CHAPTER 2 - AERODROME DATA

2.1 Introduction

2.1.1 This chapter contains specifications relating to the provision of Aeronautical Information Service (AIS) for publication in accordance with Annex 15 to the Convention on International Civil Aviation.

2.1.2 The Aeronautical Information Services or AIS is a section within the Rwanda Civil Aviation Authority responsible for collecting, collating, editing and publishing aeronautical information. Aeronautical information is published by the AIS as an Integrated Aeronautical Information Package consisting of the following elements:

   a) **Aeronautical Information Publication** (AIP) – A publication issued by and with the authority of the AIS and containing aeronautical information of a lasting character essential to air navigation.

   b) **AIP Amendment** – Permanent changes to the information contained in the AIP.

   c) **AIP Supplement** – Temporary changes to the information contained in the AIP, which are published by means of special pages.

   d) **NOTAM** – A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

   e) **Pre-flight information bulletin (PIB)** – A presentation of current NOTAM information of operational significance, prepared prior to flight.

   f) **Aeronautical Information Circular (AIC)** – A notice containing information, which relates to flight safety, air navigation, technical, administrative or legislative matters.

2.2 Information to be reported to the AIS

2.2.1 Aeronautical data

2.2.1.1 Determination and reporting of aerodrome related aeronautical data shall be in accordance and in that respect, three types of positional data shall be identified: surveyed points (e.g. runway threshold), calculated points (mathematical calculations from known surveyed points of points in space, fixed) and declared points (e.g. flight information region boundary points).

*Note – Specifications governing the quality system are given in ICAO Annex 5, Chapter 3.*
2.2.1.2 An aerodrome operator shall ensure that integrity of aeronautical data is maintained throughout the data process from survey/origin to the next intended user. Aeronautical data integrity requirements shall be based upon the potential risk resulting from the corruption of data and upon the use to which the data item is put. Consequently, the following classification and data integrity level shall apply:

a) **critical data, integrity level \(1 \times 10^{-6}\)**: there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

b) **essential data, integrity level \(1 \times 10^{-5}\)**: there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

c) **routine data, integrity level \(1 \times 10^{-3}\)**: there is a very low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

2.2.1.3 Protection of electronic aeronautical data while stored or in transit shall be totally monitored by the cyclic redundancy check (CRC). To achieve protection of the integrity level of critical and essential aeronautical data as classified in paragraph 2.2.1.2 above, a 32 or 24 bit CRC algorithm shall apply respectively.

2.2.1.4 To achieve protection of the integrity level of routine aeronautical data as classified in paragraph 2.2.1.2 above, a 12 bit CRC algorithm should apply.


2.2.1.5 Geographical coordinates including latitude and longitude shall be determined and reported to the Aeronautical Information Services in terms of the World Geodetic System – 1984 (WGS-84) geodetic reference datum, identifying those geographical coordinates which have been transformed into WGS-84 coordinates by mathematical means and whose accuracy of original field work does not meet the requirements in ICAO Annex 14 Vol. I APPENDIX3; Table 1

2.2.1.6 The order of accuracy of the field work shall be such that the resulting operational navigational data for the phases of flight will be within the maximum deviations, with respect to an appropriate reference frame, as indicated in the tables contained in ICAO Annex14 Vol. I APPENDIX 3

2.2.1.7 In addition to the elevation (referenced to mean sea level) of the specific surveyed ground positions at aerodromes, geoid undulation (referenced to the WGS-84
ellipsoid) for those positions as indicated in ICAO Annex 14 Vol. I APPENDIX 3 shall be determined and reported to the Aeronautical Information Services.

Note 1 – An appropriate reference frame is that which enables WGS-84 to be realized on a given aerodrome and with respect to which all coordinate data are related.

Note 2 – Specifications governing the publication of WGS-84 coordinates are given in ICAO Annex 4, Chapter 2 and ICAO Annex 15, Chapter 3.

2.2.2 Aerodrome reference point

2.2.2.1 An aerodrome reference point shall be established for an aerodrome.

2.2.2.2 The aerodrome reference point shall be located near the initial or planned geometric centre of the aerodrome and shall normally remain where first established.

2.2.2.3 The position of the aerodrome reference point shall be measured and reported to the Aeronautical Information Services in degrees, minutes and seconds.

2.2.3 Aerodrome and runway elevations

2.2.3.1 The aerodrome elevation and geoid undulation at the aerodrome elevation points shall be measured to the accuracy of one-half metre and reported to the Aeronautical Information Services.

2.2.3.2 For an aerodrome used by international civil aviation for non-precision approaches, the elevation and geoid undulation of each threshold, the elevation of the runway end and any significant high and low intermediate points along the runway shall be measured to the accuracy of one-half metre and reported to the Aeronautical Information Services.

2.2.3.3 For precision approach runways, the elevation and geoid undulation of the threshold, the elevation of the runway end and the highest elevation of the touchdown zone shall be measured to the accuracy of one quarter metre and reported to the Aeronautical Information Services.

Note – Geoid undulation must be measured in accordance with the appropriate system of coordinates.

2.2.4 Aerodrome reference temperature

2.2.4.1 An aerodrome reference temperature shall be determined for an aerodrome in degrees Celsius.

2.2.4.2 The aerodrome reference temperature should be the monthly mean of the daily maximum temperatures for the hottest month of the year (the hottest month being, that which has the highest monthly mean temperature). This temperature should be averaged over a period of years.
2.2.5 Aerodrome dimensions and related information

2.2.5.1 The following data shall be measured or described, as appropriate, for each facility provided on an aerodrome:

a) runway – true bearing to one-hundredth of a degree, designation number, length, width, displaced threshold location to the nearest metre, slope, surface type, type of runway and, for a precision approach runway category I, the existence of an obstacle free zone when provided;

b) strip, runway end safety area, stopway – length, width to the nearest metre, surface type;

c) taxiway – designation, width, surface type;

d) apron – surface type, aircraft stands;

e) the boundaries of the air traffic control service;

f) clearway – length to the nearest metre, ground profile;

g) visual aids for approach procedures, marking and lighting of runways, taxiways and aprons, other visual guidance and control aids on taxiways and aprons, including runway-holding positions and stop bars, and location and type of visual docking guidance systems;

h) location and radio frequency of any VOR aerodrome check-point;

i) location and designation of standard taxi-routes; and

j) distances to the nearest metre of localizer and glide path elements comprising an instrument landing system (ILS) or azimuth and elevation antenna of microwave landing system in relation to the associated runway extremities.

2.2.5.2 The geographical coordinates of each threshold shall be measured and reported to the AIS in degrees, minutes, seconds and hundredths of seconds.

2.2.5.3 The geographical coordinates of appropriate taxiway centre line points shall be measured and reported to the AIS in degrees, minutes, seconds and hundredths of seconds.

2.2.5.4 The geographical coordinates of each aircraft stand shall be measured and reported to the AIS in degrees, minutes, seconds and hundredths of seconds.

2.2.5.5 The geographical coordinates of significant obstacles in the approach and take-off areas, in the circling area and in the vicinity of an aerodrome shall be measured and reported to the AIS in degrees, minutes, seconds and tenths of seconds. In addition, the top elevation rounded up to the nearest metre, type, marking and lighting (if any) of the significant obstacles shall be reported to the AIS.
Note – This information may be best shown in the form of charts such as those required for the preparation of aeronautical publications as specified in ICAO Annexes 4 and 15.

2.2.6 Strength of pavements

2.2.6.1 The bearing strength of a pavement shall be determined.

2.2.6.2 The bearing strength of a pavement intended for aircraft of apron (ramp) mass greater than 5,700 kg shall be made available using the aircraft classification number – pavement classification number (ACN-PCN) method by reporting all of the following information:

a) the pavement classification number (PCN);
b) pavement type of ACN-PCN determination;
c) sub-grade strength category;
d) maximum allowable tire pressure category or maximum allowable tire pressure value; and
e) evaluation method.

Note – If necessary, PCNs may be published to an accuracy of one tenth of a whole number.

2.2.6.3 The pavement classification number (PCN) reported shall indicate that an aircraft with an aircraft classification number (ACN) equal to or less than the reported PCN can operate on the pavement subject to any limitation on the tire pressure, or aircraft all-up mass for specified aircraft type(s).

Note – Different PCNs may be reported if the strength of the pavement is subject to significant seasonal variation.

2.2.6.4 The ACN of an aircraft shall be determined in accordance with the standard procedures associated with the ACN-PCN method.

Note – The standard procedures for determining the ACN of an aircraft are given in the ICAO Aerodrome Design Manual, Part 3. For convenience several aircraft types currently in use have been evaluated on rigid and flexible pavements found on the four sub-grade categories in paragraph 2.2.6.6 b) below and the results tabulated in that manual.

2.2.6.5 For the purposes of determining the ACN, the behaviour of a pavement shall be classified as equivalent to a rigid or flexible construction.

2.2.6.6 Information on pavement type for ACN-PCN determination, sub-grade strength category, maximum allowable tire pressure category and evaluation method shall be reported using the following codes:
a) Pavement type for ACN-PCN determination:

- Rigid pavement
- Flexible pavement

Note – If the actual construction is composite or non-standard, include a note to that effect (See example 2 below).

b) Sub-grade strength category:

- High strength: characterized by K = 150 MN/m³ and representing all K values above 120 MN/m³ for rigid pavements, and by CBR = 15 and representing all CBR values above 13 for flexible pavements.

- Medium strength: characterized by K = 80 MN/m³ and representing a range in K of 20 to 120 MN/m³ for rigid pavements, and by CBR = 10 and representing a range in CBR of 8 to 13 for flexible pavements.

- Low strength: characterized by K = 40 MN/m³ and representing a range in K of 25 to 20 MN/m³ for rigid pavements, and by CBR = 2 and representing a range in CBR of 4 to 8 for flexible pavements.

- Ultra low strength: characterized by K = 20 MN/m³ and representing all K values below 25 MN/m³ for rigid pavements, and by CBR = 3 and representing all CBR values below 4 for flexible pavements.

c) Maximum allowable tire pressure category:

<table>
<thead>
<tr>
<th>Category</th>
<th>Limitation</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>no pressure limit</td>
<td>W</td>
</tr>
<tr>
<td>Medium</td>
<td>pressure limited to 1.50 MPa</td>
<td>X</td>
</tr>
<tr>
<td>Low</td>
<td>pressure limited to 1.00 MPa</td>
<td>Y</td>
</tr>
<tr>
<td>Very low</td>
<td>pressure limited to 0.50 MPa</td>
<td>Z</td>
</tr>
</tbody>
</table>

d) Evaluation method:

<table>
<thead>
<tr>
<th>Type</th>
<th>Representation</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical evaluation</td>
<td>Representing a specific study of the pavement characteristics and application of pavement behaviour technology.</td>
<td>T</td>
</tr>
<tr>
<td>Using aircraft experience</td>
<td>Representing knowledge of the specific</td>
<td>U</td>
</tr>
</tbody>
</table>
Note – The following examples illustrate how pavement strength data are reported under the ACN-PCN method.

Example 1 – If the bearing strength of a rigid pavement, resting on a medium strength sub-grade, has been assessed by technical evaluation to be PCN 80 and there is not tire pressure limitation, then the reported information would be:

PCN 80/ R / B / W / T

Example 2 – If the bearing strength of a composite pavement, behaving like a flexible pavement and resting on a high strength sub-grade, has been assessed using aircraft experience to be PCN 50 and the maximum tire pressure allowable is 1.00 MPa, then the reported information would be:

PCN 50/ F / A / Y / U

Example 3 – If the bearing strength of a flexible pavement, resting on a medium strength sub-grade, has been assessed by technical evaluation to be PCN 40 and the maximum allowable tire pressure is 0.80 MPa, then the reported information would be:

PCN 40 / F / B / 0.80 MPa / T

Example 4 – If a pavement is subject to a B747-400 all-up mass limitation of 390 000 kg, then the reported information should include the following note:

Note – The reported PCN is subject to a B747-400 all-up mass limitation of 390 000 kg.

2.2.6.7 Criteria should be established to regulate the use of a pavement by an aircraft with an ACN higher than the PCN reported for that pavement in accordance with paragraphs 2.2.6.2 and 2.2.6.3.

Note: – ICAO Annex 14 Vol. I, Attachment A, Section 18 details a simple method for regulating overload operations while the ICAO Aerodrome Design Manual, Part 3 includes the descriptions of more detailed procedures for evaluation of pavement sand their suitability for restricted overload operations.

2.2.6.8 The bearing strength of a pavement intended for aircraft of apron (ramp) mass equal to or less than 5 700 kg shall be made available by reporting the following information:

a) maximum allowable aircraft mass; and

b) maximum allowable tire pressure.

Example: 4 000 kg/0.50 MPa.
2.2.7 Pre-flight altimeter check location

2.2.7.1 One or more pre-flight altimeter check locations shall be established for the aerodrome.

2.2.7.2 A pre-flight check location should be located on an apron.

Note 1 – Locating a pre-flight altimeter location on an apron enables an altimeter check to be made prior to obtaining taxi clearance and eliminates the need for stopping for that purpose after leaving the apron.

Note 2 – Normally an entire apron can serve as a satisfactory altimeter check location.

2.2.7.3 The elevation of a pre-flight altimeter check location shall be given as the average elevation, rounded to the nearest metre, of the area on which it is located. The elevation of any portion of a pre-flight altimeter check location shall be within 3m of the average elevation for that location.

2.2.8 Declared distances

2.2.8.1 The following distances shall be calculated to the nearest meter for a runway intended for use by international commercial air transport:

   a) take-off run available;
   b) take-off distance available;
   c) accelerate-stop distance available; and
   d) landing distance available.

Note – Guidance on calculation of declared distances is given in ICAO Annex 14, Attachment A, Section 3.

2.2.9 Condition of the movement area and related facilities

2.2.9.1 Information on the condition of the movement area and the operational status of related facilities shall be provided to the Aeronautical Information Services, and similar information of operational significance to the air traffic service units, to enable those units to provide the necessary information to arriving and departing aircraft. The information shall be kept up to date and changes in conditions reported without delay.

2.2.9.2 The condition of the movement area and the operational status of related facilities shall be monitored and reports on matters of operational significance or affecting aircraft performance given, particularly in respect of the following:

   a) construction or maintenance work;
   b) rough or broken surfaces on a runway, taxiway or an apron;
c) water on a runway, a taxiway or an apron;

d) other temporary hazards, including parked aircraft;

e) failure or irregular operation of part of all of the aerodrome visual aids; and

f) failure of the normal or secondary power supply.

2.2.9.3 To facilitate compliance with paragraphs 2.2.9.1 and 2.2.9.2, inspections of the movement area shall be carried out each day at least once where the code number is 1 or 2 and at least twice where the code number is 3 or 4.


**Water on a runway**

2.2.9.4 Whenever water is present on a runway, a description of the runway surface conditions on the centre half of the width of the runway, including the possible assessment of water depth, where applicable, should be made available using the following terms:

DAMP – the surface shows a change of colour due to moisture.

WET – the surface is soaked but there is no stagnant water.

WATER PATCHES – significant patches of standing water are visible.

FLOODED – extensive standing water is visible.

2.2.9.5 Information that a runway or portion thereof may be slippery when wet should be made available.

2.2.9.6 A runway or portion thereof shall be determined as being slippery when wet when the measurements specified in paragraph 10.2.3 show that the runway surface friction characteristics as measured by a continuous friction measuring device are below the minimum friction level specified in this Manual.

Note – Guidance on determining and expressing the minimum friction level is provided in ICAO Annex 14, Vol. I, Attachment A, Section 7.

2.2.9.7 Information on the minimum friction level specified in this Manual for reporting slippery runway conditions and the type of friction measuring device used shall be made available.

2.2.9.8 When it is suspected that a runway may become slippery under unusual conditions, then additional measurements should be made when such conditions occur, and information on the runway surface friction characteristics made available when these additional measurements shows that the runway or a portion thereof has become slippery.
2.2.10 Disabled aircraft removal

Note: – See section 9.4 of this Manual for information on disabled aircraft removal services.

2.2.10.1 The telephone/telefax number(s) of the office of the aerodrome coordinator of operations for the removal of an aircraft disabled on or adjacent to the movement area shall be made available to aircraft operators.

2.2.10.2 Information concerning the capability to remove an aircraft disabled on or adjacent to the movement area should be made available.

Note – The capability to remove a disabled aircraft may be expressed in terms of the largest type of aircraft which the aerodrome is equipped to remove.

2.2.11 Rescue and fire fighting services

Note: – See section 9.3 of this Manual for information on rescue and fire fighting services.

2.2.11.1 Information concerning the level of protection provided for aircraft rescue and fire fighting purposes shall be made available.

2.2.11.2 The level of protection normally available at the aerodrome shall be expressed in terms of the category of the rescue and fire fighting services as described in section 9.3.5 and 9.3.6 of this Manual and in accordance with the types and amounts of extinguishing agents normally available at the aerodrome.

2.2.11.3 Significant changes in the level of protection normally available at an aerodrome for rescue and fire fighting shall be notified to the air traffic services unit and the Aeronautical Information Services to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly.

Note – A significant change in the level of protection is considered to be a change in the category of the rescue and fire fighting service from the category normally available at the aerodrome, resulting from a change in availability of extinguishing agents, equipment to deliver the agents or personnel to operate the equipment, etc.

2.2.11.4 A significant changes should be expressed in terms of the new category of the rescue and fire fighting service available at the aerodrome.

2. 2.12. Visual approach slope indicator systems

2.2.12.1 The following information concerning a visual approach slope indicator system installation shall be made available:

   a) associated runway designation number;
b) type of system according to paragraph 5.2.3.5.2 of this Manual. For an AT-VASIS, PAPI or APAPI installation, the side of the runway on which the lights are installed, i.e. left or right, shall be given;

c) where the axis of the system is not parallel to the runway centre line, the angle of displacement and the direction of displacement, i.e. left or right shall be indicated;

d) nominal approach slope angle(s). For a T-VASIS or an ATVASIS this shall be angle $\theta$ according to the formula in Figure 5-17 of ICAO Annex 14 Vol. I and for a PAPI and an APAPI this shall be angle $(B+C)/2$ and $(A+B)/2$, respectively as in ICAO Annex 14 Vol. I Figure 5-19; and

e) minimum edge height(s) over the threshold of the on-slope signal(s). For a T-VASIS or an AT-VASIS this shall be the lowest height at which only the wing bar(s) are visible; however, the additional heights at which the wing bar(s) plus one, two or three fly down light units come into view may also be reported if such information would be of benefit of aircraft using the approach. For a PAPI, this shall be the setting angle of the third unit from the runway minus 2\', i.e. angle B minus 2\', and for an APAPI this shall be the setting angle of the unit farther from the runway minus 2\', i.e. angle A minus 2\'.

2.2.13 Coordination between the aerodrome operator and the Aeronautical Information Services

2.2.13.1 To ensure that the Aeronautical Information Services obtain information to enable them to provide up-to-date pre-flight information and to meet the need for in-flight information, the aerodrome operator shall establish arrangements with the Aeronautical Information Services to report, with a minimum of delay:

a) information on aerodrome conditions (reference sections 2.2.9, 2.2.10, 2.2.11, 2.2.12 above);

b) the operational status of associated facilities, services and navigation aids within their area of responsibility;

c) any other information considered to be of operational significance.

2.2.13.2 Before introducing changes to the air navigation system, due account shall be taken by the aerodrome operator of the time needed by the Aeronautical Information Services for the preparation, production and issue of relevant material for promulgation. To ensure timely provision of information to the Aeronautical Information Services, close coordination between those services concerned is therefore required.

2.2.13.3 Of a particular importance are changes to aeronautical information that affects charts and/or computer-based navigation systems, which qualify to be notified by the aeronautical information regulation and control (AIRAC) system, as specified in ICAO Annex 15, Chapter 2 and Appendix 4. The pre-determined internationally agreed AIRAC effective dates in addition to 14 days postage time shall be observed by the
responsible aerodrome operator when submitting the raw information/data to the Aeronautical Information Services.

2.2.13.4 The aerodrome operator responsible for the provision of raw aeronautical information/data to the Aeronautical Information Services shall do that while taking into account accuracy and integrity requirements for aeronautical data as specified in ICAO Annex 14 Vol. I; Appendix 5

Note 1 – Specifications for the issue of a NOTAM are contained in ICAO Annex 15, Chapter 5, Appendix 2.

Note 2 – AIRAC information is distributed by the AIS at least 42 days in advance of the AIRAC effective dates with the objective of reaching recipients at least 28 days in advance of the effective date.

Note 3 – The schedule of the predetermined internationally agreed AIRAC common effective dates at intervals of 28 days, including 2 November 1997 and guidance for the AIRAC use are contained in the ICAO Aeronautical Information Services Manual (ICAO Doc 8122, Chapter 3, 3.1.1 and Chapter 4, 4.4).