

- a) Actual progress is too slow to complete within the Time for Completion, and/or
- b) Progress has fallen (or will fall) behind the current program under Sub-Clause 8.3 [Program], other than as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Program], a revised program and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause Procuring Entity to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Procuring Entity's Claims] pay these costs to Procuring Entity, in addition to delay damages (if any) under Sub-Clause 8.7 below.

Additional costs of revised methods including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.4 [Extension of Time for Completion] shall be paid by Procuring Entity, without generating, however, any other additional payment benefit to the Contractor.

8.7. Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 2.5 [Procuring Entity's Claims] pay delay damages to Procuring Entity for this default. These delay damages shall be the sum stated in the SCC,

which shall be paid for everyday which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the **SCC**.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Procuring Entity] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

8.8. Suspension of Work

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9, 8.10 and 8.11 shall not apply.

8.9. Consequences of Suspension

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions under Sub-Clause 8.8 [Suspension of Work] and/or from resuming the work, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) Payment of any such Cost, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

8.10. Payment for Plant and Materials in Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/or Materials which have not been delivered to Site, if:

- a) the work on Plant or delivery of Plant and/or Materials has been suspended for more than 30 days, and
- b) the Contractor has marked the Plant and/or Materials as Procuring Entity's property in accordance with the Engineer's instructions.

8.11. Prolonged Suspension

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Engineer's permission to proceed. If the Engineer does not give permission within 30 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.12. Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer an instruction to this effect under Clause 13 [Variations and Adjustments].

9. TESTS ON COMPLETION

9.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing], after providing the documents in accordance with sub-paragraph (d) of Sub-Clause 4.1 [Contractor's General Obligations].

The Contractor shall give to the Engineer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the Works by Procuring Entity on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

9.2 Delayed Tests

If the Tests on Completion are being unduly delayed by Procuring Entity, Sub-Clause 7.4 [Testing] (fifth paragraph) and/or Sub-Clause 10.3 [Interference with Tests on Completion] shall be applicable.

If the Tests on Completion are being unduly delayed by the Contractor, the Engineer may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, Procuring Entity's Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3. Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4. Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:

- a) Order further repetition of Tests on Completion under Sub-Clause 9.3;
- b) If the failure deprives Procuring Entity of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event Procuring Entity shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or
- c) Issue a Taking-Over Certificate, if Procuring Entity so requests.

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to Procuring Entity as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, Procuring Entity may require the reduction to be;

- (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or
- (ii) determined and paid under Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause 3.5 [Determinations].

10. PROCURING ENTITY'S TAKING OVER

10.1. Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by Procuring Entity when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.

The Engineer shall, within 30 days after receiving the Contractor's application:

- a) issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
- b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 30 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works

The Engineer may, at the sole discretion of Procuring Entity, issue a Taking-Over Certificate for any part of the Permanent Works.

Procuring Entity shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if Procuring Entity does use any part of the Works before the Taking-Over Certificate is issued:

- a) The part which is used shall be deemed to have been taken over as from the date on which it is used,
- b) The Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to Procuring Entity, and
- c) If requested by the Contractor, the Engineer shall issue a Taking-Over Certificate for

this part.

After the Engineer has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

If the Contractor incurs Cost as a result of Procuring Entity taking over and/or using a part of the Works, other than such use as is specified in the Contractor agreed by the Contractor, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost-plus profit, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [Delay Damages] and shall not affect the maximum amount of these damages.

10.3. Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which Procuring Entity is responsible, Procuring Entity shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

The Engineer shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer shall require the Tests on Completion to be carried out by giving 14 days' notice and in accordance with the relevant provisions of the Contract.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) Payment of any such Cost-plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

10.4. Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11. DEFECTS LIABILITY

11.1. Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

- a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and
- b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) Procuring Entity on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) Procuring Entity.

11.2. Cost of Remedying Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- a) Any design for which the Contractor is responsible,
- b) Plant, Materials or workmanship not being in accordance with the Contract, or
- c) Failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) Procuring Entity, and Sub-Clause 13.3 [Variation Procedure] shall apply.

11.3. Extension of Defects Notification Period

Procuring Entity shall be entitled subject to Sub-Clause 2.5 [Procuring Entity's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8

[Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4. Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) Procuring Entity, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], Procuring Entity may (at his option):

- a) Carry out the work itself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay to Procuring Entity the costs reasonably incurred by Procuring Entity in remedying the defect or damage;
- b) Require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or
- c) If the defect or damage deprives Procuring Entity of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use.

Without prejudice to any other rights, under the Contract otherwise, Procuring Entity shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5. Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and Procuring Entity gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6. Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Engineer may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 30 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7 Right of Access

Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with Procuring Entity's reasonable security restrictions.

11.8 Contractor to Search

The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search plus profit shall be agreed or determined by the Engineer in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price.

11.9 Completion Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 30 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to Procuring Entity.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11 Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 30 days after receipt by the Contractor of the Performance Certificate, Procuring Entity may sell or otherwise dispose of any remaining items. Procuring Entity shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than Procuring Entity's costs, the Contractor shall pay the outstanding balance to Procuring Entity.

12. MEASUREMENT AND EVALUATION

12.1. Works to be Measured

The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [Application for Interim Payment Certificates], 14.10 [Statement on Completion] and 14.11 [Application for Final Payment Certificate] the quantities and other particulars detailing the amounts which he considers to be entitled under the Contract.

Whenever the Engineer requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

- a) promptly either attend or send another qualified representative to assist the Engineer in making the measurement, and
- b) supply any particulars requested by the Engineer.
 - i. If the Contractor fails to attend or send a representative, the measurement made by (or on behalf of) the Engineer shall be accepted as accurate.

Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

If the Contractor examines and disagrees the records, and/or does not sign them as agreed, then the Contractor shall give notice to the Engineer of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Engineer shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Engineer within 14 days after being requested to examine the records, they shall be accepted as accurate.

12.2. Method of Measurement

Except as otherwise stated in the Contract and notwithstanding local practice:

- a) Measurement shall be made of the net actual quantity of each item of the Permanent Works, and
- b) The method of measurement shall be in accordance with the Bills of Quantities or other applicable Schedules.

12.3. Evaluation

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause

3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contractor, if there is no such item, specified for similar work.

Any item of work included in the Bills of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bills of Quantities and will not be paid for separately.

However, a new rate or price shall be appropriate for an item of work if:

- a) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bills of Quantities or another Schedule,
 - i. This change in quantity multiplied by such specified rate of this item exceeds 0.25% of the Accepted Contract Amount,
 - ii. This change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and
 - iii. This item is not specified in the Contract as a “fixed rate item”; or
- b) the work is instructed under Clause 13 [Variations and Adjustments],
- c) no rate or price is specified in the Contract for this item, and
- d) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned work commences.

Where the contract price is different from the corrected tender price, in order to ensure the Contractor is not paid less or more relative to the contract price (*which would be the tender price*), payment valuation certificates and variation orders on omissions and additions valued based on rates in the Bill of Quantities or schedule of rates in the Tender, will be adjusted by a plus or minus percentage. The percentage already worked out during tender evaluation is worked out as follows: $(\text{corrected tender price} - \text{tender price}) / \text{tender price} \times 100$.

12.4. Omissions

Whenever the omission of any work form's part (or all) of a Variation, the value of which has not been agreed, if:

- a) the Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount;
- b) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and
- c) this cost is not deemed to be included in the evaluation of any substituted work; then the Contractor shall give notice to the Engineer accordingly, with supporting particulars. Upon receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this cost, which shall be included in the Contract Price.

13. VARIATIONS AND ADJUSTMENTS

13.1. Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

- a) Changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),
- b) Changes to the quality and other characteristics of any item of work,
- c) Changes to the levels, positions and/or dimensions of any part of the Works,
- d) Omission of any work unless it is to be carried out by others,
- e) Any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or
- f) Changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

13.2. Variation Order Procedure

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

- a) a description of the proposed work to be performed and a program for its execution,
- b) the Contractor's proposal for any necessary modifications to the program according to Sub-Clause 8.3 [program] and to the Time for Completion, and
- c) the Contractor's proposal for evaluation of the Variation.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt.

Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Engineer instructs or approves otherwise in accordance with this Clause.

13.3. Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to Procuring Entity of executing, maintaining or operating the Works, (iii) improve the efficiency or value to Procuring Entity of the completed Works, or (iv) otherwise be of benefit to Procuring Entity.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

- a) The Contractor shall design this part,
- b) Sub-paragraphs (a) to (d) of Sub-Clause 4.1 [Contractor's General Obligations] shall apply, and
- c) If this change results in a reduction in the contract value of this part, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price. This fee shall be half (50%) of the difference between the following amounts:
 - i. such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost], and
 - ii. the reduction (if any) in the value to Procuring Entity of the varied works, taking account of any reductions in quality, anticipated life or operational efficiencies.

However, if amount (i) is less than amount (ii), there shall not be a fee.

13.4. Variation Procedure for Value Engineering proposal

If the Architect requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

- a) A description of the proposed work to be performed and a program for its execution,
- b) the Contractor's proposal for any necessary modifications to the program according to Sub-Clause 8.3 [Program] and to the Time for Completion, and
- c) the Contractor's proposal for evaluation of the Variation.

The Architect shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Project Engineering] or otherwise), respond with approval, disapproval or

comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Architect to the Contractor, who shall acknowledge receipt.

Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Architect instructs or approves otherwise in accordance with this Clause.

13.5. Payment in Applicable Currencies

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

13.6. Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed. For each Provisional Sum, the Engineer may instruct:

- a) Work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-Clause 13.3 [Variation Procedure]; and/or
- b) Plant, Materials or services to be purchased by the Contractor, from a nominated Sub-contractor (as defined in Clause 5 [Nominated Sub - contractor]) or otherwise; and for which there shall be included in the Contract Price:
 - i. The actual amounts paid (or due to be paid) by the Contractor, and
 - ii. A sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule.
 - iii. If there is no such rate, the percentage rate stated in the **SCC** shall be applied.

The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

13.7. Day work

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a day work basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub- Clauses shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

- a) The names, occupations and time of Contractor's Personnel,
- b) The identification, type and time of Contractor's Equipment and Temporary Works, and
- c) The quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Engineer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payment Certificates].

13.8. Adjustments for Changes in Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contract or suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) Payment of any such Cost, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the table of adjustment data in accordance with the provisions of Sub-Clause [Adjustments for Changes in Cost].

13.9. Adjustments for Changes in Cost

In this Sub-Clause, “table of adjustment data” means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub- Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labor, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

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

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

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

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

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

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

The cost indices or reference prices stated in the table of adjustment data shall be used. If their

source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table) for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the “currency of index” is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central Procuring Entity of the Country, of this relevant currency on the above date for which the index is required to be applicable.

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favorable to Procuring Entity.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

14. CONTRACT PRICE AND PAYMENT

14.1. The Contract Price

Unless otherwise stated in the Particular Conditions:

- a) the Contract Price shall be agreed or determined under Sub-Clause 12.3 [Evaluation] and be subject to adjustments in accordance with the Contract;
- b) the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation];
- c) any quantities which may be set out in the Bills of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities:
 - i. of the Works which the Contractor is required to execute, or
 - ii. for the purposes of Clause 12 [Measurement and Evaluation]; and
- d) the Contractor shall submit to the Engineer, within 30 days after the Commencement Date, a proposed breakdown of each lumpsum price in the Schedules.

The Engineer may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.

Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts there for, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

14.2. Advance Payment

Procuring Entity shall make an advance payment, as an interest- free loan for mobilization and cashflow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the **SCC**. Unless and until Procuring Entity receives this guarantee, or if the total advance payment is not stated in the **SCC**, this Sub-Clause shall not apply.

The Engineer shall deliver to Procuring Entity and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after Procuring Entity receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by a reputable Procuring Entity or financial institution selected by the Contractor and shall be in the form annexed to the Particular Conditions or in another form approved by Procuring Entity.

The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee

specify its expiry date, and the advance payment has not been repaid by the date 30 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless stated otherwise in the SCC, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates], as follows:

- a) Deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount Less Provisional Sums; and
- b) Deductions shall be made at the amortization rate stated in the **SCC** of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.

If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Procuring Entity], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Procuring Entity], except for Sub-Clause 15.5 [Procuring Entity's Entitlement to Termination for Convenience], payable by the Contractor to Procuring Entity.

14.3. Application for Interim Payment Certificates

The Contractor shall submit a Statement in six copies to the Engineer after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers itself to be entitled, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.21 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

- a) The estimated contract value of the Works executed and the Contractor's Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);
- b) Any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [Adjustments for Changes in

- Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost];
- c) Any amount to be deducted for retention, calculated by applying the percentage of retention stated in the **SCC** to the total of the above amounts, until the amount so retained by Procuring Entity reaches the limit of Retention Money (if any) stated in the **SCC**;
 - d) Any amounts to be added for the advance payment and (if more than one instalment) and to be deducted for its repayments in accordance with Sub-Clause 14.2 [Advance Payment];
 - e) Any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [Plant and Materials intended for the Works];
 - f) Any other additions or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and
 - g) The deduction of amounts certified in all previous Payment Certificates.

Where the contract price is different from the corrected tender price, in order to ensure the Contractor is not paid less or more relative to the contract price (*which would be the tender price*), payment valuation certificates and variation orders on omissions and additions valued based on rates in the Bill of Quantities or schedule of rates in the Tender, will be adjusted by a plus or minus percentage. The percentage already worked out during tender evaluation is worked out as follows: $(\text{corrected tender price} - \text{tender price}) / \text{tender price} \times 100$.

14.4. Schedule of Payments

If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

- a) The instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates];
- b) Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and
- c) If these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works.

14.5. Plant and Materials intended for the Works *(see SCC for lists)*

If this Sub-Clause applies, Interim Payment Certificates shall include, under sub-paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates].

If the lists referred to in sub-paragraphs (b) (i) or (c) (i) below are not included in the Schedules, this Sub-Clause shall not apply. The Engineer shall determine and certify each addition if the following conditions are satisfied:

- a) The Contractor has:
 - i. Kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and
 - ii. Submitted a statement of the Cost of acquiring and delivering the Plant and Materials to the Site, supported by satisfactory evidence; and either:
- b) The relevant Plant and Materials:
 - i. Are those listed in the Schedules for payment when shipped,
 - ii. Have been shipped to the Country, enroute to the Site, in accordance with the Contract; and
 - iii. are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with evidence of payment of freight and insurance, any other documents reasonably required, and an Procuring Entity guarantee in a form and issued by an entity approved by Procuring Entity in amounts and currencies equal to the amount due under this Sub- Clause: this guarantee may be in a similar form to the form referred to in Sub-Clause 14.2[Advance Payment] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;
- c) the relevant Plant and Materials:
 - i. are those listed in the Schedules for payment when delivered to the Site, and
 - ii. have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The additional amount to be certified shall be the equivalent of eighty percent (80%) of the Engineer's determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and of the contract value of the Plant and Materials.

The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates]. At that time, the Payment Certificate shall include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials.

14.6. Issue of Interim Payment Certificates

No amount will be certified or paid until Procuring Entity has received and approved the Performance Security. Thereafter, the Engineer shall, within 30 days after receiving a Statement and supporting documents, deliver to Procuring Entity and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer fairly determines to be due, with all supporting particulars for any reduction or withholding made

However, prior to issuing the Taking-Over Certificate for the Works, the Engineer shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated in the **SCC**. In this event, the Engineer shall give notice to the Contractor accordingly.

An Interim Payment Certificate shall not be withheld for any other reason, although:

- a) if anything supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or
- b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or satisfaction.

14.7. Payment

Procuring Entity shall pay to the Contractor:

- a) The first instalment of the advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub-Clause 14.2 [Advance Payment], whichever is later;
- b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents; or, at a time when Procuring Entity's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor within 14 days after such statement is submitted, any discrepancy being rectified in the next payment to the Contractor; and
- c) the amount certified in the Final Payment Certificate within 56 days after Procuring Entity receives this Payment Certificate; or, at a time when Procuring Entity's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the undisputed amount shown in the Final Statement within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2 [Termination by Contractor].

Payment of the amount due in each currency shall be made in to Procuring Entity account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

14.8. Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its subparagraph (b)) of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central Procuring Entity in the country of the currency of payment, or if not available, the inter-Procuring Entity offered rate, and shall be paid in such currency.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

14.9. Payment of Retention Money

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].

Unless otherwise stated in the Particular Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by Procuring Entity and issued by a reputable Procuring Entity or financial institution selected by the Contractor, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contract or has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub-Clause 4.2. On receipt by Procuring Entity of the required guarantee, the Engineer shall certify and Procuring Entity shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release under the second paragraph of this Sub-Clause. Procuring Entity shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.

If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security.

14.10. Statement at Completion

Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer six copies of a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates], showing:

- a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,
- b) any further sums which the Contractor considers to be due, and
- c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Engineer shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

14.11. Application for Final Payment Certificate

Within 56 days after receiving the Performance Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

- a) The value of all work done in accordance with the Contract, and

- b) Any further sums which the Contractor considers to be due to him under the Contractor otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require within 30 days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement".

However, if, following discussions between the Engineer and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer shall deliver to Procuring Entity (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [Obtaining Dispute Board's Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to Procuring Entity (with a copy to the Engineer) a Final Statement.

14.12. Discharge

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.

14.13. Issue of Final Payment Certificate

Within 30 days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall deliver, to Procuring Entity and to the Contractor, the Final Payment Certificate which shall state:

- a) The amount which he fairly determines is finally due, and
- b) After giving credit to Procuring Entity for all amounts previously paid by Procuring Entity and for all sums to which Procuring Entity is entitled, the balance (if any) due from Procuring Entity to the Contractor or from the Contractor to Procuring Entity, as the case may be.

If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 30 days, the Engineer shall issue the Final Payment Certificate for such amount as he fairly determines to be due.

14.14. Cessation of Procuring Entity's Liability

Procuring Entity shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

- a) In the Final Statement and also
- b) (Except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10[Statement at Completion].

However, this Sub-Clause shall not limit Procuring Entity's liability under his indemnification obligations, or Procuring Entity's liability in any case of fraud, deliberate default or reckless misconduct by Procuring Entity.

14.15. Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

- a) If the Accepted Contract Amount was expressed in Local Currency only:
 - i. The proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;
 - ii. payments and deductions under Sub-Clause 13.5 [Provisional Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be made in the applicable currencies and proportions; and
 - iii. other payments and deductions under sub-paragraphs (a) to (d) of Sub-Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub- paragraph (a) (i) above;
- b) payment of the damages specified in the **SCC**, shall be made in the currencies and proportions specified in the Schedule of Payment Currencies;
- c) other payments to Procuring Entity by the Contractor shall be made in the currency in which the sum was expended by Procuring Entity, or in such currency as may be agreed by both Parties;
- d) if any amount payable by the Contractor to Procuring Entity in a particular currency exceeds the sum payable by Procuring Entity to the Contractor in that currency, Procuring Entity may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and
- e) if no rates of exchange are stated in the Schedule of Payment Currencies, they shall be those prevailing on the Base Date and determined by the central Procuring Entity of the Country.

15. TERMINATION BY PROCURING ENTITY

15.1. Notice to Correct

If the Contractor fails to carry out any obligation under the Contract, the Engineer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2. Termination by Procuring Entity

Procuring Entity shall be entitled to terminate the Contract if the Contractor:

- a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],
- b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,
- c) without reasonable excuse fails:
 - i. to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or
 - ii. to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub-Clause 7.6 [Remedial Work],
- d) within 30 days after receiving it, subcontracts the whole of the Works or assigns the Contract without the required agreement,
- e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or
- f) gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward:
 - i. for doing or forbearing to do any action in relation to the Contract, or
 - ii. for showing or for bearing to show favor or disfavor to any person in relation to the Contract, or
 - iii. if any of the Contractor's Personnel, agents or Sub - contractor gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination, or
- g) based on reasonable evidence, has engaged in Fraud and Corruption as defined in paragraph 2.2 of the Appendix B to these General Conditions, in competing for or in executing the Contract.

In any of these events or circumstances, Procuring Entity may, upon giving 14 days' notice to

the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub- paragraph (e) or (f) or (g), Procuring Entity may by notice terminate the Contract immediately.

Procuring Entity's election to terminate the Contract shall not prejudice any other rights of Procuring Entity, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his lowest efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works.

After termination, Procuring Entity may complete the Works and/or arrange for any other entities to do so. Procuring Entity and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor.

Procuring Entity shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to Procuring Entity, these items may be sold by Procuring Entity in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

15.3. Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Procuring Entity] has taken effect, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

15.4. Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Procuring Entity] has taken effect, Procuring Entity may:

- a) Proceed in accordance with Sub-Clause 2.5 [Procuring Entity's Claims],
- b) Withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by Procuring Entity, have been established, and/or
- c) Recover from the Contractor any losses and damages incurred by Procuring Entity and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, Procuring Entity shall pay any balance to the Contractor.

15.5. Procuring Entity's Entitlement to Termination for Convenience

Procuring Entity shall be entitled to terminate the Contract, at any time for Procuring Entity's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 30 days after the later of the dates on which the Contractor receives this notice or Procuring Entity returns the Performance Security. Procuring Entity shall not terminate the Contract under this Sub-Clause in order to execute the Works itself or to arrange for the Works to be executed by another Contractor or to avoid a termination of the Contract by the Contractor under Clause 16.2[Termination by Contractor]. After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination].

15.6. Fraud and Corruption

Procuring Entity requires compliance with the national law and regulations against corruption. All available sanctions will apply where corruption is detected.

16. SUSPENSION AND TERMINATION BY CONTRACTOR

16.1. Contractor's Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or Procuring Entity fails to comply with Sub-Clause 2.4 [Procuring Entity's Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days' notice to Procuring Entity, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if Procuring Entity has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Procuring Entity's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after Procuring Entity having received the suspension notification from Procuring Entity.

The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2[Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing

the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- I) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- II) payment of any such Cost-plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineers shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.3 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

- a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Procuring Entity's Financial Arrangements],
- b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
- c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Procuring Entity's Claims]),
- d) Procuring Entity substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
- e) Procuring Entity fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
- f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension], or
- g) Procuring Entity becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events.
- h) The Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to Procuring Entity, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event Procuring Entity suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due

to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to Procuring Entity, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

16.4. Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Procuring Entity's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

- a) Cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works,
- b) Handover Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and
- c) Remove all other Goods from the Site, except as necessary for safety, and leave the Site.

16.5. Payment on Termination

After a notice of termination under Sub-Clause 16.2 [Termination by Contractor] has taken effect, Procuring Entity shall promptly:

- a) Return the Performance Security to the Contractor,
- b) Pay the Contractor in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release], and
- c) Pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

17. RISK AND RESPONSIBILITY

17.1. Indemnities

The Contractor shall indemnify and hold harmless Procuring Entity, Procuring Entity's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- a) Bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, willful act or breach of the Contract by Procuring Entity, Procuring Entity's Personnel, or any of the irrelative agents, and
- b) Damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, willful act or breach of the Contract by Procuring Entity, Procuring Entity's Personnel, the irrelative agents, or any one directly or indirectly employed by any of them.

Procuring Entity shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, willful act or breach of the Contract by Procuring Entity, Procuring Entity's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in subparagraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2. Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to Procuring Entity. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section or part shall then pass to Procuring Entity.

After responsibility has accordingly passed to Procuring Entity, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-

Clause 17.3 [Procuring Entity's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.3. Procuring Entity's Risks

The risks referred to in Sub-Clause 17.4 [Consequences of Procuring Entity's Risks] below, insofar as they directly affect the execution of the Works in the Country, are:

- a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country,
- c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel,
munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity,
- d) pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds,
- e) use or occupation by Procuring Entity of any part of the Permanent Works, except as may be specified in the Contract,
- f) design of any part of the Works by Procuring Entity's Personnel or by others for whom Procuring Entity is responsible, and
- g) any operation of the forces of nature which is Unforeseeable or against which an experienced Contractor could not reasonably have been expected to have taken adequate preventive precautions.

17.4. Consequences of Procuring Entity's Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1[Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

- b) payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (f) and (g) of Sub-Clause 17.3 [Procuring Entity's Risks], Cost plus profit shall be payable.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

17.5. Intellectual and Industrial Property Rights

In this Sub-Clause, “infringement” means an infringement (or alleged infringement) of any patent, registered design, copyright, trademark, tradename, trade secret or other intellectual or industrial property right relating to the Works; and “claim” means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 30 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

Procuring Entity shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

- a) An unavoidable result of the Contractor's compliance with the Contract, or
- b) A result of any Works being used by Procuring Entity:
 - i. For a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
 - ii. In conjunction with anything not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold Procuring Entity harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6. Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any Contractor for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in Sub-

Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remedying Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [Indemnities]; Sub-Clause 17.4 (b) [Consequences of Procuring Entity's Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

The total liability of the Contractor to Procuring Entity, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Procuring Entity's Equipment and Free-Issue Materials], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than one) to the Accepted Contract Amount, as stated in the SCC, or (if such multiplier or other sum is not so stated) the Accepted Contract Amount.

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

17.7. Use of Procuring Entity's Accommodation/Facilities

The Contractor shall take full responsibility for the care of Procuring Entity provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contract or until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works).

If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which Procuring Entity is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer.

18. INSURANCE

18.1. General Requirements for Insurances

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms approved by Procuring Entity. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

Wherever Procuring Entity is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that Procuring Entity shall act for Procuring Entity's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within the respective periods stated in the **SCC** (calculated from the Commencement Date), submit to the other Party:

- a) Evidence that the insurances described in this Clause have been affected, and
- b) Copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

The insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or Procuring Entity, under the other terms of the Contract otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or Procuring Entity.

Procuring Entity in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves

the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Procuring Entity's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

18.2. Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability]).

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

- a) Shall be effected and maintained by the Contractor as insuring Party,
- b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,
- c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Procuring Entity's Risks],
- d) shall also cover, to the extent specifically required in the tendering documents of the Contract, loss or damage to a part of the Works which is attributable to the use or occupation by Procuring Entity of another part of the Works, and loss or damage from the risks listed in sub-paragraphs (c), (g) and (h) of Sub-Clause 17.3 [Procuring Entity's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the SCC (if an amount is not so stated, this sub-paragraph (d) shall not apply), and

- e) may however exclude loss of, damage to, and reinstatement of:
 - i. a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
 - ii. a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,
 - iii. a part of the Works which has been taken over by Procuring Entity, except to the extent that the Contractor is liable for the loss or damage, and
 - iv. Goods while they are not in the Country, subject to Sub-Clause 14.5 [Plant and Materials intended for the Works].

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to Procuring Entity, with supporting particulars. Procuring Entity shall then (i) be entitled subject to Sub-Clause 2.5 [Procuring Entity's Claims] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [General Requirements for Insurances].

18.3. Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

This insurance shall be for a limit per occurrence of not less than the amount stated in the **SCC**, with no limit on the number of occurrences. If an amount is not stated in the **SCC**, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

- a) Shall be affected and maintained by the Contractor as insuring Party,
- b) Shall be in the joint names of the Parties,
- c) Shall be extended to cover liability for all loss and damage to Procuring Entity's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and
- d) May however exclude liability to the extent that it arises from:
 - i. Procuring Entity's right to have the Permanent Works executed on, over, under, in or

- ii. through any land, and to occupy this land for the Permanent Works,
- iii. damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and
- iv. a cause listed in Sub-Clause 17.3 [Procuring Entity's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4. Insurance for Contractor's Personnel

The Contractor shall affect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

The insurance shall cover Procuring Entity and the Engineer against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of Procuring Entity or of Procuring Entity's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Sub-contractor's employees, the insurance may be affected by the Sub-contractor, but the Contractor shall be responsible for compliance with this Clause.

19. FORCE MAJEURE

19.1. Definition of Force Majeure

In this Clause, "Force Majeure" means an exceptional event or circumstance:

- a) Which is beyond a Party's control,
- b) Which such Party could not reasonably have provided against before entering into the Contract,
- c) Which, having arisen, such Party could not reasonably have avoided or overcome, and
- d) Which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

- i. war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- ii. rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,
- iii. riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,
- iv. munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio- activity, and
- v. natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

19.2. Notice of Force Majeure

If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

19.3. Duty to Minimize Delay

Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure. A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4. Consequences of Force Majeure

If the Contractor is prevented from performing his substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause

20.1 [Contractor's Claims] to:

- a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment].

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

19.5. Force Majeure Affecting Sub Contractor

If any Sub-contractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause.

19.6 Optional Termination, Payment and Release

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include:

- a) The amounts payable for any work carried out for which a price is stated in the Contract;
- b) The Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) Procuring Entity when paid for by Procuring Entity, and the Contractor shall place the same at Procuring Entity's disposal;
- c) other Cost or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;
- d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and

- there turn of these items to the Contractor's works in his country (or to any other destination at no greater cost); and
- e) the Cost of repatriation of the Contractor's staff and labor employed wholly in connection with the Works at the date of termination.

19.7. Release from Performance

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

- a) The Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and
- b) The sum payable by Procuring Entity to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20. CLAIMS, DISPUTES AND ARBITRATION

20.1 Contractor's Claims

If the Contractor considers itself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give Notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 30 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 30 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and Procuring Entity shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub- Clauses shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Engineer. Without admitting Procuring Entity's liability, the Engineer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all these records, and shall (if instructed) submit copies to the Engineer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

- a) This fully detailed claim shall be considered as interim;
- b) The Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require; and
- c) The Contractor shall send a final claim within 30 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

Within 42 days after receiving a Notice of a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer and approved by the Contractor, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the Engineer does not respond within the time frame defined in this Clause, either Party may consider that the claim is rejected by the Engineer and any of the Parties may refer to Arbitration in accordance with Sub-Clause 20.4 [Arbitration].

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of Sub-Clause 20.3 (f).

20.2 Procuring Entity's Claims

If Procuring Entity considers itself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Procuring Entity or the Architect shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Procuring Entity's Equipment and Free-Issue Materials], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 30 days after the Procuring Entity became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim and shall include substantiation of the amount and/or extension to which the Procuring Entity considers itself to be entitled in connection with the Contract. The Architect shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Procuring Entity is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

This amount may be included as a deduction in the Contract Price and Payment Certificates.

The Procuring Entity shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

20.3 Amicable Settlement

Where a notice of a claim has been given, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, the Party giving a notice of a claim in accordance with Sub-Clause 20.1 above should move to commence arbitration after the fifty-sixth day from the day on which a notice of a claim was given, even if no attempt at an amicable settlement has been made.

20.4 Matters that may be referred to arbitration

Notwithstanding anything stated herein the following matters may be referred to arbitration before the practical completion of the Works or abandonment of the Works or termination of the Contract by either party:

- a) The appointment of a replacement Engineer upon the said person ceasing to act.
- b) Whether or not the issue of an instruction by the Engineer is empowered by these Conditions.
- c) Whether or not a certificate has been improperly withheld or is not in accordance with these Conditions.
- d) Any dispute arising in respect of war risks or war damage.
- e) All other matters shall only be referred to arbitration after the completion or alleged completion of the Works or termination or alleged termination of the Contract, unless Procuring Entity and the Contractor agree otherwise in writing.

20.5 Arbitration

Any claim or dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.3 shall be finally settled by arbitration.

No arbitration proceedings shall be commenced on any claim or dispute where notice of a claim or dispute has not been given by the applying party within ninety days of the occurrence or discovery of the matter or issue giving rise to the dispute.

Notwithstanding the issue of a notice as stated above, the arbitration of such a claim or dispute shall not commence unless an attempt has in the first instance been made by the parties to settle such claim or dispute amicably with or without the assistance of third parties. Proof of such attempt shall be required.

The Arbitrator shall, without prejudice to the generality of his powers, have powers to direct such measurements, computations, tests or valuations as may in his opinion be desirable in order to determine the rights of the parties and assess and award any sums which ought to have been the subject of or included in any certificate.

The Arbitrator shall, without prejudice to the generality of his powers, have powers to open up, review and revise any certificate, opinion, 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.

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, and the Engineer shall not be altered by reason of any arbitration being conducted during the progress of the Works.

The terms of the remuneration of each or all the members of Arbitration shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

20.6 Arbitration with National Contractors

If the Contract is with national Contractors, arbitration proceedings will be conducted in accordance with the Arbitration Laws of Kenya. In case of any claim or dispute, such claim or dispute shall be notified in writing by either party to the other with a request to submit it to arbitration and to concur in the appointment of an Arbitrator within thirty days of the notice. The dispute shall be referred to the arbitration and final decision of a person to be agreed between the parties. Failing agreement to concur in the appointment of an Arbitrator, the Arbitrator shall be appointed, on the request of the applying party, by the Chairman or Vice Chairman of any of the following professional institutions;

- i) Architectural Association of Kenya
- ii) Institute of Quantity Surveyors of Kenya
- iii) Association of Consulting Engineers of Kenya
- iv) Chartered Institute of Arbitrators (Kenya Branch)
- v) Institution of Engineers of Kenya

The institution written to first by the aggrieved party shall take precedence over all other institutions.

20.7 Arbitration with Foreign Contractors

Arbitration with foreign Contractors shall be conducted in accordance with the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL); or with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

The place of arbitration shall be a location specified in the **SCC**; and the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language].

20.8 Alternative Arbitration Proceedings

Alternatively, the Parties may refer the matter to the Nairobi Centre for International Arbitration (NCIA) which offers a neutral venue for the conduct of national and international arbitration with commitment to providing institutional support to the arbitral process.

20.9 Failure to Comply with Arbitrator's Decision

The award of such Arbitrator shall be final and binding upon the parties.

In the event that a Party fails to comply with a final and binding Arbitrator's decision, then the other Party may, without prejudice to any other rights it may have, refer the matter to a competent court of law

SECTION IX - SPECIAL CONDITIONS OF CONTRACT

Conditions	Sub-Clause	Data
Part A - Contract Data		
Procuring Entity's name and address	Heading & ITT 1.1	KENYA AIRPORTS AUTHORITY P.O. BOX 19001 -00501 NAIROBI TEL. 822111/661000/661200
Name and Reference No. of the Contract	Heading & ITT 1.1	PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL KAA/OT/KIA/0090/2024-2025
Engineers Name and address	Heading and 3.1.1	GENERAL MANAGER (P & ES) KENYA AIRPORTS AUTHORITY. P.O. BOX 19001 -00501 NAIROBI TEL. 822111/661000/661200
Contractor's Representative's name	4.3.1	<i>[insert the name of the Contractor's Representative agreed by Procuring Entity prior to Contract signature]</i>
Key Personnel names	6.9.1	<i>[insert the name of each Key Personnel agreed by Procuring Entity prior to Contract signature]</i>
Time for Completion	1.1.	4 Months <i>If Sections are to be used, refer to Table: Summary of Sections below</i>
Defects Notification Period	11.1.1	12 Months
Sections	1.1	<i>If Sections are to be used, refer to Table: Summary of Sections below</i>
Electronic transmission systems	1.3.1 (a)	Emails may be used to deliver communications to parties
Time for the Parties entering into a Contract Agreement	1.6	Within 30 days
Commencement Date	8.1.1	Delete and replace with; The Commencement Date shall be 14 days after the Engineer has issued Notice of Commencement . This shall be issued after the following precedent conditions have all been fulfilled:

Conditions	Sub-Clause	Data
		a) Submission of Performance Guarantee in accordance with Clause 4.2 of the GCC b) Signature of the Contract Agreement by both Parties. c) Submission of revised program of works in the form and detail provided for under Clause 8.3 of GCC d) Access to the Site as provided in Clause 2.1 of the SCC. e) Submission of Insurance Policies f) Issuance of NOTAM (Where applicable)
Time for access to the Site	2.1.1	No later than the Commencement Date, and not later than <u>28</u> days after Commencement Date
Engineer's Duties and Authority	3.1.3	Variations resulting in an increase of the Accepted Contract Amount in excess of <u>25</u> % shall require approval of Procuring Entity.
Performance Security	4.2.1	The performance security will be in the form of a <u>Bank Guarantee</u> in the amount(s) of 10% percent of the Accepted Contract Amount and in the same currency(ies) of the Accepted Contract Amount.
	4.2.3	Delete and replace with: The Performance Security shall be issued by a bank located in Kenya, licensed by the Central Bank of Kenya and acceptable to the Procuring Entity and in the form provided in Section III. The Procuring Entity shall seek authentication of the Performance Security from the issuing bank. It is the responsibility of the Contractor to ensure that: - <i>the issuing bank responds with reasonable dispatch to an inquiry from the Procuring Entity. Failure by the issuing bank to respond to the inquiry within a reasonable period may lead to the Contractor's Performance Security being rejected and returned.</i> The Performance Security shall be valid and enforceable until the Contractor has executed and completed the Works and remedied any defects and upto the time of issuance of the Performance Certificate. Or

Interim Payment Certificates	14.6.2	<p>Add the following; Default in Contractor's obligation but not limited to</p> <ul style="list-style-type: none"> i. Non payment of Engineer's staff salaries ii. Submission of revised programme iii. Submission of Insurances and PGs iv. Abandonment of site without notice to Engineer v. Non remittance of payments for material tests vi. Non facilitation of transport for engineer and his staff.
	14.6.3	<p>In addition No incorrect statement or supporting documents shall be certified, no correction shall be done by the Engineer, all required corrections shall be done by the Contractor including correction of Amounts and IPC resubmitted. <i>Date of submission will be after all corrections are done and signed by the Engineer.</i></p>
Payment	14.7.1 b	<p>Within 60days of submission of the correct Certified Interim Payment Certificate (<i>agreed between the Contractor and the Engineer</i>) to the Procuring Entity by the Engineer</p>
Delayed Payment	14.8.1	<p>Delete and replace with: If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges computed annually on simple interest on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued.</p> <p>The maximum interest payable will be capped at the value of the principal amount.</p>
Publishing source of commercial interest rates for financial charges in case of delayed payment	14.8.2	<p>Specify <u>3</u> % simple rate above CBK rates.</p>

Maximum total liability of the Contractor to Procuring Entity	17.6.2	<i>[Select one of the two options below as appropriate]</i> The product of <u>1.15</u> <i>[insert a multiplier less or greater than one]</i> times the Accepted Contract Amount, or <u> </u> <i>[insert amount of the maximum total liability]</i>
Periods for submission of insurance: a. evidence of insurance. b. relevant policies	18.1.6	<i>[Insert period for submission of evidence of insurance and policy. Period may be from 14 days to 30days.]</i> <u>14</u> days upon Order to Commence <u>14</u> days upon Order to Commence
Maximum amount of deductibles for insurance of Procuring Entity's risks	18.2.5	<i>10% of Contract Amount</i>
Minimum amount of Third-Party Insurance	18.3.2	Kshs. 10,000,000
The place of arbitration	20.7	Chief Justice of the Republic of Kenya; CIARB (Kenya Branch). In Nairobi, Kenya

Conditions	GCC Clause	Data
Procuring Entity's name and address	1.1.3	KENYA AIRPORTS AUTHORITY P.O. Box 19001-00501 NAIROBI-KENYA
Engineer's name and address	3.1.1	<p>The said "Engineer" shall be;</p> <p>THE GENERAL MANAGER PROJECTS AND ENGINEERING SERVICES, KENYA AIRPORTS AUTHORITY, P.O. BOX 19001 – 00501, NAIROBI, KENYA</p> <p>or</p> <p>any other "Competent Person" appointed by the Employer, and notified to the Contractor, to act in replacement of the Engineer.</p> <p>The "Competent Person" may be an individual(s), a Consultancy Firm, a Government Agency, or any combination of professionals to be appointed at the discretion of the Employer.</p>
Engineer's Duties and Authority	3.1	<p>The Engineer shall obtain specific approval of the Employer before taking any of the following actions specified in Part I:</p> <ul style="list-style-type: none"> (i) Consenting to the sub-letting of any part of the Works. (ii) Certifying additional cost determined (iii) Determining an Extension of Time (iv) Issuing a Variation except in an emergency situation as reasonably determined by the Engineer. (v) Fixing rates or prices
Sub Contractors	4.4	No single subcontract may be for more than 10 percent of the Contract Price nor shall the sum of all subcontracts exceed 25 percent of the Contract price. No one subcontractor may be awarded subcontracts to a total value greater than 10 percent of the Contract Price. All subcontracts greater than 2 percent of the Contract Price are to have the prior consent of the Engineer. The Contractor shall however, not require such consent for purchases of

		materials or to place contracts for minor details or for any part of the Works of which the manufacturer of supplier is named in the Contract. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen.
Compliance with Laws	1.4.1 & 1.4.2	<p>(a) The language governing this Contract shall be English.</p> <p>The “Ruling Language” which shall be used to interpret this Contract shall be English. Communication between the Contractor and Engineer or Engineer’s representative shall be in English.</p> <p>(b) The law applicable to this Contract shall be the laws of the Republic of Kenya. Except to the extent otherwise provided by the Contract, the Kenyan courts shall have exclusive jurisdiction to hear and to determine all actions and proceedings in connection with and arising out of the Contract, and the Contractor shall submit to the jurisdiction of Kenyan courts for the purpose of any such actions and proceedings.</p>
Contractor's General Obligations	4.1	<p>(a) Within 28 days after receipt of the Engineer’s order to commence the Works, the Contractor shall establish an office at the Site duly equipped for the Contractor’s representative and his supervisory personnel.</p> <p>The Contractor shall maintain this office throughout the Contract period. The said office shall be the legal domicile of the Contractor, and all correspondence sent to this office shall be deemed to have been sent to the Contractor’s head office.</p> <p>(b) A foreign Contractor or a Kenya-foreign joint venture, if not registered in Kenya under the applicable laws of Kenya, shall undertake registration upon receipt of the letter of acceptance and prior to signing of the Contract.</p>
Performance Security	4.2	The Contractor shall obtain a Performance Security within 14 days after receiving the Letter of Acceptance

		<p>The Performance Security shall be issued by a Bank incorporated in Kenya. The amount of guarantee shall be 10% of the contract amount.</p> <p>The bank guarantee, shall be issued either (a) by an established and reputable bank approved by the Employer and located in Kenya or a foreign bank through a correspondent established and reputable bank located in Kenya and approved by the Employer or (b) directly by a foreign bank acceptable to the Employer. The performance security shall normally be in the currency or currencies requested for payment by the Contractor and in the same proportions as those requested for payment in the Contract.</p> <p>The performance security may, subject to the approval of the Engineer, be adjusted at the end of each period of 12months to reflect the residual value of the Contract Works.</p> <p>The performance guarantee shall be valid until a date 28days after the date of issue of the Taking-Over Certificate. The security shall be returned to the Contractor within 28 days of the expiration.</p>
Program	8.3	<p>The time within which the Program shall be submitted shall be twenty-eight (28) days. This detailed Program shall be based upon the program submitted by the Contractor as part of his tender and shall, in no material manner, deviate from the said program.</p> <p>The Contractor shall allow in his Program for the following 11 public holidays per calendar year in Kenya upon which the Contractor shall not be permitted to work.</p> <ol style="list-style-type: none"> New Year's Day (1st January) Good Friday Easter Monday Labor Day (1st May) Madaraka Day (1st June) Idd-Ul-Fitr Moi Day (10th October) Mashujaa Day (20th October) Jamhuri Day (12th December) Christmas Day (25th December)

		<p>k) Boxing Day (26th December)</p> <p>The Contractor should also allow per calendar year for a further 4 unspecified public holidays which may be announced by the Government of Kenya with no prior notification, and upon which he shall not be permitted to work.</p> <p>The Employer shall have the right to withhold payment at any time if the Contractor fails to submit the contractual construction programs in accordance with sub clause 14.1 above or revise construction programs due to his negligence, failure or omission.</p> <p>Cash Flow Estimate to be submitted</p> <p>The time limit within which a detailed cash flow estimate is to be submitted shall be twenty-eight (28) days. In preparing the estimates, the Contractor shall make provision for Advance payment, repayment of advance, retention, payment for services provided by the Employer and timing implications of sub clause 60 – Certificates and Payments.</p>
Contractor's Superintendence	6.8	<p>The Contractor shall, within seven (7) days of receipt of the Engineer's order to commence the Works, inform the Engineer in writing, the name of the Contractor's representative and the anticipated date of his arrival on Site.</p> <p>The Contractor's agent or representative on the Site shall be an Engineer registered as a Professional Engineer by the Engineers Board of Kenya in accordance with the Engineers Act of 2011 and shall be able to read, write and speak English fluently.</p>
Health and Safety procedures	4.8	<p>The formulation and enforcement of an adequate safety program shall be the obligation of the Contractor with respect to all the Works under this Contract, regardless of whether performed by the Contractor or his Sub Contractors. The Contractor shall, within 14 days after commencement of the Works, meet the Engineer to present and discuss his plan for the establishment of such safety measures as may be necessary to provide against accidents, unsafe acts and so forth. Within 28 days after commencement of the Works, the</p>

		<p>Contractor shall submit a written safety program to the Engineer covering the overall Works and based on the laws and regulations of Kenya. In addition, he shall prepare special safety programs for blasting and handling of explosives as stipulated in the General and Special Specifications.</p> <p>Notwithstanding the foregoing, the Contractor shall observe the following measures with a view to reducing or eliminating adverse environmental effects by the Site Works:</p> <ul style="list-style-type: none"> (i). All queries and borrow pits shall be filled and landscaped to their original state after extraction of construction material (ii). Soil erosion due to surface runoff or water from culverts or other drainage structures should be avoided by putting in place proper erosion control measures that shall include, but not limited to grassing, planting of trees, gabions etc. (iii). Long traffic diversion roads shall be avoided so as to minimize the effect of dust on the surrounding environment. In any case all diversions shall be kept damp and dust free at the Contractor's expense. (iv). Spillage of oils, fuels and lubricants shall be avoided and if spilt, shall be collected and disposed of in such a way as not to adversely affect the environment. (v). Rock blasting near settlement areas shall be properly coordinated with the relevant officers of the Government so as to minimize noise pollution and community interference. (vi). Dumping shall be done only at designated dumping areas and not haphazardly on surroundings. (vii). The Contractor must register the site as a workplace. (viii). Within seven (7) days upon receipt of order to Commence Works the Contractor shall submit the following Health and Safety documents.
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		<p>a) Written Health and Safety Policy which shall be displayed at all times on site at a location visible to all visitors entering the site.</p> <p>b) Obtain and keep records of Permits to Work for operations.</p> <p>c) Carry out Job Safety Analysis and submit Risk assessment before commencement of site activities.</p> <p>d) Contractor shall give Notices of accidents, incidences and near misses during the performance of the Contract and shall give copies of the notices to the Engineer.</p> <p>(ix). The Contractor shall provide wholesome portable water for drinking to all workers on site.</p> <p>(x). Contractor must have safe work practices and procedures displayed on site at a location visible to all visitors entering the site.</p> <p>(xi). Contractor shall form a safety and health committee if the site shall have more than 20 persons/workers.</p>
Insurance	18	<p>The formulation and enforcement of an adequate safety program shall be the obligation of the Contractor with respect to all the Works under this Contract, regardless of whether performed by the Contractor or his subcontractors. The Contractor shall, within 14 days after commencement of the Works, meet the Engineer to present and discuss his plan for the establishment of such safety measures as may be necessary to provide against accidents, unsafe acts and so forth. Within 28 days after commencement of the Works, the Contractor shall submit a written safety program to the Engineer covering the overall Works and based on the laws and regulations of Kenya. In addition, he shall prepare special safety programs for blasting and handling of explosives as stipulated in the General and Special Specifications.</p> <p>Notwithstanding the foregoing, the Contractor shall observe the following measures with a view to reducing or eliminating adverse environmental effects by the Site Works:</p>

		<p>(i) All queries and borrow pits shall be filled and landscaped to their original state after extraction of construction material</p> <p>(ii) Soil erosion due to surface runoff or water from culverts or other drainage structures should be avoided by putting in place proper erosion control measures that shall include, but not limited to grassing, planting of trees, gabions etc.</p> <p>(iii) Long traffic diversion roads shall be avoided so as to minimize the effect of dust on the surrounding environment. In any case all diversions shall be kept damp and dust free at the Contractor's expense.</p> <p>(iv) Spillage of oils, fuels and lubricants shall be avoided and if spilt, shall be collected and disposed of in such a way as not to adversely affect the environment.</p> <p>(v) Rock blasting near settlement areas shall be properly coordinated with the relevant officers of the Government so as to minimize noise pollution and community interference.</p> <p>(vi) Dumping shall be done only at designated dumping areas and not haphazardly on surroundings.</p>
Royalties	7.8	The Contractor shall also be liable for all payments or compensation, if any, that are levied in connection with the dumping of part or all of any such material."
Defects Liability	11	Any work ordered to be executed under this clause shall be done at a time and in a manner as directed by the Engineer so as to interfere as little as possible with the operations of the Employer or of other contractors and no extension(s) of the defect's liability period will be allowed for the execution of this Work.
Provisional Sums	13.5	<p>The Contractor shall also be liable for all payments or compensation, if any, that are levied in connection with the dumping of part or all of any such material."</p> <p>If the Engineer desires to secure final payment to any nominated sub-contractor before final payment is due to the Contractor and if such sub-contractor has satisfactorily indemnified the Contractor against any latent defects, the Engineer may, in an interim certificate, include an amount to</p>

		cover the said final payment, and thereupon the Contractor shall pay to such nominated sub-contractor the amount so certified. Upon such final payment, the amount named in the Appendix to Form of Tender as Limit of Retention Money shall be reduced by the sum which bears the same ratio to the amount as does the subcontract and sub-contractor shall be discharged from all liability for the Work, materials or goods executed or supplied by such subcontractor under the Contract to which the payment relates
Advance payment	14.2	<p>In the event that an advance payment is granted, the following shall apply: -</p> <ul style="list-style-type: none"> a) Provision in the PPADA 2015 in regard to this shall be followed b) No advance payment may be made before the Contractor has submitted proof of the establishment of deposit or of a directly liable guarantee satisfactory to the Employer in the amount of the advance payment. The guarantee shall be in the same currency as the advance. c) Reimbursement of the advance shall be affected by deductions from monthly interim payments. d) Reimbursement of the lump sum advance shall be made by deductions from the Interim payments and where applicable from the balance owing to the Contractor. Reimbursement shall begin when the amount of the sums due under the Contract reaches 20% of the original amount of the Contract. It shall have been completed by the time 80% of this amount is reached. <p>The amount to be repaid by way of successive deductions shall be calculated by means of the formula:</p> $R = A (x1 - x11) 80 - 20$ <p>Where:</p> <p>R = the amount to be reimbursed</p> <p>A = the amount of the advance which has been granted</p>

		<p>X1 = the amount of proposed cumulative payments as a percentage of the original amount of the Contract. This figure will exceed 20% but not exceed 80%.</p> <p>X11 = The amount of the previous cumulative payments as a percentage of the original amount of the Contract. This figure will be below 80% but not less than 20%.</p> <p>(e) With each reimbursement the counterpart of the directly liable guarantee may be reduced accordingly.</p>
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SECTION X: CONTRACT FORMS

FORM No. 1 -	NOTIFICATION OF INTENTION TO AWARD
FORM NO. 2 -	REQUEST FOR REVIEW
FORM No. 3-	LETTER OF AWARD
FORM No. 4 -	CONTRACT AGREEMENT
FORM No. 5 -	PERFORMANCE SECURITY [Option 1 - Unconditional Demand Bank Guarantee]
FORM No. 6-	PERFORMANCE SECURITY [Option 2- Performance Bond]
FORM No. 7 -	ADVANCE PAYMENT SECURITY
FORM No. 8 -	RETENTION MONEY SECURITY
FORM NO. 9-	BENEFICIAL OWNERSHIP DISCLOSURE FORM

FORM No 1: NOTIFICATION OF INTENTION TO AWARD FORMAT

For the attention of Tenderer's Authorized Representative

Name..... **MANAGING DIRECTOR/CEO** Address: **KENYA AIRPORTS
AUTHORITY, P.O. BOX 19001 – 00501 NAIROBI** Telephones: **+254-020-
822111/6611000/6612000** Email Address: *info@kaa.go.ke*

Date of Transmission: This Notification is sent by: **info@kaa.go.ke** on

PROCURING ENTITY

Contract title:

Country: Kenya, County **KISUMU**

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

- a) Request a debriefing in relation the evaluation of your Tender, and/or
- b) Submit a Procurement-related Complaint in relation to the decision to award the contract.

The successful Tenderer

Name: _____ Address: _____

Contract price: _____

Other Tenderers: *insert names of all Tenderers that submitted a Tender. If the Tender's price was evaluated include the evaluated price as well as the Tender price as read out.]—N/A---*

1. How to request a debriefing

- a) DEADLINE: The deadline to request a debriefing expires at midnight on *[is provided in the PPADA 2015]*
- b) You may request a debriefing in relation to the results of the evaluation of your Tender. If you decide to request a debriefing your written request must be made within five (5) Business Days of receipt of this Notification of Intention to Award.
- c) Provide the contract name, reference number, name of the Tenderer, contact details; and address the request for debriefing as follows:
 - i) Attention: **N/A**
 - ii) Title/position: **GENERAL MANAGER (PROCUREMENT & LOGISTICS)**
 - ii) Agency: **KENYA AIRPORTS AUTHORITY**
 - iii) Email address: **info@kaa.go.ke**
- d) If your request for a debriefing is received within the 3 Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.
- e) The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.
- f) If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Days from the date of publication of the Contract Award Notice.

2. **How to make a complaint**

- a) Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight,
- b) Provide the contract name, reference number, name of the Tenderer, contact details; and address the Procurement-related Complaint as follows:
 - i) Attention: **N/A**
 - ii) Title/position: **GENERAL MANAGER (P & ES)**
 - iii) Agency: **KENYA AIRPORTS AUTHORITY**
 - iv) Email address: **info@kaa.go.ke**
- c) At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

- d) Further information: For more information refer to the Public Procurement and Disposals Act 2015 and its Regulations available from the Website info@ppra.go.ke or complaints@ppra.go.ke.

You should read these documents before preparing and submitting your complaint.

- e) There are four essential requirements:

- i) You must be an 'interested party'. In this case, that means a Tenderer who submitted a Tender in this tendering process, and is the recipient of a Notification of Intention to Award.
- ii) The complaint can only challenge the decision to award the contract.
- iii) You must submit the complaint within the period stated above.
- iv) You must include, in your complaint, all of the information required to support your complaint.

3. Standstill Period

- i) DEADLINE: The Standstill Period is due to end at midnight on
- ii) The Standstill Period lasts ten (14) Days after the date of transmission of this Notification of Intention to Award.
- iii) The Standstill Period may be extended as stated in paragraph Section 5 (d) above.

If you have any questions regarding this Notification please do not hesitate to contact us. On behalf of the Procuring Entity:

Signature: _____

Name: _____

Title/position: _____

Telephone: _____

Email: _____

FORM NO. 2 - REQUEST FOR REVIEW

FORM FOR REVIEW (r.203(1))

PUBLIC PROCUREMENT ADMINISTRATIVE REVIEW BOARD

APPLICATION NO..... OF.....20.....BETWEEN

..... APPLICANT

AND.....RESPONDENT (Procuring Entity)

Request for review of the decision of the **KENYA AIRPORTS AUTHORITY** dated the...day of20.....in the matter of Tender No.....of20.... for

REQUEST FOR REVIEW

I/We....., the above named Applicant(s), of address: Physical address..... P. O. Box..... No..... Tel. No..... Email, hereby request the Public Procurement Administrative Review Board to review the whole/part of the above mentioned decision on the following grounds, namely:

- 1.
- 2.

By this memorandum, the Applicant requests the Board for an order/orders that:

- 1.
- 2.

SIGNED (Applicant) Dated on..... day of/...20.....

FOR OFFICIAL USE ONLY Lodged with the Secretary Public Procurement Administrative Review Board on.....day of20.....

SIGNED

Board Secretary

FORM NO 3: LETTER OF AWARD

To:
This is to notify you that your Tender dated _____ for execution of the **PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT** for the Accepted Contract Amount _____, as corrected and modified in accordance with the Instructions to Tenderers, is hereby accepted by **KENYA AIRPORTS AUTHORITY**.

You are requested to furnish the Performance Security within 30 days in accordance with the Conditions of Contract, using, for that purpose, one of the Performance Security Forms included in Section VIII, Contract Forms, of the Tender Document.

Authorized Signature:

Name and Title of Signatory:

Name of Procuring Entity **KENYA AIRPORTS AUTHORITY**

Attachment: *Contract Agreement*.....

FORM NO 4: CONTRACT AGREEMENT

THIS AGREEMENT made the _____ day of _____, 2025, between
KENYA AIRPORTS AUTHORITY (hereinafter “the Procuring Entity”), of the one part,
and _____ of _____ (hereinafter

“the Contractor”), of the other part:

WHEREAS Procuring Entity desires that the Works known as _____ should be executed by the Contractor, and has accepted a Tender by the Contractor for the execution and completion of these Works and the remedying of any defects therein, The Procuring Entity and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
 - a) the Letter of Acceptance
 - b) the Letter of Tender
 - c) the addenda Nos _____ (if any)
 - d) the Special Conditions of Contract
 - e) the General Conditions of Contract;
 - f) the Specifications
 - g) the Drawings; and
 - h) the completed Schedules and any other documents forming part of the contract.
3. In consideration of the payments to be made by the Procuring Entity to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Procuring Entity to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Procuring Entity hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the Laws of Kenya on the day, month and year specified above.

Signed and sealed by _____ (for the Procuring Entity)

Signed and sealed by _____ (for the Contractor).

FORM NO. 5 - PERFORMANCE SECURITY

[Option 1 - Unconditional Demand Bank Guarantee]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: KENYA AIRPORTS AUTHORITY *[insert name and Address of Procuring Entity]*

Date: _____ *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: _____

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

1. We have been informed that _____
_____ (hereinafter called "the Contractor") has
entered into Contract No. _____ dated
_____ with **KENYA AIRPORTS
AUTHORITY** _____ (the Procuring Entity as the Beneficiary),
for the execution of
_____ (hereinafter called "the Contract").
2. Furthermore, we understand that, according to the conditions of the Contract, a
performance guarantee is required.
3. At the request of the Contractor, we as Guarantor, hereby irrevocably undertake to pay the
Beneficiary any sum or sums not exceeding in total an amount of

(in words), ¹ such sum being payable in the types and proportions of currencies in which
the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand
supported by the Beneficiary's statement, whether in the demand itself or in a separate
signed document accompanying or identifying the demand, stating that the Applicant is
in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove
or to show grounds for your demand or the sum specified therein.
4. This guarantee shall expire, no later than the Day of, 2.....², and any
demand for payment under it must be received by us at the office indicated above on or
before that date.
5. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed
[six months] [one year], in response to the Beneficiary's written request for such
extension, such request to be presented to the Guarantor before the expiry of the
guarantee."

[Name of Authorized Official, signature(s) and seals/stamps].

FORM No. 6 - PERFORMANCE SECURITY

[Option 2– Performance Bond]

[Note: Procuring Entities are advised to use Performance Security – Unconditional Demand Bank Guarantee instead of Performance Bond due to difficulties involved in calling Bond holder to action]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: KENYA AIRPORTS AUTHORITY

Date: _____

PERFORMANCE BOND No.: _____

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

1. By this Bond _____ as Principal (hereinafter called “the Contractor”) and _____ as Surety (hereinafter called “the Surety”), are held and firmly bound unto KENYA AIRPORTS AUTHORITY as Oblige (hereinafter called “the Procuring Entity”) in the amount of _____ for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.
2. WHEREAS the Contractor has entered into a written Agreement with the Procuring Entity dated the _____ day of _____, 20, for _____ in accordance with the documents, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.
3. NOW, THEREFORE, the Condition of this Obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Contractor shall be, and declared by the Procuring Entity to be, in default under the Contract, the Procuring Entity having performed the Procuring Entity’s obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- 1) complete the Contract in accordance with its terms and conditions; or
 - 2) obtain a tender or tenders from qualified tenderers for submission to the Procuring Entity for completing the Contract in accordance with its terms and conditions, and upon determination by the Procuring Entity and the Surety of the lowest responsive Tenderers, arrange for a Contract between such Tenderer, and Procuring Entity and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by Procuring Entity to Contractor under the Contract, less the amount properly paid by Procuring Entity to Contractor; or
 - 3) pay the Procuring Entity the amount required by Procuring Entity to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.
4. The Surety shall not be liable for a greater sum than the specified penalty of this Bond.
 5. Any suit under this Bond must be instituted before the expiration of one year from the date of the issuing of the Taking-Over Certificate. No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Procuring Entity named herein or the heirs, executors, administrators, successors, and assigns of the Procuring Entity.
 6. In testimony whereof, the Contractor has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this day _____ of _____ 20 SIGNED ON _____ on behalf of _____
By _____ in the capacity of _____
In the presence of
SIGNED ON _____ on behalf of _____
By _____ in the capacity of _____

In the presence of

FORM NO. 7 - ADVANCE PAYMENT SECURITY

[Demand Bank Guarantee]

[Guarantor letterhead]

Beneficiary: KENYA AIRPORTS AUTHORITY

Date: _____

ADVANCE PAYMENT GUARANTEE No.: _____ *[Insert guarantee reference number]* **Guarantor:** _____ *[Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that _____ (hereinafter called "the Contractor") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____

_____ (hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum _____

(*in words*) is to be made against an advance payment guarantee.

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

- a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or
- b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Contractor on its account number _____ at _____.

5. The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the _____ day of _____, 2023 whichever is earlier. Consequently, demand for payment under this guarantee must be received by us at this office on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year]*, in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

[Name of Authorized Official, signature(s) and seals/stamps]

FORM NO. 8 - RETENTION MONEY SECURITY

[Demand Bank Guarantee]

[Guarantor letterhead]

Beneficiary: KENYA AIRPORTS AUTHORITY

Date: _____ *[Insert date of issue]*

Advance payment guarantee no. *[Insert guarantee reference number]*

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

1. We have been informed that _____ *[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Contractor") has entered into Contract No. _____ *[insert reference number of the contract]* dated _____ with the Beneficiary, for the execution of _____ *[insert name of contract and brief description of Works]* (hereinafter called "the Contract").
2. Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, and payment of *[insert the second half of the Retention Money]* is to be made against a Retention Money guarantee.
3. At the request of the Contractor, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* _____ *([insert amount in words _____])*¹ upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or show grounds for your demand or the sum specified therein.
4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the second half of the Retention Money as referred to above has been credited to the Contractor on its account number _____ at _____ *[insert name and address of Applicant's bank]*.
5. This guarantee shall expire no later than the Day of, 2.....², and any demand for payment under it must be

received by us at the office indicated above on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year]*, in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

[Name of Authorized Official, signature(s) and seals/stamps]

FORM NO. 9 BENEFICIAL OWNERSHIP DISCLOSURE FORM**(Amended and issued pursuant to PPRA CIRCULAR No. 02/2022)**

Tender Reference No. **KAA/OT/KIA/0090/2024-2025** The Name of the Tender Title/Description **PROPOSED RUNWAY WIDENING AND PAVEMENT REPAIRS AT KISUMU INTERNATIONAL AIRPORT** to: Procuring Entity

In response to the requirement in your notification of award dated insert date of notification of award to furnish additional information on beneficial ownership: _____ *[select one option as applicable and delete the options that are not applicable]*

I) We here by provide the following beneficial ownership information.

Details of beneficial ownership

	Details of all Beneficial Owners		% of shares a person holds in the company Directly or indirectly	% of voting rights a person holds in the company	Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer (Yes / No)	Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)
1.	Full Name		Directly----- % of shares	Directly..... % of voting rights	1. Having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer: Yes -----No---- 2. Is this right held directly or indirectly?	1. Exercises significant influence or control over the Company body of the Company (tenderer) Yes -----No---- 2. Is this influence or control
	National identity card number or Passport number		Indirectly----- % of shares	Indirectly-----% of voting rights		
	Personal Identification Number (where applicable)					
	Nationality					
	Date of birth					

Details of all Beneficial Owners		% of shares a person holds in the company Directly or indirectly	% of voting rights a person holds in the company	Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer (Yes / No)	Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)	
[did/mm/ivy]				Direct.....	exercised directly or indirectly?	
Postal address				...	Direct.....	
Residential address						
Telephone number				Indirect.....	Indirect.....	
Email address					
Occupation or profession						
2.	Full Name		Directly-----% of shares	Directly.....% of voting rights	1. Having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer: Yes ----No----	1. Exercises significant influence or control over the Company body of the Company (tenderer) Yes ----No----
	National identity card number or Passport number		Indirectly-----% of shares	Indirectly-----% of voting rights	2. Is this right held directly or indirectly?	2. Is this influence or control exercised directly or indirectly?
	Personal Identification Number (where applicable)					
	Nationality(ies)					
	Date of birth [dd/mm/yyyy]				Direct.....	Direct.....
	Postal address				...	

	Details of all Beneficial Owners		% of shares a person holds in the company Directly or indirectly	% of voting rights a person holds in the company	Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer (Yes / No)	Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)
	Residential address				Indirect.....	Indirect.....
	Telephone number					
	Email address					
	Occupation or profession					
3. et c.						

II) Am fully aware that beneficial ownership information above shall be reported to the Public Procurement Regulatory Authority together with other details in relation to contract awards and shall be maintained in the Government Portal, published and made publicly available pursuant to Regulation 13(5) of the Companies (Beneficial Ownership Information) Regulations, 2020.(Notwithstanding this paragraph Personally Identifiable Information in line with the Data Protection Act shall not be published or made public). *Note that Personally Identifiable Information (PII) is defined as any information that can be used to distinguish one person from another and can be used to deanonymize previously anonymous data. This information includes National identity card number or Passport number, Personal Identification Number, Date of birth, Residential address, email address and Telephone number.*

III) In determining who meets the threshold of who a beneficial owner is, the Tenderer must consider a natural person who in relation to the company:

- (a) holds at least ten percent of the issued shares in the company either directly or indirectly;
- (b) exercises at least ten percent of the voting rights in the company either directly or indirectly;
- (c) holds a right, directly or indirectly, to appoint or remove a director of the company; or
- (d) exercises significant influence or control, directly or indirectly, over the company.

IV) What is stated to herein above is true to the best of my knowledge, information and belief.

Name of the Tenderer:*[insert complete name of the Tenderer]_____

Designation of the person signing the Tender: [insert complete title of the person signing the Tender]

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

Date this [insert date of signing] day of..... [Insert month], [insert year]

Bidder Official Stamp