

# BIDDING DOCUMENT

**2025**



**RWANDA AIRPORTS COMPANY**

**Title of Tender: KIGALI INTERNATIONAL AIRPORT  
PAVEMENT/MAINTENANCE OF CIVIL WORKS FOR  
RUNWAY, APRON AND SERVICE ROADS AT KIGALI  
INTERNATIONAL AIRPORT, KAMEMBE, GISENYI  
AIRPORTS AND MUSANZE AERODROME**

**Tender Reference Number: 001/W/2025-2026/NCB/RAC**

**Procurement Method: Open Tender**

**August 2025**



## PREFACE

1. This Standard Bidding Document (SBD) has been prepared by Rwanda Airports Company (RAC) for the procurement of works. The procedures and practices presented in this SBD have been developed to reflect the requirements of RAC procurement Manual and the best international procurement practices.
2. This SBD for the Procurement of works is suitable for use under both International and National open competitive bidding with or without pre-qualification. It is also suitable for the restricted tendering methods.
3. This SBD is comprised of nine sections, namely; Instructions to Bidders, Bid Data Sheet, Bidding forms, General Conditions of the Contract, Special Conditions of the contract, Specifications, Drawings, Bills of Quantities and forms.
4. Before using this SBD, the user should be familiar with RAC Procurement manual which have been prepared to provide guidance to RAC officials in the conduct of the procurement process.
5. RAC welcomes any feedback or comments from the users of this SBD which will assist in improving this document.

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## Introduction

This Standard Bidding Document (SBD) is intended to be used as a model for admeasurement (unit prices or unit rates in a bill of quantities) and lump sum types of Contract, which are the most common in Works contracting. Lump sum contracts are used in particular for buildings and other forms of construction where the Works are well defined and are unlikely to change in quantity or specification, and where encountering difficult or unforeseen site conditions (for example, hidden foundation problems) is unlikely. The main text refers to admeasurement contracts. **Alternative clauses or texts are supplied for use with lump sum contracts.**

Care should be taken to check the relevance of the provisions of the standard documents against the requirements of the specific Works to be procured. The following directions should be observed when using the documents:

- (a) All the documents listed in the Table of Contents are normally required for the procurement of Works. However, they should be adapted as necessary to the circumstances of the particular Project.
- (b) Rwanda Airports Company (RAC) shall prepare the Bid Data Sheet (Section II), Special Conditions of Contract (Section V), and Sections VI, VII, VIII which deal with Specifications, Drawings, and Bill of Quantities respectively, before issuing these Bidding Documents. The PE should read and/or provide the information specified in the italicized notes inside brackets. In the few instances where the Bidder is requested to provide information, the note specifies it. **The footnotes and notes for the Rwanda Airports Company are not part of the text; they should not be incorporated in the Bidding Documents issued to the bidders.**
- (c) Modifications of the model to meet specific Project or Contract needs should be provided in the **Bid Data Sheet** and the **Special Conditions of Contract** only, as amendments to the Instructions to Bidders and the General Conditions of Contract which should not be modified.
- (d) This standard Bidding Document has been prepared to be used under post qualification of the bidders. However, it can also be used under prequalification, with relatively minor modifications. However, the document does not address the bidder prequalification process per se.



## TENDER NOTICE

**Tender Notice (TN): 001/W/2025-2026/NCB/RAC**

**Tender Title: Kigali International Airport Pavement/Maintenance of Civil Works for Runway, Apron and Service Roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome**

**Sources of funds: RAC ordinary budget**

Rwanda Airports Company (RAC) (hereinafter called "Client") intends to apply a portion of its funds to eligible payments under the tender **001/W/2025-2026/NCB/RAC for Kigali International Airport Pavement/Maintenance of Civil Works for Runway, Apron and Service Roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome**. RAC now invites, by the present invitation to tender, sealed bids from eligible and qualified bidders for the mentioned tender. The execution period is one-year renewable depending on the contractor's performance.

Bidding will be conducted through an open tender and is open to all eligible bidders as defined in the Bidding Documents.

Enquiries regarding this tender may be addressed to the Managing Director or Rwanda Airports Company, 1171 Kigali-Rwanda, [Tel:\(+250\) 252585555](tel:+250252585555); or by writing an email to [info@rac.co.rw](mailto:info@rac.co.rw), Cc: [ikamarade@rac.co.rw](mailto:ikamarade@rac.co.rw); [tkaregeya@rac.co.rw](mailto:tkaregeya@rac.co.rw) and [snabakiza@rac.co.rw](mailto:snabakiza@rac.co.rw).

A complete set of bidding Documents in English may be obtained by interested bidders at Kigali International Airport (RAC offices), upon presentation of the proof of payment of a non-refundable fee of twenty-one thousand one hundred Rwandan francs (21,100FRW) or its equivalent in *convertible currency* at the exchange rate applicable at the National Bank of Rwanda (BNR) at the day of payment. The sum is to be deposited at Bank of Kigali on the Account N° 00040-06948300-35 (RWF) opened in the name of Rwanda Airports Company. Alternatively, the tender document may be downloaded from the RAC website ([www.rac.co.rw](http://www.rac.co.rw)) and attach proof of its payment in the bid.

A compulsory site visit will be conducted by RAC representatives and scheduled as follows:

- Kamembe Airport: 21<sup>st</sup> August 2025 11:00AM local time.
- Kigali international airport: 25<sup>th</sup> August 2025 11:00AM local time.
- Musanze Aerodrome and Rubavu Airport 26<sup>th</sup> August 2025 at 11:00AM local time and 2:00 Pm local time respectively

Bids must be delivered to RAC offices, Kigali International Airport (Information Desk) at or before **09<sup>th</sup> September 2025** at 10:00 Am. Late bids will be rejected. Bids will be opened physically in the presence of the bidders or of their representatives who choose to attend in person at the address mentioned on the same day at 10:30 Am.

All bids must be accompanied by an original Bid Security of Fifteen million (15,000,000Frw) Rwandan francs or its equivalency on a freely convertible currency from a recognized bank or an insurance company operating in Rwanda which shall be valid until 30 days after the bids validity.

Bidding will be conducted in accordance with Rwanda Airports Company procurement manual revised May 2025.

**Charles HABONIMANA**  
Managing Director



## Section I. Instructions to Bidders

### Instructions to Bidders (ITB)

#### A. General

##### 1. Scope of Bid

- 1.1 RAC, as defined in the Bid Data sheet invites bids for Maintenance of Civil Works for Runway, Apron and Service Roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome, as described in the BDS and Section V, "Special Conditions of Contract" (SCC). The name and identification number of the Contract are provided in the BDS and the SCC.
- 1.2 The successful Bidder shall be expected to complete the Works by the Intended Completion Date specified in the BDS 1.2 and SCC 1.1 (r).
- 1.3 Throughout these Bidding Documents:
  - (a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, telex,) with proof of receipt;
  - (b) if the context so requires, "singular" means "plural" and vice versa;
  - (c) "day" means calendar day; and
  - (d) "Works" means small works.

##### 2. Source of Funds

RAC, as defined in the BDS, intends to apply part of the funds from the Funding Agency, as defined in the BDS, towards the cost of the Project, as defined in the BDS, to cover eligible payments under the Contract for the Works. Payments by the Funding Agency shall be made only at the

request of RAC and upon approval by The Funding Agency in accordance with the grant/credit or Loan agreement and shall be subject in all respects to the terms and conditions of that Agreement. Except as the Funding Agency may specifically otherwise agree, no party other than RAC shall derive any rights from the Grant/credit or Loan Agreement or have any rights to the loan proceeds.

##### 3. Fraud and Corruption

Following the spirit of Rwanda Airports Company requires that any public officials as well as bidders, suppliers, contractors, and consultants, observe the highest standard of ethics during the procurement proceedings and execution of such contracts. In pursuit of this policy, RAC:

- (a) Referring to RAC Procurement manual, gives the definition, for the purposes of this provision, of the terms set forth below as follows:



- (i) **“corrupt practice”** means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of RAC employee; connected to tender proceedings at any stage.
  - (ii) **“fraudulent practice”** means any legal violation, including acts of deliberate misrepresentation, intentional recklessness, misleading or attempting to mislead a RAC staff who has a connection to a given tender to obtain financial or other benefit;
  - (iii) **“collusive practice”** means an arrangement between two or more parties designed to achieve an illegal purpose, including influencing improperly the acts of another party or the RAC staff;
  - (iv) **“coercive practice”** means any act intending to harm or threaten to harm directly or indirectly persons, their works or their property to influence their participation in the procurement process or affect its performance;
  - (v) **“Obstructive practices”** means destroying, falsifying, altering or concealing of material evidence to the investigation or making false statements to investigators deliberately in order to materially impede investigation into allegations of a corrupt, coercive or collusive practice; and threatening, harassing or intimidating any party to prevent it from disclosing its information about matters relevant to the investigation or from pursuing the investigation.
- (b) shall reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive and/or obstructive practices in competing for the contract in question;
- (c) shall sanction a company or individual by debarment, either indefinitely or for a stated period of time, if it at any time determines that they have, directly or through an agent, engaged, in corrupt, fraudulent, collusive, coercive and/or obstructive practices in competing for, or in executing, a contract. Prior to debarment, the company or individual may be suspended for investigation reasons.

#### 4. Eligible Bidders

4.1 A bidder, and all parties constituting the bidder, may have the nationality of any country, unless otherwise provided for by the BDS. A bidder shall be deemed to have the nationality of a country if s/he is a citizen of that country or is constituted, incorporated, or registered and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors.

4.2 A bidder shall not have a conflict of interest. All bidders found to have conflict of interest shall be disqualified. Bidders may be considered to have a conflict of interest with one or more parties in this bidding process, if they are associated, or has been associated in the past, directly or indirectly, with the consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by RAC to provide consulting services for the preparation or supervision of the works, and any of its affiliates shall not be eligible.



4.3 A bidder that is under a declaration of ineligibility by RPPA for suspension or debarment reasons in accordance with the Public Procurement Law, at the date of contract award, shall be disqualified. The list of such debarred firms is available at the address specified in the BDS<sup>1</sup>. Likewise, shall be disqualified bidders who are not eligible in accordance with the same Law and regulations establishing public procurement.

4.4 Rwanda Government-owned enterprises may be eligible only if they can establish that they

- (i) are legally and financially autonomous,
- (ii) operate under commercial law.

## 5. Qualifications of the Bidder

5.1 All bidders shall provide in Section III, "Form of Bid, Qualification Information, Letter of Acceptance, and Agreement," a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

5.2 In the event that prequalification of potential bidders has been undertaken, only bids from prequalified bidders shall be considered for competition prior to the award of contract. These prequalified bidders should submit with their bids any information updating their original prequalification applications or, alternatively, confirm in their bids that the originally submitted prequalification information remains essentially correct as of the date of bid submission. The update or confirmation should be provided in Section III.

5.3 If RAC has not undertaken prequalification of potential bidders, all bidders shall include the following information and documents with their bids as well as those specified in Section III:

- (a) copies of original documents defining the constitution or legal status, place of registration, and principal place of business of the bidder; written power of attorney of the signatory of the bid to commit the bidder;
- (b) total monetary value of construction works performed for the period described in the BDS;
- (c) evidence of relevant experience in the execution of works of similar nature, including the nature and value of the relevant contracts for each of the last five years, as well as works in hand and contractually committed. The evidence must answer at least the criteria indicated to under subparagraph 5.5 below.



- (d) major items of construction equipment proposed to carry out the contract. The descriptions must demonstrate the bidder's ability to complete the works and should include inter alia:

The Bidder must indicate whether such equipment is owned by him, hired or used by subcontractor (s).

- (e) qualifications and experience of key site management and technical personnel proposed for the contract with their CVs and academic testimonials
- (f) reports on the financial standing of the bidder, such as profit and loss statements and auditor's reports for the period specified in the Bid Data Sheet;
- (g) evidence of adequacy of working capital for this contract (access to line(s) of credit and availability of other financial resources);
- (h) authority to seek references from the bidder's bankers;
- (i) information regarding any litigation, current or during the last five years, in which the bidder was/is involved, the parties concerned, and the disputed amounts; and awards;
- (j) Proposals for subcontracting components of the works amounting not to more than 20 percent of the contract price shall be indicated in the bid. Bidders shall be required also to indicate in their bids names of any proposed subcontractors, but in anyway a subcontract shall not be awarded to any person of company that is suspended or debarred from participation in public procurement. The ceiling for sub contractor's participation and the name of a proposed subcontractor are **stated in the BDS.**
- (k) as well as other document or information not mentioned above but appearing on Section III.**

5.4 Bids submitted by a JV of two or more companies in partnership shall comply with the following requirements, unless otherwise **stated in the BDS:**

- (a) the Bid shall include all the information listed in ITB Sub-Clause 5.3 above for each joint venture partner;
- (b) the Bid shall be a single document bearing the name of the Joint Venture and signed so as to be legally binding on all partners;
- (c) companies participating in the Joint Venture shall be jointly and severally liable towards RAC for the execution of the contract in accordance with the contract terms;
- (d) one of companies shall lead the Joint Venture and serve as its representative in all activities under the tender process and contract execution. The lead company serving as the authorized representative of others in all the tender activities shall provide as part of their bid a written agreement confirming its representation and the scope of its powers; and



- (e) a copy of the Agreement to enter into a Joint Venture between companies making up the very Joint Venture shall be submitted in the bid as well.

5.5 To qualify for award of a contract, bidders shall meet the following minimum qualifying criteria

- (a) an average annual financial amount of construction work over the period specified in the **BDS** of at least the multiple indicated in the **BDS**
- (b) experience as prime contractor in the construction of at least the number of works of a nature and complexity equivalent to the works over the period **specified in the BDS** (to comply with this requirement, works cited should be at least 70 percent complete);
- (c) proposals for the timely acquisition (own, lease, hire, etc.) of the essential equipment **listed in the BDS**;
- (d) Present key personnel with qualification and experience specified in the **BDS**; and
- (e) liquid assets and/or credit facilities, net of other contractual commitments and exclusive of any advance payments which may be made under the contract, of no less than the amount **specified in the BDS**.

A relevant history of litigation or arbitration awards against the applicant or any partner of a Joint Venture may result in disqualification.

5.6 The figures for each of the partners of a JV shall be added together to determine the bidder's compliance with the minimum qualifying criteria of ITB Sub-Clauses 5.5 (a) and (e); however, for a Joint Venture to qualify, each of its partners must meet at least 25 percent of minimum criteria of ITB Sub-Clauses 5.5 (a), (b), and (e) for an individual bidder, and the partner in charge at least 40 percent of those minimum criteria. Failure to comply with this requirement shall result in rejection of the Joint Venture's Bid. Subcontractors' experiences and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria, unless otherwise **stated in the BDS**.

5.7 Domestic bidders and Joint Ventures of domestic bidders applying for eligibility for the percent of margin's preference, as specified in the BDS, in bid evaluation shall supply all information to satisfy the criteria for eligibility as described in ITB Clause 31.

## 6. One Bid per Bidder

Each bidder shall submit only one Bid, either individually or as a partner in a Joint Venture. In case of Joint Venture, one company shall not be allowed to participate in two different Joint Ventures in the same tender nor shall a company be allowed to submit a bid both on its behalf and as part of a Joint Venture for the same tender. A bidder who submits or participates in more than one bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) shall cause all the proposals with the bidder's participation to be disqualified.

## 7. Cost of Bidding



The bidder shall bear all costs associated with the preparation, submission of his bid, appeal fee or any other expenses that s/he may incur during procurement proceedings, and RAC shall in no case be responsible or liable for those costs. RAC shall not be liable for any consequences related to the rejection of all bids or the cancellation, unless it is proved that it was a consequence of its irresponsible conduct.

#### 8. Site Visit

The bidder, at the bidder's own responsibility and risk, is encouraged to visit and examine the site of works and its surroundings and obtain all information that may be necessary for preparing the bid and entering into a contract for construction of the works. The costs of visiting the site shall be at the bidder's own expense. If RAC decides to re-advertise the tender, it may not require the second site visit to those who had visited before unless there are reasons for the second site visit.

### B. Bidding Documents

#### 9. Contents of Bidding Documents

The set of bidding documents comprises the documents listed below and addenda issued in accordance with ITB Clause 11:

Tender Notice /Invitation for Bids

Section I	Instructions to Bidders
Section II	Bid Data Sheet
Section III	Forms of Bid, Qualification Information, Letter of acceptance, Agreement
Section IV	General Conditions of Contract
Section V	Special Conditions of Contract
Section VI	Specifications
Section VII	Drawings
Section VIII	Bill of Quantities
Section IX	Forms of Securities

#### 10. Clarification to the Bidding Documents

Any bidder may request in writing to RAC, at its address **mentioned in the BDS**, for clarifications on the bidding document. RAC shall respond to any request for clarification within seven (7) days from the day of its reception. RAC shall communicate and forward, without disclosing the source of the request for clarification, to all bidders the copies of the clarifications that were given in response to the request by RAC.

#### 11. Modification to the Bidding Documents

- 11.1 Before the deadline for submission of bids, on its own initiative or in response to bidders' concerns, RAC may modify the bidding document by issuing addenda.



- 11.2 Any addendum thus issued shall be part of the bidding document and shall be communicated and forwarded in writing to all bidders who had bought the bidding document and shall be made public through the communication channel that RAC used to advertise the initial tender notice. Bidders who were given copies of addendum after they had bought the bidding document shall acknowledge receipt of each addendum in writing to RAC.
- 11.3 RAC may, as necessary and in accordance with ITB Sub-Clause 21.2 below, extend the deadline for submission of bids to give bidders sufficient time to take modifications into account when preparing their tenders.

### C. Preparation for Bids

#### 12. Language of Bid

The bidder may prepare his/her bid in a language of his/her choice consistent with the language Specified in the BDS.

#### 13. Documents Composing the Bid

The Bid submitted by the bidder shall comprise the following documents:

- (a) The bid (in the format indicated in Section III);
- (b) Bid Security or declaration of commitment where applicable, in accordance with ITB/TN Clause 17, if required;
- (c) Priced Bill of Quantities or clearly quoted unit prices;
- (d) Qualification Information Form and Documents;
- (e) Alternative offers where invited;

and any other materials required to be completed and submitted by bidders, as specified in the BDS.

#### 14. Bid Prices

- 14.1 The contract price shall cover all expenses for the whole works, as described in ITB/TN Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the bidder.
- 14.2 The bidder shall fill in rates and prices for all items of the works described in the Bill of Quantities. Items for which no rate or price is entered by the bidder shall not be paid for by RAC when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting and stamped on, if required.
- 14.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, as of the date 28 days for ICB or 14 for NCB prior to the deadline for submission of bids, shall be included in the rates, prices, and total bid price submitted by the bidder. In principle the contract price shall therefore cover taxes,



duties and levies applicable, except when they are expressly excluded or subject to exemption.

- 14.4 The rates and prices quoted by the bidder shall be subject to adjustment during the performance of the contract if **provided for in the BDS** and SCC and the provisions of Clause 47 of the General Conditions of Contract. The bidder shall submit along with the bid all the information required under the Special Conditions of Contract and GCC Clause 47.

### 15. Currencies of the Bid and Payment

- 15.1 The unit rates and prices shall be quoted by the bidder entirely in the currency specified in the BDS.
- 15.2 Foreign currency requirements shall be mentioned as percentages of the bid price (excluding provisional sums) and shall be payable at the bidder's option in only one bidder's chosen foreign currency.
- 15.3 The exchange rate to be used by the bidder in arriving at the local currency equivalent and the percentages mentioned in para. 15.1 above shall be the selling rates for similar transactions established by the Central Bank or any other authority **specified in the BDS** prevailing on the deadline for submission of bids or on any other date specified in the in the bidding document. These exchange rates shall be applied for all transactions so that no exchange risk shall be borne by the bidder. If the bidder uses other rates of exchange, the provisions of ITB Clause 29.1 shall be applied; in any case, payments shall be computed using the rates quoted in the bid. Bidder shall indicate in advance all the details of any expected foreign currency requirements in the bid.
- 15.4 A bidder may be required by RAC to clarify the foreign currency requirements and to substantiate that the amounts included in the rates and prices, **if required in the BDS**, are reasonable and responsive to ITB Sub-Clause 15.1.

### 16. Bid Validity

- 16.1 Bids shall remain valid for the period **specified in the BDS**.
- 16.2 In exceptional circumstances, the PE may request that the bidders extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing. If a Bid Security is requested in accordance with ITB Clause 17, it shall be extended up to 30 days after the deadline of the extended bid validity period. A Bidder may refuse the request without forfeiting the Bid Security. A Bidder agreeing to the request shall not be required or permitted to modify his/her Bid, except as provided in ITB Clause 17.



## 17. Bid Security

- 17.1 The bidder shall provide as part of its bid, a bid security in original form as specified in the BDS, **if required in the BDS**.
- 17.2 The Bid Security shall be in the **amount specified in BDS** and denominated in the Rwandan Francs or the currency of the Bid or in another freely convertible currency, and shall:
- (a) be in the form of either, a bank guarantee from a banking institution, or surety issued by any approved financial institution;
  - (b) be issued by a reputable institution selected by the bidder and located in any country. If the financial institution issuing the surety is located outside the Republic of Rwanda, it shall have a correspondent financial institution located in the Republic of Rwanda to make it enforceable.
  - (c) be substantially in accordance with one of the forms of Bid Security included in Section IX "Security Forms,";
  - (d) be payable promptly upon written demand by RAC in case the conditions listed in ITB Clause 17.5 are invoked;
  - (e) be submitted in its original form; copies shall not be accepted;
  - (f) remain valid for a period of 30 days beyond the validity period of the bids, as extended, if applicable, in accordance with ITB Clause 16.2.
- 17.3 If a Bid Security is required in accordance with ITB Sub-Clause 17.1, any bid not accompanied by a substantially responsive bid security in accordance with ITB Sub-Clause 17.1, shall be rejected by RAC as non-responsive.
- 17.4 A bid security issued by a local institution to guarantee a bid that was sent by a foreign bidder from his/her country before the bid submission deadline, may be presented on the opening date and shall be considered as part of that bid
- 17.5 The bid security of unsuccessful bidders shall be returned as promptly as possible upon the successful bidder's furnishing of the performance security and signing the contract with RAC.
- 17.6 RAC shall also immediately release the bid security if (i) the procurement proceedings are cancelled, or (ii) if RAC realizes that none of the submitted bids is responsive.
- 17.7 The Bid Security shall be forfeited:
- (a) if a bidder withdraws its bid after the deadline for submitting bids but before the expiry the period of bid validity specified by the bidder on the bid submission sheet, except as provided in ITB Sub-Clause 16.2; or



- (b) if the bidder does not accept the correction of its bid price pursuant to ITB Sub-Clause 28.
- (c) if the successful bidder, within the specified time:
  - (i) refuses to sign the contract; or (ii) fails to furnish the required performance security.

17.8 The Bid Security under JV must be in the name of the JV that submits the bid.

## 18. Alternative Proposals by Bidders

- 18.1 Alternatives shall not be considered, unless specifically **allowed in the BDS**. If so allowed, ITB Sub-Clauses 18.1 and 18.2 shall govern, and BDS shall specify which of the following options shall be allowed:
- (a) Option One. A bidder may submit alternative bids with the base bid and RAC shall only consider the alternative bids offered by the bidder whose bid for the base case was determined to be the lowest-evaluated bid, or
  - (b) Option Two. A bidder may submit an alternative bid with or without a bid for the base case. All bids received, for the base case, as well as alternative bids meeting the technical specifications and performance requirements pursuant to Section VI, shall be evaluated on their own merits.
- 18.2 Alternative bids shall provide all information necessary for a complete evaluation of the alternative by rac, including design calculations, technical specifications, breakdown of prices, proposed construction methods and other relevant details.

## 19. Format and Signing of Bid

- 19.1 The bidder shall prepare one original of the documents composing the bid as described in ITB Clause 13, bound with the volume containing the Form of Bid, and clearly marked "ORIGINAL." In addition, the bidder shall submit copies of the bid, in the number **specified in the BDS**, and clearly marked as "COPIES." In the event of discrepancy between them, the original shall prevail.
- 19.2 The original and all copies of the bid shall be typed in indelible ink and shall be signed by the bidder him/herself or any other person or persons duly authorized to sign on behalf of the bidder, pursuant to ITB Sub-Clause 5.3 (a). All pages of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.
- 19.3 The bid shall contain no alterations or additions, except those to comply with instructions issued by rac, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.



## D. Submission of Bids

### 20. Submission, Sealing and Marking of Bids

- 20.1 Bidders will only submit their bids to the place indicated in the tender notice or to any other place that has been officially communicated to them after the tender notice was issued. The bidder shall seal the original and all copies of the bid in two separate inner envelopes and one outer envelope, duly marking the inner envelopes as "ORIGINAL" and "COPIES."
- 20.2 The inner and outer envelopes shall
- (a) be addressed to RAC at the address **provided in the BDS**;
  - (b) bear the title and identification number of the tender as **defined in the BDS** and SCC; and
  - (c) provide a warning not to open before the specified time and date for bid opening as **defined in the BDS**.
- 20.3 In addition to the identification required in ITB Sub-Clause 20.2, the outer envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared late, pursuant to ITB Clause 22.
- 20.4 If the outer envelope is not sealed and marked as above, RAC shall assume no responsibility for the misplacement or premature opening of the bid. If the outer envelope is accidentally opened by RAC but the inner envelopes not opened, the bidder shall not claim that information in his/her bid have been accessed.

### 21. Deadline for Submission of Bids

- 21.1 Bids shall be delivered to RAC at the address specified above no later than the time and date **specified in the BDS and in the clause 21 of ITB**.
- 21.2 RAC may extend the deadline for submission of bids by issuing an addendum in accordance with ITB Clause 11, in which case all rights and obligations of RAC and the bidders previously subject to the original deadline shall then be subject to the new deadline.

### 22. Late Bids

Any bid received by RAC after the deadline prescribed in ITB Clause 21 shall be registered as a late bid with a specific time of its arrival and returned unopened to the bidder.

### 23. Withdrawal, Substitution and Modification of Bids

- 23.1 Before the deadline prescribed in ITB Clause 21, bidders may write to RAC requesting to withdraw, substitute or modify their bids.



- 23.2 Each bidder's withdrawal, substitution or modification notice shall be prepared, sealed, marked, and delivered in accordance with ITB Clauses 19 and 20, with the outer and inner envelopes additionally marked or "WITHDRAWAL," "SUBSTITUTION," OR "MODIFICATION" as appropriate.
- 23.3 No bid may be substituted or modified after the deadline for submission of bids.
- 23.4 Withdrawal of a bid after the deadline for submission of bids and before the expiration of the period of bid validity specified in the **Bid Data Sheet** or as extended pursuant to ITB Sub-Clause 16.2 may result in the forfeiture of the bid security pursuant to ITB Clause 17.
- 23.5 Bidders may only offer discounts to, or otherwise modify the prices of their bids, by submitting bid modifications in accordance with this clause or included in the initial bid

### **E. Bid Opening and Evaluation**

#### **24. Bid Opening**

- 24.1 RAC shall open the bids, including modifications made pursuant to Clause 23, in the presence of the bidders' representatives who choose to attend at the time and in the place **specified in the BDS**. Any specific opening procedures required if electronic bidding is permitted in accordance with ITB Sub-Clause 20.1, shall be as specified in the BDS.
- 24.2 Bids for which an acceptable notice of withdrawal has been submitted pursuant to ITB Clause 23 shall be returned unopened to bidders.
- 24.3 During the opening session, for each bid opened the opening committee shall read out loudly and record in the opening session minutes the bidder's names, the bid prices, the total amount of each bid and of any alternative bid (if alternatives have been requested or permitted), any discounts, bid withdrawals, substitutions, or modifications, the presence or absence of bid security, if required, and such other details as RAC may consider appropriate, or any other information that deemed necessary by bidders to be read out and which does not compromise other bidders' interests. No bid shall be rejected during the bids' opening session except for the late bids pursuant to ITB Clause 22. Substitution bids and modifications submitted pursuant to ITB Clause 23 that are not opened and read out at bid opening shall not be considered for further evaluation regardless of the circumstances.
- 24.4 RAC (the bids' opening committee) shall prepare minutes of the bids' opening session, including the information disclosed, to those present, in accordance with ITB Sub-Clause 24.3.

#### **25. Confidentiality**

No information concerning checking, explanation, opinion and comparison of bids and recommendations concerning the contract award, will be disclosed to bidders or any other



person not officially involved in the process until the name of the successful bidder has been announced. Any bidder, who attempts to contact directly or indirectly during the evaluation period any member of the Internal Tender Committee or any other person involved in the evaluation process, shall be automatically disqualified.

## **26. Clarification of Bids**

To assist in the examination, evaluation, and comparison of bids, RAC may, at RAC's discretion, ask any bidder to provide clarifications on his/her bid or on some specific elements of it, including breakdowns of unit rates. The request for clarification and the response shall be in writing, but no change in the price or substance of the bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by RAC in the evaluation of the bids in accordance with ITB Clause 28. At his/her own initiative, a bidder may provide clarifications on his/her bid but which shall not change its price or substance.

## **27. Examination of Bids and Determination of Responsiveness**

27.1. Prior to the detailed evaluation of bids, the evaluation committee shall determine whether each bid (a) meets the eligibility criteria defined in ITB Clause 4; (b) has been properly signed; (c) is accompanied by the bid security (or declaration of commitment), if required; and (d) is substantially responsive to the requirements of the bidding document.

27.2 A substantially responsive bid is one which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the works; (b) which limits in any substantial way, inconsistent with the bidding documents, RAC's rights or the bidder's obligations under the contract; or (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

27.3 If a Bid is not substantially responsive, it shall be rejected by the evaluation committee, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

27.4 RAC may regard a bid as responsive even if it contains minor errors that do not materially alter or depart from the characteristics, terms, conditions, and other requirements set for in the bidding notice or/and document or if it contains errors that were due to the omission that may be corrected without altering the substance of the bid. Where possible such errors shall be taken into account in the evaluation and comparison of bids.

## **28. Correction of Errors**



28.1 Bids determined to be substantially responsive shall be checked by the evaluation committee for any arithmetic errors. Errors shall be corrected by the evaluation committee as follows:

- (a) where there is a discrepancy between the amounts in figures and in words, the amount in words shall govern; and
- (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted shall govern, unless in the opinion of RAC there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted shall govern, and the unit rate shall be corrected.

28.2 The amount stated in the bid shall be adjusted by the evaluation committee in accordance with the above procedure for the correction of errors and, with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount, the bid shall be rejected, and the bid security shall be forfeited executed in accordance with ITB Sub-Clause 17.5 (b).

## 29 Currency for Bid Evaluation

Bids shall be evaluated as quoted in the Rwandan francs currency, in accordance with ITB Sub-Clause 15.1, unless a Bidder has used different exchange rates than those prescribed in ITB Sub-Clause 15.2, in which case the bid shall be first converted into the amounts payable in different currencies using the rates quoted in the bid and then reconverted to the Rwandan francs' currency using the exchange rates prescribed in ITB Sub-Clause 15.3.

## 30 Evaluation and Comparison of Bids

30.1 The evaluation committee shall evaluate and compare only the bids determined to be substantially responsive in accordance with ITB Clause 27.

30.2 In evaluating the bids, the evaluation committee shall determine for each bid the evaluated bid price by adjusting the bid price as follows:

- (a) making any correction for errors pursuant to ITB Clause 28;
- (b) excluding provisional sums and the provision, if any, for contingencies in the Bill of Quantities, but including Daywork, where priced competitively;
- (c) making an appropriate adjustment for any other acceptable variations, deviations, or alternative offers submitted in accordance with ITB Clause 18; and
- (d) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with ITB Sub-Clause 23.5.

30.3 RAC reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in



excess of the requirements of the bidding document or otherwise result in unsolicited benefits for RAC shall not be taken into account in bid evaluation and shall not be considered against bidders who did not provide them.

30.4 The estimated effect of any price adjustment conditions under GCC Clause 47, during the period of implementation of the contract, shall not be taken into account in bid evaluation.

### **31 Preference for Domestic and Regional Bidders**

31.1 If so **indicated in the BDS**, domestic and regional bidders may receive a margin of preference in bid evaluation in compliance with the relevant provisions of RAC procurement Manual, for which this clause shall apply.

31.2 The following procedure shall be used to apply the margin of preference:

- (a) Responsive bids shall be classified into the following groups:
  - (i) Group A: bids offered by domestic bidders and joint ventures meeting the criteria
  - (ii) Group B: all other bids.
- (b) For the purpose of further evaluation and comparison of bids only, an amount equal to a maximum of a percentage specified in the BDS in accordance with ITB Sub-Clause 30.2 shall be added to all bids classified in Group B.

### **F. Award of Contract**

#### **32 Award Criteria**

Subject to ITB Clause 33, RAC shall award the contract to the bidder whose bid has been selected as being substantially responsive to the bidding document and who has offered the lowest evaluated bid price, provided that such bidder has been determined to be (a) eligible in accordance with the provisions of ITB Clause 4, and (b) qualified in accordance with the provisions of ITB Clause 5.

#### **33 RAC's Right to accept any Bid and to reject any or all Bids**

Notwithstanding ITB Clause 32, RAC reserves the right to accept or reject any bid, or to cancel the bidding process and reject all bids, at any time prior to the award of contract, in compliance with the relevant provisions of RAC procurement Manual.

#### **34 Notification of Award and Signing of Agreement**

34.1 Before the expiry of the bid validity period, RAC shall simultaneously notify the successful and the unsuccessful bidders of the provisional outcome of the bids



evaluation. The notification shall specify that the major elements of the procurement process would be made available to the bidders upon request and that they have seven (7) days in which to lodge a protest, if any, before a contract is signed with the successful bidder. Upon signature of a procurement contract, RAC shall finally notify other bidders that their bids were not successful.

The notification letter to the successful bidder (hereinafter and in the GCC called the "Letter of Acceptance") shall state the sum that RAC shall pay the contractor in consideration of the execution, completion, and maintenance of the Works by the contractor as prescribed by the contract (hereinafter and in the contract called the "contract price").

- 34.2 The Letter of Acceptance shall constitute the formation of the contract, subject to the bidder furnishing the performance security in accordance with ITB Clause 35 and signing the written contract.
- 34.3 The written contract shall base on the bidding document, the successful bid, any clarification received and accepted, and any correction made and negotiations agreement between RAC and the successful bidder. Within 15 (fifteen) and 21 (twenty-one) days for National Competitive Bidding and International Competitive Bidding respectively, after receipt of the final notification, the successful Bidder shall bring a performance security and sign a contract.
- 34.3 Only the signed contract will constitute an official commitment on the part of rac, and activities may not begin until the contract has been signed by both parties, RAC and the successful bidder.

### **35 Performance Security**

- 35.1 Within 15 and 21 days for National Competitive Bidding and International Competitive Bidding respectively, after receipt of the letter of notification, the successful bidder shall provide the performance security in the form provided in the bidding document and whose amount shall depend on the contract value and nature of activities to be carried out. However, the value of the performance security shall neither be less than 5% nor more than 10% of the contract value. Upon provision of the performance security RAC and the successful bidder shall sign the written contract.
- 35.2 If the performance security is provided by the successful bidder in the form of a bank guarantee, it shall be issued at the bidder's option, by a bank located in the Republic of Rwanda, or by an acceptable foreign bank. In case the bidder has opted to provide a security issued by a foreign bank, there must be a correspondent bank located in Rwanda to make it enforceable.
- 35.3 Failure of the successful Bidder to comply with the requirements of ITB Sub-Clauses 35.1 and 34.3 shall constitute sufficient grounds for cancellation of the award and forfeiture of the bid security. Upon the successful bidder's provision of the performance



security pursuant to ITB Clause 35.1 and signature of the written contract, RAC shall promptly finally notify the name of the winning bidder to all unsuccessful bidders and shall discharge their bid securities pursuant to ITB Clause 17.5.

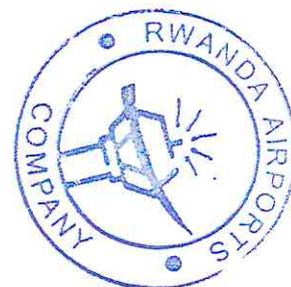
- 35.4 If the initial contract execution period has been extended or its value has increased, the contractor shall respectively extend the validity period of the performance security and increase its amount accordingly.
- 35.5 Upon amendment of the initial contract agreed between RAC and the contractor, the form of performance security may be changed but that change shall be made preserving the security continuity and without decreasing its amount.
- 35.6 In case the contract is not fully and/or well executed, the performance security shall be unconditionally seized by RAC as compensation without prejudice to other penalties provided for by RAC procurement manual
- 35.7 In case the contract is successfully completed, the performance security shall be returned to the contract in ways and conditions provided for by the RAC Procurement manual

### **36 Advance Payment and Security**

RAC may provide an advance payment on the contract price as may be stipulated in the GCC, subject to a maximum amount, as **stated in the BDS**. The Advance Payment shall be guaranteed by a Security. Section IX "Security Forms" provides a Bank Guarantee for Advance Payment form.

### **37 Adjudicator**

RAC proposes the person **named in the BDS** to be appointed as Adjudicator under the Contract, at an hourly fee **specified in the BDS**, plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in the Bid. If, in the Letter of Acceptance, RAC has not agreed on the appointment of the Adjudicator, the Adjudicator shall be appointed by the Appointing Authority designated in the BDS and the SCC at the request of either party.





## Section II. Bid Data Sheet (BDS)

<b>A. General</b>	
<b>ITB 1.1</b>	<p>The procuring entity is <b>Rwanda Airports Company</b></p> <p>The Works are <b><i>Kigali International Airport Pavement/Maintenance of Civil Works for Runway, Apron and Service Roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome</i></b></p> <p>The identification of the contract is <b>001/W/2025-2026/NCB/RAC</b></p>
<b>ITB 1.2</b>	The Intended Completion Date is <b>365 calendar days</b> .
<b>ITB 2.</b>	<p>The Project is <b><i>Kigali International Airport Pavement/Maintenance of Civil Works for Runway, Apron and Service Roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome</i></b></p> <p>The Funding Agency is <b>RAC Ordinary budget</b></p>
<b>ITB 4.3</b>	The list of firms debarred from participating in this project is available at: <a href="http://www.rppa.go.rw">www.rppa.go.rw</a> , and <a href="http://www.rac.co.rw">www.rac.co.rw</a>
<b>ITB 5.3</b>	The information required from bidders in ITB Sub-Clause 5.3 is modified as follows: <b>none</b>
<b>ITB 5.3 (j)</b>	The ceiling for sub contractor's participation is: <b>20% of the LPO amount</b>
<b>ITB 5.4</b>	The qualification data required from bidders in ITB Sub-Clause 5.4 are modified as follows: <b>none</b>
<b>ITB 5.5</b>	<p>The qualification criteria in ITB Sub-Clause 5.5 are modified as follows:</p> <div style="border: 1px solid black; padding: 10px;"> <p>The qualification criteria in ITB 5.5 are modified as follows:</p> <p>To qualify for award of the Contract, bidders shall meet the following minimum qualifying criteria:</p> <ol style="list-style-type: none"> <li>1. Experience of the contractor in the field:               <ol style="list-style-type: none"> <li>i) General Experience of at least FIVE years,</li> <li>ii) Experience in maintenance of runway and aprons of recognized airports (At least one reference or signed contract as proof). Should be submitted as part of the offer</li> </ol> </li> <li>2. Promise of credit Line of 200,000,000Frw</li> <li>3. List of technical staff supported by their CVs and qualifications as follows;</li> </ol> </div>



Position	Education	Years of experience (general)	Years of experience proposed position
(a) One(1) Project manager/ Project coordinator	Ao in construction, civil Engineer or Road Safety management Civil Engineering,	5	3
(b) One(1) Site Engineer	Ao in Civil Engineering	4	3
(c) One(1) Topographical surveyor	A0 in Survey & Geomatics Engineering	4	2
(d) One (1) General foreman	Min. Diploma ( A1) in Engineering , pavement construction or equivalent	8	5

Qualifications and experience of key personnel proposed for administration and execution of the Contract.

**ITB 5.5 (a)** The period is: *N/A*

**ITB 5.5 (c)** The essential equipment to be made available for the contract by the successful Bidder shall be:

Item of equipment (Attach the possession and/or leasing evidences ]	Qty	Owned, or leased (leasing contract or proof of ownership to be attached)
a. Asphalt Milling machine	1	
b. Motor Grader 140 H or equivalent	1	
c. Paver	1	
d. Bitumen boiler (sprayer)	1	
e. Asphalt compactor (Double drum)	1	
f. Pneumatic tyre Roller (Compactor )	1	
g. Bulldozer , D7 to D8	1	
h. Excavator -320DL or equivalent	1	
i. Tipper truck (15 to 17 CUM)	2	



	<table border="1"> <tr> <td>j. Small trucks 2.5 to 5 CUM</td> <td>2</td> <td></td> </tr> <tr> <td>k. Wheel Loader - Model 930H or equivalent</td> <td>1</td> <td></td> </tr> <tr> <td>l. Air compressor</td> <td>1</td> <td></td> </tr> <tr> <td>m. Asphalt cutter</td> <td>1</td> <td></td> </tr> </table>	j. Small trucks 2.5 to 5 CUM	2		k. Wheel Loader - Model 930H or equivalent	1		l. Air compressor	1		m. Asphalt cutter	1	
j. Small trucks 2.5 to 5 CUM	2												
k. Wheel Loader - Model 930H or equivalent	1												
l. Air compressor	1												
m. Asphalt cutter	1												
<b>ITB 5.5 (e)</b>	The minimum amount of Promise of credit line or availability of funds shall be 200,000,000Frw. For availability of funds, the bidder should provide proof of availability of such funds (bank statement).												
<b>ITB 5.6</b>	Subcontractors' experience and resources <i>shall</i> be taken into account.												
<b>ITB 5.7</b>	The percentage of margin's domestic preference is 10%.												
<b>B. Bidding Documents</b>													
<b>ITB 10</b>	RAC address's for clarification is: 1171 Kigali-Rwanda, Tel: (+250) 252585555; email: <a href="mailto:info@rac.co.rw">info@rac.co.rw</a> , Cc: <a href="mailto:ikamarade@rac.co.rw">ikamarade@rac.co.rw</a> , <a href="mailto:tkaregeya@rac.co.rw">tkaregeya@rac.co.rw</a> and <a href="mailto:snzabakiza@rac.co.rw">snzabakiza@rac.co.rw</a>												
<b>C. Preparation of Bids</b>													
<b>ITB 12</b>	The language of the bid is: English												
<b>ITB 13</b>	<p>Documents composing the bid:</p> <ol style="list-style-type: none"> <li>1. List of bidding documents submitted;</li> <li>2. Application letter signed, dated, and stamped in conformity to the one annexed to this tender document (FORMS OF BID/CONTRACTOR'S BID)</li> <li>3. Photocopy of trading license having civil works or road construction as main activity.</li> <li>4. Copy of tax clearance from Rwanda Revenue Authority</li> <li>5. Copy of debt clearance from the National Social Security Fund</li> <li>6. Bid guarantee of Frw 15,000,000 from either a bank or an insurance company operating in Rwanda which shall be valid until 30 days after the bids validity period;</li> <li>7. Written power of attorney of the signatory of the bid to commit the bidder;</li> <li>8. Priced bill of quantities or clearly quoted unit prices</li> <li>9. Proof of payment of tender document</li> <li>10. Site visit certificate</li> </ol>												
<b>ITB 14.4</b>	The Contract is subject to price adjustment in accordance with GCC Clause 47.												



<b>ITB 15.2</b>	The authority for establishing the rates of exchange shall be <i>National Bank of Rwanda (BNR)</i> .
<b>ITB 15.3</b>	Bidders <i>are not</i> required to substantiate the rates and prices.
<b>ITB 16.1</b>	The Bid shall be valid for 120 <i>days</i> .
<b>ITB 17.1</b>	Bid shall include a Bid Security issued by a bank or by surety using the form for bid security included in Section IX. Security Forms.
<b>ITB 17.2</b>	The Bid Security amount is: 15,000,000
<b>ITB 18.1</b>	Alternative Bids <i>shall not be</i> considered.
<b>ITB 19.1</b>	The number of copies of the Bid to be completed and returned shall be: 03
<b>D. Submission of Bids</b>	
<b>ITB 20.2 (a)</b>	Rac's address for the purpose of Bid submission is Attention: <i>Managing Director Rwanda Airports Company/ Procurement office</i> Address: <i>Kigali international Airport.</i> Floor-Room number: <i>RAC Front desk (Reception) ground floor.</i> City: <i>KIGALI</i> Country: <i>RWANDA</i> The deadline for the submission of bids is: Date: <b>09<sup>th</sup> September 2025</b> Time: 10:00 Am local time/8:00 GMT
<b>ITB 20.2 (b)</b>	Name and Identification number of the contract as given in ITB 1.1 above in this sheet
<b>ITB 20.2 (c)</b>	The warning should read "DO NOT OPEN BEFORE" <b>09<sup>th</sup> September 2025</b>
<b>ITB 21.1</b>	The deadline for submission of bids shall be <b>09<sup>th</sup> September 2025</b>
<b>E. Bid Opening and Evaluation</b>	
<b>ITB 24.1</b>	The bid opening shall take place at: <b>Kigali International Airport (RAC Offices)</b> Floor/ Room number: 2 <sup>nd</sup> floor, Passenger terminal City: <i>Kigali</i> <i>Country: Rwanda</i> Date: <b>09<sup>th</sup> September 2025</b>



	Time: <b>10:30 Am local time/8:30 GMT</b>
<b>ITB 31.1</b>	Domestic contractors <i>shall</i> receive a margin of preference of 10% in Bid evaluation.
<b>F. Award of Contract</b>	
<b>ITB 35.1</b>	The Standard Form of Performance Security acceptable to RAC shall be the one delivered by the bank or an approved financial institution pursuant to the form provided for under Section IX  <i>That <b>Bank Guarantee</b> shall be unconditional (on first demand) (see Section IX: Security Forms) and its value shall be comprised between 5 and 10 percent of the contract price.</i>
<b>ITB 36</b>	The Advance Payment shall be limited to 20 percent of the of the local purchase order





### Section III. Forms of Bid, Qualification Information, Letter of Acceptance, and Agreement

#### 1. Contractor's Bid

The **Bidder** shall fill in and submit this Bid form with the Bid. If the Bidder objects to the Adjudicator proposed by RAC in the Bidding Documents, it should so state in its Bid, and present an alternative candidate, together with the candidate's daily fees and biographical data, in accordance with ITB Clause 37.

[date]

Identification N° and Title of the tender: [insert identification number and title of the tender]

To: [name and address of RAC]

Having examined the Bidding Document, including addenda [insert list], we offer to execute the [name and identification number of the tender] in accordance with the GCC accompanying this Bid for the Contract Price of [insert amount in numbers], [insert amount in words] [insert name of currency].

The Contract shall be paid in the following currencies:

Currency	Percentage payable in currency	Rate of exchange: one foreign equals [insert local]	Inputs for which foreign currency is required
(a)			
(b)			

The advance payment required is:

	Amount	Currency
(a)		
(b)		

We accept the appointment of [insert name proposed in Bid Data Sheet] as the Adjudicator.

[or]



We do not accept the appointment of *[insert name proposed in Bid Data Sheet]* as the Adjudicator, and propose instead that *[insert name]* be appointed as Adjudicator, whose daily fees and biographical data are attached.

It is understood that the PE is not bound to accept the lowest or any Bid you receive.

It is hereby confirmed that this Bid complies with the Bid validity and, if required, Bid Security as required by the Bidding Document and specified in the BDS.

We, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries in accordance with ITB Sub-Clause 4.1;

We have no conflict of interest in accordance with ITB Sub-Clause 4.2;

Our firm, its affiliates or subsidiaries—including any subcontractors or suppliers for any part of the contract—has not been declared ineligible by RPPA OR RAC, or under the laws or official regulations of the Republic of Rwanda in accordance with ITB Sub-Clauses 4.3.

Authorized Signature: \_\_\_\_\_

Name and Title of Signatory: \_\_\_\_\_

Name of Bidder: \_\_\_\_\_

Address: \_\_\_\_\_



## 2. Qualification Information

*[The information to be filled in by bidders in the following pages shall be used for the purposes of post qualification or for verification of prequalification as provided for in ITB Clause 5. This information shall not be incorporated in the Contract. Attach additional pages, if needed be.]*

### 2.1. Individual Bidders or Individual Members of Joint Ventures

2.1.1 Constitution or legal status of Bidder: *[attach copy]*

Place of registration: *[insert]*

Principal place of business: *[insert]*

Power of attorney of signatory of Bid: *[attach]*

2.1.2 Annual amounts of construction works performed during the last *[insert number pursuant to ITB sub clause 5.5(a)]* years *[insert amounts in the national currency equivalent]*

2.1.3 Number *[insert number pursuant to ITB sub clause 5.5 (b)]* of works of a nature and amount similar to the Works performed as prime Contractor over the last *[insert number pursuant to ITB 5.5(b)]* years. *[The amounts should be indicated in the same currency used for Item 2.1.2 above. Also list details of work under way or committed, including expected completion date(s).]*

Project name and country	Name of client and contact person	Type of work performed and year of completion	Value of contract (national currency equivalent )
(a)			
(b)			

N.B. All completed projects should be proved by the performance certificates issued by the clients

2.1.4 Major items of Contractor's Equipment proposed for carrying out the Works. *[List all information requested below. Refer also to ITB Sub-Clause 5.5 (c).]*

Item of equipment	Description, make, and age (years)	Condition (new, good, poor) and number available	Owned, leased (from whom?), or to be purchased (from whom?)
(a)			
(b)			



N.B Attach the possession and/or leasing evidence

2.1.5 Qualifications and experience of key personnel proposed for administration and execution of the Contract. *[Attach biographical data, The CVs and academic testimonials. Refer also to ITB Sub-Clause 5.3 (e) and GCC Sub-Clause 9.1.]*

Position	Name	Years of experience (general)	Years of experience in proposed position
(a)			
(b)			

2.1.6 Proposed subcontracts and firms involved. Refer to GCC Clause 7.

Sections of the Works	Value of subcontract	Subcontractor (name and address)	Experience in similar work
(a)			
(b)			

2.1.7 Financial reports for the last *[insert number]* years: balance sheets, profit and loss statements, auditors' reports, etc. *[List below and attach copies.]*

2.1.8 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List below and attach copies of supporting documents.

2.1.9 Name, address, and telephone, telex, and facsimile numbers of banks that may provide references if contacted by the PE.

2.1.10 Information on current litigation(s) in which the Bidder is involved.

Other party(ies)	Cause of dispute	Amount involved
(a)		
(b)		

2.1.11 Proposed Program (work method and schedule). Descriptions, drawings, and charts, as necessary, to comply with the requirements of the Bidding Document.



## 2.2 Joint Ventures

- 2.2.1 The information listed in 2.1.1 – 2.1.10 above shall be provided for each partner of the joint venture.
- 2.2.2 The information in 1.11 above shall be provided for the joint venture.
- 2.2.3 Attach the power of attorney of the signatory (ies) of the Bid authorizing the signature of the Bid on behalf of the joint venture.
- 2.2.4 Attach the Agreement among all partners of the joint venture (and which is legally binding on all partners), which shows that:
- i. all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;
  - ii. one of the partners shall be nominated as being in charge, authorized to incur liabilities, and receive instructions for and on behalf of any and all partners of the joint venture; and
  - iii. The execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

## 2.3. Additional Requirements

Bidders should provide any additional information required in the BDS.



### 3. Letter of Acceptance

*[Letterhead paper of rac]*

*[The Letter of Acceptance shall be the basis for formation of the Contract as described in ITB Clauses 34 and 35. This Standard Form of Letter of Acceptance shall be filled in and sent to the successful Bidder only after evaluation of bids has been completed, subject to any review by the funding entity]*

*[insert date]*

Identification N° and Title of the tender: *[insert identification number and title of the tender]*

To: *[insert name and address of the successful bidder]*

This is to notify you that your bid dated *[insert date]* for execution of the *[insert name of the tender and identification number, as given in the SCC]* for the price of the equivalent of *[insert amount in numbers and words]* *[insert name of currency]*, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Institution *[Insert one of the following (a) or (b) options]*

- (a) We accept that *[insert name proposed by bidder]* be appointed as the Adjudicator.
- (b) We do not accept that *[insert name proposed by bidder]* be appointed as Adjudicator, and by sending a copy of this Letter of Acceptance to *[insert name of the Appointing Authority]*, we are hereby requesting *[insert name]*, the Appointing Authority, to appoint the Adjudicator in accordance with ITB Clause 37.1.

You are hereby instructed to (a) proceed with the execution of the said works in accordance with the contract documents, (b) sign and return the attached contract documents, and (c) forward the performance security pursuant to ITB Sub-Clause 35.1, i.e., Within 15 and 21 days for National Competitive Bidding and International Competitive Bidding, respectively, after receipt of this Letter of Acceptance, and pursuant to GCC Sub-Clause 52

Authorized Signature: \_\_\_\_\_

Name and Title of Signatory: \_\_\_\_\_

Name of rac: \_\_\_\_\_

Attachment: Agreement and Special Condition of the Contract



**RWANDA AIRPORTS COMPANY**

**Kigali International Airport Pavement/contract for maintenance of civil works for runway, apron and service roads at Kigali International Airport, Kamembe, Gisenyi Airports and Musanze Aerodrome**

**By and between**

**Rwanda Airports Company**

**and**

.....

**Contract number: 001/W/2025-2026/N/RAC**

**Contract amount and currency: .....**

**Contract duration: One-year renewable**

**Project Manager: RAC Manager Engineering**

**Date of contract: .....**



This CONTRACT hereinafter referred to as the “**Contract**” is entered into by and between RAC represented by Mr./Mrs./MS.....Hereinafter referred to as “**RAC**” and ..... Ltd/Co, ..... incorporated in (Country) ..... under the Registry number ..... Represented by Mr./Mrs./Ms. ...., ID/PC N°....., issued at....., the ..... of the company Hereinafter referred to as the “**Contractor**”

WHEREAS:

**I.** RAC is desirous that the Contractor to procure the works for [*insert name and identification number of Contract*] as specified in the General Conditions of Contract attached to this Contract (hereinafter called “the Works”);

**II.** RAC has accepted the bid by the Contractor for the execution and completion of such works through an appropriate tender process.

**III.** The Contractor having represented to RAC that they have the required capacity has agreed to execute the works specified in this contract;

**IV.** RAC has received funds from the [*Insert the name of the funding Institution*], hereinafter called the (“Funding Institution”) towards the cost of the works and intends to apply a portion of the proceeds of these funds to payments under this Contract;

**Or (c)** RAC has decided to allocate a portion of its own budget to finance \_\_\_\_\_

Now therefore this Agreement is entered into as follows:

1. Object of the contract is the construction of .....as specified in this contract
2. Considering the terms and conditions of payments to be made by RAC to the Contractor as hereinafter mentioned, the Contractor hereby convenes with RAC to execute and complete the works and remedy any defects therein in conformity in all respects with the provisions of the Contract.
3. RAC hereby convenes to pay the Contractor in consideration of the execution and completion of the works and the remedying of defects wherein the contract price amounting to [*insert the amount*] 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.
4. The following documents shall constitute the contract between RAC and the Contractor, and each shall be read and construed as an integral part of the contract:



- a. **Contract,**
  - b. **Letter of Acceptance,**
  - c. **Special Conditions of Contract,**
  - d. **General Conditions of Contract,**
  - e. **Specifications,**
  - f. **Drawings,**
  - g. **Bill of Quantities,**
  - h. **Bill of prices, and**
  - i. **Contractor's Bid,**
  - j. **Any other document listed in the SCC as forming part of the Contract.**
5. This contract shall prevail over all other contract documents. In the event of any discrepancy or inconsistency within the contract documents, then the documents shall prevail in the order listed above

Signed, Sealed, and Delivered by the said \_\_\_\_\_  
Binding Signature of RAC [*signature of an authorized representative of RAC*]

Binding Signature of Contractor [*signature of an authorized representative of the Contractor*]



**Section IV. General Conditions of Contract**

*The General Conditions of Contract (GCC), read in conjunction with the Special Conditions of Contract and other documents listed therein, should be a complete document expressing fairly the rights and obligations of both parties.*

*The form of General Conditions of Contract that follows has been developed on the basis of considerable international experience in the drafting and management of contracts, bearing in mind a trend in the construction industry towards simpler, more straightforward language.*

*The form can be used directly for smaller admeasurement contracts and, with the modifications noted in the footnotes, it can be adapted for lump sum contracts.*

*The use of standard General Conditions of Contract for building and civil works in a country shall promote comprehensiveness of coverage, general acceptability of its provisions, savings in cost and time in bid preparation and review, and the development of a solid background of legal case histories.*



## General Conditions of Contract

### A. General

#### 1. Definitions

- (a) The **Adjudicator** is the person appointed jointly by RAC and the Contractor to resolve disputes in the first instance, as provided for in GCC Clauses 24 and 25 hereunder.
- (b) **BDS** means Bid Data Sheet
- (c) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.
- (d) **Compensation Events** are those defined in GCC Clause 44 hereunder.
- (e) The **Completion Date** is the date of completion of the works as certified by the Project Manager, in accordance with GCC Sub-Clause 55.
- (f) The **Contract** is the contract between RAC and the Contractor to execute, complete, and maintain the works. It consists of the documents listed in GCC Clause 2.3 below.
- (g) The **Contractor** is a person or corporate body whose bid to carry out the works has been accepted by RAC and who signs the contract with the latter.
- (h) The **Contractor's bid** is the offer prepared in accordance with the requirements of the bidding document and which was submitted by the Contractor to rac.
- (i) The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the contract.
- (j) **Days** are calendar days; months are calendar months, unless provided otherwise.
- (k) **Dayworks** are varied work inputs subject to payment on a time basis for the Contractor's employees and equipment, in addition to payments for associated materials and plant.
- (l) A **Defect** is any part of the works not completed in accordance with the contract.
- (m) The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor.



- (n) The **Defects Liability Period** is the period **named in the SCC** Sub-Clause 35.1 and calculated from the Completion Date.
- (o) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract.
- (p) RAC is the party who employs the Contractor to carry out the works, **as specified in the SCC**.
- (q) **Equipment** is the Contractor's machinery and vehicles brought temporarily to the site to construct the works.
- (r) **Force Majeure** means an event or situation beyond the control of the Contractor that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Contractor. Such events may include, but not be limited to, acts of RAC in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.
- (s) The **Initial Contract Price** is the contract price listed in rac's Letter of Acceptance.
- (t) The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the works. The Intended Completion Date is **specified in the SCC**. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.
- (u) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the works.
- (v) **Plant** is any integral part of the works that shall have a mechanical, electrical, chemical, or biological function.
- (w) The **Project Manager** is the person **named in the SCC** (or any other competent person appointed by RAC and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the works and administering the contract.
- (x) **SCC** means Special Conditions of Contract
- (y) The **Site** is the area **defined as such in the SCC**.
- (z) **Site Investigation Reports** are those that were included in the bidding document and are factual and interpretative reports about the surface and subsurface conditions at the Site.
- (aa) **Specification** means the nature of the works included in the contract and any modification or addition made or approved by the Project Manager.

- (bb) The **Start Date** is given in the SCC. It is the latest date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.
- (cc) A **Subcontractor** is a person or corporate body who has a contract with the Contractor to carry out a part of the work in the contract, which includes work on the site.
- (dd) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the works.
- (ee) A **Variation** is an instruction given by the Project Manager which varies the works.
- (ff) The **Works** are what the contract requires the Contractor to construct, install, and turn over to rac, **as defined in the SCC**.
- (gg) **Other documents:** documents that may be listed in SCC as part of the contract

## 2. Interpretation

- 2.1 In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement. For the interpretation of these GCC, singular also means plural, masculine also means feminine or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.
- 2.2 If sectional completion is **specified in the SCC**, references in the GCC to the works, the completion date, and the intended completion date apply to any section of the works (other than references to the completion date and intended completion date for the whole of the Works).

## 3. Effectiveness of Contract

- 3.1. This Contract shall come into effect on the date the Contract is signed by both parties, or such other later date as may be **stated in the SCC**.

## 4. Commencement of Services

- 4.1 The Consultants shall begin carrying out the Services thirty (30) days after the date the Contract becomes effective, or at such other date as may be **specified in the SCC**.



## 5. Law and Language

5.1 The Law governing the Contract shall be laws of Rwanda and the Language of the Contract shall be as **stated in the SCC**.

## 6. Project Manager's Decisions

6.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between RAC and the Contractor in the role representing rac.

## 7. Delegation

7.1 The Project Manager may delegate any of his duties and responsibilities to other people except to the Adjudicator, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

## 8. Notices or communications

8.1 Any notice or communication given by one party to the other pursuant to the Contract shall be in writing to the address **specified in the SCC**. The term "in writing" means communicated in written form with proof of receipt.

8.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

## 9. Confidentiality

9.1 RAC and the Contractor shall keep confidentiality and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor such documents, data, and other information it receives from RAC to the extent required for the Subcontractor to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Contractor.

9.2. RAC shall not use such documents, data, and other information received from the Contractor for any purposes unrelated to the contract. Similarly, the Contractor shall not use such documents, data, and other information received from RAC for any purpose other than the performance of the Contract.

9.4 The above provisions shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the execution or any part thereof.

9.5 The provisions above shall survive completion or termination, for whatever reason, of the Contract.

## 10. Subcontracting



10.1 The Contractor may subcontract with the approval of the Project Manager, in compliance with the relevant provisions of RAC Manual and its application texts. Subcontracting shall not alter the Contractor's obligations.

## 11. Other Contractors

11.1 The Contractor shall cooperate and share the site with other contractors, public authorities, utilities, and RAC between the dates given in the Schedule of Other Contractors, as **referred to in the SCC**. The Contractor shall also provide facilities and services for them as described in the Schedule. RAC may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

## 12. Personnel

12.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as **referred to in the SCC**, to carry out the functions stated in the Schedule or other personnel approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel listed in the Schedule.

12.2 If the Project Manager requests the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the site within seven days and has no further connection with the work in the contract.

## 13. RAC's and Contractor's Risks

13.1 RAC carries out the risks which this contract states are RAC's risks, and the Contractor carries the risks which this contract states are Contractor's risks.

## 14. RAC's Risks

14.1 From the start date until the defects liability certificate has been issued, the following are RAC's risks:

- (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to
  - (i) use or occupation of the site by the works or for the purpose of the works, which is the unavoidable result of the works or
  - (ii) negligence, breach of statutory duty, or interference with any legal right by the Procuring Authority or by any person employed by or contracted to him except the Contractor and subcontractors.



- (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of RAC or in RAC's design, or due to war or radioactive contamination directly affecting the country where the works are to be executed.
- 14.2 From the completion date until the defects liability certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is a RAC's risk except loss or damage due to
- (a) a Defect which existed on the completion date,
  - (b) an event occurring before the completion date, which was not itself a RAC's risk, or
  - (c) the activities of the Contractor on the site after the completion date.

### **15. Contractor's Risks**

15.1 From the starting date until the defects liability certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not RAC's risks are Contractor's risks.

### **16. Insurance**

- 16.1 The Contractor shall provide, in the joint names of RAC and the Contractor, insurance cover from the start date to the end of the defects liability period, in the amounts and deductibles **stated in the SCC** for the following events which are due to the Contractor's risks:
- (a) loss of or damage to the Works, Plant, and Materials;
  - (b) loss of or damage to Equipment;
  - (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the contract; and
  - (d) personal injury or death.
- 16.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the start date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
- 16.3 If the Contractor does not provide any of the policies and certificates required, RAC may affect the insurance which the Contractor should have provided and recover the premiums RAC has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
- 16.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.

16.5 Both parties shall comply with any conditions of the insurance policies.

### **17. Force Majeure**

17.1 The failure of a Party to fulfil any of its obligations hereunder shall not be considered to be a breach of, or default under, this Contract insofar as such inability arises from an event of Force Majeure, provided that the Party affected by such an event has taken all reasonable precautions, due care and reasonable alternative measures, all with the objective of carrying out the terms and conditions of this Contract.

17.2 Force Majeure shall not include (i) any event which is caused by the negligence or intentional action of a Party or such Party's Subconsultants or agents or employees, nor (ii) any event which a diligent Party could reasonably have been expected to both (A) take into account at the time of the conclusion of this Contract and (B) avoid or overcome in the carrying out of its obligations hereunder.

17.3 Force Majeure shall not include insufficiency of funds or failure to make any payment required hereunder.

17.4 A Party affected by an event of Force Majeure shall take all reasonable measures to remove such Party's inability to fulfil its obligations hereunder with a minimum of delay.

17.5 A Party affected by an event of Force Majeure shall notify the other Party of such event as soon as possible, and in any event not later than five (5) days following the occurrence of such event, providing evidence of the nature and cause of such event, and shall similarly give notice of the restoration of normal conditions as soon as possible.

17.6 The Parties shall take all reasonable measures to minimize the consequences of any event of Force Majeure.

17.7 Any period within which a Party shall, pursuant to this Contract, complete any action or task, shall be extended for a period equal to the time during which such Party was unable to perform such action as a result of Force Majeure.

17.8 Not later than thirty (30) days after the Contractor, as the result of an event of Force Majeure, have become unable to perform a material portion of the works, the Parties shall consult with each other with a view to agreeing on appropriate measures to be taken in the circumstances.

### **18. Contract Amendment**

18.1 No amendment or other variation of the Contract shall be valid unless it is in writing, in form of an addendum, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party thereto.

18.2 The amendment shall not affect the substance and the nature of the original contract, and any amendment increasing 20% of the contract shall require a new tender.

### **19. Entire Agreement**

19.1 The Contract constitutes the entire agreement between RAC and the Supplier and supersedes all communications, negotiations and agreements (whether written or oral) of the parties with respect thereto made prior to the date of Contract.

## **20. No waiver**

20.1 No relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

20.2 Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

## **21. Severability**

21.1 If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

## **22. Good Faith**

22.1 The Parties undertake to act in good faith with respect to each other's rights under this Contract and to adopt all reasonable measures to ensure the realization of the objectives of this Contract

## **23. Site Investigation Reports**

23.1 Contractor, in preparing the bid, shall rely on any Site Investigation Reports **referred to in the SCC**, supplemented by any information available to the Bidder.

### **24. Queries about the Special Conditions of Contract**

24.1 The Project Manager shall clarify queries on the **SCC**.

## **25. Contractor to Construct the Works**

25.1 The Contractor shall construct and install the works in accordance with the specifications and drawings.

## **26. The Works to be completed at the Intended Completion Date**

26.1 The Contractor may commence execution of the works on the start date and shall carry out the works in accordance with the program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the intended completion date.

## **27. Approval by the Project Manager**



- 27.1 The Contractor shall submit specifications and drawings showing the proposed temporary Works to the Project Manager, who is to approve them if they comply with the Specifications and Drawings.
- 27.2 The Contractor shall be responsible for design of Temporary Works.
- 27.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.
- 27.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.
- 27.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.
- 27.6 Any other approval as specified in the contract.

## **28. Safety**

- 28.1 The Contractor shall be responsible for the safety of all activities on the Site.

## **29. Discoveries**

- 29.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of rac. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

## **30. Possession of the Site**

- 31.1 RAC shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date **stated in the SCC**, RAC shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.

## **31. Access to the Site**

- 31.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

## **32. Instructions, Inspections and Audits**

- 32.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.
- 32.2 The Contractor shall permit RAC to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by rac.

## **33. Disputes settlement**

### **33.1 Amicable Settlement**



33.1.1 The Parties shall use their best efforts to settle amicably all disputes arising out of or in connection with this Contract or the interpretation thereof.

### 33.2 Adjudication

33.2.1 In case parties fail to amicably settle a dispute in relation with technical matters like the calculations, specifications or any other details related to the works shall be referred to the Adjudicator within 14 days from the date parties fail to resolve the dispute amicably.

### 33.3 Litigation or Arbitration

33.3.1 Any dispute between the Parties as to matters arising pursuant to this Contract which cannot be settled amicably or through adjudication within thirty (30) days after the receipt by one Party of the other Party's request for such amicable settlement or thirty days (30) after the Adjudicator's decision may be submitted by either Party for settlement in accordance with the provisions **specified in the SCC**.

## B. Control of the schedule

### 34. Program

34.1 Within the time **stated in the SCC**, after the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

34.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

34.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period **stated in the SCC**. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount **stated in the SCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

34.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

### 35. Extension of the Intended Completion Date

35.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.



- 35.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.
- 35.3 Request for extension of time shall be made not later than within a time period **stated in SCC**. Any request made after that period may be rejected by RAC or accepted without prejudice to the application of liquidated damages.

### **36. Acceleration**

- 36.1 When RAC wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If RAC accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both RAC and the Contractor.
- 36.2 If the Contractor's priced proposals for acceleration are accepted by rac, they are incorporated in the Contract Price and treated as a Variation.

### **37. Delays Ordered by the Project Manager**

- 37.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works. Such instruction shall impact on the completion date which shall be extended accordingly.

### **38. Management Meetings**

- 38.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
- 38.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to rac. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

### **39. Early Warning**

- 39.1 The Contractor shall warn the Project Manager at the earliest opportunity, before the execution of the affected works or related activities, of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.



39.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.

### **C. Quality Control**

#### **40. Identifying Defects**

40.1 The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

#### **41. Tests**

41.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

#### **42. Correction of Defects**

42.1 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, **and is defined in the SCC**. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

42.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

#### **43. Uncorrected Defects**

43.1 If the Contractor has not corrected a defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

### **D. Cost Control**

#### **44. Bill of Quantities**

44.1 The Bill of Quantities shall contain items for the construction, installation, and testing, to be done by the Contractor.

#### **45 The Bill of Quantities is used to calculate the Contract Price.**

45.1 The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

#### **46. Changes in the Quantities**



46.1 If the reduction of the activities of the tender results in a reduction of its cost by more than twenty per cent (40%) of the initial contract, RAC and the Contractor shall negotiate the compensation to be given to the Contractor depending on the total expense incurred in the execution of the tender. This compensation shall not exceed twenty percent (40%) of the activities that have been reduced.

46.2 If the addition of the activities of the tender results in an increase of its costs by more than twenty percent (40%) of the initial contract, RAC shall proceed to the award of a new tender or seek for no objection from Rwanda Airports Company to award that new tender to the current contractor.

#### **47. Variations**

47.1 All Variations shall be included in updated Programs produced by the Contractor.

#### **48. Payments for Variations**

48.1 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

48.2 If the work in the variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in Sub-Clause 38 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

48.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the contract price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.

48.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

48.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

#### **49. Cash Flow Forecasts**

49.1 When the Program is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

#### **50. Payment Certificates**



- 50.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.
- 50.2 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.
- 50.3 The value of work executed shall be determined by the Project Manager.
- 50.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.
- 50.5 The value of work executed shall include the valuation of Variations and Compensation Events.
- 50.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

### **51. Payments**

- 51.1 Payments shall be adjusted for deductions for advance payments and retention. RAC shall pay the Contractor the amounts certified by the Contract Manager within 45 days of the date of each certificate.
- 51.3 Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.
- 51.4 Items of the Works for which no rate or price has been entered in shall not be paid for by RAC and shall be deemed covered by other rates and prices in the Contract.

### **52. Compensation Events**

52.1 The following shall be Compensation Events:

- (a) RAC does not give access to a part of the Site by the Site Possession Date pursuant to GCC Sub-Clause 21.1.
- (b) RAC modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.
- (c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time.
- (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.
- (e) The Project Manager unreasonably does not approve a subcontract to be let.
- (f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.



- (g) The Project Manager gives instructions for dealing with an unforeseen condition, caused by RAC, or additional work required for safety or other reasons.
  - (h) Other contractors, public authorities, utilities, or RAC does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.
  - (i) The advance payment is delayed.
  - (j) The effects on the Contractor of any of RAC's Risks.
  - (k) The Project Manager unreasonably delays issuing a Certificate of Completion.
- 52.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.
- 52.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.
- 52.4 The Contractor shall not be entitled to compensation to the extent that RAC's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.

### 53. Tax

53.1 The taxes, duties, levies applicable, shall be included in the contract price except when they are subject to exemption in accordance with the tax legal framework. The Project Manager shall adjust the contract price if taxes, duties, and other levies are changed between the date 28 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC Clause 47.

### 54. Currencies

54.1 Companies registered in Rwanda and those owned by Rwandan nationals shall only be paid in Rwanda currency. Where payments are made in currencies other than the currency of the Republic of Rwanda, the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor's bid.

### 55. Price Adjustment

55.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the SCC and in accordance with RAC procurement Manual. If so provided, the amounts certified in each



payment certificate, before deducting for Advance Payment, shall be adjusted by applying the following formula:

$$P1 = P0 [a + bL1/ L0 + cM1/ M0] - P0$$

$a+b+c = 1$  in which:

P1 = adjustment amount payable to the Supplier.

P0 = Contract Price (base price).

a = fixed element representing profits and overheads included in the Contract Price and generally in the range of five (5) to fifteen (15) percent.

b = estimated percentage of labour component in the Contract Price

c = estimated percentage of material component in the Contract Price.

L0, L1 = labour indices applicable to the appropriate industry in the country of origin on the base date and date for adjustment, respectively.

M0, M1 = material indices for the major raw material on the base date and date for adjustment, respectively, in the country of origin.

The coefficients a, b, and c as specified by RAC are as follows:

a = [insert value of coefficient]

b= [insert value of coefficient]

c= [insert value of coefficient]

55.2 The Bidder shall indicate the source of the indices and the base date indices in its bid.

Base date = thirty (30) days prior to the deadline for submission of the bids.

Date of adjustment = [insert number of weeks] weeks prior to date of shipment (representing the midpoint of the period of manufacture).

55.3 The above price adjustment formula shall be invoked by either party subject to the following further conditions:

(a) No price adjustment shall be allowed beyond the original delivery dates unless specifically stated in the extension letter. As a rule, no price adjustment shall be allowed for periods of delay for which the Supplier is entirely responsible.

RAC will, however, be entitled to any decrease in the prices of the Goods and Services subject to adjustment.

(b) If the currency in which the Contract Price P0 is expressed is different from the currency of origin of the labour and material indices, a correction factor will be applied to avoid incorrect adjustments of the Contract Price. The correction factor shall correspond to the ratio of exchange rates between the two currencies on the base date and the date for adjustment as defined above.

(c) No price adjustment shall be payable on the portion of the contract price paid to the Supplier as advance payment.



55.4 If the value of the index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next payment certificate. The index value shall be deemed to take account of all changes in cost due to fluctuations in costs.

### 56. Retention

56.1 RAC shall retain from each payment due to the Contractor the proportion **stated in the SCC**, until Completion of the whole of the Works and shall be payable to RAC for any loss resulting from the Contractor's failure to complete his obligations under this contract.

56.2 On completion of the whole works, half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected.

56.3 On completion of the whole Works, the Contractor may substitute retention money with an "on demand" Bank guarantee.

### 57. Liquidated Damages

57.1 The Contractor shall pay liquidated damages to RAC at the rate of one thousandth (1‰) of the total amount of the contract per each day of delay to complete any phase of the works as stated in the work schedule as approved by the Project Manager. The total amount of liquidated damages shall not exceed 5% of the total amount of the contract.

57.2 Once the maximum is reached, the purchaser may terminate the contract. However, if the implementation of the contract continues penalties shall continue to accrue until full completion of the contract or termination.

57.3 RAC may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

### 59. Advance Payment

59.1 RAC shall make advance payment to the Contractor of the amounts **stated in the SCC** by the date **stated in the SCC**, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to RAC in amounts and currencies equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

59.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager. If the Contractor uses part of or entire amount of the advance paid to him in activities other than those related to the contract, the advance shall immediately be considered as a debt which shall be paid by seizing the entire security or part of it.



59.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, or Liquidated Damages.

## **60. Securities**

60.1 The Performance Security shall be provided to RAC not later than the date specified in the Letter of Acceptance and shall be issued in an amount **specified in the SCC**, by a bank of the first order acceptable to RAC, and denominated in the types and proportions of the currencies in which the Contract Price is payable. The Performance Security shall be valid until the date specified therein.

60.2 If the contract execution period has been extended or its value has increased, the contractor shall respectively extend the validity period of the performance security and submit a performance security of an increased amount respectively.

## **61. Dayworks**

61.1 If applicable, the Dayworks rates in the Contractor's bid shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

61.2 All work to be paid for as Dayworks shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done.

61.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

## **62. Cost of Repairs**

62.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

## **E. Completion of the Contract**

### **63. Completion**

#### **63.1 Provisional acceptance of works**

63.1 The Contractor shall officially inform the Project Manager of the completion of the works and request him to schedule a site visit for the purpose of provisional acceptance of completed works. The provisional acceptance shall take place within twenty (20) days following effective completion of works. The Project Manager together with the Contractor shall inspect the project



and make a statement agreeing to or refusing the provisional acceptance of works, indicating mistakes to be corrected if any. In case of mistakes the Project Manager can decide to partially accept the works without mistakes and reschedule the inspection until full provisional acceptance.

### **63.2 Final acceptance of works**

63.2.1 Within twenty (20) days prior to the expiry of the guarantee period for the provisional acceptance of works a final acceptance shall be scheduled upon the request by the Contractor, subject to correction of all mistakes notified to the Contractor during the guarantee period.

### **63.3 Certificate of completion**

63.3.1 After final acceptance of works the Contractor shall request RAC to be given a certificate of good completion of works indicating the date on which he completed his contractual obligations.

### **64. Taking Over**

64.1 The Procurement Authority shall take over the site and the works within seven (7) days of the Project Manager's issuing a certificate of Completion.

### **65. Final Account**

65.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

### **66. Operating and Maintenance Manuals**

66.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates **stated in the SCC**.

66.2 If the Contractor does not supply the Drawings and/or manuals by the dates **stated in the SCC**, or they do not receive the Project Manager's approval, the Project Manager shall withhold the amount **stated in the SCC** from payments due to the Contractor.

### **67. Termination**

67.1 RAC or the Contractor may terminate the Contract if one or another party causes a grave breach of the Contract.

67.2 grave breaches of Contract shall include, but shall not be limited to, the following:



- (a) the Contractor stops work for 60 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager;
- (b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 60 days;
- (c) RAC or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- (d) a payment certified by the Project Manager is not paid by RAC to the Contractor within 90 days of the date of the Project Manager's certificate;
- (e) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;
- (f) the Contractor does not maintain a Security, which is required; and
- (g) the Contractor has delayed the completion of the works by the number of days for which the maximum amount of liquidated damages can be paid, as **defined in the SCC**.
- (h) if the Contractor, in the judgment of RAC has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

67.3 When either party to the contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC Sub-Clause 59.2 above, the Project Manager shall decide whether the breach is fundamental or not.

67.4 Notwithstanding the above, RAC may terminate the Contract for convenience.

67.5 If the Contract is terminated, the Contractor shall stop work immediately, make the site safe and secure, and leave the site as soon as reasonably possible.

## 68. Payment upon Termination

68.1 If the contract is terminated because of a fundamental breach of contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as **indicated in the SCC**. Additional Liquidated Damages shall not apply. If the total amount due to RAC exceeds any payment due to the Contractor, the difference shall be a debt payable to RAC.

68.2 If the contract is terminated for RAC's convenience or because of a fundamental breach of contract by RAC, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the works, and the Contractor's costs of



protecting and securing the works, and less advance payments received up to the date of the certificate.

### **69. Property**

69.1 All Materials on the site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of RAC if the Contract is terminated because of the Contractor's default.

### **70. Release from Performance**

70.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either RAC or the Contractor, the Project Manager shall certify that the contract has been frustrated. The Contractor shall make the site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.



### Section V: Special Conditions of Contract

*Except where otherwise indicated, all SCC should be filled in by the Procuring Authority prior to issuance of the Bidding Document. Schedules and reports to be provided by the contractor should be annexed.*

<b>A. General</b>	
<b>GCC 1 (m)</b>	The Defects Liability Period is 12 months
<b>GCC 1(p)</b>	RAC is <i>[insert name, address, and name of authorized representative]</i> .
<b>GCC 1 (t)</b>	The Intended Completion Date for the whole of the Works shall be <b>shall be specified on each purchase order and/or work order</b>
<b>GCC 1(w)</b>	The Project Manager is <b>Rwanda Airports Company Manager Engineering and Maintenance.</b>
<b>GCC 1(y)</b>	The Site is located at <b><i>Kigali International Airport, Kamembe and Gisenyi Airports, and Musanze aerodrome</i></b>
<b>GCC 1(bb)</b>	The Start Date shall be fixed on the purchase order and agreed upon depending on the work to be done
<b>GCC 1(ff)</b>	The Works consist of <b>Kigali International Airport pavement/Maintenance of civil works for runway, apron and Service roads at Kigali International Airport, Kamembe, Gisenyi airports and Musanze Aerodrome</b>
<b>GCC 1 (gg)</b>	The following documents also form part of the Contract: <ul style="list-style-type: none"> <li>a. <b>Contract,</b></li> <li>b. <b>Letter of Acceptance,</b></li> <li>c. <b>Special Conditions of Contract,</b></li> <li>d. <b>General Conditions of Contract,</b></li> <li>e. <b>Specifications,</b></li> <li>f. <b>Bill of Quantities,</b></li> <li>g. <b>Bill of prices, and</b></li> <li>h. <b>Contractor's Bid</b></li> </ul>
<b>GCC 2.2</b>	Sectional Completions are: not allowed
<b>GCC 3</b>	The effective date of this contract is the date the last of the signatories attaches its signature



<b>GCC 4</b>	Commencement date of the works is <b>the date the contract is signed by both parties</b>
<b>GCC 5</b>	The language of the contract is English.
<b>GCC 8</b>	The notice or communication shall be sent at <b>MANAGING DIRECTOR OF RWANDA AIRPORTS COMPANY</b> Address: <b>Po Box 1171 KIGALI;</b> Floor-Room number: <b>RECEPTION DESK, GROUND FLOOR</b> City: <b>KIGALI</b> <b>Email: <a href="mailto:info@rac.co.rw">info@rac.co.rw</a></b> <b>Country: RWANDA. Tel: (+250) 252585555</b>
<b>GCC 11</b>	Schedule of other contractors: N/A
<b>GCC 12.1</b>	Key Personnel: Project Manager
<b>GCC 16.1</b>	The minimum insurance amounts and deductibles shall be: (a) For the Works, Plant and Materials: 50,000,000 deductible 500,000Frw. (b) For loss or damage to Equipment: 2,000,000Frw deductible 200,000Frw. (c) for loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract: 10,000,000 deductible 100,000Frw. (d) for personal injury or death: (i) of the Contractor's employees: workmen's compensation insurance (3,000,000Frw for medical insurance) deductible of 30,000Frw (ii) of other people: 50,000,000Frw for third party liability insurance of other deductible 500,000Frw.
<b>GCC 23</b>	Site Investigation Reports are: <i>visual inspection reports</i>
<b>GCC 24</b>	Queries on Special Conditions of the Contract shall be in writing
<b>GCC 31</b>	The Site Possession Date(s) shall be: within one week from the date of signing the contract
<b>GCC 33.2</b>	Fees and types of reimbursable expenses to be paid to the Adjudicator: N/A.
<b>B. Time Control</b>	



<b>GCC 34.1</b>	The Contractor shall submit for approval a Program for the Works within 7 days from the date of the Letter of Acceptance.
<b>GCC 34.3</b>	The period between Program updates is 7 (seven) calendar days. The amount to be withheld for late submission of an updated Program is <i>N/A</i>
<b>C. Quality Control</b>	
<b>GCC 35.3</b>	The request for the extension of time shall be made within 15 days
<b>GCC42</b>	The Defects Liability Period is: 12 months from the time of provisional reception of services done
<b>D. Cost Control</b>	
<b>CGC 51.1</b>	The payment shall be made within 45 days  Penalties for a delayed payment shall be 1/1000 of the LPO price. In any case this penalty shall not exceed 3% of the total LPO price, otherwise the contract may be terminated.
<b>GCC 54</b>	The currency of RAC's country is: Rwanda Francs.
<b>GCC 55</b>	The Contract <i>insert is not</i> subject to price adjustment in accordance with GCC Clause 47, and the following information regarding coefficients <i>does not</i> apply.
<b>GCC 56.1</b>	The proportion of payments retained is <i>not applicable</i>
<b>GCC 57</b>	The liquidated damages for the whole of the Works are <i>1/1000 of</i> LPO price per day of delay. The maximum amount of liquidated damages for the whole of the Works is <i>5%</i> of the LPO Price.  Once the contract is not terminated while the maximum of liquidated damages of 5% is reached, the contract extension shall not exceed <i>30 days</i>
<b>GCC 59.1</b>	The Advance Payments shall be: <i>20% depending on the magnitude of the project.</i>
<b>GCC 60.1</b>	The Performance Security amount is <i>[insert amount(s) which is between 5 to 10% of the total LPO price denominated in the types and proportions of the currencies in which the Contract Price is payable, or in a freely convertible currency acceptable to RAC]</i>
<b>E. Finishing the Contract</b>	
<b>GCC 66.1</b>	The date by which operating and maintenance manuals are required is the date of request for temporarily reception of works.



	The date by which “as built” drawings are required is the date of commissioning of works.
<b>GCC 66.2</b>	The amount to be withheld for failing to produce “as built” drawings and/or operating and maintenance manuals by the date required in GCC 58.1 is N/A
<b>GCC 67.2 (g)</b>	The maximum number of days is: <i>one month after final reception/commissioning.</i>
<b>GCC 68.1</b>	The percentage to apply to the value of the <del>work not completed, representing</del> RAC’s additional cost for completing the Works, is <i>to be précised later</i>



## Section VI. Specifications & Performance Requirements

### 1 GENERAL REQUIREMENTS FOR WORKS

#### 1.1 Outline description of the works

The hereby tenders documents are written as part of Preparatory documents for the annual contract of civil works for Runway, Apron and Service road at Kigali International Airport, Kamembe International Airport and Gisenyi Airport to define the scope works required of refurbishment of the aeronautical pavement and to precise the other works to be implemented during the contract

#### 1.2 Abbreviation and definitions used in these specifications

##### 1. Application scope

1. The technical specifications for the works shall apply to all of the works to be executed under the contract, and shall be read in conjunction with all other documents that form the contract.
2. Any matter not provided in the specification shall be determined through consultation between the Engineer and the Contractor.

##### 2. Applicable standards

Generally speaking, all kind of material used for the works shall be in accordance with the current standard in Rwanda or International standards.

In the specifications, qualities of materials and equipment to be used and methods of sampling and testing shall be stipulated with the following codes and standards.

- ASTM : American Society for Testing and Materials.
- AASHTO: American Association of State Highway and Transportation Officials.
- Fed Spec: Federal Specifications and Standards and supplements, amendments,

And indices thereto are prepared and issued by the General Services Administration of the Federal Government.

- “BS” and “CP”: British Standard and British Standard code of Practice published or issued by the British Standards Institution, 2 Park Street, London W1A 2BS. All BS and CP’s referred to in the contract shall refer to the editions current at the time of tendering, including all amendments published thereto, unless some other edition is specifically referred to in the contract
- NFP : French Standards AFNOR.

#### 1.3 Obligations work and restrictions

1. The contractor shall:



- a) Comply with all enactments, regulations and working rules relating to safety, health and welfare;
  - b) Ascertain and comply with the regulations of the civil police affecting the execution of the works;
  - c) Arrange for general purpose industrial safety helmets to BS 5340; 1975 to be provided for use by all persons on site who could be in danger of head injury and endeavor to ensure that helmets are worn when necessary by all persons;
  - d) Not use the site for any purpose other than carrying out the works;
  - e) Not display or permit advertisements to be displayed on site;
  - f) Prevent trespass on adjoining property by his work people;
  - g) Comply with all Government laws governing the importation licensing, etc. of all plant and machinery whether new or second-hand.
2. a) The site lies within the Security Controlled Area of Kigali Airport and unauthorized access is prohibited. The contractor must provide the Engineer at least one week prior to the commencement of works a list of all personnel, machinery and plant that will be entering the site that will make the necessary arrangements for the issuance of “the airport permits”. These permits will be used by the contractor’s staff only for access to the site and only during the site working hours. If used at places outside the site or outside the working hours staff are liable for prosecution.
- b) Movements through the airport must be restricted only to the site and staff must follow the pre-arranged and approved routes. They must exercise extra caution when moving near aircraft. They must follow instructions of keeping safe distances from aircraft or stopping when instructed by the airport police or other authorized airport personnel. The speed limit within the airport area is 20Kmph.

#### 1.4 Prevention of nuisance or accident

1. Where the works are to be carried out adjacent to occupied premises, the contractor shall proceed with the works in such a manner as to cause the minimum inconvenience and nuisance to occupants and users. The contractor must take all necessary precautions including regular watering of any service roads and other airport earthed areas as directed to prevent any inconvenience from dust. It is expressly stated that the contractor shall be liable for damages caused by dust resulting from the construction works. Access to properties adjacent to the site shall be maintained at all times.
2. All Airport pavements must be swept clean from any debris or dust arising from the execution of the works with an approved mechanical brush sweeper.
3. Flying operations and aircraft movements will take place during /throughout the period of the contract. The contractor shall comply at all times with the directions of the Engineer regarding any possible stoppage of work arising from such flying operations and aircraft movements. If such instruction is issued and as a result work hard stopped more than one hour, an extension of time will be granted without extra payment to the contractor.



4. All reasonable precautions shall be taken by the contractor to prevent any pollution being caused by the execution of the works.
5. The contractor shall ensure that the risk of infestation is minimized by the adequate arrangements for the disposal of food waste or other matters attractive to pests. Should infestation occur, the Engineer shall be informed immediately?

### **1.5 Complaints and claims by third parties**

During the course of the work, complaints and claims may arise from the public or from various authorities. The contractor shall satisfy the Engineer that he is dealing with all such matters without delay until appropriate clearance certificates from any authority concerned are produced by the contractor.

### **1.6 Setting out**

The contractor shall set out the works in accordance with the Drawings supplied by the Engineer or as instructed in writing by the Engineer. The contractor shall construct and maintain any external survey points which are required for the accurate location of the centre line of the works.

### **1.7 Drawings of survey**

1. The drawing for the purposes of recording initial, monthly and final surveys shall be prepared by the contractor to the satisfaction of the Engineer, and unless otherwise agreed shall be not larger than A0 size including 10mm margin in around. The scales of the plans and cross sections shall be agreed between the contractor and the engineer.
2. Three copies of each agreed drawing shall be submitted to the Engineer's Representative and transparency of the initial and final surveys shall be submitted to the Engineer on the completion of the works.

### **1.8 Working drawing**

3. Before any part of the work is put in hand, contractor shall prepare and submit for the approval of the Engineer copies of any further detailed working drawings and schedules which may be required for such part of the work, and at the same time call the attention of the Engineer to any alternative detail or modification. Such drawings shall be submitted to one week before approval is required.
4. The Engineer will, after any alteration which he may require have been made by the contractor, record on the copies as amended his approval, and will return one copy to the contractor, who shall carry out the work in accordance therewith. The contractor shall forward to the Engineer three additional copies of the working drawings as approval.

### **1.9 Alteration to drawing**

1. In all cases where drawings are specified or required to be supplied by the contractor for the approval of Engineer for any work included in this contract, any alteration to such drawings which the Engineer may require to have been made, shall be made by the contractor to the Engineer's satisfaction.

### **1.10 contractor's facilities**



1. The contractor will propose to the approval of the Engineer the drawing of site installation area within the Airport Security fence. As soon as it was reported by the Engineer, the contractor shall use this area for the setting of all spoil heaps, plant, temporary buildings, works and services.

#### **1.11 Contractor's performance of tests**

1. The contractor shall perform the tests required by the contract, at the frequencies specified therein, and he shall be responsible for his own quality control of the works. Three copies of the results of each test performed by the contractor in a form approved by the Engineer shall be submitted to him. A fourth copy of the test results of each test shall be retained on site for as long as the Engineer may require.
2. Where required by the contract, the contractor shall provide on the site and maintain and remove on issue of the maintenance certificate.  
The contractor shall have a laboratory including its contents for his own testing of materials.
3. The contractor's site laboratory shall be provided with the minimum equipment. Testing required under the contract that cannot be performed in the contractor's site laboratory shall be carried out in other laboratories which must meet the Engineer's approval.
4. The laboratory shall be adequately staffed and equipped so that there shall never occur any interruption to the progress of the works as a result of the need to carry out tests required under the contract. The laboratory staff shall include a qualified English speaking engineer or engineers, suitably qualified and experienced in the testing of soils, concrete and bituminous materials, and a sufficient number of laboratory assistants and laborers.
5. If required by the Engineer the contractor shall perform any or all tests in the presence of authorized representatives of the Engineer.
6. Without relieving the contractor of his responsibilities under the contract, the contractor shall perform any additional tests which the Engineer may require, and /or repeat tests the results of which, in the opinion of the Engineer are not representative.

#### **1.12 Access to the site**

1. The contractor shall make all arrangements for providing safe and expeditious access to the various parts of the site, where necessary, shall construct to an approved standard, maintain, safeguard, and reinstate, all to the satisfaction of the Engineer, all roads and other access works which may be required of that purpose.
2. The contractor shall ensure that none of the aforementioned access work (whether of a permanent or temporary nature) shall obstruct or impede services, drainage, or irrigation systems, or have other avoidable effects on surrounding land or property.

#### **1.13 Prevention of mud on the airport pavements**

The contractor shall keep all the airport clear of mud and other debris arising from the works and shall avoid mud and debris from being brought on to the airport pavements by construction traffic by washing down vehicles if necessary.

#### **1.14 Proprietary materials**

Reference in this contract to the names of any firms or proprietary articles shall be construed only as an indication of the quality performance and workmanship may be offered to the Engineer for approval.



### 1.15 Samples

1. In addition to any specific provision in the contract for the sampling and testing of materials, the contractor shall submit to the Engineer, as he may require, samples of all materials and goods which he proposes to use or to employ in or for the works. Such samples, if approved, will be retained by the Engineer. No materials or goods of which samples have been approved in writing by the Engineer.
2. The engineer may reject any materials and goods which, in his option, are inferior to the samples, thereof previously approved and the contractor shall prompt remove such materials and goods from the sites.

### 1.16 Tests in general

1. The Engineer may examine and may require to be tested any materials or goods required in or for the works such as he may decide from time to time. The contractor shall arrange for the Engineer to have unrestricted access to the contractor's sub- contractor's, and suppliers' promise for such purposes at all times.
2. The contractor shall afford the Engineer all facilities, assistance, and labor necessary for the convenient examination, testing, or analysis of all such materials or goods.
3. notwithstanding any tests which may have been carried out the Engineer shall be empowered to order further tests of any materials or goods should they fail to pass such tests.
4. For manufactured materials or goods the contractor shall obtain certificates of tests which are representative of the delivered materials or goods from the suppliers of such materials and shall send four copies of certificates to the Engineer. Such certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the contract and shall give the results of all tests carried out. The contractors shall provide adequate means of identifying the materials and goods delivered to the site with the corresponding certificates.
5. Various clauses of the specification state the types of test which the contractor shall carry out for the control of the quality of the works, together with the frequencies at which each type of test shall be conducted. The contractor's attention is drawn to the fact that the frequencies of testing specified in the relevant clauses are intended to represent only a general guide. The Engineer shall be empowered to vary the frequencies at which tests are conducted should he deem this necessary for the proper control of the quality of the works.

### 1.17 Materials and workmanship in general

1. All materials incorporated in the works shall be new and of the best quality and description of their respective kinds. All materials supplied shall be in accordance with the standards specified in this specification, or equivalent as decided by the Engineer. The workmanship in every case shall be of the best character and the whole shall be subject to the approval of the Engineer.
2. The contractor shall provide the Engineer with three copies of all orders for the supply of materials and goods required in connection with the works as the Engineer may require.
3. Before entering into any agreement for the supply of any materials or goods, the contractor shall obtain the Engineer's approval in writing of the supplier from whom he proposes to obtain such materials or goods. Should the Engineer, at any time, be dissatisfied with such materials or goods or with the methods of operations carried out at such supplier's works or place of



business, he shall be empowered to cancel his previously given approval of such supplier, or to approve another supplier for the supply of such materials and goods from another approved supplier and shall bear any additional cost thereof.

### **1.18 Sources of materials**

#### **QUARRIES**

1. For the purposes of the contract, quarries shall mean and include all such areas as may be approved in writing by the Engineer as sources from which the contractor may excavate materials for use in the works.
2. The contractor shall be wholly responsible for locating quarries and obtaining any necessary consents licenses, permits, royalties etc., from land-owners and relevant authorities for the use of quarries. The contractor shall submit to the Engineer copies of all such consents etc.
3. At the commencement of the works, or as soon thereafter as is practicable, the contractor shall submit to the Engineer for approval details of:
  - a) The surfaces from which he proposes to obtain rock; aggregates, and sand;
  - b) The periods during which he proposes to obtain material from each of the several sources;
  - c) The means and routes by which he proposes to obtain and transport these materials;
  - d) Results of his investigations of the materials.
4. No approval by the Engineer of such proposals shall relieve the contractor of his obligations to provide all the materials required for the works, or any other obligation under the contract.

#### **BORROW AREAS**

1. For the purposes of the contract, borrow areas shall be provided by the Employer and will be used as a sources from which the contractor may excavate materials for use in the works. These areas mainly concern the Glide Platform.
2. Before commencing the removal of materials from any of the provided borrow areas, the contractor shall carry such investigations as he deems necessary to establish and satisfy himself as to the quality and quantities of material available from the area and the suitability of the plant methods he proposes to use for its removal.
3. The contractor shall work each borrow area in a systematic manner, and, on completion of removal of material from any of the given areas, shall leave the site in a tidy condition, to the satisfaction of the engineer and relevant authority, without unsightly holes or heaps of excavated or inset material. The area shall be left free draining without any features resulting from excavation operations which might result in erosion or instability.

### **1.22 removals of condemned materials**

The engineer may require the contractor to remove and dispose of any materials employed in the construction of the works, which, in the opinion of the engineer, are



unsuitable or have been incorrectly deposited or have suffered damage by exposure to the weather or otherwise are not in accordance with the specified requirements for such materials. The contractor shall be entitled to no payment whatsoever in respect of the removal of such materials.

### **1.23 disposals of spoil, rubbish and surplus materials**

1. The contractor shall prevent excavated spoils; rubbish and surplus materials arising from the works being dumped on an area other than an area approved by the engineer, and shall comply with legislation governing the controlled tipping of refuse.
2. should any excavated spoil, rubbish or surplus materials be deposited elsewhere than at an approved area, the contractor will be held responsible, cleaning away such deposits and place them in an approved area at his own expense.

### **1.24 existing service installations**

1. The contractor shall not use or interfere with the existing service installations without the permission of the engineer and, where applicable, of service and utilities authorities and private owners. He shall take precautions to avoid damage and draw employees' attention to the attendant risks and danger.
2. Should any damage to existing service installations occur, the contractor shall immediately notify in writing the engineer and, where applicable, service and utility authorities and private owners of any damage. he shall make arrangements for the repair at his own expense to the satisfaction of the engineer and, where applicable, or service and utilities authorities and private owners. For urgent repairs shall he shall accept any arrangements made by the engineer. Such arrangements by the engineer will not affect the extend of the contractors' liability.
3. Prior to the beginning of works, underground network system shall be detected in association with the technical services of Kigali Airport in order to find all nature of network system that could exist in the perimeter of works. All consequences of damage on the current installation (pipe, cable, lightning...) that could occurred during the work, shall be supported by the contractor.
4. Prior to the beginning of works, the contractor shall also detect the topographical references that could exist in the perimeter of works. All the displacement of the current reference (stake, stone ...) that could occurred during the work, shall be overhauled by the contractor.

### **1.25 Traffic safety measures**



1. The contractor shall provide, erect and maintain adequate temporary traffic and warning signs on all access routes and pavements within the site. The size, wording and the locations of the signs shall be approved by the engineer.
2. The contractor shall provide, fix and maintain signs, markings and lights which comply with the requirements on vehicles, plant, stockpiles and at each end of the static plant sites and directed by the engineer.
3. Steps shall be taken by the contractor to ensure at all times the safety of the employer's personnel as well as for the contractor 'employees working along trafficked areas.
4. All details or traffic safety and management measures necessitated by the works shall be submitted to the engineer for his consent 15 days before the contractor intends to commence any work. The contractor shall also furnish any further relevant details and information requested by the engineer.
5. After their erection, the contractor shall not remove or modify in any manner the permanent or temporary traffic signs, without the consent of the engineer. Should the progress of the works necessitate the modification of the permanent or temporary traffic signs arrangement the contractor shall follow the procedure described in sub-clause 6 above.

## **2. WORKS ON EXISTING PAVEMENT AND SHOULDER**

### **2.1 Cutting out deflective surfacing**

1. When surfacing is cut out, for any reason, it shall be removed for the full depth of the layer.
2. The area to be cut out shall extend across the full width of the lane between the longitudinal joints.
3. The area of the lane to be cut out shall be defined by straight saw cuts, at least 40 mm deep or for the full thickness of the layer, whichever is the thinner, at right angles to the longitudinal joints.
4. The area shall be cut away carefully by pneumatic spade cutters or approved mechanical scabbing or planning machines. Where spade cutters are used, the cutting tool blades shall overlap the previous cut on each move and each cut shall penetrate the course its full thickness.
5. The surface of the exposed material below shall be thoroughly cleared of all loose fragments and cleaned.
6. Replacement shall not start until the Engineer has approved the condition and cleanliness of the exposed surface.

### **2.2 Replacement of deflective or old surfacing**

1. Where directed by the Engineer existing bituminous surfaces shall be cold planed by approved milling machines to depths shown on the drawings or directed by the



Engineer. The exposed surfaces shall be cleaned with mechanical brush sweeper and compressed air.

2. A tack coat in accordance with clause 10 shall be applied over the exposed surface, care being taken to include all corners, angles and irregularities by vigorous brooming.
3. The exposed vertical faces of the surfacing shall be painted with hot bitumen.
4. Replacement surfacing shall comply with the nominal course thickness shown on the drawings and tolerances and with the standards detailed in this specification.

### 2.3 Preparation of existing of bituminous surfacing

Before the tack coat is applied, all vegetable growth and loose aggregate or other particles shall be removed from all cracks in the existing bituminous surfacing on which new surfacing is to be laid. Loose laitance and other sapling or debonded slurry seal shall be removed from the surface. The surfaces shall be swept until standing water, mud, grit and all other extraneous matter has been removed. Immediately ahead of tack coating, all dust shall be removed by vacuum extraction cleaning, with or without high pressure water at the discretion of the Engineer.

### 2.4 Milling of bituminous surfaces

Where the surface level of an existing bituminous surface is being reduced by milling, thicknesses shall be removed with an approved planning machine. The machine shall be provided with control devices which enable the rapid adjustment of blades to fine depth-of-cut settings while the machine is operating.

## 3 GENERAL EXCAVATION AND EMBANKMENT

### 3.1 Scope of work

1. This work covers excavation, disposal, placement, and compaction of all materials or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the contract drawings and as specified herein.
2. The contractor shall, before starting the excavation, secure the Engineer's approval on the methods of excavation.

### 3.2 Classification of works

#### 3.2.1 Top soil excavation

Top soil excavation shall consist of the removal and disposal of deposits of mixture of soils and organic matter not suitable for foundation material or of any other material which will decay.

The Engineering will conduct together with the Contractor, surveys prior to embankment construction and prior to subgrade acceptance in order to locate all the areas where top soil excavation is deemed necessary.



The excavated top soil shall be dumped to earth store close to places submitted to the agreement of the Engineer.

### **3.2.2 Borrow excavation**

Borrow excavation shall consist of approved material required for the construction of embankment or for other portions of the work in the excess of the quantity of usable materials available from required excavation. Borrow material shall be always obtained within the Airport property; from the earthworks of the glide platform; or may be within the limits of the Airport at the location of the new taxiway or the new apron.

Borrow area(s) will be indicated by the Engineer, borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed.

### **3.2.3 Excavation of unsuitable material**

Any material containing vegetable or organic matter, such as muck, peat, organic slit, or sod shall be considered unsuitable for use in embankment construction. Material, when approved by the Engineer as suitable to support vegetation, may be used on the embankment slopes.

Excavation of unsuitable material shall also include the excavation of (the removal and the disposal of deposit) of the areas where the soil in place will produce subsidence in the embankment.

The Engineer will conduct, together with the contractor, surveys prior to embankment construction and prior to subgrade acceptance in order to locate all the areas where excavation of unsuitable material is deemed necessary.

### **3.2.4 Rock excavation**

Rock excavation shall consist of the excavation of boulders 1 cubic meter in volume or greater and all rock or other hard material which, in the opinion of the Engineer, it is not practical to excavate without the use of pneumatic tools or drilling and blasting. It shall not include a material which is in the opinion of the Engineer, can be loosened by a single type hydraulic ripper drawn by a tractor unit with a minimum weight of 15 tones and net horse power rating of 180H.P

### **3.2.5 Drainage excavation**

Drainage excavation shall consist of all excavation made for the primary purpose of drainage ditches, excavation to manholes, inspection and interception chambers, inlets or outlets, grading of the natural ground to re-establish the flow of water or any other type as shown on the plans.

The work shall be performed in the proper sequence with other construction. All satisfactory material shall be placed in fills; unsuitable material shall be placed in waste areas or as directed. All necessary work shall be performed to secure a finish to line, elevation, and cross section.

### **3.2.6 Common embankment**

Fill classified as common embankment shall consist of excavated earth or rock material, approved by the Engineer as suitable for embankment not used for supporting any aeronautical pavement.

Materials will also be selected preferentially to exclude the use of highly plastic clay soils, classified as A-7-6 by AASHTO specification M145, or CH on the unified cassagrande soil classification system. Where the use of highly plastic soils cannot reasonably be avoided, such material shall be used only in embankment not



required to possess good bearing or shear strength. Such highly plastic soil shall never be used in the 30cm of material directly beneath any common pavement or shoulder sub grade or in the 80cm of material beneath aeronautical pavement. In addition, the fill in these zones shall, when tested in accordance with AASHTO T193, have a CBR value of not less than 4% (four percent) after four days soaking when compacted to 95% of the maximum dry density as determined according to AASHTO T180.

### **3.2.7 Selected embankment**

Fill or sub base materials shall only be classified as “selected embankment” when used in locations or for purposes where selected embankment has been specified or otherwise approved in writing by the Engineer. All other fill used shall be regarded as common embankment

Fill classified as selected embankment shall consist of soil or rock material which meets all the above material requirements for common embankment and in addition shall possess certain other required properties, depending on its intended use, as directed or approved by the Engineer. In all cases, all selected embankment shall, when tested in accordance with AASHTO T193 have a CBR value of at least 15% (fifteen percent) after four days soaking when compacted to 95% of the maximum dry density as determined according to AASHTO T180.

### **3.3 Sequences of construction works**

#### **3.3.0 Preliminary works**

Before beginning excavation, grading, and embankment operations in any area, the area shall be completely cleared and grubbed.

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of in waste areas within the airport or transported outside as directed by the Engineer. All waste areas inside the airport perimeter shall be graded to allow positive drainage of the area and of adjacent area. The surface elevation of waste areas shall not extend above the surface elevation of adjacent usable areas of the airport, unless specified on the plans or approved by the Engineer.

Those areas outside of the pavement areas in which the top layer of soil material has become compacted, by hauling or other activities of the contractor, shall be scarified and disked to a depth of 100mm, in order to loosen and pulverize the soil.

#### **3.3.1 Mobilization idling machine**

##### **3.3.1.1. Scope**

The work does not consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

##### **3.3.1.2. Equipment and material**

Mobilization of idling machine; shall be referred to; in case the timeline shall not respect as per the approved work plan which will be mentioning the exactly execution of works in Hrs and the compensation of idling machine will only if the delay is caused by the client occupational.



### 3.3.2 Excavation

No excavation shall be started until the work has been staked out by the contractor and the Engineer has obtained elevations and measurements of the ground surface. All suitable excavated material shall be used in the formation of embankment, or sub grade, or for other purposes shown on the plans. When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed of as directed. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be obtained outside from the borrow areas.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the work.

#### 3.3.2 1 Removal of Top soil

The removal of topsoil shall be made to a depth of 0.20m below the ground surface, after the clearing and grubbing operations are completed. If any humus is found at depth at depths of below 0.20m from the ground surface, it shall also be removed as directed by the Engineer. During and after the removal operation, the ground surface exposed after the topsoil is removed shall be provided with proper drainage to avoid storm water remaining on the surface.

The material produced in the removal of topsoil shall be hauled to the disposal area, and graded evenly.

#### 3.3.2 2 Selective grading

When selected grading is indicated on the plans, the more suitable material, as designed by the Engineer, shall be used in the constructing of the embankment or in capping the pavement sub-grade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas so that it can be measured for double-handling as specified.

#### 3.3.2 3 Undercutting

Rock, shale, hardpan, loose rock, boulders, or other materials unsatisfactory for runway safety areas, subgrades, roads, shoulders or any areas intended for turning shall be excavated to a minimum depth of 300mm, or to the depth specified by the Engineer, below the subgrade. Muck, peak, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of at locations shown on the plan. This excavated material shall be paid for at the corresponding contract unit price per cubic meter.

The excavated area shall be refilled with suitable material, obtained from the grading operations or borrow areas and thoroughly compacted by rolling. The necessary refilling will constitute a part of the embankment.

#### 3.3.2 4 over break

Over break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer. The Engineer shall determine if the displacement of such material was unavoidable and his decision shall be final. All over breaks shall be graded or removed by the contractor and disposed of as the directed;



however, payment will not be made for the removal and disposal of over break which the Engineer determines as avoidable. Unavoidable over break will be classified as: "Common Excavation".

### 3.3.2 5 Subgrade preparation in cut

#### 3.3.2.5.1 General

Subgrade preparation in cut shall include sloping, compacting and testing of soil in place and maintenance of the surface prepared until the pavement materials are placed on it, all in accordance with the drawings and these specifications or as directed by the Engineer.

The finished grades after compaction shall be not more than one centimeter higher or lower than those specified or approved.

All finished surfaces shall be sufficiently smooth and uniform, and have sufficient grade to ensure the free run-off of surface water.

The contractor shall repair at his own expense any ruts or ridges occasioned by his own workmen or traffic or that of others by reshaping and compacting with rollers of the size and type necessary for such repair.

The contractor shall rectify, in the manner directed by the Engineer, any deterioration of the subgrade that may occur from drying out and cracking, or from flooding or other natural event.

#### 3.3.2.5.2 Compaction Requirements for sub grade under Aeronautical Pavement and Shoulders

The present specification refers to the Advisory Circular AC 150/5320-6 (Chapter 3, section 2 for Flexible Pavement, and section 3 for Rigid Pavement) issued by the department of the Transportation-Federal Aviation Administration-Washington D.C.

The compaction specified in the present Paragraph 3.3.2.5.2 refer to ASTM D 1557 (Modified Compaction).

#### Compaction requirements under flexible aeronautical pavement (in cohesive soil)

Depth under pavement	Required compaction
From 0 to 22cm	Min.95%
From 22cm to 41cm	Min.90%
From 41cm to 83cm	Min.85%

#### Compaction requirements under flexible aeronautical pavement (in cohesionless soil)-

Depth under pavement	Required compaction
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From 0 to 60cm	Min.100%
From 60cm to 100cm	Min.95%
From 100cm to 150cm	Min.90%
From 150cm to 190cm	Min. 85%

If deemed necessary, the Engineer will specify the appropriate moisture content. The moisture limitations shall be specified using acceptable moisture ranges as determined by ASTM D 1557.

Payment for suitable materials removed, manipulated and replaced in order to obtain the required depth of density will be paid for as common excavation.

In cut, the top 15cm shall be compacted at 90% of maximum density.

#### 3.3.2.5.3 Compaction Requirements for subgrade under other pavements and shoulders

Layers 30cm or less below subgrade level shall be compacted to 100% of the maximum

#### 3.3.2.6 In place Field Density Tests and Frequencies in Cut

The in place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167.

For subgrade under aeronautical pavement, one density test shall be performed for each 50m<sup>3</sup> of material per layer at locations as directed by the Engineer but which shall not be more than 100m apart.

#### 3.3.2.7 Rock and Blasting

Stones or rock fragments larger than 100mm in their greatest dimension will not be permitted in top 150mm of the subgrade. The finished grading operations, conforming to the typical cross section, shall be completed and maintained at least 300m ahead of the paving operations or as directed by the Engineer.

In cuts, all loose or protruding rocks on the back slopes shall be bared loose or otherwise removed to line of finished grade of slope. All –cut-and –fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the engineer.

Normal blasting will not be necessary to perform excavation as designed. In case blasting would be unavoidable, it will be permitted only when proper precautions are taken for the safety of all persons, the work, and property. All damage done to the work or property shall be repaired at the contractor's expense. All operations of the contractor in connection with the transportation, storage, and use of explosives shall conform to all state and local regulations and explosive manufacturer's instructions, with applicable approved permits reviewed by the engineer. Any approval given, however, will not relieve the contractor of his responsibility in blasting operations.

In each distinct blasting area, where pertinent factors affecting blast vibrations and their effects in the area remain the same, the contractor shall submit a blasting plan of the initial blasts to the engineer for approval. This plan must consist on hole, size, depth, spacing, burden, and type of explosive, type of delay sequence, maximum amount of explosive on any one delay of period, depth of rock, and depth of overburden if any. The maximum explosive charge weights



par delay period included in the plan shall not be increased without the approval of the engineering.

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### **3.3.3 PREPARATION OF EMBANKMENT AREA**

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Where an embankment is to be constructed , all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 150 mm . This area shall then be compacted as indicated in paragraph 3.3.6

Where the embankments are placed on natural slopes steeper than 3 to 1, horizontal benches shall be constructed as directed by the engineer.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

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### **3.3.4 EMBANKMENTS**

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Embankments shall be formed in successive horizontal layers of not more than 20 cm in loose depth for the full width of the cross section, unless otherwise approved by the engineer.

The grading operations shall be conducted, and the various soil strata be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as bush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Compaction areas shall be kept separate, and no layer shall be covered by another until the proper density is obtained.

Operations on earthwork shall be suspended at any time when satisfactory results can not be obtained because of rain, or other unsatisfactory conditions of the field. The contractor shall drag, blade, or slope the embankment to provide proper drainage.

The material in the layer shall be within 2% of optimum moisture content before rolling to obtain prescribed compaction. In order to achieve uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary. Should the material be too wet to permit proper compaction or rolling, all work on all of the affected portions of the embankment 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 sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each 750 m<sup>3</sup> per layer. Based on these tests the contractor shall make the necessary corrections and adjustments in methods, material or moisture content in order to achieve the correct embankment density.

#### **(VI) 3.3.4.1 COMPACTION REQUIREMENTS AND SUB GRADE PREPARATION IN FILL**

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##### **3.3.4.1.1 GENERAL**

Subgrade preparation in fill shall include slopping, compacting and testing of soil in place and the maintenance of the surface prepared until the pavement materials are placed on it, all in accordance with the drawings and these specifications or as directed by the engineer.



The finished grades after compaction shall be not more than one centimeter higher or lower than those specified or approved.

All finished surfaces shall be sufficiently smooth and uniform, and have sufficient grade to ensure the free run-off of surface water.

The contractor shall repair at his own expense any ruts or ridges occasioned by his own workmen or traffic or that of others by resolving and compacting with rollers of the size and type necessary for such repair.

The contractor shall rectify, in the manner directed by the engineer, any deterioration of the subgrade that may occurs from drying out and cracking, or from flooding or other natural event.

#### **(VII) 3.3.4.1.2 COMPACTION REQUIREMENTS OF EMBANKMENTS UNDER AERONAUTICAL PAVEMENT AND SHOULDERS**

The present specification refers to the advisory circular AC 150/5320-6 (Chapter 3,section 2) issued by the department of Transportation – Federal Aviation Administration – Washington D.C

The compactions specified in the present paragraph 3.3.4.1.2 refer to ASTM D 1557 (Modified compaction)

Compaction requirements under flexible aeronautical pavement are as follow:

The minimum density of soils placed in fill shall be 90%, and for the top 230 mm in fill shall not be less than 95% of the ASTM D 1557 compaction.

The soil in place below the fill shall meet the charted criteria of paragraph 3.3.2.5.2. before.

#### **3.3.4.1.3 COMPACTION REQUIREMENTS FOR OTHER EMBANKMENTS**

The embankment shall be constructed and compacted in layers not exceeding 30 cm in thickness. The embankment shall be compacted to 95% of the standard dry density determined according to AASHTO T99.

Layers less than 30 centimeters below subgrade level shall be compacted to 100% of the standard dry density determined according to AASHTO T99.

No compaction will be required on the top 10 centimeters of embankments constructed outside of the pavement and shoulders areas.

#### **3.3.4.2 IN -PLACE FIELD DENSITY TESTS FREQUENCIES FOR EMBANKMENT**

The in- place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. The in place field density test frequencies for embankment and embankment subgrade shall be as follow:

- For embankment under aeronautical pavement one density test shall be performed for each 50 cubic meters of materials placed per layer. The engineer may specify other frequencies as appropriate to the job size.
- For embankment and subgrade under pavement (other than aeronautical) the density test shall be made per layer at least for every 500 cubic meter at locations as directed by the engineer but which shall not be more than 100 m apart.



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### 3.3.5 CONSTRUCTION METHOD

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In the construction of embankments, layer placement shall begin in the deepest portion of the fill, as the placement progresses layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 100 mm in their greatest dimensions will not allowed in the top 150 mm of the subgrade. Rock fill shall be brought up in layers as specified or as directed and every effort shall be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankments areas, except at places and in the manner designated by the engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot placed in layers of prescribed thickness without crushing ,pulverizing or further breaking down the pieces ,such material may be placed in the embankment as directed in the layers not exceeding 60 cm in thickness. Each layer shall be leveled and smoothed with suitable leveling equipment by distribution of spalls and finer fragments or rock. These types of lifts shall not be constructed above an 120 cm below the finished subgrade. Density requirements will not apply to portions of embankment constructed of materials which cannot be tested in accordance with specified methods.

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### 3.3.6 SUBGRADE ACCEPTANCE

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When the CBR of the subgrade under aeronautical pavement or shoulders is less than 13, a sub base course shall be formed in successive horizontal layers in cut or fill and in sufficient deep to obtain a CBR value of 13.

Prior using laterite gravel, selected embankment shall be used as sub base materials as much as available.

In any case a minimum, CBR OF 13 is to be obtained on the subgrade under aeronautical pavement or shoulders before constructing the pavement structure.

For other areas, no sub base, or surface course shall be placed on subgrade until the subgrade has been approved by the engineer.

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### 3.3.7 HAUL

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All hauling shall be considered as necessary and incidental part of the work. Its cost shall be considered by the contractor and included in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

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### 3.3.8 TOLERANCES

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In those areas upon which a foundation, sub base or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 5 m straight edge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 15 mm, or shall not be more than 2 cm, from elevation established by the contract drawings. Any deviation in excess of these amounts shall be corrected by



loosening, adding, or removing materials, reshaping and recompacting by sprinkling and rolling.

For other surfaces the tolerances shall be as follow:

- Excavation and embankments + 5 cm

The frequency of verification of tolerance will be done on all points of the 25×25m grid and on specific points to be determined by the engineer.

### **3.4 METHOD OF MEASUREMENT**

The quantity of excavation to be paid for shall be the number of cubics meters measured in its original position. The quantity of embankments to be paid for shall be the number of cubic meters measured in its final position.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of materials used for purposes other than those directed. Borrow material shall be paid for on the basis of the number of cubic meters measured in its original position at the borrow pit.

For payment specified by the cubic meter, measurement for all excavation and embankment shall be computed and the average and area method. The end area is that bound by the original ground line established by field cross sections shown in the plans, subject to verification by the engineer. After completion of all excavation and embankment operations and prior to the placing of base or sub base material the final excavation and the final embankment shall be verified by engineer by means of field cross sections taken randomly at intervals not exceeding 150 linear meters.

Final field cross sections shall be employed if the following changes have been made

- Plan width of embankments or excavations are changed by more than plus or minus 0.3m
- Plan elevations of embankments or excavations are changed by more than plus or minus 0.15m

The quantity of subgrade preparation (including additional rolling) to be paid for shall be the number of square meters of pavement and shoulders according to the contract drawings.

### **3.5. QUANTITY AND WORK DONE STANDARDS**

3.5.1 Quantity standards concerning cutting materials for embankment or subgrade works

All excavated or borrow material to be used as embankment or subgrade material shall be tested as follows:

Work item	Test item	Test method	frequency	Soil classification	notes



Materials to be excavated in common cut and ditch excavation works for use in embankment or subgrade works	Grading Plasticity index of soil Moisture content of soil Moisture Density Relation of soil CBR	AASHTO T88 AASHTO T89/T90 ASTM D2216 AASHTO T99 ASTM D1557 AASHTO T193	At least once every 3000m <sup>3</sup> and  or each time when indicated by the engineer	Classified as SM,SP,SC, CL,CH according to the unified soil classification system or material approved by engineer	Analysis findings to be submitted to the engineer for his instructions
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### 3.5.2 QUANTITY STANDARDS FOR EMBANKMENT AND SUBGRADE

The quantity standards for embankment and subgrade shall be as follow:

- Embankment

Item	Required density	compaction		Density in place	
		Ref.	Frequ.	Ref.	Frequ.
Aeronautical	≥ 90%	ASTM D 1557 AASHTO T99	See(1) below	ASTM D 1556 or	One per 50 cubic meter per layer
Non aeronautical	≥ 95%			ASTM D 2167	One per 500 cubic meter per layer

Item	Required density	compaction		Density in place	
		Ref.	Frequ.	Ref.	Frequ.



Aeronautical flexible pay. In cut (cohesive soil)	0 to 23 cm ≥ 95% 23 to 42 cm ≥ 90% 41 to 61 cm ≥ 85% 61 to 81 cm ≥ 80%	ASTM  D 1557	(1) At least once per 10,000m <sup>3</sup> Or more when Deem necessary and as directed by the Engineer	ASTM D 1556 or ASTM D 2167	One per 50 cubic meter per layer
Aeronautical flexible pay. In fill (cohesive soil)	0 to 23 cm ≥ 95% fill ≥ 90%	ASTM D 1557	ditto	Ditto	Ditto
Non Aeronautical pavement areas in cut or fill	0 to 30 cm ≥ 100%	AASHTO T99	ditto	Ditto	Cubic meters per lays not more than 100 m apart

### 3.5.3 WORK DONE STANDARDS

The work shall be controlled as follows:

Work item	Test item	Test method	frequency	tolerance
Removal of top soil	Work area	By surveying as specified	Area as shown contract drawings	
	Thickness of top soil	ditto	All points of the 25×25 m grid	Remove the top soil entirely
Common excavation	Worked area	ditto	Area as shown on the contract drawings	
	Finish elevation (pavement)	ditto	All points of the 25×25 grid	+0cm - 2 cm
	Finish elevation (others)	ditto	ditto	+ 0 cm - 5 cm
Surface of ground and slope in cut	Finish elevation and grade at finishing stakes	ditto	Areas as shown on contract drawings	± 5 cm



Ditch excavation	Location width and length	ditto	All points of 25×25 m grid	± 5 cm
Slopes	Finish elevation of top and bottom of slope	ditto	ditto	± 5 cm
Embankment	Embankment area	ditto	Area as shown on the drawing	
	Finish embankment elevation (pavement)	ditto	All points of the 25×25 m grid	± 2 cm
	Finish embankment elevation (others)	ditto	All points of the 25×25 m grid	± 5 cm
Slope of embankment	Finish elevation and grade at finishing stakes	ditto	All points of 25×25 m grid	± 5 cm

#### 4 LATELITE GRAVEL

##### 4.1 SCOPE OF WORK

This item consist of a sub base or bas course composed of gravel and sand mixture with fine laterite module constructed on the prepared underlying subgrade course as defined in section 3 in accordance with these specifications and in conformity to the dimension and typical cross section shown on the plans.

##### 4.2 MATERIALS

##### 4.2.1 LATERITE GRAVEL

The laterite gravel materials shall be obtained from sources approved by Engineer prior to use of the materials.

##### 4.2.2 GRADING

The grading of the laterite material shall meet the requirements of the following grading when tested in accordance with ASTM C117 and 136.

Requirements for grading of laterite gravel

Sieve designation square openings	Percentage by weight passing sieves
Standard (mm)	
40	90-100
20	70-100



10	50-100
5	30-55
2	20-40
0,7	15-50
0,08	5-30

The gradings in the table represent the limits which shall determine suitability of materials for use from the sources of supply.

In case the grading of the materials shall not permit a optimum compaction, the Engineer could demand to the contractor a modification of the grading.

#### 4.2.3 ATTERBERG LIMIT

The portion of the laterite filler shall not exceed a percentage between 15% and 20%.

The laterite gravel shall have a plasticity index not more than 10%, Liquid limit not more than 25% and Organic Matter not more than 2% when tested in accordance with ASTM D 4318.

#### 4.2.4 CBR INDEX

The CBR (on sample compacted to 95% of the maximum dry density and obtained after 4 days of immersion) of the material shall be not less than 30%.

### 4.3 CONSTRUCTION METHODS

#### 4.3.1 GENERAL CONDITION

Work on the foundation course shall not be accomplished when the subgrade is wet. In case of storm rains during the spreading operation without finishing the compaction, the materials shall be, according to the agreement of the Engineer.

- Either kept in position standing for the drying out; the compaction shall be continued as soon as the materials will have a normal content,
- Or cleared at the contractor's own expense and replaced by new materials which will be placed in normal condition.

The Engineer shall demand the wetting of the foundation layer immediately before the placing of the base layer.

The contractor shall have a permanent water tank consequently and appropriated to the rate of the worksite.

#### 4.3.2 EQUIPMENT

The machines to be used for proper performance of this work shall be those having obtained Engineer's approval prior to commencement of the works.

#### 4.3.3 OPERATIONS IN PITS AND QUARRIES

All work involved in clearing and stripping pits and quarries, including handling of unsuitable material, shall be performed by the contractor. The pits shall be operated such a manner that a



clean and uniform material will be secured. The material shall be obtained from approved sources.

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#### 4.3.4 PREPARING UNDERLYING COURSE

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The underlying shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft, yielding places due to improper drainage condition, hauling, or any other cause, shall be corrected and rolled to the required density before the course is placed thereon. The underlying course shall be slightly scarified before the laterite gravel is placed thereon.

To protect the underlying course and to ensure proper drainage, the spreading of the material shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

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#### 4.3.5 PLACING

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The laterite gravel shall be placed on the prepared underlying course and compacted in layers of uniform thickness with a mechanical spreader as shown on the plans.

The maximum depth of a compacted layer shall be 150mm. If the total depth of the compacted material is more, then it shall be constructed in two or more layers.

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#### 4.3.6 COMPACTION

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Immediately upon completion of the spreading operations, the laterite gravel shall be thoroughly compacted. The number, type and rollers shall be sufficient to compact the material to the required density.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the material delivered to the jobsite. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM 2167.

The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content (Proctor test according to ASTM D 1557).

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the base course. When the rolling develops irregularities that exceed 3/8 inch (9mm) when tested with a 16-foot (4.8m) straightedge, 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 above.

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#### 4.3.7 FINISHING

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The surface of this course shall be finished by balding or with automated equipment especially designed for this purpose.

In no case will the addition of thin layers of materials be added to the top layer of base course to meet grade. If the elevation of the top layer is 1/2 inch (12mm) or more grades, the top layer of base shall be scarified to a depth of at least 3 inches (75mm), new material added, and the layer shall be blended and re- compacted to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and rerolled.



#### 4.3.8 SURFACE TEST

After the course has been completely compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified, reshaped, re compacted, and otherwise manipulated as Engineer may direct until the required smoothness and accuracy are obtained. The finished surface shall not vary more than 20mm from a 5.0m straightedge when applied to the surface parallel width and at right angles to, the centerline or shall not be more than 20mm from true elevation according to contract drawings.

#### 4.3.9 THICKNESS

The thickness of the base course shall be determined by depth tests or cores taken at intervals in such manner that each test shall represent no more than 300 square yards (250 square meters). Where the thickness is deficient by more than 20mm, the contractor shall correct such areas at no additional cost by excavating to the required depth and replacing with new material. Additional test holes may be required to identify the limits of deficient areas. The contractor shall replace, at his/ her expense, the base material where borings have been taken for test purposes.

#### 4.3.10 PROTECTION

Hauling equipment may be routed over completed portions of the foundation course, provided no damage results and provided such that equipment is routed over the full width of the foundation course to avoid rutting or uneven compaction. However, the Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed foundation course when, in his opinion, such hauling is causing damage. Any damage resulting to the foundation course from routing equipment over the foundation course shall be repaired by the contractor at his own expense.

#### 4.3.11 Maintenance

Following the completion of the foundation course, the contractor shall perform all maintenance work necessary to keep the foundation course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The foundation course shall be properly drained at all times. 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.

### 4.4 QUALITY AND WORK DONE STANDARDS

#### 4.4.1 QUALITY STANDARDS LATERITE GRAVEL COURSE

Quality standards laterite gravel course shall satisfy the following values:

Work item	Test method	frequency	Standard value	Notes
Grading	ASTM C 117 C 136	Once for every 500 m <sup>3</sup> as designed by the Engineer	According to grading requirements	



Moisture content	ASTM B2216	ditto	-	
Plasticity index	ASTM D 4318	ditto	15% to 20%	
CBR(modified)		ditto	More than 30%	
Percent compaction	ASTM D 1556 or 2167	1000 m <sup>2</sup> as designed by the engineer	Not less than 100% of max dry density determined by ASTM 1557 for specimen density	

#### 4.4.2 WORK DONE STANDARDS

The work shall be controlled as follows:

Test item	Test method	Frequency	Standard value	notes
Thickness	ASTM D 3665	Four tests for every lot (2000 or 4000 m <sup>2</sup> )	+ not specified - 2 cm	
Elevation	by surveying as specified in section 2	At point designated by the engineer	+ 1.5 cm - 1.5 cm	

## 5. ASPHALT TREATED BASE COURSE: BITUMINOUS GRAVEL

### 5.1 DESCRIPTION

This item shall consist of a asphalt treated base course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thickness and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

### 5.2 MATERIALS

#### 5.2.1 AGGREGATE

Aggregates shall consist of crushed stone or crushed gravel with or without sand or other inert finely divided mineral aggregate. The portion of materials retained on the no. 8 sieve is coarse aggregate. The portion passing No.8 (2.36 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No.200 (0.075 mm) sieve is mineral filler. Aggregate shall be provided from a carry in accordance with the agreement of the engineer.



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**(VIII) 5.2.1.1 COARSE AGGREGATE**

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Course 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. The percentage of wear shall not be greater than 25% for the asphalt treated base when tested in accordance with ASTM C 131. The sodium sulphate soundness loss shall not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.

Aggregate shall contain at least 70 percent by weight of individual pieces having two or more fractured faces and 85 percent by weight having at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsection area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by crushing.

The aggregate shall not contain more than 8 percent, by weight, of flat or elongated pieces, when tested in accordance with ASTM D 4791.

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**(IX) 5.2.1.2 FINE AGGREGATE**

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Fine aggregate shall consist of clean, sound, durable, angular shaped, particles produced by crushing stone or gravel that meet the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coating of clay, slit, or other objectionable matter and shall contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid limit not more than 25 when tested in accordance with ASTM D 4318.

Natural (no manufactured) sand may be used to obtain the grading of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification.

The aggregates shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D 2419.

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**(X) 5.2.1.3 SAMPLING**

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ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler.

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**5.2.2 MINERAL FILLER**

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If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

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**5.2.3 BITUMINOUS MATERIAL**

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Bituminous material shall conform to the following requirements:

Penetration grade: 60-70 as specified ASTM D 946.

The contractor shall furnish vendor's certified test reports for each lot of bituminous material shipped to the project. The vendor's certified test report for bituminous material can be used for acceptance or the material can be tested independently by the Engineer at contractor's expense.

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**5.2.4 PRELIMINARY MATERIAL ACCEPTANCE**

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Prior to delivery of materials to the job site, the contractor shall submit certified test reports to the Engineer for the following materials:

- Coarse aggregate
  - Percentage of wear
  - Soundness
- Fine aggregate
  - Liquid limit
  - Plastic index
  - Sand equivalent
- Mineral
- Bituminous material.

The certification(s) shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material meets the specification requirements.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

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### **5.3 COMPOSITION**

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#### **5.3.1 COMPOSITION OF MIXTURE**

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The bituminous plant mix shall be composed of a mixture of well- graded aggregate, filler and bituminous material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading equipments of the job Mix formula (JMF).

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#### **5.3.2 JOB MIX FORMULA**

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No bituminous mixture for pavements shall be produced until a job mix formula has been approved by the Engineer. The bituminous mixture shall be designed using procedures contained in chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No.2 (MS-2), Mix Design Methods for Asphalt Concrete, and shall meet the requirements of table 1.

The design criteria in table 1 are target values necessary to meet the acceptance requirements contained in paragraph 5.5.2.2. The criteria are based on a production process which has a material variability with the following standard deviations:

Stability (Newton) = 1200

Flow (mm) = 0.4

Air voids (%) = 0.65



If material variability exceeds the standard deviations indicated, the job mix formula and subsequent production targets should be based on stability greater than shown in Table 1, and the flow and air voids should be targeted close to the mid-range of the criteria in order meet the acceptance requirements.

If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867, is less than 75, the aggregate shall be rejected or the asphalt treated with an approved anti-stripping agent. The amount of anti-stripping agent added to the asphalt shall be sufficient to produce a TSR of not less than 75. If an anti strip agent is required, it will be provided by the contractor at no additional cost.

The job mix formula shall be submitted in writing by the contractor to the Engineer at least 30 days prior to the start of paving operations and shall include as minimum:

- Percent passing each sieve size.
- Percent of asphalt cement.
- Asphalt viscosity or penetration grade.
- Number of blows of hammer compaction per side of molded specimen.
- Mixing temperature.
- Compaction temperature.
- Temperature of mix when discharged from the mixer.
- Temperature –viscosity relationship of the asphalt cement.
- Plot of the combined grading.
- Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight verses asphalt content.
- Percent natural sand.
- Percent fractured faces.
- Percent elongated particles.
- Tensile Strength Ratio.
- Anti strip agent (if required).

The contractor shall submit samples to the Engineer, upon request, for job mix formula verification testing.

The job mix formula for each mixture shall be in effect until modified in writing by the Engineer should a change in sources of materials be made, a new job mix formula must be approved by the Engineer before the new material is used.



**TABLE1. MARSHALL DESIGN CRITERIA**

Test property	0/20
Number of blows	75
Stability, (Newton) minimum	9500
Flow(mm)	2.5-3.6
Air voids (percent)	3-5
Percent voids in mineral aggregate,(minimum)	15

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the grading or grading specified in table 2 when tested in accordance with ASTM standard C 136 and C 117.

The grading in table 2 represents the limits which shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in JMF), shall have a grading within the limits designated in table 2 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Deviations from the final approved mix design for bitumen content and grading of aggregates shall be within the action limits for individual measurements as specified in paragraph 5.6.5.1. The limits still will apply if they fall outside the master grading band in Table 2.

**TABLE2. AGGREGATE- BITUMINOUS PAVEMENTS**

Sieve	Percentage by weight passing sieves
	0/20
1 <sup>1/4</sup> in. (31.25mm)	-
1 in. (25.0mm)	-
¾ in. (19.0mm)	100



½ in. (12.5mm)	79-99
3/8 in. (9.5mm)	68-88
No.4 (4.75mm)	48-68
No.8 (2.36mm)	33-53
No.16 (1.18mm)	20-40
No.30 (0.60mm)	14-30
No.50 (0.30mm)	9-21
No.100 (0.15mm)	6-16
No.200 (0.075mm)	3-6
Asphalt percent	5,0-6.5

The aggregate gradings shown as based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the asphalt Institute Manual Series No.2 (MS-2), appendix A.

### 5.3.3 TEST SECTION

Prior to full production, the contractor shall prepare and place a quantity of bituminous mixture according to the job mix formula. The amount of mixture should be sufficient to construct a test section the surface of which is 800 squares meter at least, in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be in the same as the remainder of the course represented by test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

Three random samples shall be taken at the plant and test for stability, flow and air voids in accordance with paragraph 5.5.1.1.2. Two random samples of mixture shall be taken at the plant and tested for aggregate grading and asphalt content in accordance with paragraphs 5.6.3.1 and 3.2 and evaluated in accordance with paragraphs 5.6.5.1 and 5.2. Three randomly selected cores shall be taken from the finished pavement mat, and three from the longitudinal joint, and tested in accordance with paragraph 5.5.1.2.4. Random sampling shall be in accordance with procedures contained in ASTM D 3665.

Mat density and air voids shall be evaluated in accordance with paragraph 5.5.2.6.1. Stability and flow shall be evaluated in accordance with paragraph 5.5.6.2. Joint density shall be evaluated in accordance with paragraph 5.5.2.6.3.



Voids in the mineral aggregate (VMA), for each plant sample, shall be computed in accordance with procedures contained in chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No 2.(MS-2), Mix Design Methods for Asphalt Concrete.

The test section shall be considered acceptable if:

- Stability, flow, mat density, air voids, and joint density are 90 percent or more within limits.
- Grading and asphalt content are within the action limits specified in paragraphs 5.6.5.1 and 5.2 and 3.
- The void in the mineral aggregate is within the limits of Table 1.

If the initial test section should prove to be unacceptable, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the contractor's expense. Full production shall not begin until acceptable section has been constructed and accepted by the Engineer.

Job mix control testing shall be performed by the contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. It should be recognized that the aggregates produced by the plant may not satisfy the grading requirements or produce a mix that exactly meets the JMF. In those instances, it will be necessary to re- evaluate and redesign the mix using plant- produced aggregates. Specimens should be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

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### **5.3.4 TESTING LABORATORY**

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A certification signed by the manager of the laboratory shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:

- Qualifications of personnel; laboratory manager, supervisor technician, and testing technicians.
- A listing of equipment to be used in developing the job mix.
- Nevertheless, the engineer may request the test of any material or sampling on any completed work for Quality assurance.

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## **5.4 CONSTRUCTION METHODS**

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### **5.4.1 WEATHER LIMITATIONS**

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The bituminous mixture shall not be placed upon a wet surface.

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### **5.4.2 BITUMINOUS MIXING PLANT**

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Plant used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following challenges:

**(XI) 5.4.2.1 REQUIREMENTS FOR ALL PLANT**

**5.4.2.1.1 TRUCK SCALES**

The bituminous mixture shall be weighed on approved scales furnished by the contractor. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy.

**5.4.2.1.2 TESTING FACILITIES**

The contractor shall provide laboratory facilities at the plant for the use of the Engineer's acceptance testing and the contractor's quality control testing, in accordance with paragraph 5.6.2.4.

**5.4.2.1.3 INSPECTION OF PLANT**

The engineer or engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment, inspection operation of the plant, verifying weights, proportions, and material properties, and checking the temperatures maintained in the preparation of the mixtures.

**5.4.2.1.4 STORAGE BINS AND SURGE BINS**

Paragraph 3.9. of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

- The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours.
- The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

**5.4.2.1.5 RADIO CONNECTION**

The plant shall be radio connected to the bituminous pavers.

**5.4.3 HAULING EQUIPMENT**

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. Each truck shall have a suitable cover to protect the mixture from adverse weather. When



necessary, to ensure that the mixture will be delivered to the site at specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

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#### 5.4.4 BITUMINOUS PAVERS

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Bituminous pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The pavers used for airside road construction shall be equipped with an automatic grade control device. The paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/ or through a system of mechanical sensors or sensor- directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

The controls shall be capable of working in conjunction with any of the following attachments:

- Ski-type device of not less than 30 feet (9.14m) in length.
- Taut string line (wire) set to grade.
- Short ski or shoe.
- Laser control.

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#### 5.4.5 ROLLERS

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Rollers of the steel wheel, and pneumatic-typed shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The use of equipment which causes excessive crushing of the aggregate will not be permitted. The rollers shall have self-propelled liquid to avoid material sticking on the tires, nevertheless no kerosene shall be used to remove asphalt on tires.

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#### 5.4.6 PREPARATION OF BITUMINOUS MATERIALS

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The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at uniform temperature.



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 160°C.

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#### **5.4.7 PREPARATION OF MINERAL AGGREGATE**

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The aggregate mixture shall be heated and dried prior to introduction into the mixer. The maximum temperature and the rate of heating shall be such that no damage occurs to the aggregates. The temperature of aggregate and mineral filler shall not exceed 170°C when the asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

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#### **5.4.8 PREPARATION OF BITUMINOUS MIXTURE**

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The aggregates and bituminous material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by driving the weight of its content at operating level by weight of the mixture delivered per second by the mixer. The moisture content of all bituminous mix upon discharge shall not exceed 0.5%.

For all plants, wet mixing time begins with the introduction of bituminous material into the mixer and ends with the opening of the mixer discharge gate.

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#### **5.4.9 PREPARATION OF THE UNDERLYING SURFACE**

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Immediately before placing the bituminous mixture, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied as required by the contractor specifications.

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#### **5.4.10 TRANSPORTING, PLACING, AND FINISHING**

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The bituminous mixture shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 9.4.3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements as stipulated in general requirements. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The contract may elect to use a material transfer vehicle to deliver mix to the paver.

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 135°C.

Upon arrival, the mixture shall be placed by a bituminous paver. It shall be struck off in uniform layer of such depth that, when the work is completed, it shall have the required thickness and



conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless other permitted, placement of the mixture shall begin on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips except where edge lanes require less width to complete the area. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 30cm; however, the joint in the surface top course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3m from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 3m.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and lusted by hand tools.

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#### 5.4.11 COMPACTION OF MIXTURE

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After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the contractor.

The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing or of the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained.

In areas not accessible to roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the contractor's expense. Skin patching shall not be allowed.

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#### 5.4.12 JOINTS

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The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the courses and meet the requirements of smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent line. In both methods all contact surfaces shall be given a tack coat of bituminous material before any fresh mixture against the joint.

All longitudinal joints that fall below the cessation temperature (below 80°C) shall be treated as cold joints and a cutback of minimum 25mm shall be required before placing the hot lane.

Longitudinal joints shall be as straight as possible; however, joints which are irregular, damaged, uncompacted, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.



## **5.5 MATERIAL ACCEPTANCE**

### **5.5.1 ACCEPTANCE SAMPLING AND TESTING**

All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section shall be performed by the contractor at his own expense and under supervision of the Engineer or of his authorized representative. All equipment in contractor-furnished laboratories shall be calibrated prior to the start of operations.

#### **(XII) 5.5.1.1 PLANT –PRODUCED MATERIAL**

Plant –produced material shall be tested for stability, flow, and air voids on a lot basis. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. A lot will consist of:

- One day's production not to exceed 2,000 tones.
- A half day's production where a day's production is expected to consist of between 2,000 and 4,000 tones, or
- Similar subdivisions for tonnages over 4,000 tones.

Where more than one plant is simultaneously producing material for the job, the hot sizes shall apply separately for each plant.

##### **5.5.1.1.1 SAMPLING**

Each of lot will consist of four equal sub lots. Sufficient material for preparation of test specimens will be sampled under the Engineer supervision on a random basis, in accordance with the procedures contained in ASTM D 3665. One set of laboratory compacted specimens will be prepared for each sub lot in accordance with ASTM D1559, paragraph at the number of blows required by paragraph 5.3.2 Table 1.

Each set of laboratory compacted specimens will consist of three test portions prepared from the same sample increment.

The sample of bituminous mixture may be put in covered metal tin and placed in an oven for not more than 30 minutes to maintain the heat. The compaction temperature of the specimens should be as specified in the job mix formula.

##### **5.5.1.1.2 TESTING**

Sample specimens shall be tested for stability and flow in accordance with ASTM D 1559, paragraph 5. Air voids will be determined in accordance with ASTM D 3203. Prior to testing, the bulk specific gravity of each test specimen shall be measured in accordance with ASTM D2726 or D 1188, whichever is applicable, for use in computing air voids and pavement density.

For air voids determination, the theoretical maximum specific gravity of the mixture shall be measured twice for each lot in accordance with ASTM D 2041, Type C or D container. Samples shall be taken on a random basis in accordance with ASTM D 3665. The value used in the voids computation for each sub lot shall be the average of the two maximum specific gravity measurements for the lot.



The stability, flow, and air voids for each sub lot shall be computed by averaging the results of the three test specimen's representing that sub lot.

#### ***5.5.1.1.3 ACCEPTANCE***

Acceptance of plant produced material for stability, flow, and air voids shall be determined by the Engineer in accordance with the requirements of paragraph 5.5.2.2.

### ***(XIII) 5.5.1.2. FIELD PLACED MATERIAL***

Material placed in the field shall be tested for mat and joint density on a lot basis.

#### ***5.5.1.2.1 MAT DENSITY***

The lot size shall be the same as that indicated in paragraph 5.5.1.1 and shall be divided into four equal sub lots. One core of finished, compacted materials shall be taken by the contractor from each sub lot. Core location will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Cores shall not be taken closer than one foot from a transverse or longitudinal joint.

#### ***5.5.1.2.2 JOINT DENSITY***

The lot size shall be the total length of longitudinal joint constructed by a lot of material as defined in paragraph 5.5.1.1. The lot shall be divided into four equal sub lots. One core of finished, compacted materials shall be taken by the contractor from each sub lot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665.

#### ***5.5.1.2.3 SAMPLING***

Samples shall be neatly cut with a core drill. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be 75mm. samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken .the contractor shall furnish all tools, labor, and material for cutting samples and filling the cored pavement. Cored holes shall be filled in a manner acceptable to the Engineer and within one day after sampling.

#### ***5.5.1.2.4 TESTING***

The bulk specific gravity of each cored sample will be measured in accordance with ASTM D 2726 or D 1188, whichever is applicable. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sub lot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in paragraph 5.5.1.1.2.

#### ***5.5.1.2.5 ACCEPTANCE***

Acceptance of field placed material for mat density will be determined by the Engineer in accordance with the requirements of paragraph 5.5.2.3. Acceptance for joint density will be determined in accordance with the requirements of paragraph 5.5.2.4.

### 5.5.1.3 Partial lots-Plant-Produced Material

When operational conditions cause a lot to be terminated before the specified numbers of tests have been made for the lot, the following procedure will be used to adjust the lot size and the number of tests for the lot.

The last batch produced where production is expectedly halted will be sampled and its properties shall be considered as representative of the particular sub lot from which it has taken. Where three sub lots are produced, they shall constitute a lot. Where one or two sub lots are produced, they shall be incorporated into the next lot and the total number of sub lots shall be used in the acceptance plan calculation, i.e.,  $n=5$  or  $n=6$  for example.

### 5.5.1.4 Partial lots-Field Placed Material

The lot size for field placed material shall correspond to that of plant material, except that in no cases less than(3) cored samples shall be obtained, i.e.,  $n=3$ .

## 5.5.2 Acceptance Criteria

### 5.5.2.1 General

Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement as well as the implementation of the contractor's quality control plan and tests results:

- Stability
- Flow
- Air voids
- Mat density
- Joint density
- Thickness
- Smoothness
- Grade

Stability, flow and air voids will be evaluated for acceptance in accordance with the paragraph 5.5.2.2.mat density will be evaluated for acceptance in accordance with paragraph 5.5.2.3.joint density will be evaluated for acceptance in accordance with paragraph 5.5.2.4.

Acceptance for mat density and air voids will be based on the criteria contained in paragraph 5.5.2.6.1.acceptance for stability and flow will be based on the criteria contained in paragraph 5.5.2.6.2.acceptance for joint density will be based on the criteria contained on paragraph 5.5.2.6.3.thickness will be evaluated by the engineer for compliance in accordance with paragraph 5.5.2.6.4.acceptance for smoothness will be based on the criteria contained in paragraph 5.5.2.6.5.acceptance for grade will be based on the criteria contained in paragraph 5.5.2.6.6.

The engineer may at any time, notwithstanding previous plant acceptance, reject and require the contractor to dispose of any batch of bituminous mixture which is rendered unfit for use due to contamination, segregation, incomplete coating for aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. Any segregated portion of the placed mat shall be measured and pay cut be applied during payment adjustments.



### 5.5.2.2 Stability, Flow, Air voids

Acceptance of each lot plant produced material for stability, flow, and air voids shall be based on the percentage of material within specification limits (PWL). The PWL plan considers the variability (standard deviation) of the material and the testing procedures, as well as the average (mean) value of the test results. If a material with high variability is produced, the production target must be adjusted as outlined in paragraph 5.3.2 to achieve a PWL of 90 or more.

### 5.5.2.3 Mat Density

Acceptance of each lot of in-place pavement for mat density shall be based on the percentage of material within specification limits (PWL). If material with high variability is produced, then a higher target density must be maintained in order to achieve a PWL of 90 or more.

### 5.5.2.4 Joint Density

Acceptance of each lot of in-place pavement for joint density shall be based on the percentage of material within specification limits (PWL) if a material with high variability is produced, then a higher target density must be maintained in order to achieve a PWL of 90 or more.

### 5.5.2.5 Percentage of material within specification limits (PWL)

The percentage of material within specification limits (PWL) shall be determined in accordance with procedures specified in annex 1 section 10.

The specification tolerance limits (L) and (U) are contained in table 3.

### 5.5.2.6 Acceptance Criteria

#### 5.5.2.6.1 Mat density and Air voids

If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, payment shall be made in accordance with paragraph 5.8.1.1.

#### 5.5.2.6.2 Stability and Flow

If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, the contractor shall determine the reason and take corrective action. If the (PWL) is below 80 percent, the contractor must stop production and make adjustment to the mix.

#### 5.5.2.6.3 Joint density

If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, the contractor shall evaluate the method of compacting joints. If the (PWL) is below 80 percent, the contractor shall stop production until the reason for poor compaction can be determined.

#### 5.5.2.6.4 Thickness

Thickness shall be evaluated for compliance by the engineer to the requirements shown on the plans. Measurements of thickness shall be made by the engineer using the cores extracted for each sub lot for density measurement.

#### 5.5.2.6.5 Smoothness

The finished surface of the pavement shall not vary more than 10 mm for the base course. Each lot shall be evaluated with a 3.6 m straightedge. The lot size shall be 1600 square meters. Measurements will be made perpendicular and parallel to the centerline at distances not exceed 15 m. when more than 15 percent of all measurements within a lot exceed the specified tolerance, the contractor shall remove the deficient area and replace with new material.



Sufficient material shall be removed to allow at least one inch of asphalt concrete to be placed. Skin patching shall not be permitted. High points may be ground off.

#### 5.5.2.6.6 Grade

The finished surface of the pavement shall not vary from the grade line elevations and cross sections shown on the plans by more than 15 mm. The finished grade of each lot will be determined by running levels at intervals of 15 m or less longitudinally and transversely to determine the elevation of the completed pavement. The lot size shall be 1600 square metres. When more than 15 percent of all the measurements within a lot are outside the specified tolerance, the contractor shall remove the deficient area and replace with new material. Sufficient material shall be removed to allow at least one inch of asphalt concrete to be placed. Skin patching for correcting low areas shall not be permitted. High points may be ground off.

**TABLE 3 ACCEPTANCE LIMITS STABILITY, FLOW, AIR VOIDS, AND DENSITY (75 BLOWS)**

	Specification tolerance	
	0/20	
	L	U
Stability, minimum, (Newtons)	8.100	-
Flow, mm	2	4
Air voids total mix (percent)	2.0	5.0
Density, (percent)	96.3	-
Joint density (percent)	93.3	-

### 5.5.3 Resampling Pavement

#### 5.5.3.1 General

Resampling of a lot pavement for mat density will be allowed if the contractor request in writing, within 48 hours after receiving the written test results from the engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 5.5.1.1 and 5.5.2.3. Only one resampling per lot will be permitted.

- A redefined PWL shall be calculated for the resampled lot. The number of tests used to calculate the redefined PWL shall include the initial tests made for that lot plus the retests.
- The cost for resampling and retesting shall be borne by the contractor.

#### 5.5.3.2 Payment for resampled lots

The redefined PWL for a resampled lot shall be used to calculate the payment for that lot in accordance with Table 4.

#### 5.5.3.3 Outliers

If the tests within a lot include a very large or a very small value which appears to be outside the normal limits of variation, check for an outlier in accordance with ASTM E 178, at a significance level of 5 percent, to determine if this value should be discarded when computing the PWL.



#### 5.5.4 Leveling Course

Any course used for truing and leveling shall meet the requirements of paragraph 5.3.2 and 5.2.2, but shall not be subject to the density requirements of paragraph 5.5.2.3 and 4. The leveling course shall be compacted with the same effort used to achieve density of the test section. The truing and leveling course shall not exceed a nominal thickness of 37.5 mm.

### 5.6 Contractor quality control

#### 5.6.1 General

The contractor quality control shall address all elements which affect the quality of the pavement including, but not limited to:

- Mix design
- Aggregate grading
- Quality of materials
- Stockpile management
- Proportioning
- Mixing and transportation
- Placing and finishing
- Joints
- Compaction
- Surface smoothness

#### 5.6.2 Testing Laboratory

The field laboratory shall be equipped with all the necessary apparatus for carrying out all the tests related to asphalt treated base. It shall be available for joint use by the contractor for quality control testing and by the engineer for acceptance testing and must have adequate equipment for the performance of the tests required by these specifications. The engineer shall have priority in use of the equipment necessary for acceptance testing.

Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The engineer shall be permitted unrestricted access to inspect the contractor's laboratory facility and witness quality control activities. The engineer will advise the contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

#### 5.6.3 Quality Control Testing

The contractor shall perform all quality control test necessary to control the production and construction processes applicable to these specifications. The testing program shall include, but not necessarily limited to, tests for the control of asphalt content, aggregate grading, temperatures, aggregate moisture, field compaction, and surface smoothness.



**5.6.3.1 Asphalt content**

A minimum of two extraction tests shall be performed per lot in accordance with ASTM D 2172 for determination of asphalt content. The weight of ash portion of the extraction test, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content of the mixture.

The use of the nuclear method for determining asphalt content in accordance with ASTM D 4125 is permitted, provided that it is calibrated for the specific mix being used.

**5.6.3.2 Grading**

Aggregate grading shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with AASHTO T 30 and ASTM C 136 (dry sieve). When asphalt content is determined by the nuclear method, aggregate grading shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weight to the combined aggregate grading of the mixture.

**5.6.3.3 Moisture content of aggregate**

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

**5.6.3.4 Moisture content of mixture**

The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461.

**5.6.3.5 Temperatures**

Temperatures shall be checked; at least four time per lot, at necessary locations to determine the Temperatures of the dryer, the bitumen in the storage tank the mixture at the plant, and the mixture at the job site.

**5.6.3.6 In-place density monitoring**

The contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950.

**5.6.3.7 Additional testing**

Any additional testing that the contractor deems necessary to control the process may be performed at the contractor's option.

**5.6.3.8 Monitoring**

The engineer reserves the right to monitor any or all of the above testing.

**5.6.4 Sampling**

When directed by the engineer, the contractor shall sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed



and replaced or deficiencies corrected by the contractor. All sampling shall be in accordance with standard procedures specified.

### 5.6.5 Control Charts

The contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate grading and asphalt content.

Control charts shall be posted in a location satisfactory to the engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the action and suspension limits applicable to each test parameter, and the contractor's test results. The contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the contractor's projected data during production indicates a problem and the contractor is not taking satisfactory corrective action, the engineer may suspend production or acceptance of the material.

#### 5.6.5.1 Individual measurements

Control charts for individual measurements shall be established to maintain the process control within tolerance for aggregate grading and asphalt content. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated action and suspension limits:

#### CONTROL CHARTS LIMITS FOR INDIVIDUAL MEASUREMENTS

(0/20)

Sieve	Action limit	Suspension limit
3/4 inch(19.0 mm)	±0%	±0%
1/2 inch(12.5 mm)	±6%	±9%
3/8 inch (9.5 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No.50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt content	±0.45%	±0.70%

#### 5.6.5.2 Range

Control charts for range shall be established to control process variability for the test parameters and suspension limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameters. The suspension limits specified below are based on a sample size of n=2. Should the contractor elect to perform more than two tests per lot, the suspension limits shall be adjusted by multiplying the suspension limit by 1.18 for n=3 and by 1.27 for n=4.

#### CONTROL CHARTS LIMITS BASED ON RANGE (0/20)

(Based on n=2)

Sieve	Suspension limit
1/2 inch (12.5 mm)	11%
3/8 inch (9.5 mm)	11%



No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No.50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt content	0.8%

### 5.6.5.3 Corrective action

The quality control plan shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The plan shall contain sets of rules to when a process is out of control and detail what action will be taken to bring the process into control and production stopped and corrective action taken, if:

- One points falls outside the suspension limit line for individual measurements or range; or
- Two points in a row fall outside the action limit line for individual measurements.

The aggregate control chart parameters and suspension and action limits contained in the above paragraphs are based on 19.0 mm maximum size aggregate grading. When 31.5 mm maximum size aggregate is specified, the individual measurements chart requirements should be amended as follows:

Sieve	Action limit	Suspension limit
1 or 1 ¼ inch	0%	0%
¾ inch	6%	11%

### 5.7 Testing requirements

ASTM C 29	Unit Weight of aggregate.
ASTM C 88	Soundness of aggregates by use of sodium sulphate or Magnesium sulphate.
ASTM C 117	Test Method for Materials finer than 75-um (No.200) sieve in Mineral aggregates by washing.
ASTM C 131	Resistance to abrasion of small size coarse aggregates by use of the Los Angeles machine.
ASTM C 136	Sieve or screen analysis of fine and coarse aggregates.
ASTM C 183	Sampling hydraulic cement.
ASTM C 566	Total moisture content of aggregates by drying.
ASTM D 75	Sampling aggregates.
ASTM D 995	Requirements for mixing plant for hot-mixed hot-laid bituminous paving mixtures.
ASTM D 118	Bulk specific gravity of compacted bituminous mixtures using paraffin-coated specimens.
ASTM D 1461	Moisture or volatile distillates in bituminous paving mixtures.
ASTM D 1559	Resistance to plastic flow of bituminous mixtures using Marshall apparatus.



ASTM D 2041	Theoretical maximum specific gravity and density 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 2489	Degree of particle coating of bituminous – aggregate mixtures.
ASTM D 2726	Bulk specific gravity of compacted bituminous mixtures using saturated surface- dry specimens.
ASTM D 3203	Percent air voids in compacted dense and open bituminous paving mixtures.
ASTM D 2950	Density of bituminous concrete in place by nuclear method.
ASTM D 3665	Random sampling of paving materials.
ASTM D 3666	Inspection and testing agencies of bituminous paving material
ASTM D 4125	Asphalt content of bituminous mixtures by the nuclear method.
ASTM D 4318	Liquid limit, plastic limit, and plasticity index of soils.
ASTM D 4791	Flat or elongated particles in coarse aggregate.
ASTM D 4867	Effect of moisture on asphalt concrete paving mixtures.
ASTM E 178	Practice for dealing with outlying observations.
AASHTO T 30	Mechanical analysis of extracted aggregate.
The asphalt Institute's Manual No. 2 (MS-2)	Mix design methods for asphalt concrete.
The asphalt Institute's Manual No. 20 (MS-20)	Hot- mix recycling.

### 5.8 Material requirements

ASTM D 242	Mineral filler for bituminous paving mixtures.
ASTM D 946	Asphalt cement for use in pavement construction.
ASTM D 3381	Viscosity –Graded asphalt cement for use in pavement construction.
ASTM D 4552	Classifying Hot-Mix Recycling Agents.

## 6 ASPHALT CONCRETE SURFACE COURSES: BITUMINOUS CONCRETE

### 6.1 DESCRIPTION

This item shall consist of a surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with



these specifications and shall conform to lines, grades, thickness, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

## **6.2 Materials**

### **6.2.1 Aggregate**

Aggregates shall be consisting of crushed stone or crushed gravel with or without sand or other inert finely divided mineral aggregate. The portion of materials retained on the No. 8 sieve is coarse aggregate. The portion passing the No.8 (2.36mm) sieve and retained on the No.200 (0.075mm) sieve is mineral filler.

#### **6.2.1.1 Coarse Aggregate**

Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of mater that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 25 percent when tested in accordance with AASTM C131. The sodium suphate soundness loss shall not exceed 10 percent, or the magnesium sulphate soundness loss shall not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.

Aggregate shall contain at least 70 percent by weight of individual pieces having two or more fractured faces and 85 percent by weight having at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest mid-sectional area of piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by crushing.

The aggregate shall not contain more than 8 percent, by weight, of flat or elongated pieces, when tested in accordance with ASTM D 4791.

#### **6.2.1.2 Fine aggregate**

Fine aggregate shall consist of clean, sound, durable, angular shaped particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clays, silt, or other objectionable matter and shall contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid of not more than 25 when tested in accordance with ASTM D 4318.

Natural (non-manufactured) sand may be used to obtain the grading of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 20 percent natural sand by weight of total aggregates.

The aggregates shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D 2419.

#### **6.2.1.3 Sampling**

ASTM D 75 shall be used in sampling coarse and fine aggregate, AND ASTM C 183 shall be used in sampling mineral filler.

### **6.2.2 Mineral Filler**



If, filler in addition to the naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D242.

### 6.2.3 Bituminous Material

Bituminous material shall conform to the following requirements:

Penetration grade: 60-70 as specified ASTM D 946.

The contractor shall furnish vendor's certified test reports for each lot of bituminous material shipped to the project. The vendor's certified test report for the bituminous material can be used for acceptance of the material can be tested independently by the Engineer at contractor's expense.

### 6.2.4 Preliminary Material Acceptance

Prior to delivery of materials to the job site, the contractor shall submit certified test reports to the Engineer for the following materials:

- Coarse aggregate
  - Percent of wear
  - Soundness
- Fine aggregate
  - Liquid limit
  - Plastic index
  - Sand equivalent
- Mineral filler
- Bituminous material

The certification(s) shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material meets the specification requirements.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

## 6.3 Composition

### 6.3.1 Composition of mixture

The bituminous plant mix shall be composed of a mixture of well- graded aggregate, filler and bituminous material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading equipment of the job Mix formula (JMF).

### 6.3.2 Job Mix Formula

No bituminous mixture for pavements shall be produced until a job mix formula has been approved by the Engineer. The bituminous mixture shall be designed using procedures contained in chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No.2 (MS-2), Mix Design Methods for Asphalt Concrete, and shall meet the requirements of table 1.

The design criteria in table 1 are target values necessary to meet the acceptance requirements contained in paragraph 5.5.2.2. The criteria are based on a production process which has a material variability with the following standard deviations:

Stability (Newton) = 1200



Flow (mm) = 0.4

Air voids (%) = 0.65

If material variability exceeds the standard deviations indicated, the job mix formula and subsequent production targets should be based on stability greater than shown in Table 1, and the flow and air voids should be targeted close to the mid-range of the criteria in order meet the acceptance requirements.

If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867, is less than 75, the aggregate shall be rejected or the asphalt treated with an approved ant-stripping agent. The amount of ant-stripping agent added to the asphalt shall be sufficient to produce a TSR of not less than 75. If an anti strip agent is required, it will be provided by the contractor at no additional cost.

The job mix formula shall be submitted in writing by the contractor to the Engineer at least 30 days prior to the start of paving operations and shall include as minimum:

- Percent passing each sieve size.
- Percent of asphalt cement.
- Asphalt viscosity or penetration grade.
- Number of blows of hammer compaction per side of molded specimen.
- Mixing temperature.
- Compaction temperature.
- Temperature of mix when discharged from the mixer.
- Temperature –viscosity relationship of the asphalt cement.
- Plot of the combined grading.
- Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight verses asphalt content.
- Percent natural sand.
- Percent fractured faces.
- Percent elongated particles.
- Tensile Strength Ratio.
- Anti strip agent (if required).

The contractor shall submit samples to the Engineer, upon request, for job mix formula verification testing.



The job mix formula for each mixture shall be in effect until modified in writing by the Engineer should a change in sources of materials be made, a new job mix formula must be approved by the Engineer before the new material is used.

**TABLE1. MARSHALL DESIGN CRITERIA**

Test property	
Number of blows	75
Stability, (Newton) minimum	11.000
Flow(mm)	2.5-3.6
Air voids (percent)	3-5
Percent voids in mineral aggregate,(minimum)	16

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the grading or grading specified in table 2 when tested in accordance with ASTM standard C 136 and C 117.

The grading in table 2 represents the limits which shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in JMF), shall have a grading within the limits designated in table 2 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Deviations from the final approved mix design for bitumen content and grading of aggregates shall be within the action limits for individual measurements as specified in paragraph 6.6.5.1. The limits still will apply if they fall outside the master grading band in Table 2.

**TABLE2. AGGREGATE- BITUMINOUS PAVEMENTS**

Sieve	Percentage by weight passing sieves 0/14 bituminous concrete
½ in. (12.5mm)	100
3/8 in. (9.5mm)	79-99
No.4 (4.75mm)	58-78
No.8 (2.36mm)	39-59



No.16 (1.18mm)	26-46
No.30 (0.60mm)	19-35
No.50 (0.30mm)	12-24
No.100 (0.15mm)	7-17
No.200 (0.075mm)	3-6
Asphalt percent	5.5-7.0

The aggregate grading shown as based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the asphalt Institute Manual Series No.2 (MS-2), appendix A.

### 6.3.3 Test section

Prior to full production, the contractor shall prepare and place a quantity of bituminous mixture according to the job mix formula. The amount of mixture should be sufficient to construct a test section the surface of which is 800 squares meter at least, in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be in the same as the remainder of the course represented by test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

Three random samples shall be taken at the plant and test for stability, flow and air voids in accordance with paragraph 6.5.1.1.2. Two random samples of mixture shall be taken at the plant and tested for aggregate grading and asphalt content in accordance with paragraphs 6.6.3.1 and 3.2 and evaluated in accordance with paragraphs 6.6.5.1 and 5.2. Three randomly selected cores shall be taken from the finished pavement mat, and three from the longitudinal joint, and tested in accordance with paragraph 6.5.1.2.4. Random sampling shall be in accordance with procedures contained in ASTM D 3665.

Mat density and air voids shall be evaluated in accordance with paragraph 5.5.2.6.1. Stability and flow shall be evaluated in accordance with paragraph 5.5.6.2. Joint density shall be evaluated in accordance with paragraph 6.5.2.6.3.

Voids in the mineral aggregate (VMA), for each plant sample, shall be computed in accordance with procedures contained in chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No 2.(MS-2), Mix Design Methods for Asphalt Concrete.

The test section shall be considered acceptable if:

- Stability, flow, mat density, air voids, and joint density are 90 percent or more within limits.
- Grading and asphalt content are within the action limits specified in paragraphs 6.6.5.1 and 5.2 and 3.
- The void in the mineral aggregate is within the limits of Table 1.



If the initial test section should prove to be unacceptable, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the contractor's expense. Full production shall not begin until acceptable section has been constructed and accepted by the Engineer.

Job mix control testing shall be performed by the contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. It should be recognized that the aggregates produced by the plant may not satisfy the grading requirements or produce a mix that exactly meets the JMF. In those instances, it will be necessary to re-evaluate and redesign the mix using plant-produced aggregates. Specimens should be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

#### **6.3.4 Testing Laboratory**

A certification signed by the manager of the laboratory shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:

- Qualifications of personnel; laboratory manager, supervisor technician, and testing technicians.
- A listing of equipment to be used in developing the job mix.

### **6.4 Construction methods**

#### **6.4.1 Weather Limitations**

The bituminous mixture shall not be placed upon a wet surface.

#### **6.4.2 Preparation of pavement before reinforcement**

##### **6.4.2.1 Erasing of the old paint**

The contractor shall erase all the existing paint and eventually the most important rubber deposit.

##### **6.4.2.2 Repair of the depression, scrapping and crack sealing**

The corresponded plans a precise the areas which require, prior to the placing of the surface course, reparation of depressions or a scrapping of the existing pavement.

All areas, where the thickness of reinforcement is less than 5 cm, shall be scrapped in order to place a minimum thickness of bituminous concrete of 5cm.

The areas, where it is necessary to repair the depression, shall receive a tack coat which consists of a dosage at 400g of bitumen per square meter without sanding. This operation shall be done after the cleaning and the sucking up of the areas to be treated.

The sealing of cracks shall concern the most important cracks according to the Engineer's assessment.

#### **6.4.3 Bituminous Mixing Plant**



Plant used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following challenges:

#### **6.4.3.1 Requirements for all plant**

##### **6.4.3.1.1 Truck scales**

The bituminous mixture shall be weighed on approved scales furnished by the contractor. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy.

##### **6.4.3.1.2 Testing facilities**

The contractor shall provide laboratory facilities at the plant for the use of the Engineer's acceptance testing and the contractor's quality control testing, in accordance with paragraph 6.6.2.4.

##### **6.4.3.1.3 Inspection of plant**

The engineer or engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment, inspection operation of the plant, verifying weights, proportions, and material properties, and checking the temperatures maintained in the preparation of the mixtures.

##### **6.4.3.1.4 Storage bins and surge bins**

Paragraph 3.9. of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

- The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours.
- The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

##### **6.4.3.1.5 Radio connection**

The plant shall be radio connected to the bituminous pavers.

#### **6.4.4 Hauling equipment**

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. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.



#### 6.4.5 Bituminous Pavers

Bituminous pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The pavers used for airside road construction shall be equipped with an automatic grade control device. The paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/ or through a system of mechanical sensors or sensor- directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

The controls shall be capable of working in conjunction with any of the following attachments:

- Ski-type device of not less than 30 feet (9.14m) in length.
- Taut string line (wire) set to grade.
- Short ski or shoe.
- Laser control.

#### 6.4.6 Rollers

Rollers of the steel wheel, and pneumatic-typed shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The use of equipment which causes excessive crushing of the aggregate will not be permitted.

#### 6.4.7 Preparation of Bituminous Materials

The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at uniform temperature. 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 160°C.

#### 6.4.8 Preparation of Mineral Aggregate

The aggregate mixture shall be heated and dried prior to introduction into the mixer. The maximum temperature and the rate of heating shall be such that no damage occurs to the aggregates. The temperature of aggregate and mineral filler shall not exceed 170°C when the



asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

#### **6.4.9 Preparation of Bituminous Mixture**

The aggregates and bituminous material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by driving the weight of its content at operating level by weight of the mixture delivered per second by the mixer. The moisture content of all bituminous mix upon discharge shall not exceed 0.5%.

For all plants, wet mixing time begins with the introduction of bituminous material into the mixer and ends with the opening of the mixer discharge gate.

#### **6.4.10 Preparation of the Underlying surface**

Immediately before placing the bituminous mixture, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied as required by the contractor specifications.

#### **6.4.11 Transporting, Placing, and Finishing**

The bituminous mixture shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 9.4.3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements as stipulated in general requirements. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The contract may elect to use a material transfer vehicle to deliver mix to the paver.

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 135°C.

Upon arrival, the mixture shall be placed by a bituminous paver. It shall be struck off in uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless other permitted, placement of the mixture shall begin on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips except where edge lanes require less width to complete the area. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 30cm; however, the joint in the surface top course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3m from transverse joints in the previous course.



Transverse joints in adjacent lanes shall be offset a minimum of 3m.

On areas where irregularities or unavoidable obstacles make the use mechanical spreading and finishing equipment impractical, the mixture may be spread and lusted by hand tools.

#### **6.4.12 Compaction of Mixture**

After placing, the mixture shall be thoroughly and uniformly compacted by rolling during the compaction temperature range as specified in the Job Mix Formula. The surface shall be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the contractor.

The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing of the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. The type, weight and number of rollers passes shall be predetermined and shown in the JMF.

In areas not accessible to roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the contractor's expense. Skin patching shall not be allowed.

#### **6.4.13 Joints**

The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the courses and meet the requirements of smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form transverse joint. When necessary to form a transverse joint, it shall be made means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent line. In both methods all contact surfaces shall be given a tack coat of bituminous material before any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, un-compacted, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

### **6.5 Material Acceptance**

#### **6.5.1 Acceptance Sampling and Testing**

All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section shall be performed by the contractor at his own expense and under supervision of the Engineer or of his authorized representative. All equipment in contractor-furnished laboratories shall be calibrated prior to the start of operations.

##### **6.5.1.1 Plant –produced material**



Plant –produced material shall be tested for stability, flow, and air voids on a lot basis. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. A lot will consist of:

- One day’s production not to exceed 2,000 tones.
- A half day’s production where a day’s production is expected to consist of between 2,000 and 4,000 tones, or
- Similar subdivisions for tonnages over 4,000 tones.

Where more than one plant is simultaneously producing material for the job, the hot sizes shall apply separately for each plant.

#### 6.5.1.1.1 Sampling

Each of lot will consist of four equal sub lots. Sufficient material for preparation of test specimens will be sampled under the Engineer supervision on a random basis, in accordance with the procedures contained in ASTM D 3665. One set of laboratory compacted specimens will be prepared for each sub lot in accordance with ASTM D1559, paragraph at the number of blows required by paragraph 6.3.2 Table 1.

Each set of laboratory compacted specimens will consist of three test portions prepared from the same sample increment.

The sample of bituminous mixture may be put in covered metal tin and placed in an oven for not more than 30 minutes to maintain the heat. The compaction temperature of the specimens should be as specified in the job mix formula.

#### 6.5.1.1.2 Testing

Sample specimens shall be tested for stability and flow in accordance with ASTM D 1559, paragraph 5. Air voids will be determined in accordance with ASTM D 3203. Prior to testing, the bulk specific gravity of each test specimen shall be measured in accordance with ASTM D2726 or D 1188, whichever is applicable, for use in computing air voids and pavement density.

For air voids determination, the theoretical maximum specific gravity of the mixture shall be measured twice for each lot in accordance with ASTM D 2041, Type C or D container. Samples shall be taken on a random basis in accordance with ASTM D 3665. The value used in the voids computation for each sub lot shall be the average of the two maximum specific gravity measurements for the lot.

The stability, flow, and air voids for each sub lot shall be computed by averaging the results of the three test specimen’s representing that sub lot.

#### 6.5.1.1.3 Acceptance

Acceptance of plant produced material for stability, flow, and air voids shall be determined by the Engineer in accordance with the requirements of paragraph 6.5.2.2.

### 6.5.1.2. Field placed material

Material placed in the field shall be tested for mat and joint density on a lot basis.

#### 6.5.1.2.1 Mat density

The lot size shall be the same as that indicated in paragraph 6.5.1.1 and shall be divided into four equal sub lots. One core of finished, compacted materials shall be taken by the contractor from each sub lot. Core location will be determined by the Engineer on a random basis in



accordance with procedures contained in ASTM D 3665. Cores shall not be taken closer than one foot from a transverse or longitudinal joint.

#### 6.5.1.2.2 Joint density

The lot size shall be the total length of longitudinal joint constructed by a lot of material as defined in paragraph 6.5.1.1. The lot shall be divided into four equal sub lots.

One core of finished, compacted materials shall be taken by the contractor from each sub lot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665.

#### 6.5.1.2.3 Sampling

Samples shall be neatly cut with a core drill. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be 75mm. samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. the contractor shall furnish all tools, labor, and material for cutting samples and filling the cored pavement. Cored holes shall be filled in a manner acceptable to the Engineer and within one day after sampling.

#### 6.5.1.2.4 Testing

The bulk specific gravity of each cored sample will be measured in accordance with ASTM D 2726 or D 1188, whichever is applicable. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sub lot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in paragraph 6.5.1.1.2.

#### 6.5.1.2.5 Acceptance

Acceptance of field placed material for mat density will be determined by the Engineer in accordance with the requirements of paragraph 6.5.2.3. Acceptance for joint density will be determined in accordance with the requirements of paragraph 6.5.2.4.

### 6.5.1.3 Partial lots-Plant-Produced Material

When operational conditions cause a lot to be terminated before the specified numbers of tests have been made for the lot, the following procedure will be used to adjust the lot size and the number of tests for the lot.

The last batch produced where production is expectedly halted will be sampled and its properties shall be considered as representative of the particular sub lot from which it has taken. Where three sub lots are produced, they shall constitute a lot. Where one or two sub lots are produced, they shall be incorporated into the next lot and the total number of sub lots shall be used in the acceptance plan calculation, i.e.,  $n=5$  or  $n=6$  for example.

### 6.5.1.4 Partial lots-Field Placed Material

The lot size for field placed material shall correspond to that of plant material, except that in no cases less than (3) cored samples shall be obtained, i.e.,  $n=3$ .

## 6.5.2 Acceptance Criteria

### 6.5.2.1 General

Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement as well as the implementation of the contractor's quality control plan and tests results:

- Stability
- Flow



- Air voids
- Mat density
- Joint density
- Thickness
- Smoothness
- Grade

Stability, flow and air voids will be evaluated for acceptance in accordance with the paragraph 6.5.2.2.mat density will be evaluated for acceptance in accordance with paragraph 6.5.2.3.joint density will be evaluated for acceptance in accordance with paragraph 6.5.2.4.

Acceptance for mat density and air voids will be based on the criteria contained in paragraph 6.5.2.6.1.acceptance for stability and flow will be based on the criteria contained in paragraph 6.5.2.6.2.acceptance for joint density will be based on the criteria contained on paragraph 6.5.2.6.3.thickness will be evaluated by the engineer for compliance in accordance with paragraph 6.5.2.6.4.acceptance for smoothness will be based on the criteria contained in paragraph 6.5.2.6.5.acceptance for grade will be based on the criteria contained in paragraph 6.5.2.6.6.

The engineer may at any time, notwithstanding previous plant acceptance, reject and require the contractor to dispose of any batch of bituminous mixture which is rendered unfit for use due to contamination, segregation, incomplete coating for aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements.

#### **6.5.2.2 Stability, Flow, Air voids**

Acceptance of each lot plant produced material for stability, flow, and air voids shall be based on the percentage of material within specification limits(PWL).the PWL plan considers the variability(standard deviation)of the material and the testing procedures, as well as the average(mean)value of the test results. If a material with high variability is produced, the production target must be adjusted as outlined in paragraph 6.3.2 to achieve a PWL of 90 or more.

#### **6.5.2.3 Mat Density**

Acceptance of each lot of in-place pavement for mat density shall be based on the percentage of material within specification limits (PWL). If material with high variability is produced, then a higher target density must be maintained in order to achieve a PWL of 90 or more.

#### **6.5.2.4 Joint Density**

Acceptance of each lot of in-place pavement for joint density shall be based on the percentage of material within specification limits (PWL) if a material with high variability is produced, then a higher target density must be maintained in order to achieve a PWL of 90 or more.

#### **5.5.2.5 Percentage of material within specification limits (PWL)**

The percentage of material within specification limits (PWL) shall be determined in accordance with procedures specified in annex 1 section 10.

The specification tolerance limits (L) and (U) are contained in table 3.

#### **6.5.2.6 Acceptance Criteria**

##### **6.5.2.6.1 Mat density and Air voids**



If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, payment shall be made in accordance with paragraph 10.8.1.1.

#### 6.5.2.6.2 Stability and Flow

If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, the contractor shall determine the reason and take corrective action. If the (PWL) is below 80 percent, the contractor must stop production and make adjustment to the mix.

#### 6.5.2.6.3 Joint density

If the (PWL) of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, the contractor shall evaluate the method of compacting joints. If the (PWL) is below 80 percent, the contractor shall stop production until the reason for poor compaction can be determined.

#### 6.5.2.6.4 Thickness

Thickness shall be evaluated for compliance by the engineer to the requirements shown on the plans. Measurements of thickness shall be made by the engineer using the cores extracted for each sub lot for density measurement.

#### 6.5.2.6.5 Smoothness

The finished surface of the pavement shall not vary more than 10 mm for the base course. Each lot shall be evaluated with a 3.6 m straightedge. The lot size shall be 1600 square meters. Measurements will be made perpendicular and parallel to the centerline at distances not exceed 15 m. when more than 15 percent of all measurements within a lot exceed the specified tolerance, the contractor shall remove the deficient area and replace with new material. Sufficient material shall be removed to allow at least one inch of asphalt concrete to be placed. Skin patching shall not be permitted. High points may be ground off.

#### 6.5.2.6.6 Grade

The finished surface of the pavement shall not vary from the grade line elevations and cross sections shown on the plans by more than 15 mm. The finished grade of each lot will be determined by running levels at intervals of 15 m or less longitudinally and transversely to determine the elevation of the completed pavement. The lot size shall be 1600 square meters. When more than 15 percent of all the measurements within a lot are outside the specified tolerance, the contractor shall remove the deficient area and replace with new material. Sufficient material shall be removed to allow at least one inch of asphalt concrete to be placed. Skin patching for correcting low areas shall not be permitted. High points may be ground off.

**TABLE 3 ACCEPTANCE LIMITS STABILITY, FLOW, AIR VOIDS, AND DENSITY (75 BLOWS)**

	Specification tolerance	
	L	U
Stability, minimum, (Newton)	9.350	-
Flow, mm	2	4
Air voids total mix (percent)	2.0	5.0
Density, (percent)	96.3	-
Joint density (percent)	93.3	-

### 6.5.3 Re-sampling Pavement



### 6.5.3.1 General

Re-sampling of a lot pavement for mat density will be allowed if the contractor request in writing, within 48 hours after receiving the written test results from the engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 6.5.1.1 and 6.5.2.3. Only one re-sampling per lot will be permitted.

- A redefined PWL shall be calculated for the re-sampled lot. The number of tests used to calculate the redefined PWL shall include the initial tests made for that lot plus the retests.
- The cost for re-sampling and retesting shall be borne by the contractor.

### 6.5.3.2 Payment for re-sampled lots

The redefined PWL for a re-sampled lot shall be used to calculate the payment for that lot in accordance with Table 4.

### 6.5.3.3 Outliers

If the tests within a lot include a very large or a very small value which appears to be outside the normal limits of variation, check for an outlier in accordance with ASTM E 178, at a significance level of 5 percent, to determine if this value should be discarded when computing the PWL.

### 6.5.4 Leveling Course

Any course used for truing and leveling shall meet the requirements of paragraph 6.3.2 and 6.2.2, but shall not be subject to the density requirements of paragraph 6.5.2.3 and 4. The leveling course shall be compacted with the same effort used to achieve density of the test section. The truing and leveling course shall not exceed a nominal thickness of 37.5 mm.

## 6.6 Contractor quality control

### 6.6.1 General

The contractor quality control shall address all elements which affect the quality of the pavement including, but not limited to:

- Mix design
- Aggregate grading
- Quality of materials
- Stockpile management
- Proportioning
- Mixing and transportation
- Placing and finishing
- Joints
- Compaction
- Surface smoothness

### 6.6.2 Testing Laboratory

The field laboratory shall be equipped with all the necessary apparatus for carrying out all the tests related to asphalt treated base. It shall be available for joint use by the contractor for



quality control testing and by the engineer for acceptance testing and must have adequate equipment for the performance of the tests required by these specifications. The engineer shall have priority in use of the equipment necessary for acceptance testing.

Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The engineer shall be permitted unrestricted access to inspect the contractor's laboratory facility and witness quality control activities. The engineer will advise the contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

### **6.6.3 Quality Control Testing**

The contractor shall perform all quality control test necessary to control the production and construction processes applicable to these specifications. The testing program shall include, but not necessarily limited to, tests for the control of asphalt content, aggregate grading, temperatures, aggregate moisture, field compaction, and surface smoothness.

#### **5.6.3.1 Asphalt content**

A minimum of two extraction tests shall be performed per lot in accordance with ASTM D 2172 for determination of asphalt content. The weight of ash portion of the extraction test, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content of the mixture.

The use of the nuclear method for determining asphalt content in accordance with ASTM D 4125 is permitted, provided that it is calibrated for the specific mix being used.

#### **6.6.3.2 Grading**

Aggregate grading shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with AASHTO T 30 and ASTM C 136 (dry sieve). When asphalt content is determined by the nuclear method, aggregate grading shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants and tested in accordance with ASTM C 136 (dry sieve) using actual batch weight to the combined aggregate grading of the mixture.

#### **6.6.3.3 Moisture content of aggregate**

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

#### **6.6.3.4 Moisture content of mixture**

The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461.

#### **6.6.3.5 Temperatures**



Temperatures shall be checked; at least four time per lot, at necessary locations to determine the Temperatures of the dryer, the bitumen in the storage tank the mixture at the plant, and the mixture at the job site.

#### 6.6.3.6 In-place density monitoring

The contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950.

#### 6.6.3.7 Additional testing

Any additional testing that the contractor deems necessary to control the process may be performed at the contractor's option.

#### 6.6.3.8 Monitoring

The engineer reserves the right to monitor any or all of the above testing.

#### 6.6.4 Sampling

When directed by the engineer, the contractor shall sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the contractor. All sampling shall be in accordance with standard procedures specified.

#### 6.6.5 Control Charts

The contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate grading and asphalt content.

Control charts shall be posted in a location satisfactory to the engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the action and suspension limits applicable to each test parameter, and the contractor's test results. The contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the contractor's projected data during production indicates a problem and the contractor is not taking satisfactory corrective action, the engineer may suspend production or acceptance of the material.

##### 6.6.5.1 Individual measurements

Control charts for individual measurements shall be established to maintain the process control within tolerance for aggregate grading and asphalt content. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated action and suspension limits:

#### CONTROL CHARTS LIMITS FOR INDIVIDUAL MEASUREMENTS

(0/20)

sieve	Action limit	Suspension limit
1/2 inch(12.5 mm)	±0%	±0%
3/8 inch (9.5 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%



No. 16 (1.18 mm)	±5%	±7.5%
No.50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt content	±0.45%	±0.70%

### 6.6.5.2 Range

Control charts for range shall be established to control process variability for the test parameters and suspension limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameters. The suspension limits specified below are based on a sample size of n=2. Should the contractor elect to perform more than two tests per lot, the suspension limits shall be adjusted by multiplying the suspension limit by 1.18 for n=3 and by 1.27 for n=4.

#### CONTROL CHARTS LIMITS BASED ON RANGE (Based on n=2)

sieve	Suspension limit
3/8 inch (9.5 mm)	11%
No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No.50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt content	0.8%

### 6.6.5.3 Corrective action

The quality control plan shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The plan shall contain sets of rules to when a process is out of Control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production control stopped and corrective action taken, if:

- One point falls outside the suspension limit line for individual measurements or range; or
- Two points in a row fall outside the action limit line for individual measurements.

## 6.7 Testing measurements

ASTM C 29	Unit Weight of Aggregate.
ASTM C 88	Soundness of aggregates by use of sodium sulfate or magnesium sulfate.
ASTM C 117	Test method for materials finer than 75- $\mu$ m (No.200)
ASTM C 131	Resistance to Abrasion of Small Size Coarse Aggregate by Use of Los Angeles Machine.
ASTM C 183	Sampling Hydraulic Cement.
ASTM C 566	Total Moisture Aggregate by Drying.
ASTM D 75	Sampling Aggregates.
ASTM D 995	Requirements for mixing Plants for Hot-Mixed Hot Laid Bituminous Paving Mixtures.
ASTM D 118	Bulk Specific Gravity of Compacted of Compacted Bituminous Mixtures Using Paraffin-coated Specimens.
ASTM D 1461	Moisture or Volatile Distillates in Bituminous Paving Mixtures.



ASTM D 1559	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
ASTM D 2041	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
ASTM D 2172	Quantitative Extraction of Bitumen from Bitumen from bituminous Paving Mixtures.
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D 2489	Degree of Particle Coating of Bituminous –Aggregate Mixtures.
ASTM D 2726	Bulk specific Gravity of Compacted Bituminous Mixtures using Saturated Surface-Dry specimens.
ASTM D 3203	Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
ASTM D 2950	Density of Bituminous Concrete in Place by Nuclear Method.
ASTM D 3665	Random Sampling of Paving Materials.
ASTM D 3666	Inspection and Testing Agencies of Bituminous Paving Material.
ASTM D 4125	Asphalt Content of Bituminous Mixtures by Nuclear Method.
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4791	Flat or Elongated Particles in Coarse Aggregate.
ASTM D 4867	Effect of Moisture on Asphalt Concrete Paving Mixtures.
ASTM E 178	Practices for Dealing with Outlying Observations.
AASHTO T 30	Mechanical Analysis of Extracted Aggregate.
The Asphalt Institute's Manual No.2 (MS-2)	Mix Design Methods for Asphalt Concrete.
The Asphalt Institute's Manual No.20 (MS.20)	Hot- Mix Recycling

## 6.8 Material Requirements

ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 946	Asphalt Cement for Use in Paving Construction
ASTM D 3381	Viscosity-Graded Asphalt Cement for Use in Paving Construction
ASTM D 4552	Classifying Hot-Mix Recycling Agents.

## 7. EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

### 7.1 Scope of works

The work shall consist of a mixture of emulsified asphalt, mineral aggregate, and water; properly proportioned, mixed, and spread on the existing wearing course of the runway shoulders or service roads in accordance with these specifications and shall conform to the dimensions shown on the plans or as directed by the engineer.



The emulsified asphalt slurry seal surface treatment shall be used for the runway overlay shoulders as much as for the separation coat between a concrete pavement and a flexible overlay course.

If the contractor wishes to resurface the runway shoulders pavement by a method other than the one specified in this item, he is allowed to propose his method to the agreement of the engineer at the time of tendering.

## 7.2 Materials

### 7.2.1 Aggregate.

The aggregate shall consist of sound and durable natural and manufactured sand, slag crusher fines, crushed stone, or crushed stone and rock dust, or a combination thereof. Smooth-textured sand of less than 1.25 percent water absorption, as tested by ASTM C 128, shall not exceed 50 percent of the total combined aggregate. The aggregate shall be clean and free from vegetable matter, dirt, dust, and other deleterious substances. The aggregate blend shall have a sand equivalent of not less than 45 when tested in accordance with ASTM D2419. The aggregate shall show a loss of not more than 25 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 9 percent, or the magnesium soundness loss shall not exceed 12 percent after 5 cycles when tested in accordance with ASTM C88.

Aggregate retained on the no.50 sieve (300 micro m) shall be 100 percent Crushed.

The combined aggregate shall conform to the grading shown in table 1 when tested in accordance with ASTM C 136. **TABLE 1 AGGREGATE-**



The aggregate, as finally selected, shall have a grading within the limits designated in table 1,

Sieve Size	Percentage by Weight Passing Sieves
No.4 ( 4.75 mm)	100
No.8 (2.36 mm)	90-100
No. 16 ( 1.18 mm)	65-90
No.30 ( 600 μm)	40-60
No. 50 ( 300μm)	25-42
No. 100 (150μm)	15-30
No. 200 (75μm)	10-20
Residual asphalt content percent dry aggregate	10-16
Pounds of aggregate Per square yard	6-10
Kilograms of aggregate Per square meter	3.2-5.2

and should not vary from the low limit on one sieve to the high-limit on the adjacent sieve and vice versa.

Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

#### 7.2.2 Filler

If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242 and shall be used in the minimum amounts required. Mineral filler shall only be used if needed to improve the workability of the mix or to improve the grading of the aggregate. The filler shall be considered as part of the blended aggregate.

#### 7.2.3 Emulsified asphalt

The emulsified asphalt shall be conforming to the requirements of ASTM D2397 for type CSS-1 or CSS-1h for type Cationic emulsion (used for hot moderate or climates).

#### 7.2.4 Water

All water used in making the slurry shall be potable and free from- harmful soluble salts.

#### 7.2.5 Tack coat



The tack coat shall be a diluted asphalt emulsion of the same type specified for the slurry mix. The ratio of asphalt emulsion to water shall be 1 to 3.

### **7.3 Construction methods**

#### **7.3.1 Weather limitations**

The slurry seal, shall not be applied if either the pavement or the air temperature is 55 F (13°C) or below or when rain is imminent.

#### **7.3.2 Equipment and Tools**

All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working order at all times. Descriptive information on the slurry mixing and applying to be used shall be submitted to the Engineer for approval not less than 10 days before work starts.

##### **a. Slurry mixing Equipment**

Pressure distributors used for application of diluted asphalt emulsion tack coat shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.3 and 0.4 kg per square meter of diluted emulsion over the required width of application distributors shall be equipped with tachometers, pressure gages, and volume- measuring devices.

##### **b. Slurry Mixing Equipment**

The slurry mixing machine shall be a continuous flow mixing unit capable of accurately delivering a predetermined proportion of aggregate, water, and asphalt emulsion to the mixing chamber and of discharging the thoroughly mixed product on a continuous basis. The aggregate shall be prevented immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. No excessive mixing shall be permitted. The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed into the mixer. The fines feeder shall be used whenever added mineral filler is part of the aggregate blend.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.3 and 0.4 kg per square meter preceding the spreading equipment.

Sufficient machine storage capacity to mix properly and apply a minimum of 5 tones (4500 kg) of the slurry shall be provided. Proportioning devices shall be calibrated prior to placing the slurry seal.

##### **c. Slurry spreading Equipment**

Attached to the mixing machine shall be a mechanical-type squeegee distributor equipped within flexible material in contact with the surface to prevent loss of slurry from the distributor. It shall be maintained to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. There shall be a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the specified rate of application. The spreader box shall have an adjustable width. The box shall be kept clean, and built-up asphalt and aggregate on the box shall not be permitted. The user of burlap drags or other drags shall be approved by the Engineer.

##### **d. Roller**



The roller shall be a pneumatic-tired roller capable of exerting a contact pressure during rolling of 50 pounds per square inch (350000newtons per square meter).

e. **Auxiliary Equipment**

Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushes, power blowers, barricades, etc., shall be provided as required.

**7.3.3 Equipment calibration**

Each slurry mixing unit to be used on the project shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machines metering devices. No machine will be allowed to work on the project until the calibration has been completed and / or accepted.

**7.3.4 Cleaning existing surface**

Prior to placing the tack coat, unsatisfactory areas shall be repaired and the surface shall be cleaned of dust, dirt or other loose foreign matter, grease, oil, or any type of objectionable surface film. Any standard cleaning method will be accepted except that water flushing will not be permitted in areas where considerable cracks are present in the pavement surface.

Any painted stripes or markers on the surface to be treated shall be removed before applying the tack coat.

When the surface of the existing pavement or base is irregular or broken, it shall be repaired or brought to uniform grade and cross section as directed by the engineer. Cracks wider than 3/8 inch (9 mm) shall be sealed with compatible joint sealer prior to applying the slurry seal.

**7.3.5 Application of bituminous tack coat**

Following the preparation for sealing, application of the diluted emulsion tack coat shall be made by means of a pressure distributor in amounts between 0.3 and 0.4 kg per square meter as directed by the Engineer. The tack coat shall be applied, at least 2 hours before slurry seal, but within the same day.

**7.3.6 Composition of slurry mix.**

No slurry seal for payment shall be placed until a mix design has been approved by the Engineer. The mix design shall be developed by a laboratory with experience in designing slurry seal mixes and a signed copy submitted in writing by the contractor to the Engineer at least 10 days prior to the start operations.

The laboratory report must indicate the proportions of aggregates, mineral filler (min and max), water (min and max), and asphalt based on the dry aggregate weight. It shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effects). The mix design shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new mix design shall be established before the new material is used.

The percent of aggregate passing each sieve shall not vary more than +/-14.0 percent from the mix design formula. The residual asphalt content shall not vary more than +/-1.0 percent from the mix design quantity.



### 7.3.7 Test sections

Test sections shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designed by the Engineer and will be located on the existing pavement.

Test strips shall be made by each machine after calibration. Samples of the slurry seal shall be taken and mix consistency and proportions verified. The rate of application will also be verified. If any test does not meet specification requirements, additional tests shall be made at the contractor's cost until an acceptable test strip is placed.

### 7.3.8 Application of slurry

The surface shall be preventing by forging ahead of the slurry spreader box. Water used in preventing the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 5 minutes. A sufficient amount of slurry shall carry in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box which shall be towed at the slow and uniform rate not to exceed 5 miles per hour (8 kilometers per hour). No lumping, balling, or unmixed aggregate shall be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement surface. A sufficient amount of slurry shall be fed in the box to keep a full supply against the full width of the squeegee. The mixture shall not be permitted to overflow the front sides of the spreader box. No excessive breaking of the emulsion will be allowed in the spreader box. No streaks such as caused by oversized aggregate will be left in the finished pavement.

Adjacent lanes shall be lapped at the edges a minimum of 4 inches (100 mm) to provide complete sealing at the overlap. All edges shall be feathered with hand squeegees.

After application of the slurry seal, the surface shall be rolled with a pneumatic-tired roller a minimum of 4 coverage. The roller should be operated at a tire pressure of 50 pounds per square inch (350000Kpa).

The fresh slurry seal application shall be protected by barricades and markers and permitted to dry for 4 to 24 hours, depending on weather conditions. Any damage to uncured slurry will be repaired at the Contractor's expense.

In areas where the spreader box cannot be used, the slurry shall be applied by means of a hand filled by using hand squeegee. Any joints or cracks that are not filled by the slurry mixture shall be filled by using hand squeegee. No excessive buildup or unsightly appearance shall be permitted on longitudinal or transverse joints. Upon completion of the work, the seal coat shall have no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform and skid resistant texture satisfactory to the Engineer. All wasted and unused material and all debris shall be removed from the site prior to final acceptance.

### 7.3.9 Emulsion material (contractor's responsibility).

Samples of the emulsion that the contractor proposes to use, together with a statement as to its source, must be submitted, and approval must be obtained before using such material. The contractor shall furnish the Engineer a manufacturing's certified report for each consignment of the emulsion. The manufacturer's certified report shall not be interpreted as a basis for final



acceptance. All such reports shall be subject to verification by testing samples of the emulsion as received for use on the project.

#### 7.4. Testing requirements

ASTM C88	Soundness of aggregates by use of sodium sulfate or magnesium sulfate
ASTM C128	Specific gravity and absorption of fine aggregate
ASTM C131	Resistance to abrasion of small size coarse aggregate by use of the Los Angeles Machine
ASTM C136	Sieve or screen analysis of fine and coarse aggregates
ASTM D2419	Sand Equivalent Value of soils and fine aggregate

#### 7.5 MATERIAL REQUIREMENTS

The asphalt	Table IV-3 Temperature-Volume corrections for institute Emulsified Asphalts Manual MS-6
ASTM D 242	Mineral Filler for Bituminous paving mixtures
ASTM D 977	Emulsified Asphalt
ASTM D 2397	Cationic Emulsified Asphalt

### 8 JOINT SEALERS

#### 8.1 Scope of work

This work shall consist in the supply and installation of resilient and adhesive joint sealing filler.

#### 8.2 Materials

Joint sealing material shall be submitted for the Engineer's approval and will conform to one of the following:

- Cold applied sealing compound two component elastomeric, polymer type (jet fuel resistant) –meeting Fe Spec. SS200.
- Hot poured one component (jets fuel resistant) meeting either ASTM D 1854 or ASTM D 3569.

Pre- formed joint sealer will not be accepted.

Each lot o batch of sealing compound shall be delivered to the job site in the manufacturer's original sealed container, marked with the manufacturer's name, batch or lot number, and the safe heating temperature. They shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this specification.

#### 8.3 Construction method

##### 8.3.1 Time Application



Joints shall be sealed as soon as possible after completion of the slab curing period, and the pavement shall not be opened to traffic (including construction equipment) during this period. If the pavement must be opened to traffic prior to placement of the sealant, the contractor will be required to temporarily fill the joint with a jute or nylon rope immediately after the joint is sawn. The rope should be slightly larger than the joint and should be forced into the joint so that the top rope is 3 mm below the pavement surface. The rope shall be removed immediately prior to cleaning.

### **8.3.2 Preparation of joints**

Immediately before sealing, the joints shall be thoroughly cleaned of all curing compound and other foreign material. Cleaning shall be accomplished by sand blasting 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 sealant is to be applied.

### **8.3.3 Application of sealant**

Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the following requirements.

#### **8.3.3.1 Hot poured sealants**

The joint sealant shall be applied uniformly solid from bottom to top and shall not contain any voids. A backing material shall be placed as shown on the drawings and shall be non-adhesive to the concrete or sealant. For safety reasons, heating of the sealant shall be indirect means. Positive temperature control and mechanical agitation shall be provided. The sealant shall not be heated to more than 10°C below the safe heating temperature as indicated by the manufacturer. A direct connecting pressure type extruding device with nozzles shaped for insertion into the joint shall be provided. Any sealant spilled on the surface of the pavement shall be removed immediately.

#### **8.3.3.2 Cold applied sealants**

Cold 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. A backing material shall be placed as shown on the plans and shall be non-adhesive to both concrete and sealant. Sealant which fails to bond with the concrete, is porous and does not achieve a tack-free condition will be rejected and replaced by the contractor at no additional cost. Before sealing the joints, the contractor shall demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. This shall include the previous preparation of two small batches and the application of the resulting material on the trial section executed for slabs. The use of a backup material should be compatible with the sealant, should not adhere to the sealant, should be compressible without extruding the sealant, and should recover to maintain contractor with the joint faces when the joint is open.

## **8.4 Quality and work- done standards**

### **8.4.1 Quality standards**

The quality standards will be as follows:



Test item	Test method	Frequency	Standard value	Notes
Joint sealant	As approved by the Engineer	At every delivery	To meet: -SS-S200 Fed spec for cold applied sealant - ASTM D 1854 D 3569 for hot applied sealant	Manufacturer's data may substitute as directed by Engineer

## 11. PRIME COAT

### 9.1 Scope of work

This work shall consist of the prime coat to be applied on the prepared laterite gravel course to be overlaid by a treated bituminous base, in accordance with the requirements designated in the contract drawings, and as specified herein.

The contractor shall, before the work on the prime coat is started, secure the Engineer's approval in the material to be used and the methods of application.

### 9.2 Material

For the prime coat, a cut back asphalt meeting MC 70 type according to AASHTO M 82 or ASTM D 2028 will be used. The application temperature shall be from 50°C to 70°C.

### 9.3. Construction methods

#### 9.3.1 Distribution Quantity of Cut-back Asphalt

The cut-back asphalt shall be uniformly applied by means of a bituminous distributor at the rate of 0,7 kg/m<sup>2</sup> to 0,8 kg/m<sup>2</sup> depending on the course surface texture.

#### 9.3.2 Weather Limitations

The prime coat may be applied on dry or humid surfaces, but never in foggy or rainy weather conditions.

#### 9.3.3 Equipment

The equipment used by the contractor for the application shall include a self-powered bituminous material distributor and the requirement for heating the bituminous material.

The distribution equipment shall have the capacity which allows the bituminous material at even heat to be applied uniformly on the surface at controlled specified rates from 0.5 kg/m<sup>2</sup> to 3 kg/m<sup>2</sup> with a maximum variation of specified rate not exceeding 10%. The distribution equipment shall include a tachometer, pressure gauges, volume measuring devices or calibrated tank and a thermometer for measuring temperatures of tank contents. The asphalt distributor shall be provided with a chart showing the relation between the working speeds, the spray bar pressure (or the rev. speed of the pump) and the rate of asphalt application. The distribution shall be self powered and shall be equipped with a power unit for the pumps and full circulation spray bars adjustable laterally and vertically. The spray bar shall work according to the triple overlap principle.

A power broom shall be provided for cleaning of the surface to be treated.



### 9.3.4 Application of cut-back Asphalt

Immediately before applying the prime coat, the total surface area shall be swept with a power broom to remove all loose dirt and other objectionable material. The application of the cut-back asphalt shall be made by means of the pressure distributor at the temperature designated, and at a rate of 0.7 kg/m<sup>2</sup> to 0.8 kg/m<sup>2</sup>.

After the application of cut-back asphalt on the aggregate course, the surface shall be allowed to dry not less than 48 hours without being distributed or for such additional time as may be necessary to permit the drying out of the prime coat. The period shall be determined by the Engineer.

The contractor shall then maintain and protect the prime coated surface from any damage until the hot asphalt treated base or sub base is placed. Where the prime coat is separated from the surface, the application of the cut-back asphalt shall be re-laid on the corresponding surface.

## 9.4 Quality and work- done standards

### 9.4.1 Quality standards

The Engineer will decide if manufacturer test data will be sufficient. Otherwise he will designate a test method to be performed at every stage of completion.

The quality standards shall be as follows:

Test item	Test method	Frequency	Standard value	Notes
Cut back asphalt	To be approved by the Engineer	A every receiving	To meet AASTHO M 82 or ASTM D 2028	Manufacturer's data may substitute as directed by Engineer
Material not to be used 3 months after delivery				

### 9.4.2 Work done standards

The works shall be controlled as follows:

Test item	Test method	Frequency	Standard value	Notes
Application of cut back asphalt	As approved by the Engineer	As decided by the Engineer	0.7 to 0.8 kg/m <sup>2</sup> ±10%	-

## 12. TACK COAT

### 10.1 Scope of work

This work shall consist of tack coat to be applied on the asphalt treated base or on the asphalt sub base course, in accordance with the requirements designated in the contract drawings, and as specified herein.

The contractor shall, before the work on the tack coat is started, secure the Engineer's approval in the material to be used and the methods of application.

### 10.2 Material

For the tack coat, an emulsified asphalt meeting SS1 type according to ASTM D 977 will be used. The application temperature shall be from 25°C to 55°C.



### 10.3. Construction methods

#### 10.3.1 Distribution Quantity of emulsified Asphalt

The application of emulsified asphalt shall be uniformly applied by means of a bituminous distributor at the rate of 0.3 to 0.4 kg/m<sup>2</sup> of residual asphalt.

#### 10.3.2 Weather Limitations

The tack coat may be applied on dry or humid surfaces, but never in foggy or rainy weather conditions.

#### 10.3.3 Equipment

The equipment used for the application shall include a self- powered bituminous material distributor and the requirement for heating the bituminous material.

The distribution equipment shall have the capacity which allows the bituminous material at even heat to be applied uniformly on the surface at controlled specified rates from 0.5 Liter/m<sup>2</sup> to 1 Liter/m<sup>2</sup> with a maximum variation of specified rate not exceeding 10%. The distribution equipment shall include a tachometer, pressure gauges, volume measuring devices or calibrated tank and a thermometer for measuring temperatures of tank contents. The distribution shall be self powered and shall be equipped with a power unit for the pumps and full circulation spray bars adjustable laterally and vertically.

A power broom shall be provided for cleaning of the surface to be treated.

#### 10.3.4 Application of emulsified Asphalt

Immediately before applying the tack coat, the total surface area shall be swept with a power broom to remove all loose dirt and other objectionable material. The application of the emulsified asphalt shall be made by means of the pressure distributor at the temperature designated, and at a rate of 0.liter/m<sup>2</sup>to 1 liter/m<sup>2</sup>.

After the application of emulsified asphalt on the asphalt treated base or sub base course, the surface shall be allowed to dry as may be necessary until it will not be picked up by traffic or equipment. The period shall be determined by the Engineer.

The contractor shall then maintain and protect the tack coated surface from any damage until the hot asphalt cement mixture is placed. Where the tack coat is separated from the surface, the application of the emulsified asphalt shall be re- laid on the corresponding surface area.

### 10.4 Quality and work- done standards

#### 10.4.1 Quality standards

The Engineer will decide if manufacturer test data will be sufficient. Otherwise he will designate a test method to be performed at every stage of completion of works.

The quality standards shall be as follows:

Test item	Test method	Frequency	Standard value	Notes
Emulsified asphalt	As approved by the Engineer	A every completion of works	To meet ASTM D 977	Manufacturer's data may substitute as directed by Engineer



### 10.4.2 Work done standards

The works shall be controlled as follows:

Test item	Test method	Frequency	Standard value	Notes
Application of emulsified asphalt	As approved by the Engineer	As decided by the Engineer	0.3 to 0.4 kg/m <sup>2</sup> of residual asphalt ±10%	-

## 11 ANTI-KEROSENE PROTECTION

### 11.1 Scope of work

This work shall consist in applying a cover protection against Kerosene aggression on the bituminous surface of aircraft stand of apron.

It shall be used a binder placed in aqueous solution for surface protection. The concerned areas are shown on the plans.

The anti- kerosene product shall be in accordance with the French standard NFP 98-170 for category C product.

The contractor shall, before the application of the anti- kerosene protection is started, secure the Engineer's approval on the material to be used and the methods of application.

### 11.2 Materials

For information, the product to be used could have the following characteristics:

Number of component: 1

Color of the dry thin layer: black

Aspect of the dry film layer: black silk finish emulsion, half- flexible

Relative density at 20<sup>0</sup>: approximately 1.2 g/ml

### 11.3 Construction methods

The underlying support shall be prepared to be clean without any wet trace when applying the anti-K protection.

It recommended that the covering should be applied in three (3) layers.

For instance, the application could be as follows:

1<sup>st</sup> layer:

- Application of the pure product if the conditioning is 30kg, or diluted between 20% and 30% if the conditioning is 250kg according a consumption of 300 to 500g per square meter.

2<sup>nd</sup> layer:

- Application of the pure product according a consumption of 300 to 500g per square meter.

3<sup>rd</sup> layer:

- Application of the pure product according a consumption of 300 to 500g per square meter.

The average total thickness of the product could be around 500μ.



It shall be necessary to respect the minimum required drying time, but also the time of covering over between the first and the second layer as defined by the manufacturer of the product.

## **12 AIRFIELD PAVEMENT MARKING**

### **12.1 Description**

1. This item shall consist of the painting of numbers, markings, and stripes on the surface of runways and taxiways applied in accordance with these specifications and at the locations shown on the plans, or as directed by Engineer.
2. The markings shall be continuous or intermitted lines, arrows or symbols and shall be of the color and dimensions shown on the drawings or as directed by Engineer.
3. Markings on all bituminous surfaces shall be “peinture en phase aqueuse” and on concrete surfaces “Emulsion paint for external use”.

### **12.2 Materials**

Paint shall meet the requirements of Fed. Spec TT-P-1952 (water emulsion base) or British Standard BS (3262) or other equivalent approved international standard, with additional specific requirements stated herein.

Regarding the characteristic of paint, the yellow pigmentation shall respect the colorimetric limits defined by ICAO (Annex 14 appendix 1).

### **12.3 Construction methods**

#### **12.3.1 Weather limitations.**

The painting shall be performed on when the surface is dry, when the atmospheric temperature is above 45F (7°C), and when the weather is not foggy or windy.

#### **12.3.2 Equipment.**

All equipment for the work shall be approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxil.

## **13 FENCING**

### **13.1 General**

The scope of works to be executed consists of furnishing and erecting fences in accordance with these specifications and the details shown on the plans and in conformity with lines and grades shown on plans or established by the Engineer.

In particular, the contractor shall, before work on fences and gates is started, secure the Engineer's approval on the materials to be use and on the methods of execution.

### **13.2 Material**



**13.2.1 Wooden fence**

The wooden fence shall be made of wood board with length of 150mm and spaced out by 500mm, and shall receive a treatment against weather aggression.

**13.2.2 Wooden structure**

The structural members shall be wooden posts 120 wide and 80mm thick, fully slotted in a concrete foundation (500mm wide and 750mm deep). Two perpendicular wooden boards shall be also fixed to the wooden posts to support the vertical wooden board. The structural wooden posts shall be spaced every 6m.

**13.2.3 Concrete for Foundation**

The concrete to be used shall conform to K 175 or K 225 as specified in paragraph 15, in concrete works.

**13.3 Construction methods****13.3.1 Clearing fence line**

The site shall be sufficiently cleared of obstructions. The fence line shall be cleared to a minimum of 60cm on each side of the centerline of the fence. This clearing shall include the removal of all stumps, brush, rocks, tree, or other obstructions within this area of the fence line. The area shall be grubbed or excavated as necessary and all holes remaining after stump removal shall be back-filled with suitable soil, or other materials acceptable to the Engineer and shall be compacted properly with tampers.

**13.3.2 Fixing of wooden fence**

The wooden fence will be fixed to the posts as shown on contract drawings or as proposed by the contractor and accepted by the Engineer.

**13.3.3 Cleaning up**

After the work is completed the contractor shall clear the site of surplus materials, dirt and rubbish and shall restore the site to conditions acceptable by the Engineer.

**13.4 Quality and work done standards****13.4.1 Quality standards**

The quality standards shall be as follows:

Test item	Test method	frequency	Standard value	Notes
chain link fence or wire fence	As approved by the Engineer	At every delivery of materials	To meet requirements specified in this section	Manufacture's test data may substitute as directed by the Engineer



Welding	Ditto	Ditto	Ditto	
Concrete	As specified in paragraph 15-concrete works			

## 14 CONCRETE KERBING

### 14.1 Scope of work

- This shall consist of the concrete kerbs to be constructed in accordance with the requirements of location, dimension, line and grade designated in the contract drawings and as specified herein.
- The contractor shall, before work commences, secure the Engineer's approval on the materials to be used and the methods of execution.

### 14.2 Materials

#### 14.2.1 Prefabricated concrete blocks

The concrete blocks shall be of the shape and dimensions designated in the contract drawings. The concrete to be used shall meet the requirements of K 175 and K225 as specified in paragraph 15-concrete works.

#### 14.2.2 Reinforcing Bars

All reinforcing bars shall meet the requirements specified for steel bars in paragraph 15, - concrete works.

Size and dimension of reinforcing bars shall meet the requirements designated in the contract drawings or those of the Engineer where specifically requested.

#### 14.2.3 Laterite gravel

The laterite gravel shall be in accordance with the requirements as specified in the paragraph 4.

#### 14.2.4 Mortar

The mortar shall be in accordance with the requirements as specified in the paragraph 15-concrete works.

### 14.3 Construction methods

#### 14.3.1 Foundation

The foundation materials (laterite gravel) shall be placed to the line grades and dimensions shown on the contract drawings and shall be compacted by the tamper.

#### 14.3.2 Placing concrete

The concrete shall be placed according to the contract drawings which show in particular the quantity of concrete to be placed in order to prevent, any displacement of the concrete kerb.

#### 14.3.3 Placing kerb

The prefabricated concrete kerb shall be set on a concrete foundation and with any necessary additional concrete to give support to the kerb. The top surface and alignment of finished concrete curb shall not show depressions more than 5mm when measured with a3 straightedge.

#### 14.3.4 Cleaning and restoration of the site

After is completed, the contractor shall clear the site of surplus material, dirt and rubbish and shall restore the site to the original conditions.

### 14.4 quality and work done standards



**14.4.1 Quality standards**

The quality standards shall be as follows:

Test item	Test method	Frequency	Standard value	Note
Concrete reinforcing bars mortar	As specified in paragraph 15-concrete works			
Laterite gravel	As specified in paragraph 4			

**14.4.2 Work done standards**

The work shall be controlled as follows:

Work item	Test item	Test method	Frequency	tolerance	Notes
Concrete kerbing	Finish elevation	By surveying specified in part 1-section 2	At points designated by the engineer	±1cm	
	width	By the Engineer's instruction	Ditto	±2cm	
	Length	Ditto	Ditto	Not specified -2cm	
	thickness	Ditto	Ditto	±2cm -1cm	
	Flatness and alignment	By 3m straightedge	At lines designated by the Engineer	Irregularities Shall not exceed 5mm	

**15 CONCRETE WORKS****15.1 General****15.1.1 Scope of works**

The works to be executed by the contractor under this section shall comprise all the concrete works, reinforced or unreinforced, in the civil works.

**15.1.2 Codes and standards**

The concrete works shall be carried out in accordance with the requirements of the following codes and standards:

- ASTM : The American Society for Testing and Materials.
- AASHITO : Standards Specifications for Transportation Materials and Methods of



- ACI 305 : Sampling and Testing (Part I specifications & Part II Testing).  
: Hot Weather Concreting, American Concrete Institute.
- ACI 315 : Details and Detailing of Concrete Reinforcement, American Concrete  
Institute
- ACI 318 : Building Code Requirements for Reinforced Concrete, American  
Concrete  
Institute
- ASTM C 207 : Hydrated Lime
- ASTM C 227 : Test Method for Potential Alkali Reactivity of Cement Aggregate  
Combinations (Mortar bar Method)
- ASTM C242 : Terminology of Ceramic White wares and Related  
Products
- ASTM C 289 : Test Method for Potential Reactivity of Aggregates  
(Chemical Method)
- ASTM C 476 : Mortar and Grout for Reinforcement of Masonry
- ASTM C586 : Test Method for Potential Alkali Reactivity of  
Carbonate Rocks for Concrete Aggregate (Rock Cylinder Method)  
and:
- AASHTO M 31: Deformed and Plain Billet- Steel Bars for Concrete  
Reinforcement.
- AASHTO M 32: Cold Drawn Steel Wire for Concrete Reinforcement.
- AASHTO M 45: Aggregate for Masonry Mortar.
- AASHTO M 55: Welded Steel Wire Fabrics for Concrete  
Reinforcement.
- AASHTO M 85: Portland cement.
- AASHTO M 153: Preformed Sponge Rubber and Cork Expansion Joint  
Fillers for Concrete Paving and Structural Construction.
- AASHTO M 173: Concrete Joint Sealer, Hot- Poured Elastic Type.
- AASHTO M 213: Preformed Expansion Joint Fillers for Concrete  
Paving and Structural Construction.



- AASHTO T11: Amount of Materials Finer than 0.075mm Sieve in Aggregate.
- AASHTOT 21: Organic Impurities in Fine Aggregate for Concrete.
- AASHTO T 22: Compressive Strength of Cylindrical Concrete Specimens.
- AASHTO T 23: Marking and Curing Concrete Compressive and Flexural Test Specimens in the Field.
- AASHTO T 26: Quality of Water to be used in Concrete.
- AASHTO T 84: Specific Gravity and Absorption of fine Aggregate.
- AASHTO T 85: Specific Gravity and Absorption of Coarse Aggregate.
- AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
- AASHTO T 97: Flexural Strength of concrete (Using Simple Beam in the Third- Point Loading).
- AASHTO T 104: Soundness of Aggregate by use of Sodium Sulphate or Magnesium Sulphate.
- AASHTO T 112: Clay Lumps and Friable Particles in Aggregates.
- AASHTO T 119: Slump of Hydraulic Cement Concrete.
- AASHTO T 126: Making and Curing Concrete Test Specimens in the Laboratory.
- AASHTO T 141: Sampling Fresh Concrete.
- Shop drawings for all works required indicating, in detail, the reinforcement bar

Schedules, the materials list properties, and the construction requirements. Shop drawings shall e submitted not less than two (2) months before construction commences. In addition, the contractor shall submit structural calculations for any work proposed which is at variance with work as shown or specified in the tender documents.

- A detailed construction plan indicating the proposed methods, sequences, standards, etc., to be adopted.



Furthermore the contractor shall submit the mix design for each type of concrete thirty (30) days prior to the intended start of concrete placement, and he shall notify in writing twenty four (24) hours before starting mixing or placing of any concrete.

The results in writing of all specified quality control tests shall be submitted as soon as they are available or requested by the engineer. In the case of compressive or flexural strength tests, this will involve submitting the 3-days strength, 7-days strength and 28-days strength test results 3 days and 28 days respectively following the date of mixing.

## **15.2 Materials**

### **15.2.1 General**

All materials shall be new and of the best quality of the specified type. They shall meet the requirements of the relevant standards.

### **15.2.2 Source and storage of material**

All materials and plant necessary for the construction shall be supplied by the contractor. A statement of the original of all materials and plant intended to be used on the site shall be submitted by contractor within a period of sixty (60) calendar days from the date of acceptance of the tender. This statement shall include the characteristics of the materials and plant, the standards of performance, test reports, proofs of past performance and the reason for their selection.

Samples shall be submitted to the Engineer for all materials which may be subject to acceptance tests (aggregates, cements, prefabricated components, coatings and renderings, sealing products, mastics, etc...). Acceptance samples shall be kept as reference to be compared with the materials delivered on site as the works proceed.

The contractor shall provide, on request, proof of the origin and quality of the materials. No materials shall be permitted on site which are not specified or specifically approved in writing. Any modification of the origin and quality of materials shall not be permitted without the Engineer's authorization. The contractor shall submit proof the proposed material is equal or better than that specified, including detailed description, tests reports and past performance data.

The contractor shall provide storage areas, with suitable surfacing, large and resistant enough to preclude any pollution of the materials throughout the duration of the works. The storage of cements and reinforcement steel bars on bare ground is prohibited.

### **15.2.3 Acceptance Tests**

The Engineer may stipulate complementary acceptance tests, as well as tests methods, in addition to those performed by the contractor's laboratory.

These tests shall be carried out in this same laboratory under the control of the Engineer or his representative. Rejected lots shall be immediately isolated and labeled to avoid any risk of confusion. They shall be removed from the work site by the contractor within 48 hours following their rejection.

### **15.2.4 Cements**

#### **15.2.4.1 Nature of cements and testing**

The cements used for the concrete works shall be any type of Portland cement conforming to AASHTO M 85. However, unless otherwise permitted by the Engineer, air-entraining cements shall not be used.

Supply of cement shall be submitted for approval before use, with respect to origin and quality. Subsequent deliveries shall be also subject to quality control testing as work proceeds.



Approval of origin and quality shall be given on presentation of tests results showing that the cement factory proposed is able to supply a product which will consistently meet the physical and chemical qualities specified. Quality control tests shall be made on each cement delivery, in order to determine the following characteristics:

- Specific gravity,
- Specific surface by means of air permeability,
- Heat loss,
- Hot and cold expansion properties,
- Compressive strength at 3, 7 and 28 days,
- Setting time, and periodically determination of carbonate, alkali and chloride contents.

All these tests shall be carried out in accordance with a procedure agreed by the engineer. When cement is stored for long periods, the Engineer shall be entitled to ask for a renewal of quality control tests, restricted to heat loss, setting and chemical resistance.

Manufacture's test certificates shall be submitted to the Engineer on request.

Unless otherwise permitted by the Engineer, the product of only one mill and one brand shall be used to the project for each type of Portland cement used in the project.

#### **15.2.4.2 Storage**

Cement must be stored in a way approved by the Engineer, which will prevent deterioration or contamination. A suitable building or tank shall be provided for this purpose.

No cement which is in any way affected by dampness or aeration shall be used in the work, and any cement which the Engineer considers to be unfit for use shall be rejected without any further testing.

Cement delivered in bags shall be stored under cover, in a weatherproof shed that is airtight and has a raised wooden floor covered with polyethylene sheeting. The stacks of cement bags shall be always kept covered with an envelope of polyethylene sheeting.

#### **15.2.4.3 Aggregates**

##### **15.2.4.3.1 General specifications for aggregates**

Aggregate for concrete shall be supplied from the most suitable source determined by the contractor in accordance with the Employer's requirements, with the technical requirements there under specified, and with the agreement of the Engineer.

Regular tests shall thence forward be carried out during the entire period of construction works, to ensure that the quality of subsequent supplies is maintained.

Aggregates for concrete (reinforced and non- reinforced) shall originate from stable rock, not subject to deterioration under the influence of water or air.

They shall contain no impurity detrimental to the essential properties of concrete: stress resistance, durability and impermeability.

The documentation required to be submitted to the Engineer to substantiate their origin and quality is as follows:



- A document identifying the workings, giving the exact location of the bed being worked and the place of extraction, and describing the technique of preparation of the aggregates (crushing, sieving, washing or dust-freeing) and the production and storage capacity.
- The mineralogical identification reports of the natural materials or rock-based prepared materials and the results of qualitative and quantitative analysis carried out by the contractor's laboratory which must thus be equipped with the necessary means. References must be established from a sufficient number of analyses for a valid identification of homogeneity of the bed or geological horizon being worked.

The contractor's attention is drawn to the particular importance of the mineralogical composition of the aggregates. Tests shall be carried out to ensure that the aggregates do not contain any component liable to affect the durability of the concrete. For this purpose, the following appropriate tests shall be carried out:

- Reactivity of aggregates (chemical method-ASTM C.289),
- Sodium sulphate and magnesium sulphate soundness of aggregates (AASHTO 104); the loss after 5 cycles shall be at maximum 10% for fine aggregates and 12% for coarse aggregates; if a loss lower than those specified cannot be obtained, the Engineer may approve the use of material, based on other data and experience,
- Alkali reactivity of the concrete mix (mortar bar-ASTM C.227-C.586),
- Change of volume of the concrete mix (ASTM C.242).

The contractor shall consider that these tests are quite long to carry out. He shall therefore take the necessary measures so that the tests do not delay the regular progress of the works. The contractor shall be responsible for possible delays.

#### 15.2.4.3.2 Fine aggregates

Fine aggregates may be either sand resulting from crushing of the rock used for the fabrication of coarse aggregates with a Loss Angles abrasion coefficient lower than 35% at 500 revolutions (AASHTO T96) or a water absorption capacity lower than 5% (AASHTO T 84), or natural river sand, and shall conform to the requirements specified here above. The use of sea sand is not allowed.

Fine aggregates shall not include any excessive quantity of flat and elongated matter such as shells and shall conform to the following grading requirements:

Sieve designation		Percentage of passing material
Standard (mm)	Imperial (inches)	(By weight)
10	3/8	100



4.75	#4	95-100
2.36	#8	80-100
1.18	#16	50-85
0.6		25-60
0.3	#50	5-30
0.15	#100	0-10
0.075	#200	0-3

The fineness module shall be between 2.3 and 3.1. The granulometric dispersion range shall not allow a variation in the fineness module of more than 0.5.

The cleanliness of the fine aggregates shall be assessed generally by the application of the sand Equivalent Test (AASHTO T 176), the result of which must be above 75%. The material shall be washed or freed of dust, if necessary.

The following shall be considered as impurities and shall not be accepted:

- Wood or coal particle, or their residues'
- Organic matter, which may only accepted if present in sufficiently small quantities, as revealed by the coloration tests (AASHTO T 21) to show a lighter colour than the typical colouring.
- Sulphates and sulphides, which shall only be tolerated if the total sulphur content, expressed in SO<sub>3</sub>, does not exceed 1% by weight (the proportions shall be determined by chemical analysis if their presence is detected by qualitative test),
- Chlorides, which shall only be tolerated as trace elements, but the total amounts of chlorine present in concrete due to its constituents (aggregates, cement, mixing water) shall under no circumstances exceed 0.4% in respect of reinforced concrete, calculated in relation to the weight of the cement,
- Clay and crumbly particles, which must of represent less than 1% of the weight of the aggregates (AASHTO t 112).

If considered necessary by the Engineer, the sand shall be rewashed at the contractor's expense. The use of granite fines in lieu of shall be subject to the approval of the Engineer who may require adjustments to the mix proportions as deemed necessary.

#### 15.2.4.3.3 Coarse aggregates

Coarse aggregates shall be rounded natural aggregates or crushed aggregates obtained by crushing a rock which meets the general description specified here above. It shall have a Los Angeles abrasion coefficient after 500 revolutions below 35% (AASHTO T 96) and a water absorption capacity < 5% (AASHTO T 85).

The aggregates shall include as few as possible of flat and elongated particles. The testing for checking the amount of particles with an incorrect shape shall be carried out either by determining the average volumetric coefficient of the aggregates, or by any other equivalent method approved by the Engineer.

The coarse aggregates shall meet the following grading requirements:



Sieve designation		Percentage of passing material
Standard (mm)	Imperial (inches)	(by weight)
25	1	100
20	3/4	90-100
10	3/8	20-55
4.75	#4	0-10
2.36	#8	0-5
1.18	#16	0-2
0.075	#200	Max .1

The coarse aggregates shall be selected so that the maximum particle size is no more than  $\frac{3}{4}$  of the minimum clear space:

- Between reinforcing bars,
- Or between reinforcing bars and formwork,
- Or between any other restrictions in the space that the concrete must occupy in the work.

The same requirements regarding impurities as those specified for fine aggregates shall be applicable.

#### 15.2.5 Water

Water for concrete mixing shall be clean and free from harmful matters, such as grease, oil, salt, acid, alkali, sugar or organic matters. It shall have a pH approximately neutral.

Analyses to be submitted to obtain approval of the water quality must that:

- The amount of matter in suspension is less than 2g per litre,
- The amount of dissolved salts does not exceed 15g per litre.

Among salts in solution, chlorides shall only be permitted if the (Cl<sup>-</sup>) ion content in the concrete, included all constituents, calculated in relation to the weight of the cement, and does not exceed a maximum content of 0.4%. The total amount of sulphates shall be less than 1% if cement ASTM type I is used. Otherwise ASTM cement type V shall be used.

In case of doubt concerning the quality of the water, verification can be made by comparing the influence of the water on the setting time of the cement, and the quantities of resistance of the concrete mix, one made with the water submitted for approval and the other with distilled water. Resistance to compression after 28 days using the water proposed shall not be less than 90% of the resistance of the sample mixed with distilled water.



### 15.2.6 Admixtures

All admixtures shall conform to the relevant AASHTO standards and shall be approved by the Engineer. Any delivered admixtures shall be accompanied with a certificate of origin starting the date of manufacturing and the limit date of use.

### 15.2.7 Curing products

All curing products are subject to the Engineer's approval.

All requests for approval must be accompanied by a test report, the test having been carried out by a specialised laboratory establishing the efficiency of the product under hazardous conditions: at 40<sup>o</sup> Celsius and with humidity of 55%, the coefficient of efficiency of the product shall not be less 85% after 6 hours and 80% after 24%.

Furthermore the curing product shall not adversely affect the bond of neither coatings nor insulation, or the bond of water proofing systems to be applied to the concrete.

A certificate of origin and directions for use shall be submitted with every delivery.

### 15.2.8 Reinforcement steel

Unless otherwise specified all reinforcement steel shall comply with the requirements of the ACI315, and shall be free of any defect which would affect their strength or ability to be bent, such as faults, cracks, crevices, blow-holes, or material deficiency.

The surface shall be regular without hair-cracks or holes, undulations or incipient oxidation pitting. Sawn or sheared sections shall be clean, uniform and free of defects.

Reinforcing steel shall be plain or deformed billet steel bars, conforming to the following requirements:

- Plain bars, for diameters less or equal to 12mm (and for dowel bars, even with diameters greater than 12mm):

With  $f_Y = 2.400 \text{ kg/cm}^2$

- Deformed bars, for diameters more or equal to 16mm:

With  $f_Y = 3.900 \text{ kg/cm}^2$

Steel mesh reinforcement shall be welded steel fabric, type BRC or similar, conforming to the following requirements: with  $f_Y = 5.000 \text{ kg/cm}^2$ .

Approval given by the Engineer to any source of steel under the above conditions does not in any way relieve the contractor from his contractual liability to supply materials which comply with the specifications. Any material which in opinion of the Engineer, is unsatisfactory or does not comply with the requirements of the ACI 315 shall be rejected.

Any delivery of steel in which satisfactory material has been mixed with unsatisfactory material shall be rejected and shall be removed from the site. Bars in very long reinforcement shall be supplied in such lengths that laps are at least 11.50m apart.

### 15.2.9 Coal tar Base Products

Rendering on concrete surfaces below ground shall be generally a de-acidified coal tar base product submitted to the Engineer for approval, except, as otherwise specified.

### 15.2.10 Supports and Ties

Supports for reinforcement shall be formed from lightweight steel bars or precast concrete blocks of class K275 concrete, unless otherwise directed by the Engineer. Wood, bricks, stone or other materials shall not be permitted as supports.



Ties fastening reinforcement shall be annealed steel wire conforming to AASHITO M 32.

#### **15.2.11 Mild Steel Sections and Tubes**

Steel tubes and profiles for minor works included in the concrete works, such as sleeves, will not be subject to acceptance tests. They shall however meet the size characteristics shown on the drawings, or the equivalent.

They shall be free from deformation or incipient oxidation pitting.

#### **15.2.12 PVC Pipes**

PVC pipes embedded in the concrete works shall be of standard type and shall be approved by the Engineer.

They must be of sufficient strength to withstand pressures created by freshly pounced concrete or forces set up during fixing of reinforcement, or any other stresses to which they may be subjected. All joints must perfectly seal.

### **15.3 Workmanship**

#### **15.3.1 General**

The workmanship shall be of first class quality and shall follow the normally accepted methods defined by the applicable codes of practice. In the absence of special mention in these specifications, the instructions included in standard international regulations and, especially, in the Indonesian code of practice for reinforced concrete construction, ACI135 shall apply.

The concrete works shall be carried out in such a manner as to ensure a satisfactory co-ordination with the works of the other trades.

#### **15.3.2 Equipment, Plants and Construction Methods**

Within a period of thirty (30) days from the date of award, the contractor shall submit the list of heavy equipment and plants he intends to use, to the Engineer's approval. This list must include, as a minimum, the following items:

- Bulldozers, graders, tire rollers, vibrating cylinders,
- Excavators,
- A shop for bending reinforcement steel bars, and for each separate construction site:
- One automatic-weighing concrete mixer, and a separate facility for weighing cement with a tolerance of 0.5%,
- One or more cement containers equipped with thermometers, permitting the storage of a minimum quantity of cement corresponding to 2-day consumption when concreting in continuous,
- The trucks necessary for resupplying aggregate stockpiles and other socks necessary for the jobsite,
- Cranes providing service to all parts of the jobsite, if deemed necessary by the Engineer,
- Props, joints and platforms,



- Formwork in sufficient quantity to ensure that the specified striking is strictly maintained,
- Provision for safety rails,
- Compressors and concrete vibrators, vibration tables, poker vibrators,
- Mats or and tarpaulins for protection of freshly pounced concrete.

The contractor shall join to the equipment list a memorandum specifying the construction methods and the equipment planned for each work.

### **15.3.3 on Site Laboratory and Controls**

The contractor shall install an onsite laboratory staffed and equipped before the beginning of stockpiling materials.

This laboratory shall be used by the contractor, at his cost, to perform all permanent control tests of production and working quality required by the Engineer under the present contract, and any others which it shall deem necessary to perform on the site.

In particular, the contractor shall be able to control the quality of the constituents of pounced and precast concrete, and of other materials intending for masonry works.

Here shall provide the minimum following equipment:

- Complete sieve analysis equipment: sets of sieves from 80 microns to 50 mm, scales, oven etc.
- Equipment for measuring and equivalent and  $\text{CaCO}_3$  content,
- A series of metal moulds for making concrete test cylinders,
- Two Abram's cones for concrete slump testes,
- A concrete press (minimum force 1.200kN),
- A flexural strength testing machine,
- Equipment for smoothing concrete test specimens,
- Equipment for normal and modified Proctor compaction test,
- A diagram dens meter for compaction control,
- Precision scales suitable for the various tests,
- Cement testing equipment :setting test, fast identification, specific area,
- Various necessary chemicals,
- An accelerometer or a concrete hammer for non- destructive testing of concrete in-situ.



This laboratory shall also be able to perform the acceptance tests started in the present contract specifications, other than those within the competence of the surveyors.

All the test results shall be noted in test reports, to be submitted to the Engineer's within three (3) days following the tests.

#### 15.3.4 Composition of Mortars and Concretes

The material proportions and batch weights for mortars and concretes shall be determined in accordance with the limits given in the following table.

Reference class	or	Designation	Composition	Purpose
M1		Masonry mortar	400kg of cement per m <sup>3</sup> of dry sand	Laying the masonry blocks
M2		Mortar for capping and coatings	450kg of cement per m <sup>3</sup> of dry sand	Standard facings and capping, anchoring, filling, grouting
M3		Mortar for vertical facings	250kg of cement & 250kg of lime per m <sup>3</sup> of dry sand	Renderings on walls
M4		Waterproofing mortar	600kg of class 5 cement per m <sup>3</sup> of dry sand	Facings of conduits, underground structures & basis damp-proofed courses

Reference class	or	Designation	Composition	Purpose
K125		Lean concrete	Estimated cement content: 250kg/m <sup>3</sup> Maximum water content: 130kg/m <sup>3</sup>	Blinding beds under concrete slabs in contact with the ground, and under foundations
K175		Structural unreinforced concrete	Estimated cement: 300kg/m <sup>3</sup> Maximum water content: 150kg/m <sup>3</sup>	Unreinforced plain concrete structures, such as sidewalks, curbs, cable ducts
K225		Structural reinforced concrete	Estimated cement content: 350kg/m <sup>3</sup> Maximum water content: 160kg/m <sup>3</sup>	All reinforced concrete drainage and civil works structures

Within thirty (30) days from the date of acceptance of the contract, the contractor shall propose to the Engineer, for each of the mortars and concrete listed in the table here above:

- The origin and grading of the aggregates,



- The mix designs (contents of sand, coarse aggregates, cement and water) for the concretes.

The contractor shall support his proposals for the mix designs of the structural concretes, by making and testing trial mixes, in the presence of the Engineer, using the same type of plant and equipment as will be used for the works, and shall submit the test reports to the Engineer. The Engineer, within five (5) working days, shall make his comments on those proposals, or approve them. However, even after his approval the contractor shall still be entirely responsible for achieving the results required by the concrete quality control testing specified there under.

### 15.3.5 Structural Concrete Design Tests

#### 15.3. 5.1 Nature of the tests

For each class of structural concrete, K175, K225, the design tests shall consist of:

Type of tests	Age	Number of specimens tested
Compressive strength	3 days	20
	7 days	20
	28 days	20
Flexural strength	3 days	20
	7days	20
	28 days	20

And plasticity control tests by measurement of the slump.

All these tests shall be carried out in accordance with the requirements of AASHITO T22, T97, T126 and T119.

The trial mix designs shall be deemed acceptable provided they meet all the mix property requirements specified here after.

#### 15.3.5.2 Mix property requirements

All structural concretes used in the work shall meet the compressive strength, flexural strength and slump requirements specified in the following tables, or approved by the Engineer, when sampled, cured and tested in accordance with AASHITO T22.T23, T97, T119, T126 and T141.

Concrete	Minimum compressive strength (kg/cm <sup>3</sup> )					
	15 cm cube specimen $\sigma_{bK}$			15cm x30cm cylinder specimen $0.83\sigma_{bK}$		
Class	3-day	7-day	28-day	3-day	7-day	28-day
K 175	70	115	175	55	95	145



K 225	90	145	225	75	120	185
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Concrete class	Minimum flexural strength = modulus of rupture MR (kg/cm <sup>2</sup> )		
	3-day	7-day	28-day
K 175	23	31	39
K 225	26	35	43

Note: MR from=  $K \sqrt{f'_c}$ , with  $K=8$  to  $10$ , and  $f'_c= 0.83\sigma_{bK}$ , in psi.

concrete class	Slump (mm)	
	Vibrated	Non- vibrated
K 175	20-60	50-80
K 225	20-60	50-100

### 15.3.8 Structural concrete quality control Tests

#### 15.3.8.1 Nature of the tests

Systematic quality control tests of the structural concretes K175, K225, shall be carried out throughout the works execution.

These tests consist of:

Type of tests	Number of specimens	Age
Compressive strength	2cylinders	3days
	2cylinders	7days
	2cylinders	28days
Flexural strength	2 prisms	3days
	2 prisms	7days
	2 prisms	28days

The compressive strength tests shall be normally carried out on cylinder specimens. However the contractor may use cube specimens with the approval of the engineer.

Plasticity control tests by measurement of the slump of fresh concrete, shall be carried out using the Abrams cone, and completed if necessary by the compacting factor test described in ACL 315. One slump test, or more as directed by the engineer, shall be called out on every batch of concrete produced, and the test shall not be deemed to have been carried out unless witnessed by the engineer or his representative.

All these testes shall be carried out according to the methods specified there under.



### 15.3.8.2 Sampling of specimens for quality control testing

The sampling of the concrete specimens for the quality control testing shall be carried out as directed by the Engineer, either from the concrete mixer, or when placed.

Each test series shall comprise 6 cylinders and 6 prisms for each grade of concrete poured. The following shall apply every day:

- 1 test series if the quantity poured is less than 60 m<sup>3</sup>,
- 2 test series if the quantity poured is more than 60 m<sup>3</sup>,
- 1 test series for any isolated structure, regardless of its volume,
- 1 test series every day.

However, the Engineer may reduce the test frequency as soon as production and strength consistency of the various grades of concrete has been achieved. The test frequency shall not however, ever be less than at one week interval.

The specimens for the 3-day and 7-day tests shall always be stored near the structure, adequately protected and maintained by the contractor, so that their thermal and hygrometric history is comparable to that of the structure.

The specimens intended for the 28-day tests shall be kept in their moulds at a temperature as close as possible to 20°C during the first 24 hours. They shall be removed from the moulds after 24 hour, placed into sealed casings and transported to the laboratory as quickly as possible. They shall be kept under water until are tested. They shall be wiped, but not dried, just before testing.

### 15.3.8.3 Test results

The results of the quality control tests shall be in accordance with the mix property requirements, as specified here above.

They shall be submitted to the Engineer as soon as they are available.

### 15.3.8.3 Consequences of unsatisfactory test results

#### 15.3.8.4.1 Plasticity

Concrete not meeting the slump requirements shall generally not be placed in the work, except that the Engineer may in some instances approve the limited use of small quantities of such concrete in lowly-stressed parts of certain works. The workability and texture of the mix shall be such that it can be replaced in the works without the formation of hollow spaces or gaps or retention of air or water bubbles, and such that on removal of formwork as smooth, uniform, dense surface is presented.

If it appears impossible to get the specified workability with the original mix design approved by the engineer, the contractor shall submit to the Engineer's approval mix adjustments. Admixtures for increasing the workability will be permitted only when specifically approved by the Engineer.

#### 15.3.8.4.2 Compressive strength

When the results of 7-day tests give strengths below those specified, the contractor shall not place any further concrete until the cause of low results has been ascertained and until he has taken such steps to ensure that the production of concrete complies with the specifications.

The Engineer may also suspend the work and/ or direct the contractor to take corrective action to improve the mix quality on the basis of the 3-day compressive strength test results. In a such



case the contractor shall immediately cease placing the concrete in question but may elect to wait until the results of the 7-day test are available before implementing corrective measures, at which time the Engineer will review both 3-day and 7-day test results, and may direct immediate implementation of whatever corrective measures he judges are necessary.

Rectification of unsatisfactory concrete work involving the complete removal and replacement of the concrete shall not be based on the results of 3-day compressive strength tests alone unless the contractor and Engineer mutually agree on the rectification.

If 28-day results are not satisfactory, the structure or part of the structure shall be subject to additional quality control testing including dynamic non-destructive testing, as loading tests, sclerometer or concrete hammer testing, and compressive strength testing on core drilled samples, according to schedule approved by the Engineer.

The final decision of acceptance, rectification of the structure or part of the structure shall be under the Engineer's responsibility, who will be entitled to order the demolition of the deficient part of the structure, if the results of additional testing are not satisfactory.

The cost of the 28-day strength tests, core drilling and testing, dynamic non-destructive testing and load test, including all supplies and use of specialized staff, shall be supported by the contractor.

#### **15.3.9 Concrete information Tests**

Concrete information testing shall be carried out at time periods chosen by the contractor. The purpose of this testing is to assess the strength actually met in the structure after a certain time, and to assess the possibility for skirting forms and scaffolding.

The specimens prepared for information testing shall be kept near the structure, so that their thermal and hygrometric history is similar to that of structure.

#### **15.3.10 Concrete Testing Methods**

The concrete mix design tests, the systematic concrete quality control tests and the concrete information tests shall be carried out according to the following methods.

##### **15.3.10.1 Plasticity control**

The concrete plasticity measured with the Abrams cone shall be kept between eight and twelve tenths of the specified slump. The slump to be taken into account is the arithmetical mean of the results of six tests, measured after removal of the cone.

##### **15.3.10.2 Compressive tests**

The compressive strength of the structural concrete shall be normally measured on cylinder specimens, diameter 15cm x height 30cm, which shall be crushed. The tests shall be carried out in accordance with AASHTO T 22.

The definition of the characteristics strength and standard deviation shall be conforming to the ACI 315.

##### **15.3.10.3 Flexural tests**

The flexural tests shall be carried out on prismatic specimens, 15cm x 15cm x 50cm, in accordance with AASHTO T 97.

##### **15.3.10.4 Preparation of moulds**

The mould shall be of metal, capable of disassembly, and shall include a bottom and walls. They shall be equipped with a cover. The maximum tolerance on each of their dimensions shall be +/- 0.3 mm for a new mould and 0.6mm for a mould in service. The bottom and the walls shall be adjusted with sufficient accuracy so that a satisfactory sealing is ensured. They shall be thick enough not to be significantly deformed during concrete pouring.



The moulds shall be thoroughly cleaned after the specimens are removed from the moulds and shall be greased immediately afterwards.

The Engineer may refuse to use unsatisfactory moulds, or those, which, because of their wear, no longer meet the above requirements. The rejected moulds, shall be removed from the site. The moulds shall be in sufficient quantity on the site for the execution of all the tests and controls specified here above or those specified by the Engineer.

#### **15.3.10.5 Test specimen marking**

The specimens shall be marked when removed from the moulds. The marks shall be affixed by paint or by any other process approved by the Engineer.

#### **15.3.11 Formwork**

##### **15.3.11.1 General**

The materials selected for formwork shall be approved by the Engineer as to strength reliability and impact on the finished appearance concrete.

All timber shall be stored above the ground in an adequate position to prevent warping. Formwork unemployed for the next 7 days shall be cleaned, oiled and stored flat and protected against humidity by a tarpaulin or similar waterproof cover.

##### **15.3.11.2 Types of formwork**

###### **15.3.11.2.1 Ordinary (or wrought) formwork**

All the formwork used below ground or for unexposed surfaces shall be of the ordinary type. They shall consist either of aligned parallel wood boards with sharp edges, simply juxtaposed, or of compressed particle or plywood panels. The joints shall be closed enough to eliminate any loss of grout when the concrete is poured. If necessary, this sealing may be obtained by used of adhesive tape. The level difference between two juxtaposed panels or boards, measured normal to the face plane, shall not exceed 3.

###### **15.3.11.2.2 Prepared (or sawn) formwork**

Formwork for all exposed faces shall be prepared or sawn forms. These forms shall consist of aligned parallel boards with sharp edges, planed on their four faces, juxtaposed, butted and suitably leveled, or of compressed wood fiber or plywood panels with a finish equivalent to that of plywood. If these panels are to be used repeatedly their edges shall be protected against wear and water penetration by means of linings or special paints. These forms may consist also of steel panels. The sealing of joints between formwork constituents shall be such that only slight water seepage occurs when a concrete is poured. The used of adhesive tape to obtain this sealing is not authorized.

The level difference between two adjacent boards or panels, measured perpendicularly to the plane, shall not exceed 1mm.

##### **15.3.11.3 Design, construction and erection**

Formwork for exposed surfaces shall be (if they are made of wood) of the same kind of wood and of the same thickness, without knots and with parallel grain. Without prior agreement of the engineer, it cannot be painted or provided with a plasticized lining.

Formwork shall be so designed and constructed and constructed that concrete can be properly placed and thoroughly compacted without loss of water. Formwork shall be adequately strutted, braced, and tied. It shall be capable of adjustment to the lines and the dimensions of the finished concrete and be sufficiently strong to withstand the pressure resulting from placing the fresh concrete, whatever method of compaction is employed, without undue deflection or



loss of alignment. The contractor shall submit to the engineer the design calculation for the formwork.

Forms shall be constructed so that they can be removed without damaging the concrete. Formworks shall provide chamfering of all sharp edges.

The rigidity of forms shall be such that the surfaces do not deviate by more than five (5) mm from the theoretical surfaces and that the cross-sections of parts of the structure are never less than those specified on the working drawings. The contractor shall conciliate this requirement with possible formwork deformation due to internal vibration of the concretes. The 5mm tolerance shall not be required for concrete below ground.

The permissible tolerance for the verticality of upright forms shall be 10mm for a height of 3m.

The components of prefabricated forms shall be designed to withstand, without deformation, the various stresses which they undergo during their transport, assembly and disassembly, as well as during concrete pouring.

Whenever permitted by the desired appearance of the surfaces of the structure, the engineer may authorize that the holes reserved for formwork fastening be left exposed. In this case, their locations, dimensions and shapes will be carefully studied as to appearance and pattern, and shall be submitted to the engineer.

The contractor is required to make allowance for any settlement or deflection of formwork which might occur during construction so that the hardened concrete shall conform accurately to the specified line and level.

All the horizontal forms shall be leveled, taking into account cambers necessary to compensate the elastic deformation under dead loads and the deformation due to shrinkage and possibly to creep.

Furthermore, all arrangements shall be made to prevent deformation of forms at construction joints. In the case of pouring in several stages within the same formwork, this formwork shall be retightened and rebounded to the faces of the part already hardened before the beginning of a new concreting stage.

Ties shall be provided where necessary. They shall be of a variety acceptance to the engineer and spaced to a regular pattern to the architect's approval. All ties anchored against timber shall pass through a plate washer at least 50mm\*50mm and of sufficient thickness to transfer the load into the timber without visible deflection or penetration into the timber.

All holes left after the removal of the ties shall be filled with mortar of approved color and composition and finished to the architect's approval.

Forms shall not be spotted by hydrocarbon products, such as grease, oil sludge, etc. nor by rust. Any accidental spots which might appear before pouring shall be removed as quickly as possible.

Immediately before concrete pouring, the forms shall be cleaned and free of dust and waste of any kind. Opening with removable hatches shall be made in the forms, if necessary to facilitate cleaning and inspection of areas where access is difficult. Final cleaning shall be by blasting with compressed air.

Then, just after cleaning and before concrete pouring, the forms shall be saturated with water or coated internally with a form-removal oil (non-staining mineral oil) applied in two coats, the excess of which, accumulated at the bottom of the moulds shall be removed before concreting by sponging. The form-removal oils or chemicals shall be submitted for approval



by the engineer together with the direction for use. Preliminary moulding tests shall be performed to control the quality of the oils.

Forms and scaffolding components which have projecting nails or spikes after use shall be immediately cleaned of nails or spikes, if they are intended to be reused. Otherwise, they shall be burned immediately or stored away from the site in closed premises.

#### **15.3.11.4 Compliance with the scheduled and formwork striking times**

The contractor shall supply a sufficient number of formwork components to meet the work execution deadlines and to comply with the various requirements in particular with that of form work striking times.

### **15.3.12 Shaping and placing reinforcement**

#### **15.3.12.1 Bending reinforcing bars**

Reinforcing bars shall be bent to the length and shapes specified in the working drawings. The bars shall be cold cut and bent. The bending devices shall be equipped with full sets of mandrels permitting to achieve all specified curvatures. Mandrels shall be permanently available in the bending shops. No minus tolerance shall be allowed on mandrel diameters. Plus tolerances may be allowed, if agreed by the engineer, and if no disadvantage results for the structural quality of the reinforced concrete and if there is no regulation transgression. Shaping of the reinforcing bars shall be in accordance with the type of steel. The minimum diameters for bending shall be as specified in the certificates.

#### **15.3.12.2 Placing reinforcement**

##### **15.3.12.2.1 Fastening and wedging**

Bars shall be placed into the moulds in the exact positions given in the shop drawings and shall be fastened by ties and wedges by blocks, sufficiently solid and in a sufficient number (about 2 blocks per square meter) so that the bars cannot be displaced during pouring, in particular during vibration, or by accident by the workmen.

No part of the placed reinforcement shall be used to support concrete conveying equipment, access ways, working platforms or any other construction loads.

Ties shall be in annealed mild steel wire. They shall be well tightened with pliers. They shall be located at all bar intersections unless otherwise directed by the engineer. The twisted ends of the tie wires shall be directed away from concrete exposed surfaces.

Wedges keeping the bars away from the formwork surfaces may be metal, concrete, mortar or plastic.

The concrete or mortar blocks shall be of a composition similar to that of the concrete in the structure, and of the same color if exposed.

Plastic blocks and metal blocks insulated by plastic linings resting on the formwork shall be approved by the engineer as to their shape and constitution. The use of these blocks shall not prejudice the reinforced concrete as far as its mechanical strength and corrosion resistance are concerned.

Unless they are perfectly stable because of their shape, blocks of all kinds shall be provided with devices permitting their fastening to the reinforcing bars, so that they are not displaced during pouring concrete.

##### **15.3.12.2.2 Reinforcement continuity**



All reinforcement shall be furnished in the full length, as indicated on the drawings. Splicing of bars, except shown on the drawings, will not be permitted without the written approval of the engineer. Any splices that may be approved shall be staggered as far as possible and shall be located at points of minimum tensile stress.

The continuity of continuous reinforcing bars shall be ensured by overlapping of a minimum of forty (40) diameters or more, as required by ACI 318.

When reinforced consists of several bars or bundles of bars, the joints shall be distributed over a length such that every section has at least two thirds of continuous bars.

Welded wire fabric shall be installed in as long length as practicable, with adjoining pieces lapped at least one full mesh. The fabric shall be cut to fit at curbs and openings, and shall be discontinuous at construction/contraction and expansion joints between slabs.

Welding of reinforcing steel shall not be permitted unless detailed on the drawings or specifically authorized by the engineer in writing. If the engineer approves splices welding, the welds shall be full penetration butt welds conform the requirements of AWS D 2.0. Water quenching of welds shall not be permitted.

#### 15.3.12.2.3 Reinforcement cleanliness

When ready for pouring concrete, bars in place shall be perfectly clean, without dirt or loose rust, paint, grease oil, mortar, concrete or soil.

When fixed reinforcement is to be left exposed for a delayed period of time, it shall be thoroughly cleaned and painted with a cement grout.

### 15.3.13 concrete production, transport and pouring

#### 15.3.13.1 Mixing

The mixing shall be placed in the skip in the following order: coarse aggregates, cement, sand, and water, each of them having been weighed separately from the others. The mixing duration shall be at least two (2) minutes.

The contractor shall display, in the site office, for each type of concrete, the certified theoretical composition (according to the approved mix design), and at the batching plant, the practical composition which shall take into account the actual moisture contents of the aggregates.

For each component the tolerance shall be:

- +/- 3% (three percent) for each category of aggregates,
- +/- 2% (two percent) for the total amount of aggregates and sand,
- +/- 2% (two percent) for the total amount of water,
- +/- 2% (two percent) for the cement.

Sampling of aggregates and checking of cement and water may be performed, at the Engineer's request, at the discharge point of the batching equipment.

#### 15.3.13.2 Transport

All plant and tools for transporting concrete shall always be kept clean and free from concrete accumulation. Concrete shall be transported under conditions which do not give rise to segregation of the components or setting before pouring.

All precautions shall be taken to avoid excessive evaporation or intrusion of foreign matter during transport. The transport methods shall be approved by the Engineer.

The conditions of transport and use of dry mixes shall be approved by the Engineer.

Details of any proposed pumping, conveyor belt or shutting plant must be approved by the Engineer before such plant is delivered to the site. When concrete pump is used, the end of the pipe shall be placed as close as possible to the surface of the concrete already in place.



If the contractor uses concrete pumps, pneumatic conveyors or belt conveyors, the pipes or belts shall be thoroughly cleaned after every shutdown. When the Engineer so specifies, pipes exposed to the sun shall be suitably protected, for instance by periodically watered straw matting or tarpaulins.

#### **15.3.13.3 Arrangements for pouring**

The arrangements made by the contractor for pouring concrete into forms shall be submitted to the Engineer's approval. These arrangements shall prevent segregation. In particular, for heavily reinforced members, the Engineer may require concrete pouring through spouts or chutes.

#### **15.3.13.4 Concreting schedule**

The concreting program shall be prepared by the contractor taking into account the following points:

- The restrictions imposed by the program planned for the construction works,
- The methods of construction which must be selected in order to stay within the limits of the bearing capacity of all structural members during all phases of the construction works.

The overall program may require several mixing station operating simultaneously so that the structure of the various buildings be completed in time.

The concreting schedule shall define, for all concretes, the stages of concrete pouring, which shall be sequenced without interruption, as well as the succession of the stages. This schedule shall be presented by the contractor to the approval of the Engineer before any concrete is poured.

This program shall define the position and configuration of the construction joints, taking into account the indications shown on the working drawings. It shall be prepared so as to reduce interruptions as much as possible and to arrange the construction joints satisfactory, with regard to mechanical correctness and appearance.

For the structural concretes, the concreting schedule shall specify the type, the characteristics and the number of vibration devices to be used during each concreting stage. It shall also specify the number of vibrators to be held in stand-by to replace those out of order.

The concreting schedule shall give the arrangements and maximum distances of the points where the vibrators shall be used. The time of action at each point shall be set for each of them when clamp on vibrators are used.

#### **15.3.13.5 Placing concrete**

No concrete shall be placed until the forms and the steel reinforcement (dimensions and position) have been checked and approved by the Engineer.

Concrete shall be placed in its final position as soon as possible after mixing in such a manner as to avoid segregation of the concrete and displacement of the reinforcement from the framework. Placing shall be continuous between specified or approved construction joints.

Suspended gangways for the work men placing and vibrating the concrete are to be provided wherever possible to avoid damaging and displacing the reinforcement. Steel fixers shall be constantly in attendance while pouring concrete is in process to maintain the reinforcement in correct position.

Concrete shall not be dropped from a height likely to cause segregation.



Any concrete unused for more than fifteen (15) minutes after mixing, or any concrete dropped during transportation shall be rejected.

#### **15.3.13.6 Concrete vibration**

##### **15.3.13.6.1 General**

Concrete shall be thoroughly compacted by means of mechanical vibration during placing, and carefully worked around the reinforcement and embedded fixtures (if any) and into corners of the formwork.

The vibration shall be thorough and at least equal to six thousand (6000) vibrations per minute. It shall be stopped as soon as grout rises to the surface.

##### **15.3.13.6.2 Internal vibration**

The contractor shall supply enough vibrators of each type to ensure that vibration is carried out efficiently without delay and without breaks in continuity throughout the operation of concrete placing. Hand compacting shall not be allowed without prior approval of the Engineer.

The vibrators shall be of such sizes as to penetrate within the form walls wherever specified, so as to act on all the concrete, taking into account their radius of action. A vibrator shall never use to spread the concrete or to push it into the corners of the formwork. Unless otherwise specified by the Engineer, the depth of action of an immersion vibrator shall be at most equal to forty five (45) centimeters.

Concrete shall be placed in layers not thicker than forty five (45) centimeters until vibration of each layer is completed. Care must be taken to ensure that successive layers are well worked together.

When the thickness of the concrete to be poured is at most equal to thirty (30) centimeters, this concrete shall be poured in a single layer.

If the positions and vibration time of vibrators are not specified in concreting schedule, suitable ones shall be assessed during the work by observing the mortar reflux circle at the surface of the concrete. The radius of this circle may be considered as the radius of action of vibrator.

A layer of fresh concrete over a layer already poured shall not be considered as a construction joint if the first layer can be vibrated. This may be assessed if the immersion vibrator penetrates easily into this layer and if the hole closes up when the vibrator is removed. In that case, when vibrating a new layer, the vibrators shall have to penetrate into the underlying layer. If the concrete already placed cannot be vibrated, the superposition of a layer of fresh concrete over the first one shall be considered as a construction joint on hardened concrete.

The thickness of the layers consolidated by the surface vibration using vibrating tampers or screeds shall be limited to 20 cm for non-structural concretes and 15cm for structural concretes, unless tests performed by the contractor have shown the possibility of accepting greater thickness. The vibration shall be carried out at each position of the vibrating device until device a reflux of mortar occurs on the edges. The successive location the device shall overlap.

#### **15.3.13.7 Construction joints**

Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be as shown on the drawings or as approved by the Engineer.

The contractor may be required to submit a drawing showing the intended sequence of pouring, location and details of proposed construction joints. No casting shall commence until approval has been given.

Where practical, construction joints shall be either vertical or horizontal; vertical joints shall be formed against a rigid stop board and rebated, horizontal joints shall be leveled and formed with a suitable key, if required. Whenever possible, the position of construction joints shall be



settled before concreting begins. As a general rule, joints in column are to be made as near as possible to the underside of the deepest beam. Vertical joints in walls shall be kept to a minimum.

Before placing new concrete, the surface of the old concrete shall be thoroughly roughened and cleaned; in the case of horizontal surface, any grout or scum on the surface shall be removed by spraying water into the surface and brushing to expose the coarse aggregates. The final cleaning shall be with compressed air. The surface of the construction joint shall be wetted abundantly, so that the old concrete is moisture-saturated before the fresh concrete is placed. However its surface should have no free water when concrete is internally vibrated, the vibrator action duration shall be increased by one-half with respect to those which would be used if the old concrete were able to be vibrated.

Constructions joints due to unplanned cessation of concreting shall be performed according to the above specifications, but only after approval of the configuration of the construction joint surface by the Engineer. The Engineer may specify to provide a surface suitable for mechanical strength and appearance, and small diameter dowels into the fresh concrete to ensure continuity.

#### **15.3.13.8 Concreting without the use of formwork**

The surfaces shall have the shapes and positions specified in the working drawings. They shall be made flush and finish during the operation of concreting, without addition of concrete after the initial set and without addition for mortar at any time whatsoever. Any concrete added to correct the surface finish shall be vibrated in the same way as the underlying concrete, if the latter has been vibrated.

Necessary arrangements, such as use of templates, installation of reference marks, guide straightedges for templates or for vibrating screeds, etc, shall be made for correct adjustment of surfaces. These arrangements shall be approved by the Engineer.

The finishing of surfaces shall be uniform finish matching that of adjacent faces poured inside forms.

For construction joints of vertical facings, the contractor may use wire meshing to retain the concrete in the required position.

#### **15.3.13.9 Fixtures, indentations and miscellaneous**

Anchor holes, grooves, openings, etc, shall be part of the forms. Unless they are made of Styrofoam, the boxes for anchor holes shall be made of several parts, to permit their removal without damaging the concrete.

Angle sections, cover frames, anchor rails, etc, shall be screwed to the forms to prevent their displacement during vibration. Flanges of pipes shall be screwed to the forms and adjusted perpendicularly to the formwork faces.

No opening, chases, holes or other voids shall be formed in the concrete without the Engineer's approval. Details of any fixture intended to remain in the concrete shall be submitted to the Engineer's approval. All fixtures must comply with the requirements of the Engineer and must be of character and size to avoid any weakening or contamination of the concrete.

#### **15.3.13.10 Concrete foundation**

The foundation shall be of lean concrete K125, thickness according to drawings.

#### **15.3.13.11 concreting in hot weather**

Batching, mixing and delivery of concrete in hot weather shall comply with ACI305.



The contactor shall provide, on each work area, the equipment for measuring the following parameters required for the calculation of the quantity of water evaporated per hour and per square meter of concrete placed:

- Air velocity,
- Relative humidity of the atmosphere,
- Air temperature,
- Concrete temperature.

If special measures have to be taken, all methods and equipment shall be submitted to the Engineer, either for reducing the temperature of fresh concrete, or for increasing the air humidity above the placed concrete, or for using both measures.

The procedures of cooling concrete shall be one or more of the following method:

- Shading the aggregates,
- Sprinkling the coarse aggregates with water,
- Using chilled water in the mix,
- Replacing some, or all, of the mix water with ice but with no un melted ice left in concrete after mixing,
- Placing concrete during night.

If necessary, an artificial fog shall be kept above the concrete before placing the curing compound so that no drop of water can condense on top of the concrete slab.

Nevertheless the concrete work shall be stopped when any one of the following conditions occurs:

- Temperature of concrete above 35°C;
- Temperature of cement above 70°C;
- Water evaporation measured according to ACI 305 above 1kg/m<sup>2</sup>/h
- Time between mixing and beginning of curing above the following values:

Time in minutes	Temperature of fresh concrete (°C)
90	Less than 25°C
60	25°C to 30°C
45	30°C to 35°C

#### 15.3.14 concrete curing

Concrete shall be kept in the moist state necessary for satisfactory hardening, taking into account the climatic conditions.



The Engineer will decide or approve the curing procedures applicable to each part of the structure. The curing should involve both final surfaces and construction.

Curing shall be performed by spraying a film of a curing compound approved by the Engineer. This product should allow a perfect bonding of finishing layers or of thermal insulating panels. The directions for use of the product shall be provided by the supplier. The compound shall be colored, so that it is possible to check visually the continuity and uniformity of the film. However its color should disappear with time or be easily wiped off the finished surface.

To the concrete curing shall be added, as needed, formwork watering, thorough placing of straw matting, other mats or materials kept permanently moist, day and night, by repeated or permanent sprinkling. The use of waterproof forms, such as metal forms, will save the watering of the forms.

The arrangements adopted for concrete curing shall be submitted to the approval of the Engineer together with the concreting schedule.

#### 15.3.15 Coal Tar coating

The faces of concrete structures which will remain permanently in contact with the ground shall be covered with three (3) coats of desacidified coal tar, except as otherwise specified.

#### 15.3.16 striking of props and Forms

The forms striking schedule shall be submitted to the Engineer for approval, together with detailed work schedule and calculations based on the required strength of concrete.

Formwork shall be kept in position fully, supported, until the concrete has hardened and gained enough strength for supporting its own dead load and any load likely to be imposed upon it.

The forms shall be removed without shock or vibration which could damage the concrete.

#### 15.3.17 Expansion joints

Expansion joints shall be installed in accordance with the manufacturer requirements, and not less than 28 days after pouring the concrete.

#### 15.3.18 Checking and Acceptance Tests

TYPE OF WORK	TYPE OF CONTROL	FREQUENCY	RESULTS REQUIRED	TOLERANCE	PENALTIES IF OUT OF TOLERANCE
Formwork	Rigidity Quality		Control of complete form; Qualities as specified	tolerance as specified	Rejection; do again Rejection; do again



Concretes for reinforced concrete	Cement temperature in containers	Constantly	70°C	No tolerance	Stop using this cement
	Water content of mixes	Twice daily	As in mix design	+/- 5 L	Stop concrete mixing until new water proportion adjustment
	Slump test	As specified	As specified	+/- 2 cm	
	Compression and flexural strengths	As specified	As specified	As specified	Correct water proportion As specified

TYPE OF WORK	TYPE OF CONTROL	FREQUENCY	RESULTS REQUIRED	TOLERANCE	PENALTIES IF OUT OF TOLERANCE
Concrete structures	Checks for levels, height, dimensions, verticality	All structures	As specified		Rejection. Contractor must check and propose adjustments. Engineer may require demolition



Anchoring	Layout Leveling	Each anchoring	Theoretical dimensions	+/- 2 cm +/- 1 cm	Rejection. Do again adjustments of anchorage
Sleeves and opening in structures	Layout Contour regularity	Each sleeve or opening	Theoretical dimensions. Contour set	+/- 2 cm None	Rejection. Changes to be made.

#### 15.4 Design

##### 15.4.1 Design loads

All concrete works under aeronautical pavement shall comply with the load of an aircraft type B-747-400 t (maximum takeoff weight) to be increased by 50 t.

##### 15.4.2 Structure analysis and shop drawings

The contractor shall have to develop, from the information provided in the tender documents, all the calculations and the shop drawings necessary for the implementation of the concrete works. In particular the contractor shall have to develop, as required, the design of the reinforced concrete foundations of all structures, including calculations, reinforcement bar schedules and detailed shop drawings.

He shall submit these documents to the Engineer for approval before starting the construction of any part of the structure.

The shop drawings shall include the complete schedule of reinforcement bars. The amount of reinforcement to be included in the contract shall be the weight shown on the shop drawings, as approved by the Engineer.

He shall submit the details of the construction, and fixing of all precast elements.

#### 16 PIPE CULVETS

##### 16.1 scope of work

The work shall consist of the construction of pipe culverts in accordance with the following specifications and close conformity with the lines and grades shown on the contract drawings. Before work on pipe culverts is started, the contractor shall secure the Engineer's approval on the materials to be used and the methods of execution.

##### 16.2 Materials

###### 16.2.1 General

General materials shall meet the requirements shown on the contract drawings and as follows.

###### 16.2.2 Pipe

In general the pipes to be used for drainage network will be reinforced D load pipe meeting the requirements of ASTM 655. They will be chosen to ensure a 0.01 inch crack for D load (allowable load in ponds per linear foot per foot of internal diameter) equal to 3,000 according to US standards.



Diameter	0.01”crack D load in da N/m
400	4,800
500	6,000
600	7,500
800	10,500
1000	13,500
1200	17,100

These pipes shall include spigot or groove joints with rubber joint seals. The mechanical characteristics and source of supply will be submitted to the Engineer’s approval.

#### **16.2.3 Concrete**

Concrete used in this section shall meet the following requirements:

K175 for structural unreinforced concrete,

K175 for structural reinforced concrete,

Paragraph 15 of specification-concrete works.

#### **16.2.4 Reinforcement steel**

The reinforcing bars shall meet the requirements specified in paragraph 15- concrete works.

#### **16.2.5 Laterite gravel**

The laterite gravel will be in accordance with the requirements specified in paragraph 4- of this part (civil works).

#### **16.2.6 Joint materials**

The joint materials shall meet the requirements specified in specifications paragraph 15- concrete works.

#### **16.2.7 Rubber gaskets**

Rubber gaskets for concrete pipe shall be conformed the requirements of ASTM C443.

#### **16.2.8 Joint mortar**

Pipe joint mortar shall consist of one part of Portland cement and two parts of sand.

- Portland cement shall conform to ASTM C 150 requirements’
- Sand shall conform to ASTM C 144 requirements.

Water shall be clean and free from alkaline, acid, organic substances or other deleterious materials.

### **16.3 Construction method**

#### **16.3.1 Excavation**

The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall be less than the external diameter of the pipe plus 15 cm (150mm) on each side. The trench walls shall be approximately vertical.

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 30 cm but for no more than three-quarters of the nominal diameter of the pipe. The width of the excavation shall be at least 30 cm greater than the horizontal outside diameter of the pipe.

The foundation bed shall be compacted to not less than 95% of the maximum dry density as determined by AASHTO T 99.



Nevertheless, if the pipe or the box culvert is to be constructed under aeronautical pavement, the foundation bed shall be compacted:

- Either to the compaction level requested, in paragraph 2 “General Excavation and Embankment” of the present specifications, at the elevation of the foundation bed.
- Or to not less than 95% of the maximum dry density as determined by AASHTO T 99.

Whichever is greater.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width.

The Engineer shall determine the depth of removal necessary. The granular material shall be compacted to not less than 90% of the maximum dry density as determined by AASHTO T 180.

The excavation for pipes that are placed in embankment fill shall not be made until the embankment has been completed to the height above the top of the pipe as shown on the plans.

### **16.3.2 Bedding**

The pipe bedding shall conform to the class specified on the plans. When no bedding class is specified or detailed on the plans, the requirements for class C bedding shall apply.

#### **16.3.2.1 Class A bedding**

Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.

#### **16.3.2.2 Class B bedding**

Class B bedding shall consist of a bed of granular material having a thickness of at least 6 inches (150 mm) below the bottom of the pipe and extending up around the pipe for a depth of not less than 30 percent of the pipe's vertical outside diameter. The layer of bedding material shall be shaped to fit the pipe for at least 10 percent of the pipe's vertical diameter and shall have recesses shaped to receive the bell of bell and spigot pipe. The bedding material shall be sand or selected sandy soil, all of which passes a 3/8 inch (9mm) sieve and not more than 10 percent of which passes a No.200 (0.075mm) sieve.

#### **16.3.2.3 Class C bedding**

Class C bedding shall consist of bedding the pipe in its natural foundation to a depth of not less than 10 percent of the pipe's vertical outside diameter. The bed shall be shaped to fit the pipe and shall have recesses shaped to receive the bell of bell and spigot pipe.

### **16.3.3 Laterite gravel for foundation**

The laterite gravel shall be placed in accordance with the location grade elevation and thickness as designed on contract drawings, or as directed by the Engineer. The laterite gravel shall be compacted to not less than 90 % of the maximum dry density as determined by AASHTO T 180.

### **16.3.4 Laying pipes**

The pipe laying shall begin at the lowest point of the trench and precede up-grade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or grove ends of rigid pipes shall be placed facing up grade.

Paved or partially lined pipe shall be placed so that the longitudinal centre line of the paved segment coincides with the flow line. The leveling tolerance shall be  $\pm 1$  cm from design drawings and no counter slope admitted.

### **16.3.5 Joining pipe**



Joints shall be made with Portland mortar.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Rubber ring gaskets shall be installed to form a flexible watertight seal.

Concrete pipe will be either bell and spigot or tongue and groove. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even joints shall be thoroughly wetted before mortar is applied.

#### **16.3.6 Placing reinforcement bars and concrete**

The reinforcement bars and concrete shall be placed in accordance with the specified requirements, specified in paragraph 15- concrete works.

#### **16.3.7 Backfilling**

Pipes shall be inspected by the Engineer before any backfill is placed; any pipes found to be out of alignment, unduly settle, or damaged shall be removed and re- laid or replaced at the contractor's expense.

Material for backfill shall be fine, readily compatible soil, or granular material selected from the excavation or a source of the contractor's choosing and submitted for the Engineer's approval. It shall not contained, stones that would be retained on a 2 inch (50mm) sieve, checks of highly plastic clay, or other objectionable material.

When the top of the pipe is even with or below the top of the trench, the backfill shall be compacted in layers not exceeding 150mm on both sides of the pipe and shall be brought up 30cm above the of the pipe or to natural ground level, whichever is greater. Care shall be exercised to thoroughly compact the backfill material under the haunches of the pipe. Material shall be brought up evenly on both sides of the pipe.

When the top of the pipe is above the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches (150 mm) and shall be brought up evenly on both sides of the pipe to 30 cm above the top of the pipe. The width of backfill on each side of the pipe for the portion above the top of the trench shall be equal to twice the pipe's diameter or 3.5 m whichever less is.

The backfill shall be compacted to not less than 95% of the maximum dry density as determined by AASHTO T 99.

Nevertheless, if the pipe or the box culvert is to be constructed under aeronautical pavement, the backfill shall be compacted:

- Either to the compaction level requested, in paragraph 2 "General Excavation and Embankment" of the present specifications, at the elevation of the foundation bed.
- Or to not less than 95% of the maximum dry density as determined by AASHTO T 99.

Whichever is greater.

#### **16.3.8 Cleaning and restoration of site**

After the backfill is completed the contractor shall dispose of surplus materials dirt and rubbish from the site. The contractor shall restore all disturbed areas to their original conditions.

### **16.4 Quality standards**

The quality standards will be as follows:



Test item	Test method	Frequency	Standard value	Notes
Reinforcing bars	As specified in paragraph 15- concrete works			
Mortar cement	As approved by the Engineer	At every receiving of material		
Mortar sand	Ditto	One for 500m <sup>3</sup>		
Laterite gravel	As specified in paragraph 4 of this part (civil works)			
Joint materials	As specified			
Density in place	As determined by AASHTO T 191	Once every 25 m at points designated by the Engineer	Not less than 95% of max dry density by AASHTO T 99	
Pipe	As approved by the Engineer	At every Delivery	ASTM 655 type 3,000	Manufacturer's test data may substitute as directed by the Engineer

### 16.5 Work done standards

The works shall be controlled as follows:

Test item	Test Method	Frequency	Standard Value	Notes
Finish elevation	As specified	At points designated by the Engineer	±1cm	-
Width	According to Engineer's instruction	Ditto	±2cm	-
Length	Ditto	Ditto	±2cm	-
Thickness	Ditto	Ditto	±2cm -1cm	-



## **17. MANHOLES AND COLLECTIONS**

### **17.1 Scope of work**

This work shall consist of the manholes and collectors to be constructed in accordance with the requirements of the location, dimension, shape, and elevation designated in the contract drawings or required by the Engineer and as specified herein.

The contractor shall, before the work on the manholes and collectors is started, secure the Engineer's approval on the material to be used and on the methods of the work execution.

### **17.2 Materials**

#### **17.2.1 Concrete**

Concrete to be used shall meet the requirements of K175 or K225 structural unreinforced or reinforced concrete specified in specification paragraph 15- concrete works.

#### **17.2.2 Reinforcement steel**

The reinforcing bars shall meet the requirements specified in specifications – paragraph 15- concrete works. The dimensions for the reinforcing bars shall meet the requirements shown on the contract drawings.

#### **17.2.3 Laterite gravel**

The laterite gravel shall be in accordance with the requirements specified in paragraph 4.

#### **17.2.4 Mortar**

The mortar shall consist the mixture of Portland cement, sand and water (cement – sand volume ratio of 1 to 2). The Portland cement shall meet the requirements of AASHTO M-85.

Water shall be clean and free from alkaline, acid or organic substances or other deleterious materials.

#### **17.2.5 Frames, Covers, and Grates**

The castings shall conform to one of the following requirements:

- a. Grey iron castings shall meet the requirements of ASTM 48, class 30B and 35 B.
- b. Malleable iron castings shall meet the requirements of ASTM A 47.
- c. Steel castings shall meet the requirements of ASTM A 47.
- d. Structural steel for grates and frames shall conform to the requirements of ASTM A 283, grade D.
- e. Ductile iron castings shall conform to the requirements of ASTM A 536.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned and given two coats of approved bituminous paint. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123.

#### **17.2.6 Steps**

The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of bituminous paint, when directed.

### **17.3 Construction methods**

#### **17.3.1 Excavation**



- a. The contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the plans, or as asked by the Engineer. The excavation shall be of sufficient size to permit the placing of full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.
- b. 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. 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 is to be placed.
- c. The contractor shall do all bracing, sheating, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheating, or shoring shall be included in the unit price bid for the structure.
- d. Unless otherwise provided, bracing, sheating or shoring involved in the construction of this item shall be removed by the contractor after the completion of the structure. Removal shall be effected in a manner which will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.
- e. After each excavation is completed, the contractor shall notify the Engineer to that effect; and concrete or reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.

### **17.3.2 Concrete structure**

Concrete structures shall be built on prepared foundations, conforming to the dimensions and form indicated of the contract drawings. The construction shall conform to the specified requirements. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is poured.

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 toward the outlet.

#### **17.3.2.1 Inlet and outlet pipes**

For concrete or brick structures, the mortar shall be placed around these pipes so as to form a tight, neat connection.

#### **17.3.2.2 Placement and Treatment of castings, frames, and Fittings**

All castings, frames, and fittings shall be placed in the positions indicated on the contract drawings or as directed by the Engineer, and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.



When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or 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 plans or as directed and approved by the engineer. All units shall set firm and secure.

### 17.3.3 Installation of steps

The steps shall be installed as indicated on the contact drawings or as directed by the engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. 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 and painted, unless they have been galvanized.

In case prefabricated ladders may be installed instead of steps, they shall be held in place by grouting the supports in drilled holes.

### 17.3.4 Backfilling

- a. After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed 20 cm in loose depth, and compacted to the density required in paragraph 2. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the engineer.
- b. Backfilling shall not be placed against any structure until permission is given by the engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under supervision of the engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.
- c. Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the contractor covered under the contract unit price for the structure involved.

### 17.3.5 Cleaning and restoration of site

After the backfill is completed, the contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the engineer. The contractor shall restore all disturbed areas to their original condition.

After all work is completed, the contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

## 17.4 quality and work done standards

### 17.4.1 Quality standards

The quality standard shall be as follows:

Test item	Test method	Frequency	Standard value	Notes
Concrete	As specified in paragraph 15- concrete works			
Reinforcing bars	As specified in paragraph 15- concrete works			



Mortar cement	As approved by engineer	At every receiving of material		
Mortar sand	ditto	One for 500 m <sup>3</sup>		
Laterite gravel	As specified in paragraph 4 of this part (civil works)			
Joint materials	As specified			
Frames covers grates steps	As approved by the engineer	At every delivery	ASTM A 27 A 47 A 48 A 283 A 536 A 123	
Density in place	AASHTO T 191	At points designed by the engineer	Not less than 95% of max dry density by AASHTO T 99	

#### 17.4.2 Work done standards

The works shall be controlled as follows:

Test item	Test method	Frequency	Tolerance	Notes
Finish elevation	By surveying as specified	At points designated by the engineer	± 1 cm	
Width	By engineer's instruction	ditto	± 2 cm	
Depth	ditto	ditto	± 2 cm	
Thickness	ditto	ditto	+ 2 cm - 1 cm	

### 18 BOX CONCRETE CULVERTS

#### 18.1 Scope of work

This work shall consist of plain or reinforced box concrete culverts, head walls and miscellaneous drainage structures (inlet and outlet) constructed in accordance with these specifications at specified locations and conforming to the lines, grades and dimensions shown on contract drawings or required by the Engineer.

Before these works be started, the contractor shall secure the Engineer's approval of the materials to be used and the method of execution.

#### 18.2 Materials

Plain or reinforced concrete shall be in accordance with the specifications of paragraph 15-concrete works. If concrete culverts should be equipped with frames covers or grates they will conform to specifications in Paragraph 15.



### 18.2.1 General

The materials (concrete, reinforcing bars, joint material, crushed aggregates) shall conform to the specifications of paragraph 15-concrete works.

### 18.2.2 Mortar

The mortar shall consist of a mixture of Portland cement, sand and water (cement/ sand ratio in volume =1 to 2). The materials shall meet the requirements.

### 18.2.3 Frames and Grates

Frames and Grates if needed shall conform to the requirements of specifications paragraph 17.2.5 in the present specification.

## 18.3 Construction methods

### 18.3.1 Excavations

Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the plans. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevation of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.

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. 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.

The contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for excavation.

After each excavation is complete, the contractor shall notify the Engineer to that effect, and concrete or reinforcing steel shall be placed after the Engineer, has approved the depth of the excavation and the character of the foundation material.

### 18.3.2 Concrete structures

Concrete structures shall be built on prepared foundations conforming to the dimensions and form of the contract drawings. The construction shall conform to the requirements specified. Any reinforcement required shall be placed according to contract drawings and shall be approved by the Engineer before the concrete is poured.

### 18.3.3 Backfilling

After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 3 inches (200mm) in loose depth, and compacted. The back fill shall be compacted to not less than 90% of the maximum dry density as determined by AASHTO 99.

Nevertheless, if the concrete culvert is to be constructed under aeronautical pavement, the back fill shall be compacted:

- either to the compaction level requested, in paragraph 2 “General excavation and Embankment” of the present specifications, at the elevation of the foundation bed.
- or to not less than 95% of the maximum dry density as determined by AASHTO T 99.



Whichever is greater. The field density shall be determined in accordance with ASTM D 2167. No backfilling shall be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until



**Section VIII. Bill of quantities**

N°	Description of work	Unity	Qty	Unit Price	Amount
<b>Kigali International Airport</b>					
I.1	Provisional sum for nominated supplier- Overhead profit by applying the percentage of works' amount.	%	1		
<b>II</b>	<b>Labor</b>				
II.1	Unskilled	pers.	1		
II.2	Skilled	pers.	1		
<b>A</b>	<b>Earthwork</b>				
A.1	Top soil excavation ( <b>Dumping area to be provided by the client in the airport within less 3 Km</b> )	m <sup>3</sup>	1		
A.2	Excavation of unsuitable materials ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.3	Rock excavation	m <sup>2</sup>	1		
A.4	Drainage excavation ( <b>Dumping area to be provided by the client in the airport within less 3 Km</b> )	m <sup>3</sup>	1		
A.5	Top soiling	m <sup>3</sup>	1		
A.6	Common embankment	m <sup>3</sup>	1		
A.7	Sub grade preparation (in cut or in fill)	m <sup>3</sup>	1		
	Fill from existing cut	m <sup>3</sup>	1		
	Fill from imported materials	m <sup>3</sup>	1		
A.8	Drainage cleaning	ml	1		
A.9	Plate form leveling and compaction	m <sup>2</sup>	1		
A.10	Supply and installation of sand 0/5mm	m <sup>3</sup>	1		
A.12	Road side bush clearing	m <sup>2</sup>	1		
A.12.1	Grassing (planting passpalm)	m <sup>2</sup>	1		
A.12.2	Grass seed- including watering and protection until grass is established	m <sup>2</sup>	1		
A.12.3	Planting passpalm (with turf grass)	m <sup>2</sup>	1		
	<b>Demolitions</b>		1		
A.11	Demolition of concrete slabs ≤5cm thickness	m <sup>2</sup>	1		
A.12	Destruction of existing channels	m	1		
A.13	Demolition of road kerbs	m	1		
A.14	Demolition of pavers	m <sup>2</sup>	1		
A.15	Demolition and evacuation of masonry blocks, bricks and rubble	m <sup>3</sup>	1		
A.16	Demolition and evacuation of unreinforced concrete	m <sup>3</sup>	1		



A.17	Demolition and evacuation of reinforced concrete	m <sup>3</sup>	1		
<b>B</b>	<b>Pavement works preparation</b>				
B.1	Cutting out and excavation of Existing pavement	m <sup>3</sup>	1		
B.2	Erasing of old marking paint	m <sup>2</sup>	1		
B.3	Rubber deposit removal	m <sup>2</sup>	1		
B.4	Milling	m <sup>2</sup>	1		
B.5	Repair of bituminous depression	ton	1		
B.6	Cracks sealing	m	1		
<b>C</b>	<b>Pavement</b>				
C.1	supply and installation of marram	m <sup>3</sup>	1		
C.2	supply, mix, spread evenly approved crushed stone aggregate base course with 0/31,5mm	m <sup>3</sup>	1		
C.3	Bituminous gravel	m <sup>3</sup>	1		
C.4	Bituminous concrete for aeronautical pavement (AC20)	m <sup>3</sup>	1		
C.5	Bituminous concrete for aeronautical pavement (AC14)	m <sup>3</sup>	1		
C.6	Bituminous concrete, 20mm thick	m <sup>3</sup>	1		
C.7	Bituminous concrete, 10mm thick	m <sup>3</sup>	1		
C.8	Bituminous concrete for roads pavement	m <sup>3</sup>	1		
C.9	Triple surface treatment 6/10, 4/6; 2/4 with emulsion	m <sup>2</sup>	1		
C.9.1	Double surface treatment (2/6; 6/14)	m <sup>2</sup>	1		
C.10	Slurry seal	m <sup>2</sup>	1		
C.11	Prime coat	m <sup>2</sup>	1		
C.12	Tack coat	m <sup>2</sup>	1		
C.13	Anti-Kérosène protection	m <sup>2</sup>	1		
C.14	Airfield pavement marking, TT-P-1952E	m <sup>2</sup>	1		
C.15	Road marking paint	m <sup>2</sup>	1		
C.16	Rubber removal	m <sup>2</sup>	1		
<b>D</b>	<b>Béton Drainage</b>				
D.1	Hardcores masonry	m <sup>3</sup>	1		
D.3	Screed on foundation 5cm thick	m <sup>2</sup>	1		
D.4	Culvert Ø80 - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.5	Culvert Ø60 - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		



D.6	Culvert $\Phi 40$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.7	Culvert $\Phi 30$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.8	Culvert $\Phi 20$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.9	ARMCO Culvert $\Phi 80$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.10	ARMCO Culvert $\Phi 60$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.11	ARMCO Culvert $\Phi 40$ - including excavation, supply and installation of pipes, jointing and haunching, bedding material, backfill, reinstatement of ground and removal of surplus material	m	1		
D.12	Supply and install of PVC drain Pipes $\Phi 50$ PN6	m	1		
D.13	Supply and installation of Evacuation PVC drain pipe, $\Phi 63$ mm PN 6 or 10	m	1		
D.14	Supply and installation of Evacuation PVC drain pipe, $\Phi 90$ mm PN 6 or 10	m	1		
D.15	Supply and installation of Evacuation PVC drain pipe, $\Phi 90$ mm PN 16	m	1		
D.16	Supply and installation of Evacuation PVC drain pipe, $\Phi 110$ mm PN 16	m	1		
D.18	Supply and installation of Evacuation PVC drain pipe, $\Phi 160$ mm PN 16	m	1		
D.19	Metal Gird with 10mm diameter steel bar spaced at 150mm	m <sup>2</sup>	1		
D.20	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.21	Supply and installation of steel angle of assorted sizes	Kg	1		
D.23	Supply and installation of Concrete kerbs T1	m	1		
D.24	Supply and installation of Concrete kerbs T2	m	1		
D.25	Surface water drainage channel	m	1		
D.26	Supply and installation of guardrails	m	1		
<b>E</b>	<b>Concrete</b>				
E.1	Blinding concrete dosed at 150 kg / m <sup>3</sup>	m <sup>3</sup>	1		



E.2	Unreinforced concrete dosed at 300 kg/m <sup>3</sup>	m <sup>3</sup>	1		
E.3	Reinforced concrete dosed at 350 kg/m <sup>3</sup>	m <sup>3</sup>	1		
	Reinforced concrete dosed at 400 kg/m <sup>3</sup>	m <sup>3</sup>	1		
E.4	Filling stones	m <sup>3</sup>	1		
E.5	Pavers for walkway( 6cm thick)	m <sup>2</sup>	1		
E.6	Pavers for vehicle passage ( 8cm thick)	m <sup>2</sup>	1		
E.7	Supply and installation of honeycomb	m <sup>2</sup>	1		
<b>F</b>	<b>Supply and installation of Road Signs</b>				
F.1	Class A	piece	1		
F.2	Class AB	piece	1		
F.3	Class B	piece	1		
F.4	Type C	piece	1		
<b>G</b>	<b>Granite Pavers</b>				
G.1	Supply and installation of golden granite slates 30*10*4- black	sqm	1		
G.2	Supply and installation of golden granite slates 30*10*4-grey	sqm	1		
G.3	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.4	Supply and installation of granite slates 20*5*3 grey Nyagatare	sqm	1		
G.5	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.6	Supply and installation of granite slates 20*5*3 pink Nyagatare	sqm	1		
G.7	supply and installation of granite slates 30*10*4- Nyarubakaa	sqm	1		
G.8	supply and installation of granite paver 40*40*5 cm-golden	sqm	1		
G.9	supply and installation of granite paver 40*40*5 cm-black	sqm	1		
G.10	Supply and installation of granite paver 50*50*5 cm-golden	sqm	1		
G.11	Supply and installation of granite paver 50*50*5 cm-black	sqm	1		
G.12	Supply and installation of granite paver 40*20*5 cm-golden	sqm	1		
G.13	Supply and installation of granite paver 40*20*5 cm-black	sqm	1		



G.14	Supply and installation of granite paver 20*20*5 cm-golden	sqm	1		
G.15	Supply and installation of granite paver 20*20*5 cm-gblack	sqm	1		
G.16	Supply and installation of granite paver 20*10*5 cm-golden	sqm	1		
G.17	Supply and installation of granite paver 20*10*5 cm-black	sqm	1		
G.18	Supply and installation of granite paver 15*15*5 cm-golden	sqm	1		
G.19	Supply and installation of granite paver 15*15*5 cm-black	sqm	1		
G.20	Supply and installation of granite paver 40*40*5 cm-grey Nyagatare	sqm	1		
G.21	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm	1		
G.22	Supply and installation of granite paver 40*20*5 cm-grey Nyagatare	sqm	1		
G.23	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm	1		
G.24	Supply and installation of granite paver 40*40*5 cm-pink Nyagatare	sqm			
G.25	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm			
G.26	Supply and installation of granite paver 40*20*5 cm-pink Nyagatare	sqm			
G.27	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm			
G.28	Supply and installation of granite paver 20*20*5 cm-black Nyagatare	sqm			
<b>H</b>	<b>Miscellaneous</b>				
H.1	ACO Qmax Neo 300 chanel L1000mm with ACO Neo Q-flow dictile iron grting flat pack without leveling feet	ml	1		
H.2	Supply and intallatyion of stainless steel slot drain of 400x400mm	ml			
H.3	Supply and intallatyion of stainless steel slot drain of 600x600mm	ml			
H.4	Supply and intallatyion of stainless steel slot drain of 800x800mm	ml			



H.5	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 950x950mm and clear opening of 800x800,100mm thick.	ml			
H.6	Supply and INSTALLATION OF D-400 HEAVY-DUTY CAST-IRON MANHOLE COVER & Frame with 750x750mm and clear opening of 600x600mm,100mm thick.	ml			
H.7	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 800x800mm and clear opening of 600mm Dia ,100mm thick	ml			
H.8	Supply and installation of steel angle line	kg			
H.9	Re-installation of existing perimeter fence (including earthworks, installation of poles, chain link, barbed wire and razor wire), excluding masonry works	ml			
H.10	Re-installation of existing perimeter fence gates including all civil works	piece			
H.11	Re-installation of existing pavers, excluding platform preparation	sqm			
H.12	Demolition & evacuation of toles & roof truss	sqm			
H.13	Relocation of containers	piece			
H.14	Demolition and evacuation of spot welded mesh made of plastic coated galvanized low carbon steel wire, razor barbed round brace posts	ml			
H.15	Demolition and reinstallation of gate 1200x2422mm	piece			
H.16	Demolition andreinstallation of gate 600x2422mm	piece			
<b>KAMEMBE AIRPORT</b>					
<b>N°</b>	<b>Description of work</b>	<b>Unity</b>	<b>Qty</b>		
<b>I</b>	<b>Conception</b>				
I.1	Provisional sum for nominated supplier- Overhead profit by applying the percentage of works' amount.	%	1		
<b>II</b>	<b>Labor</b>				
II.1	Unskilled	pers.	1		
II.2	Skilled	pers.	1		
<b>A</b>	<b>Earthwork</b>		1		
A.1	Top soil excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.2	Excavation of unsuitable materials ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		



A.3	Rock excavation	m <sup>2</sup>	1		
A.4	Drainage excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.5	Top soiling	m <sup>3</sup>	1		
A.6	Common embankment	m <sup>3</sup>	1		
A.7	Sub grade preparation (in cut or in fill)	m <sup>3</sup>	1		
A.8	Drainage cleaning	m <sup>2</sup>	1		
A.9	Plate form Leveling and compaction	m <sup>2</sup>	1		
A.10	supply and installation of sand	m <sup>3</sup>	1		
A.12	Road side bush clearing	m <sup>2</sup>	1		
A.12.1	Grassing (planting passpalm)	m <sup>2</sup>	1		
A.12.2	Grass seed- including watering and protection until grass is established within the Clear and Graded Area of the Runway Strip	m <sup>2</sup>	1		
A.12.3	Planting passpalm (with turf grass)	m <sup>2</sup>	1		
	<b>Demolitions</b>				
A.11	Demolition of concrete slabs ≤5cm thickness	m <sup>2</sup>	1		
A.12	Destruction of existing channels	m	1		
A.13	Demolition of road kerbs	m	1		
A.14	Demolition of pavers	m <sup>2</sup>	1		
A.15	Demolition and evacuation of masonry blocks, bricks and rubble	m <sup>3</sup>	1		
A.16	Demolition and evacuation of unreinforced concrete	m <sup>3</sup>	1		
A.17	Demolition and evacuation of reinforced concrete	m <sup>3</sup>	1		
<b>B</b>	<b>Pavement works preparation</b>				
B.1	Cutting out and excavation of Existing pavement	m <sup>3</sup>	1		
B.2	Erasing of old marking paint	m <sup>2</sup>	1		
B.3	Rubber deposit removal	m <sup>2</sup>	1		
B.4	Milling	m <sup>2</sup>	1		
B.5	Repair of bituminous depression	ton	1		
B.6	Cracks sealing	m	1		
<b>C</b>	<b>Pavement</b>				
C.1	supply and installation of murrum	m <sup>3</sup>	1		
C.2	supply, mix, spread evenly approved crushed stone aggregate base course with 0/31,5mm	m <sup>3</sup>	1		
C.3	Bituminous gravel	m <sup>3</sup>	1		
C.4	Bituminous concrete for aeronautical pavement (AC20)	m <sup>3</sup>	1		
C.5	Bituminous concrete for aeronautical pavement (AC14)	m <sup>3</sup>	1		
C.6	Bituminous concrete, 20mm thick	m <sup>3</sup>	1		



C.7	Bituminous concrete, 10mm thick	m <sup>3</sup>	1		
C.8	Bituminous concrete for roads pavement	m <sup>3</sup>	1		
C.9	Triple surface treatment 6/10, 4/6; 2/4 with emulsion	m <sup>2</sup>	1		
C.10	Slurry seal	m <sup>2</sup>	1		
C.11	Prime coat	m <sup>2</sup>	1		
C.12	Tack coat	m <sup>2</sup>	1		
C.13	Anti-Kérosène protection	m <sup>2</sup>	1		
C.14	Airfield pavement marking, TT-P-1952E	m <sup>2</sup>	1		
C.15	Road marking paint	m <sup>2</sup>	1		
C.16	Rubber removal	m <sup>2</sup>	1		
C.17	Friction test	ff	1		
<b>D</b>	<b>Béton Drainage</b>				
D.1	Hardcores masonry	m <sup>3</sup>	1		
D.2	Construction of hardcore Masonry channel type H=0.5m, thickness=0.3m(open)	m	1		
D.3	Screed on foundation 5cm thick	m <sup>2</sup>	1		
D.4	Culvert Ø80	m	1		
D.5	Culvert Ø60	m	1		
D.6	Culvert Ø40	m	1		
D.7	Culvert Ø30	m	1		
D.8	Culvert Ø20	m	1		
D.9	ARMCO Culvert Ø80	m	1		
D.10	ARMCO Culvert Ø60	m	1		
D.11	ARMCO Culvert Ø40	m	1		
D.12	Supply and install of PVC drain Pipes Ø50 PN6	m	1		
D.13	Supply and installation of Evacuation PVC drain pipe, Ø 63mm PN 6 or 10	m	1		
D.14	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 6 or 10	m	1		
D.15	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 16	m	1		
D.16	Supply and installation of Evacuation PVC drain pipe, Ø 110mm PN 16	m	1		
D.18	Supply and installation of Evacuation PVC drain pipe, Ø 160mm PN 16	m	1		
D.19	Metal Gird	m <sup>2</sup>	1		
D.20	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.21	Supply and installation of steel angle of assorted sizes	Kg	1		
D.22	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.23	Supply and installation of Concrete kerbs T1	m	1		
D.24	Supply and installation of Concrete kerbs T2	m	1		



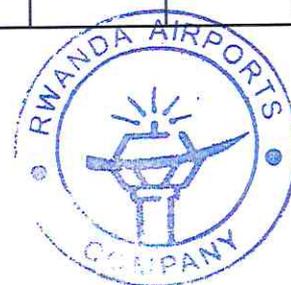
D.25	Surface water drainage channel	m	1		
D.26	Supply and installation of guardrails	m	1		
<b>E</b>	<b>Concrete</b>				
E.1	Blinding concrete dosed at 150 kg / m <sup>3</sup>	m <sup>3</sup>	1		
E.2	Unreinforced concrete dosed at 300 kg/m <sup>3</sup>	m <sup>3</sup>	1		
E.3	Reinforced concrete dosed at 350 kg m <sup>3</sup>	m <sup>3</sup>	1		
E.4	Filling stones	m <sup>3</sup>	1		
E.5	Pavers for walkway	m <sup>2</sup>	1		
E.6	Pavers for vehicle passage	m <sup>2</sup>	1		
E.7	Supply and installation of honeycomb	m <sup>2</sup>	1		
<b>F</b>	<b>Supply and installation of Road Signs</b>				
F.1	Class A	piece	1		
F.2	Class AB	piece	1		
F.3	Class B	piece	1		
F.4	Type C	piece	1		
<b>G</b>	<b>Granite Pavers</b>				
G.1	Supply and installation of golden granite slates 30*10*4- black	sqm	1		
G.2	Supply and installation of golden granite slates 30*10*4-grey	sqm	1		
G.3	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.4	Supply and installation of granite slates 20*5*3 grey Nyagatare	sqm	1		
G.5	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.6	Supply and installation of granite slates 20*5*3 pink Nyagatare	sqm	1		
G.7	supply and installation of granite slates 30*10*4- Nyarubakaa	sqm	1		
G.8	supply and installation of granite paver 40*40*5 cm-golden	sqm	1		
G.9	supply and installation of granite paver 40*40*5 cm-black	sqm	1		
G.10	Supply and installation of granite paver 50*50*5 cm-golden	sqm	1		
G.11	Supply and installation of granite paver 50*50*5 cm-black	sqm	1		
G.12	Supply and installation of granite paver 40*20*5 cm-golden	sqm	1		



G.13	Supply and installation of granite paver 40*20*5 cm-black	sqm	1		
G.14	Supply and installation of granite paver 20*20*5 cm-golden	sqm	1		
G.15	Supply and installation of granite paver 20*20*5 cm-gblack	sqm	1		
G.16	Supply and installation of granite paver 20*10*5 cm-golden	sqm	1		
G.17	Supply and installation of granite paver 20*10*5 cm-black	sqm	1		
G.18	Supply and installation of granite paver 15*15*5 cm-golden	sqm	1		
G.19	Supply and installation of granite paver 15*15*5 cm-black	sqm	1		
G.20	Supply and installation of granite paver 40*40*5 cm-grey Nyagatare	sqm	1		
G.21	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm	1		
G.22	Supply and installation of granite paver 40*20*5 cm-grey Nyagatare	sqm	1		
G.23	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm	1		
G.24	Supply and installation of granite paver 40*40*5 cm-pink Nyagatare	sqm			
G.25	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm			
G.26	Supply and installation of granite paver 40*20*5 cm-pink Nyagatare	sqm			
G.27	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm			
G.28	Supply and installation of granite paver 20*20*5 cm-black Nyagatare	sqm			
H	<b>Miscellaneous</b>				
H.1	ACO Qmax Neo 300 chanel L1000mm with ACO Neo Q-flow dictile iron grting flat pack without leveling feet	ml	1		
H.2	Supply and intallatyion of stainless steel slot drain of 400x400mm	ml			
H.3	Supply and intallatyion of stainless steel slot drain of 600x600mm	ml			

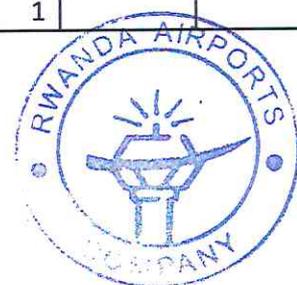


H.4	Supply and intallatyion of stainless steel slot drain of 800x800mm	ml			
H.5	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 950x950mm and clear opening of 800x800,100mm thick.	ml			
H.6	Supply and INSTALLATION OF D-400 HEAVY-DUTY CAST-IRON MANHOLE COVER & Frame with 750x750mm and clear opening of 600x600mm,100mm thick.	ml			
H.7	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 800x800mm and clear opening of 600mm Dia ,100mm thick	ml			
H.8	Supply and installation of steel angle line	kg			
H.9	Re-installation of existing perimeter fence (including earthworks, installation of poles, chain link, barbed wire and razor wire), excluding masonry works	ml			
H.10	Re-installation of existing perimeter fence gates including all civil works	piece			
H.11	Re-installation of existing pavers, excluding platform preparation	sqm			
H.12	Demolition & evacuation of toles & roof truss	sqm			
H.13	Relocation of containers	piece			
H.14	Demolition and evacuation of spot welded mesh made of plastic coated galvanized low carbon steel wire, razor barbed round brace posts	ml			
H.15	Demolition and reinstallation of gate 1200x2422mm	piece			
H.16	Demolition andreinstallation of gate 600x2422mm	piece			
<b>GISENYI AIRPORT</b>					
<b>N°</b>	<b>Description of work</b>	<b>Unity</b>	<b>Qty</b>		
<b>I</b>	<b>Conception</b>				
I.1	Provisional sum for nominated supplier- Overhead profit by applying the percentage of works' amount.	%	1		
<b>II</b>	<b>Labor</b>				
II.1	Unskilled	pers.	1		
II.2	Skilled	pers.	1		
<b>A</b>	<b>Earthwork</b>		1		
A.1	Top soil excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		



A.2	Excavation of unsuitable materials ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.3	Rock excavation	m <sup>2</sup>	1		
A.4	Drainage excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.5	Top soiling	m <sup>3</sup>	1		
A.6	Common embankment	m <sup>3</sup>	1		
A.7	Sub grade preparation (in cut or in fill)	m <sup>3</sup>	1		
A.8	Drainage cleaning	m <sup>2</sup>	1		
A.9	Plate form Leveling and compaction	m <sup>2</sup>	1		
A.10	supply and installation of sand	m <sup>3</sup>	1		
A.12	Road side bush clearing	m <sup>2</sup>	1		
A.12.1	Grassing (planting passpalm)	m <sup>2</sup>	1		
A.12.2	Grass seed- including watering and protection until grass is established within the Clear and Graded Area of the Runway Strip	m <sup>2</sup>	1		
A.12.3	Planting passpalm (with turf grass)	m <sup>2</sup>	1		
	<b>Demolitions</b>				
A.11	Demolition of concrete slabs ≤5cm thickness	m <sup>2</sup>	1		
A.12	Destruction of existing channels	m	1		
A.13	Demolition of road kerbs	m	1		
A.14	Demolition of pavers	m <sup>2</sup>	1		
A.15	Demolition and evacuation of masonry blocks, bricks and rubble	m <sup>3</sup>	1		
A.16	Demolition and evacuation of unreinforced concrete	m <sup>3</sup>	1		
A.17	Demolition and evacuation of reinforced concrete	m <sup>3</sup>	1		
<b>B</b>	<b>Pavement works preparation</b>				
B.1	Cutting out and excavation of Existing pavement	m <sup>3</sup>	1		
B.2	Erasing of old marking paint	m <sup>2</sup>	1		
B.3	Rubber deposit removal	m <sup>2</sup>	1		
B.4	Milling	m <sup>2</sup>	1		
B.5	Repair of bituminous depression	ton	1		
B.6	Cracks sealing	m	1		
<b>C</b>	<b>Pavement</b>				
C.1	supply and installation of murrum	m <sup>3</sup>	1		
C.2	supply, mix, spread evenly approved crushed stone aggregate base course with 0/31,5mm	m <sup>3</sup>	1		
C.3	Bituminous gravel	m <sup>3</sup>	1		
C.4	Bituminous concrete for aeronautical pavement (AC20)	m <sup>3</sup>	1		
C.5	Bituminous concrete for aeronautical pavement (AC14)	m <sup>3</sup>	1		

C.6	Bituminous concrete, 20mm thick	m <sup>3</sup>	1		
C.7	Bituminous concrete, 10mm thick	m <sup>3</sup>	1		
C.8	Bituminous concrete for roads pavement	m <sup>3</sup>	1		
C.9	Triple surface treatment 6/10, 4/6; 2/4 with emulsion	m <sup>2</sup>	1		
C.10	Slurry seal	m <sup>2</sup>	1		
C.11	Prime coat	m <sup>2</sup>	1		
C.12	Tack coat	m <sup>2</sup>	1		
C.13	Anti-Kérosène protection	m <sup>2</sup>	1		
C.14	Airfield pavement marking, TT-P-1952E	m <sup>2</sup>	1		
C.15	Road marking paint	m <sup>2</sup>	1		
C.16	Rubber removal	m <sup>2</sup>	1		
C.17	Friction test	ff	1		
<b>D</b>	<b>Béton Drainage</b>				
D.1	Hardcores masonry	m <sup>3</sup>	1		
D.2	Construction of hardcore Masonry channel type H=0.5m, thickness=0.3m (open)	m	1		
D.3	Screed on foundation 5cm thick	m <sup>2</sup>	1		
D.4	Culvert Ø80	m	1		
D.5	Culvert Ø60	m	1		
D.6	Culvert Ø40	m	1		
D.7	Culvert Ø30	m	1		
D.8	Culvert Ø20	m	1		
D.9	ARMCO Culvert Ø80	m	1		
D.10	ARMCO Culvert Ø60	m	1		
D.11	ARMCO Culvert Ø40	m	1		
D.12	Supply and install of PVC drain Pipes Ø50 PN6	m	1		
D.13	Supply and installation of Evacuation PVC drain pipe, Ø 63mm PN 6 or10	m	1		
D.14	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 6 or 10	m	1		
D.15	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 16	m	1		
D.16	Supply and installation of Evacuation PVC drain pipe, Ø 110mm PN 16	m	1		
D.18	Supply and installation of Evacuation PVC drain pipe, Ø 160mm PN 16	m	1		
D.19	Metal Gird	m <sup>2</sup>	1		
D.20	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.21	Supply and installation of steel angle of assorted sizes	Kg	1		
D.22	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.23	Supply and installation of Concrete kerbs T1	m	1		



D.24	Supply and installation of Concrete kerbs T2	m	1		
D.25	Surface water drainage channel	m	1		
D.26	Supply and installation of guardrails	m	1		
<b>E</b>	<b>Concrete</b>				
E.1	Blinding concrete dosed at 150 kg / m <sup>3</sup>	m <sup>3</sup>	1		
E.2	Unreinforced concrete dosed at 300 kg/m <sup>3</sup>	m <sup>3</sup>	1		
E.3	Reinforced concrete dosed at 350 kg m <sup>3</sup>	m <sup>3</sup>	1		
E.4	Filling stones	m <sup>3</sup>	1		
E.5	Pavers for walkway	m <sup>2</sup>	1		
E.6	Pavers for vehicle passage	m <sup>2</sup>	1		
E.7	Supply and installation of honeycomb	m <sup>2</sup>	1		
<b>F</b>	<b>Supply and installation of Road Signs</b>				
F.1	Class A	piece	1		
F.2	Class AB	piece	1		
F.3	Class B	piece	1		
F.4	Type C	piece	1		
	<b>MUSANZE AERODROME</b>				
<b>N°</b>	<b>Description of work</b>	<b>Unity</b>	<b>Qty</b>		
<b>I</b>	<b>Conception</b>				
I.1	Provisional sum for nominated supplier- Overhead profit by applying the percentage of works' amount.	%	1		
<b>II</b>	<b>Labor</b>				
II.1	Unskilled	pers.	1		
II.2	Skilled	pers.	1		
<b>A</b>	<b>Earthwork</b>		1		
A.1	Top soil excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.2	Excavation of unsuitable materials ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.3	Rock excavation	m <sup>2</sup>	1		
A.4	Drainage excavation ( <b>Dumping area to be provided by the client within less 3 Km</b> )	m <sup>3</sup>	1		
A.5	Top soiling	m <sup>3</sup>	1		
A.6	Common embankment	m <sup>3</sup>	1		
A.7	Sub grade preparation (in cut or in fill)	m <sup>3</sup>	1		
A.8	Drainage cleaning	m <sup>2</sup>	1		
A.9	Plate form Leveling and compaction	m <sup>2</sup>	1		
A.10	supply and installation of sand	m <sup>3</sup>	1		
A.12	Road side bush clearing	m <sup>2</sup>	1		
A.12.1	Grassing (planting passpalm)	m <sup>2</sup>	1		



A.12.2	Grass seed- including watering and protection until grass is established within the Clear and Graded Area of the Runway Strip	m <sup>2</sup>	1		
A.12.3	Planting passpalm (with turf grass)	m <sup>2</sup>	1		
	<b>Demolitions</b>				
A.11	Demolition of concrete slabs ≤5cm thickness	m <sup>2</sup>	1		
A.12	Destruction of existing channels	m	1		
A.13	Demolition of road kerbs	m	1		
A.14	Demolition of pavers	m <sup>2</sup>	1		
A.15	Demolition and evacuation of masonry blocks, bricks and rubble	m <sup>3</sup>	1		
A.16	Demolition and evacuation of unreinforced concrete	m <sup>3</sup>	1		
A.17	Demolition and evacuation of reinforced concrete	m <sup>3</sup>	1		
<b>B</b>	<b>Pavement works preparation</b>				
B.1	Cutting out and excavation of Existing pavement	m <sup>3</sup>	1		
B.2	Erasing of old marking paint	m <sup>2</sup>	1		
B.3	Rubber deposit removal	m <sup>2</sup>	1		
B.4	Milling	m <sup>2</sup>	1		
B.5	Repair of bituminous depression	ton	1		
B.6	Cracks sealing	m	1		
<b>C</b>	<b>Pavement</b>				
C.1	supply and installation of murrum	m <sup>3</sup>	1		
C.2	supply, mix, spread evenly approved crushed stone aggregate base course with 0/31,5mm	m <sup>3</sup>	1		
C.3	Bituminous gravel	m <sup>3</sup>	1		
C.4	Bituminous concrete for aeronautical pavement (AC20)	m <sup>3</sup>	1		
C.5	Bituminous concrete for aeronautical pavement (AC14)	m <sup>3</sup>	1		
C.6	Bituminous concrete, 20mm thick	m <sup>3</sup>	1		
C.7	Bituminous concrete, 10mm thick	m <sup>3</sup>	1		
C.8	Bituminous concrete for roads pavement	m <sup>3</sup>	1		
C.9	Triple surface treatment 6/10, 4/6; 2/4 with emulsion	m <sup>2</sup>	1		
C.10	Slurry seal	m <sup>2</sup>	1		
C.11	Prime coat	m <sup>2</sup>	1		
C.12	Tack coat	m <sup>2</sup>	1		
C.13	Anti-Kérosène protection	m <sup>2</sup>	1		
C.14	Airfield pavement marking, TT-P-1952E	m <sup>2</sup>	1		
C.15	Road marking paint	m <sup>2</sup>	1		
C.16	Rubber removal	m <sup>2</sup>	1		
C.17	Friction test	ff	1		



<b>D</b>	<b>Béton Drainage</b>				
D.1	Hardcores masonry	m <sup>3</sup>	1		
D.2	Construction of hardcore Masonry channel type H=0.5m, thickness=0.3m (open)	m	1		
D.3	Screed on foundation 5cm thick	m <sup>2</sup>	1		
D.4	Culvert Ø80	m	1		
D.5	Culvert Ø60	m	1		
D.6	Culvert Ø40	m	1		
D.7	Culvert Ø30	m	1		
D.8	Culvert Ø20	m	1		
D.9	ARMCO Culvert Ø80	m	1		
D.10	ARMCO Culvert Ø60	m	1		
D.11	ARMCO Culvert Ø40	m	1		
D.12	Supply and install of PVC drain Pipes Ø50 PN6	m	1		
D.13	Supply and installation of Evacuation PVC drain pipe, Ø 63mm PN 6 or10	m	1		
D.14	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 6 or 10	m	1		
D.15	Supply and installation of Evacuation PVC drain pipe, Ø90mm PN 16	m	1		
D.16	Supply and installation of Evacuation PVC drain pipe, Ø 110mm PN 16	m	1		
D.18	Supply and installation of Evacuation PVC drain pipe, Ø 160mm PN 16	m	1		
D.19	Metal Gird	m <sup>2</sup>	1		
D.20	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.21	Supply and installation of steel angle of assorted sizes	Kg	1		
D.22	Cold-rolled steel hollow sections of assorted sizes	Kg	1		
D.23	Supply and installation of Concrete kerbs T1	m	1		
D.24	Supply and installation of Concrete kerbs T2	m	1		
D.25	Surface water drainage channel	m	1		
D.26	Supply and installation of guardrails	m	1		
<b>E</b>	<b>Concrete</b>				
E.1	Blinding concrete dosed at 150 kg / m <sup>3</sup>	m <sup>3</sup>	1		
E.2	Unreinforced concrete dosed at 300 kg/m <sup>3</sup>	m <sup>3</sup>	1		
E.3	Reinforced concrete dosed at 350 kg m <sup>3</sup>	m <sup>3</sup>	1		
E.4	Filling stones	m <sup>3</sup>	1		
E.5	Pavers for walkway	m <sup>2</sup>	1		
E.6	Pavers for vehicle passage	m <sup>2</sup>	1		
E.7	Supply and installation of honeycomb	m <sup>2</sup>	1		
<b>F</b>	<b>Supply and installation of Road Signs</b>				
F.1	Class A	piece	1		



F.2	Class AB	piece	1		
F.3	Class B	piece	1		
F.4	Type C	piece	1		
<b>G</b>	<b>Granite pavers</b>				
G.1	Supply and installation of golden granite slates 30*10*4- black	sqm	1		
G.2	Supply and installation of golden granite slates 30*10*4-grey	sqm	1		
G.3	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.4	Supply and installation of granite slates 20*5*3 grey Nyagatare	sqm	1		
G.5	Supply and installation of granite slates 20*5*3 black Nyagatare	sqm	1		
G.6	Supply and installation of granite slates 20*5*3 pink Nyagatare	sqm	1		
G.7	supply and installation of granite slates 30*10*4- Nyarubakaa	sqm	1		
G.8	supply and installation of granite paver 40*40*5 cm-golden	sqm	1		
G.9	supply and installation of granite paver 40*40*5 cm-black	sqm	1		
G.10	Supply and installation of granite paver 50*50*5 cm-golden	sqm	1		
G.11	Supply and installation of granite paver 50*50*5 cm-black	sqm	1		
G.12	Supply and installation of granite paver 40*20*5 cm-golden	sqm	1		
G.13	Supply and installation of granite paver 40*20*5 cm-black	sqm	1		
G.14	Supply and installation of granite paver 20*20*5 cm-golden	sqm	1		
G.15	Supply and installation of granite paver 20*20*5 cm-gblack	sqm	1		
G.16	Supply and installation of granite paver 20*10*5 cm-golden	sqm	1		
G.17	Supply and installation of granite paver 20*10*5 cm-black	sqm	1		
G.18	Supply and installation of granite paver 15*15*5 cm-golden	sqm	1		



G.19	Supply and installation of granite paver 15*15*5 cm-black	sqm	1		
G.20	Supply and installation of granite paver 40*40*5 cm-grey Nyagatare	sqm	1		
G.21	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm	1		
G.22	Supply and installation of granite paver 40*20*5 cm-grey Nyagatare	sqm	1		
G.23	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm	1		
G.24	Supply and installation of granite paver 40*40*5 cm-pink Nyagatare	sqm			
G.25	Supply and installation of granite paver 40*40*5 cm-black Nyagatare	sqm			
G.26	Supply and installation of granite paver 40*20*5 cm-pink Nyagatare	sqm			
G.27	Supply and installation of granite paver 40*20*5 cm-black Nyagatare	sqm			
G.28	Supply and installation of granite paver 20*20*5 cm-black Nyagatare	sqm			
<b>H</b>	<b>Miscellaneous</b>				
H.1	ACO Qmax Neo 300 chanel L1000mm with ACO Neo Q-flow dictile iron grting flat pack without leveling feet	ml	1		
H.2	Supply and intallatyion of stainless steel slot drain of 400x400mm	ml			
H.3	Supply and intallatyion of stainless steel slot drain of 600x600mm	ml			
H.4	Supply and intallatyion of stainless steel slot drain of 800x800mm	ml			
H.5	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 950x950mm and clear opening of 800x800,100mm thick.	ml			
H.6	Supply and INSTALLATION OF D-400 HEAVY-DUTY CAST-IRON MANHOLE COVER & Frame with 750x750mm and clear opening of 600x600mm,100mm thick.	ml			
H.7	Supply installation of d-400 heavy-duty cast-iron manhole cover & frame with 800x800mm and clear opening of 600mm Dia ,100mm thick	ml			



H.8	Supply and installation of steel angle line	kg			
H.9	Re-installation of existing perimeter fence (including earthworks, installation of poles, chain link, barbed wire and razor wire), excluding masonry works	ml			
H.10	Re-installation of existing perimeter fence gates including all civil works	piece			
H.11	Re-installation of existing pavers, excluding platform preparation	sqm			
H.12	Demolition & evacuation of toles & roof truss	sqm			
H.13	Relocation of containers	piece			
H.14	Demolition and evacuation of spot welded mesh made of plastic coated galvanized low carbon steel wire, razor barbed round brace posts	ml			
H.15	Demolition and reinstallation of gate 1200x2422mm	piece			
H.16	Demolition andreinstallation of gate 600x2422mm	piece			





**Section VII. Drawings**

The bidding document does not include drawings









**Section IX. Forms Securities**

*Samples of acceptable forms of Bid, Performance, and Advance Payment Securities are provided in this Section X. Bidders shall not complete the Performance and Advance Payment Security forms at this stage of the procurement process. **Only the successful Bidder shall be required to provide these two securities.***



**Form of Bid Security (Bank Guarantee)**

*[If required, the **Bank** shall fill in this Bank Guarantee form in accordance with the instructions indicated in brackets.]*

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

**Beneficiary:** \_\_\_\_\_ *[Name and Address of RAC]*

**Date:** \_\_\_\_\_

**BID GUARANTEE N°.:** \_\_\_\_\_

We have been informed that *[name of the Bidder]* (hereinafter called "the Bidder") has submitted to you its bid dated (hereinafter called "the Bid") for the execution of *[name of tender]* under Invitation for Bids No. *[IFB number]* ("the IFB").

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

At the request of the Bidder, we *[name of Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[amount in figures]* (*[amount in words]*) upon receipt by us of your first demand in writing stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

- (a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid; or
- (b) having been notified of the acceptance of its Bid by RAC during the period of bid validity,
  - (i) fails or refuses to Sign the Contract or (ii) fails or refuses to furnish the performance security, in accordance with the Instructions to Bidders.
- (c) does not accept the arithmetic corrections made to their bill of quantities and price list of his bill

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

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

Date.....

Name of Authorized Representative person .....Address.....

Position.....

Signature..... Seal.....



**Performance Bank Guarantee**

(Unconditional)

[The **bank** providing the Guarantee shall fill in this form in accordance with the instructions indicated in brackets, if RAC requires this type of security.]

[insert bank's name, and address of issuing branch or office]

**Beneficiary:** [insert name and address of RAC]

**Date:** [insert date]

**PERFORMANCE GUARANTEE No.:** [insert Performance Guarantee number]

We have been informed that [insert name of Contractor] (hereinafter called "the Contractor") has entered into Contract No. [insert reference number of the Contract] dated with you, for the execution of [insert name of Contract and brief description of Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we [insert name of Bank] hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of [insert amount in figures] ([insert amount in words]), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the . . . Day/month/year..., and any demand for payment under it must be received by us at this office on or before that date. However, before that expiration date, if the planned contract execution period has been delayed or extended, or its value increased, the contractor shall respectively extend the validity period of this performance security or increase its amount accordingly.

Date.....

Name.....Address.....

Position.....

Signature.....

Seal:.....



**Bank Guarantee for Advance Payment**

*The bank/ providing the Guarantee shall fill in this form in accordance with the instructions indicated in brackets, if an Advance Payment is to be provided under the Contract*

*[insert Bank's name, and address of issuing branch or office]*

**Beneficiary:** *[insert name and address of RAC]*

**Date:** *[insert date]*

**ADVANCE PAYMENT GUARANTEE No.:** *[insert number]*

We have been informed that *[insert name of Contractor]* (hereinafter called "the Contractor") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with you, for the execution of *[insert name of contract and brief description of Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment is to be made against an advance payment guarantee in the sum indicated below.

At the request of the Contractor, we *[insert name of Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[insert amount in figures]* (*[insert amount in words]*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the Advance Payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the Advance Payment referred to above must have been received by the Contractor on its account number *[insert account number]* at *[insert name and address of Bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the Advance Payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the date of completion of its total payment. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

Date of issue.....

Name.....Address.....

Position.....

Signature: *[insert signature(s) of authorized representative (s of bank)]*

Seal.....

