Kingdom of Saudi Arabia
General Authority of Civil Aviation
Safety and Economic Regulation

Aerodrome Survey Requirements

Standards, Guidance and Information for Aerodrome Operators and Surveyors

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Change Summary

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1.0	First Edition	S&ER ASSD	10 March 2011

NOTE:
1. When amended, this document will be re-issued in full. Each page will indicate the edition number and the effective date. The edition number should be the same on each page.
2. When printed this document is un-controlled. Check the GACA website for the current release edition.

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CHAPTER 1 INTRODUCTION

1.1 Purpose

1.1.1 The purpose of aerodrome survey information is to enable Aerodrome Certificate Holders to meet their safety and regulatory responsibilities for:

a. aerodrome certification issues;

b. design and development of operational flight procedures;

c. preparation of aeronautical charts; and

d. conduct of safety evaluations.

1.1.2 This document details the survey requirements and plan presentation required by the General Authority for Civil Aviation (GACA) to ensure Aerodrome Certificate Holders comply with their mandatory responsibilities as detailed in GACA Regulations and ICAO Annexes.

1.1.3 Aerodrome Certificate Holders are advised to consult with their selected Surveyor on the technical content of this document.

1.1.4 Selected survey information will be published in the Aeronautical Information Publication (AIP) and other associated documents.

1.2 Context

1.2.1 The basic survey philosophy applied in this document is to provide reliable lists of all aerodrome facilities (i.e. runways, navigation aids, etc.) and features identified as obstacles for each aerodrome - constrained by the appropriate area of interest.

1.2.2 These lists form the basis for all charting, obstacle filtering (using obstacle identification and obstacle limitation surfaces) and analysis for Instrument Flight Procedures (IFP) design.

1.2.3 The challenge placed upon surveying companies is to identify appropriate features to survey in creating these lists. It will be totally impracticable and costly to survey all features.

1.2.4 It is important for surveying companies to understand the tasks and challenges faced by the end user - i.e., for the preparation of Aeronautical Charts, for use by AIS Service Providers, IFP designers, Aerodrome Inspectors and for Aerodrome Certificate Holders in achieving physical safeguarding.

1.2.5 From an IFP design perspective, a reliable representation of the aerodrome and its obstacle environment forms the critical baseline for successful IFP design.

1.2.6 The Aerodrome Certificate Holder is accountable for assessing the significance of any existing (or proposed) obstacle within the aerodrome boundary or in the vicinity of the aerodrome in relation to the surveyed areas.

1.2.7 Therefore the Aerodrome Certificate Holder must determine the method of assessing the results of the survey data; a method which will identify where action should be taken to lower or remove obstacles which may otherwise limit operational activities.

1.2.8 This process of assessment and results must be made available to the GACA Safety and Economic Regulation Sector (S&ER) inspectors on request.

1.3 Applicability

1.3.1 This document is applicable to all operators of Certificated Aerodromes and those considering Certification in the Kingdom of Saudi Arabia (KSA).

1.4 Reference Documents

1.4.1 This document should be read in conjunction with:

a. GACA Regulation Section 4 and ICAO Annex 4 (Aeronautical Charts);
b. GACA Regulation Section 5 and ICAO Annex 5 (Units of Measurement to be Used in Air and Ground Operations);

c. GACA Regulation Section 14 and ICAO Annex 14 (Aerodromes);

d. GACA Regulation Section 15 and ICAO Annex 15 (Aeronautical Information Services);

e. ICAO DOC 8168 - OPS/611(PANS OPS) Volume II;

f. ICAO DOC 9674-AN/946 (WGS-84 Manual);

g. ICAO Doc 9881 Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information

h. Eurocontrol e-TOD Manual (Edition 2.0 November 2011)

1.5 Guidance and Policy

1.5.1 For guidance and policy on points that are not covered within this publication, advice should be sought from the Aerodrome Standards and Safety Division, Safety Department, Safety and Economic Regulation Sector (S&ER ASSD), GACA.

1.6 Structure of this Document

1.6.1 This document is structured to assist surveyors through the following logical steps:

a. Choosing the relevant aerodrome survey classification;

b. Determining the areas to be surveyed;

c. Surveying the areas required;

d. Populating Aerodrome Facilities and Master Obstacle data lists;

e. Producing plans and filtering obstacle data as required;

f. Producing a survey report which demonstrates the reliability of the data; and

g. Distributing relevant data and information.

1.7 Mandatory Requirements

1.7.1 The requirements in this document strive to minimize the cost to aerodromes whilst providing the minimum prescribed safety standards and requirements. GACA fully recognizes that each individual aerodrome governs its own operational needs and therefore the level of survey required should be appropriate to the type of operation intended at that airport.

1.7.2 Aerodrome Certificate Holders must provide accurate survey information of their aerodrome and environs according to the type of operation identified by the aerodrome survey classification and survey areas required as

prescribed in Tables 1-1 and 1-2 and must be carried out to measure any changes at the periodic intervals as set out in Table 1-3.

Type of Operation	Aerodrome Survey Classification
Aerodrome with no Instrument Flight Procedures (IFPs)	**1**
Aerodrome with Non-Precision IFP	**2**
Aerodrome with Precision ILS CAT I / APV or equivalent IFP	**3**
Aerodrome with Precision ILS CAT II/III or equivalent IFP	**4**

Table 1-1 Aerodrome Survey Classifications

Survey Area	Reference	Aerodrome Survey Classification			
		1	**2**	**3**	**4**
Aerodrome Plan	Chapter 5	✓	✓	✓	✓
GACAR Section 14/Annex 14 OLS	Chapter 6	✓	✓	✓	✓
Aerodrome Chart – Type A (Aerodrome Survey Classification 2: if used regularly by international civil aviation)	Chapter 8	-	✓	✓	✓
Precision Approach Terrain Chart	Chapter 9	-	-	-	✓
eTOD Areas 2a and 2b (initial survey 12 November 2015)	Chapter 7	-	-	✓	✓
eTOD Areas 2c, 2d*, 3* and 4 (initial survey 12 November 2015)	Chapter 7	-	-	-	✓

NOTES: *1. Whilst eTOD Area 2 covers a similar geographical area to that of the Annex 14 OLS and the Aerodrome Obstacle Chart Type A Take Off Flight Paths, the accuracy requirements are such that the data would not be useful for safety assessments and safeguarding purposes.*

2. **eTOD Area 2d and Area 3: Optional. (Requirement determined by Aerodrome Certificate Holder in conjunction with airport users).*

Table 1-2 Aerodrome Survey Area – Mandatory Requirements

1.8 Survey Areas

1.8.1 The Aerodrome Survey Classification (Table 1-1) and the Aerodrome Survey Areas Mandatory Requirements for a particular Aerodrome Survey Classification are prescribed in Table 1-2.

1.9 Survey Frequency

1.9.1 Surveys must be undertaken for all Survey Areas required to measure any changes at the periodic intervals (frequency) prescribed in Table 1-3.

Survey Type	Aerodrome Survey Classification	Frequency
Geodetic Connection	1, 2, 3 and 4	An initial mandatory survey
Mandatory Aerodrome Survey Areas (Full Survey)	1, 2, 3 and 4	a. Initial survey b. Within 5 years c. If any doubt exists as to validity of previous survey
Validation Assessment	1, 2, 3 and 4	Annually after the mandatory surveys

Table 1-3 Aerodrome Survey - Frequency

1.10 Survey Procedures

1.10.1 Geodetic Connection

1.10.1.1 The procedures for a geodetic connection are detailed in Chapter 2.

1.10.1.2 The geodetic connection date must be included on the Survey Declaration Form (see Annex A).

1.10.2 Mandatory Surveys

1.10.2.1 The procedures for the mandatory surveys are detailed in Chapter 2.

1.10.2.2 All mandatory surveys must be included on the Survey Declaration Form (see Appendix C).

1.10.3 eTOD Surveys

1.10.3.1 Refer to Chapter 7 of this document and ICAO Annex 15 (Amendment 36), Chapter 10, Appendix 1.

1.10.4 Validation Assessment

1.10.4.1 The aim of the annual Validation Assessment is to identify any changes (including new or changes to existing obstacles) since the previous survey. If changes are suspected, then these must be surveyed to the specifications detailed in this publication.

1.10.4.2 All Validation Assessment Surveys must be included on the Survey Declaration Form (see Appendix C).

1.10.5 General

1.10.5.1 Any new survey contract between the aerodrome and a new survey company must provide a seamless transition from that point reached in the survey life cycle with the previous contractor.

1.10.5.2 It is recommended that the aerodrome ensure provision is made within any survey contract to ensure that these requirements are complied with.

1.11 Data Management

1.11.1 The surveyor must declare the new, amended and deleted records and the reason(s) for the change as part of the survey report.

1.11.2 If no changes were found to any of the attributes in an existing record, the record must retain its original record number and survey date.

1.11.3 Strict data management is crucial during the entire survey and subsequent declaration process. Survey companies are urged to implement rigorous data handling processes and practices to eliminate erroneous data. Each surveyed entity and associated attributes must be dealt with as a unique data record stream.

1.11.4 Any change to an existing data record stream identified during a subsequent Validation Assessment Survey will necessitate a re-issue of the entire data record with a new survey date while retaining the original unique identifier. A change of location to an existing feature will require a new unique identifier to be applied.

1.11.5 If a subsequent Validation Survey is submitted following an initial Full Survey, all previous data records must be updated and the existing survey obstacle number retained with the new survey date.

1.11.6 Any new obstacle or changes to existing obstacle penetration of the aerodrome OLS may be subject to NOTAM until surveyed to the standards in this document, allowing entry into the AIP.

1.11.7 All data records, including e-TOD data, must be provided in a format consistent with the requirements of this document and the requirements of ICAO Annex 15, and must be compatible with GACA GIS requirements.

1.12 Survey Declaration Form

1.12.1 A Survey Declaration Form (see Appendix C) must accompany any Full or Validation Assessment Surveys undertaken.

1.12.2 Completion of this Form confirms that the survey information meets the requirements and accuracies detailed in this document.

1.13 Qualifying Surveying Companies

1.13.1 The Aerodrome Certificate Holder must satisfy itself as to the competence of the surveyors it employs for aerodrome surveys. The following is a list of characteristics that should be considered:

a. Accreditation to an ISO standard or operate an equivalent quality control system;
b. Professionally qualified surveyors and project managers to oversee the survey;
c. Field survey staff competent in aerodrome surveying techniques and experienced at working in an operational aerodrome environment;
d. Professional indemnity cover.

1.14 Accuracy

1.14.1 Appropriate survey methods must be applied to qualify the accuracy and integrity of the data provided. Survey methodology must be clearly demonstrated in the Survey Report and all coordinates must be traceable to their source of production by an unbroken audit trail, as required by ICAO Annex 15, paragraph 3.2.

1.14.2 Requirements are clearly stated in ICAO DOC 9674-AN/946 (WGS-84 Manual) and the most stringent survey accuracy must apply for Aerodrome Survey Classification 2, 3 and 4 as prescribed in Table 1-4.

	Horizontal Accuracy	Vertical Accuracy	Integrity Classification
Aerodrome Control Network	1.0 m (1)	1.0 m (1)	1×10^{-8}
Aerodrome Facilities	0.5 m (2)	0.25 m (2)	1×10^{-8}
Obstacles and Off Aerodrome Facilities (Mandatory Surveys)	3.0 m (2)	0.3 m (2)	1×10^{-5}
e-TOD Area 2 (3)	5.0 m (1)	3.0 m (1)	1×10^{-5}
e-TOD Area 3 (3)	0.5 m (2)	0.5 m (2)	1×10^{-5}
e-TOD Area 4 (3)	2.5 m (1)	1.0 m (1)	1×10^{-5}

Notes: (1) Accuracy with respect to the appropriate geodetic reference frame
(2) Accuracy relative to the aerodrome control network
(3) For additional data numerical requirements see Chapter 7, and ICAO Annex 15 Appendix 8

Table 1-4 Minimum Survey Accuracy and Integrity Requirements

1.15 Survey Information to AIS

1.15.1 Noted changes to aerodrome data must be routed to GACA AIS, GACA-ANS Headquarters, Jeddah.

1.16 Conversion Factors

1.16.1 ICAO Annex 5 must be used as the standard for the application of all conversion factors.

CHAPTER 2 – SURVEY PROCEDURES

2.1 General

2.1.1 The accuracy and integrity requirements for the geodetic connection and surveyed data are stated in Table 1-4.

2.1.2 With the exception of those aerodromes without Instrument Flight Procedures, those with Survey Classification 2, 3 and 4 must undertake surveys to the accuracy and quality assurance requirements stated in the ICAO DOC 9674-AN/946 (WGS-84 Manual).

2.1.3 The Aerodrome Certificate Holder is responsible for ensuring the accuracy of information required for all survey areas.

2.2 Horizontal Control

2.2.1 Coordinates will be required in WGS-84 format latitude and longitude (required format for published data).

2.2.2 Survey control points must conform to the ICAO DOC 9674-AN/946 (WGS-84 Manual).

2.2.3 WGS-84 geodetic control and format requires that the methods applied must prove that the accuracy for the various surveys has been met.

2.2.4 Survey companies undertaking these surveys must be responsible for the accuracy of the control data and any transformation sets used.

2.2.5 An analysis of the accumulated error, evidence confirming the required accuracies have been met and the transformation parameters used must be included in the Survey Report.

2.3 Vertical Control

2.3.1 Orthometric and ellipsoidal elevations are required.

2.3.2 The variable separation between the geoid and the reference ellipsoid may give rise to inaccuracies greater than the allowable specified. For the computation to transform ellipsoidal to orthometric elevations the EGM96 geoid model must be used.

2.3.3 In all cases appropriate survey checks must be applied to prove the quality of vertical control. These checks must be included within the survey report.

2.3.4 Standard survey practice must be used to produce the elevation to the required specification accuracy and the integrity of the control points used must be proved.

2.4 Instrumentation

2.4.1 All relevant survey equipment must have a current calibration certificate and be able to perform to the accuracy appropriate to the requirements of the surveys.

2.5 Methodology

2.5.1 All permanent control points must be “monumented” in accordance with WGS-84 Manual (or equivalent).

2.5.2 All permanent controls that are established must be documented and their coordinates traceable to their source.

2.5.3 The use of contour maps can aid in the process of defining the probable extent of the survey and the likely position of obstacles. Local scale factor adjustment to ground distances as well as the effects of curvature and refraction must be considered.

2.5.4 Unvalidated or new obstacle data must be proved by either a minimum of two independent measurements or by other suitable checks for errors. The methodology used to ensure reliable coordinates must be documented in the Survey Report along with evidence that the resulting accuracies have met the requirements.

2.5.5 Existing obstacles within a validated dataset need only to be checked to confirm their height and position without the rigour afforded to unvalidated or new obstacles.

2.5.6 Particular attention should be paid to structures (e.g., trees) whose height may change. An appreciation of the effects of vertical angles over variable distances is necessary to give good height accuracies.

2.6 Obstacles to be Heighted

2.6.1 Surveying companies should take note that when surveying a prescribed area, a situation might arise where the highest obstacle within that area might not necessarily be the dominant obstacle for that particular phase of flight. Therefore, surveyors should always declare all surveyed obstacles in the Master List.

2.6.2 Obstacles include terrain, vegetation and structures.

2.6.3 Where there are a large number of obstacles to be heighted, it will be impractical to survey all obstacles; therefore the surveyor should consult with the Aerodrome Certificate Holder and the Instrument Flight Procedure (IFP) designers where necessary. Any agreements are to be recorded in the Survey Report.

2.6.4 Due consideration must be taken when observing transverse and longitudinal obstacles in close proximity to the runway because their leading edge may have greater significance than the highest point. (It must be appreciated that the highest object might not be the most important for consideration, see Figure 2-1).

2.6.5 Fine obstacles such as lightning conductors or aerials that surmount the object may not be visible over a distance. Therefore care must be taken when observing distant obstacles to ensure that the highest point is heighted.

2.6.6 Height above ground level (AGL) should also be measured where possible or derived by comparison with the terrain data.

2.6.7 Temporary obstacles encountered at the time of survey should be included and identified as temporary. A statement should be included in the Survey Report stating the temporal extent of all such obstacles.

2.6.8 When compiling the data, the surveyor should include all features surveyed, whether they penetrate the relevant surfaces or not.

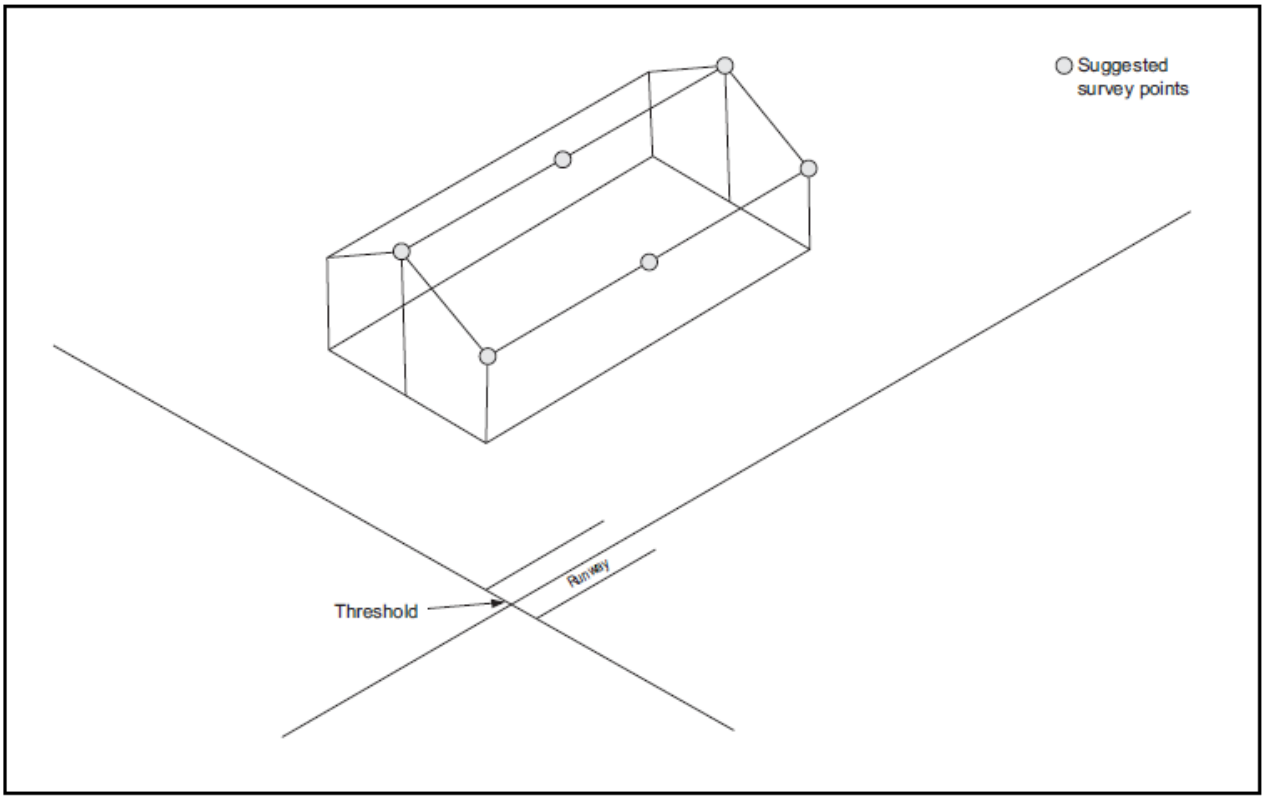

Figure 2-1 Transverse and Longitudinal Objects

CHAPTER 3 – PRESENTATION

3.1 Plans

3.1.1 Plan Format

3.1.1.1 The format of the base mapping for the Aerodrome Plan is at the discretion of the Aerodrome Certificate Holder. Listed below are the acceptable formats:

a. Digital mapping

b. Hard copy mapping compilations

3.1.2 Surveyor Requirements

3.1.2.1 Surveyors must ensure the following:

a. The most recent mapping must be used.

b. Geographical reference system must be shown with grid values along the plan edge at convenient intervals.

c. Data reference source and revision data must be shown on the plan.

3.1.3 Plan Content

3.1.3.1 Each plan must have a title panel. The information shown should consist of the following:

a. Aerodrome name

b. Drawing title

c. Drawing number or reference number including current amendment status.

d. Date of survey

e. Scale

f. Geographical coordinates system used

g. Vertical/elevation reference system used

h. Survey company name and address including telephone number

i. Surveyed by

j. Checked by

k. Plan number

l. Plan lay-out and diagram, if applicable

m. Abbreviations used

n. A reference to the appropriate survey report

3.2 Survey Reports

3.2.1 All coordinates must be traceable to their source of production by an unbroken audit trail, as required by ICAO Annex 15, paragraph 3.2. Therefore the Survey Report will need to contain the following elements to support the audit trail:

3.2.2 Geodetic Connection Report (applicable to Aerodrome Classifications 2, 3, and 4 only), must include the following:

a. Quality Records as per Chapter 4, paragraph 1

b. Details of the connection of the aerodrome control network to the geodetic network

c. Aerodrome control network plan

d. Survey stations descriptions

3.2.3 An Aerodrome Facilities Survey and Aerodrome Obstacle Survey must include Quality Records as per Chapter 4, paragraph 1.

3.2.4 Details and results of Validation Assessment Surveys carried out must include the following:

a. Quality Records as per Chapter 4, paragraph 1 for all facilities or obstacles added to the survey data.

b. Schedules listing all obstacles that have been added or deleted since the last survey (see paragraph 3.2.6)

c. Survey Declaration Form – Appendix C

3.2.5 For traceability purposes the complete documentation should be reissued if required on every occasion that a Validation Assessment Survey amends the preceding survey.

3.2.6 Format of the schedules listing changes must be at the discretion of the surveyor or as agreed with the Aerodrome Certificate Holder. It is recommended that schedules are prepared as digital spreadsheets. To enable

users to track changes each dataset should be accompanied by an 'Additions' and 'Deletions' file. Where an obstacle has been given a new feature number the old number must be referenced against it.

3.3 Digital Data

3.3.1 The following master files of all surveyed obstacles and aerodrome facilities must be created and supplied in Appendix D format:

a. Master Obstacles File, named appropriately (e.g., QEJN_obst00.crc). This will include all features identified as obstacles.

b. Aerodrome Facilities File, named appropriately (e.g., OEJN_ad00.crc). This will include all facilities surveyed for the purposes of the Aerodrome Plan survey area.

3.3.2 The integrity of the survey information supplied in digital format (see Appendix D) must be protected against third party corruption by wrapping with a Cyclic Redundancy Check (CRC). A 32 bit CRC-32Q algorithm value (CRCV format = Hexadecimal) should be utilized. CRC wrapping is mandatory for all survey data Appendix D format files.

CHAPTER 4 QUALITY ASSURANCE

4.1 Quality Records

4.1.1 All data elements must be traceable to their source of production by an unbroken audit trail.

4.1.2 The surveying company, following guidance given in the WGS-84 Manual, must provide information on the source of production in the form of Quality Records.

4.1.3 Quality Records must include:

a. Surveying organization;
b. Name of surveyor(s);
c. Date and purpose of survey;
d. Method of survey and equipment used;
e. Equipment calibration information and method of checking the survey; and
f. Evidence that the accuracy requirements have been met including details of the error budget analysis.

4.2 Methodology

4.2.1 The surveying company must maintain an effective checking system to ensure that the data collected conforms to the accuracy standard and must present a statement of that conformity within the Survey Report.

CHAPTER 5 AERODROME PLAN SURVEY AREA

5.1 Purpose

5.1.1 The Aerodrome Plan is part of the Aerodrome Manual which Aerodrome Certificate Holders are required to maintain for Certification and Safeguarding purposes. The Aerodrome Plan is a working document that gives an accurate picture of the aerodrome configuration and integral facilities.

5.2 Survey Specification

5.2.1 The survey specification for the aerodrome facilities that will be included on the Aerodrome Plan is covered in ICAO DOC 9674-AN/946 (WGS-84 Manual).

5.2.2 The elevation AMSL, at the start of LDA, start and end of TORA, end of ASDA, end of TODA and RESA must be included in the survey. In addition, elevation at the runway centreline at each end of the runway and at regular intervals (maximum 200m) extending along the runway, stopway, and clearway and at each significant change in slope must also be included.

5.2.3 Features listed at Appendix D - Section B - Aerodrome Facilities File must be shown on the plan.

Explanation: Some features such as the ARP, ends of TORA/TODA/ASDA/RESA/LDA may be computed points and cannot be surveyed; therefore it is incorrect to specify that all features in Appendix D must be surveyed. These features must be clearly indicated as calculated and not surveyed.

5.3 Plan Content

5.3.1 The scale should be such that the plan fits onto a single standard ISO sheet (A0 or A1). 1:2500 scale is preferred whenever possible but 1:5000 is acceptable. The accepted format of the plan is covered in Chapter 3 paragraph 3.1.1.

5.3.2 The area of the plan must show the limits of the aerodrome boundary and the locations of installations that are considered integral to the operational procedures of the aerodrome. Insets may be required to show off-site facilities.

5.3.3 All aerodrome characteristics must be shown true to scale with the facilities labeled in such a way as to facilitate easy cross-reference to the positional information contained within the schedules.

5.3.4 WGS-84 and UTM coordinates with ellipsoidal heights and orthometric elevations (AMSL) and height AGL (where applicable) must be shown on the plan for the features listed in Appendix D – Aerodromes Digital Data Specification (Section B - Aerodrome Facilities File).

5.3.5 The coordinates and associated data should be in a schedule format within the plan.

5.3.6 The runway threshold should be clearly indicated on the plan. The survey point for the runway threshold must be the geometric centre of the runway at the beginning of the paved surface. For a displaced runway threshold, this must be 6 metres from the threshold markings (see Figure 5-1).

5.3.7 Additional information may be required; this must be at the request of the Aerodrome Certificate Holder and may include the following:

a. Fire service accommodation;
b. Emergency access/egress gates and routes;
c. Emergency water supply tanks;
d. Facility safeguarding (fences);
e. Human Observed RVR Conversion Table.

5.4 Digital Data

5.4.1 Surveyed features must form part of the Aerodrome Facilities File depicted in Appendix D – Section B. The Aerodrome Facilities File represents a base line of aerodrome features. Additional features that the aerodrome requires to be surveyed can be added. If the feature is not listed or identified in accordance with the file then it will be considered an obstacle and added to the Master Obstacle File.

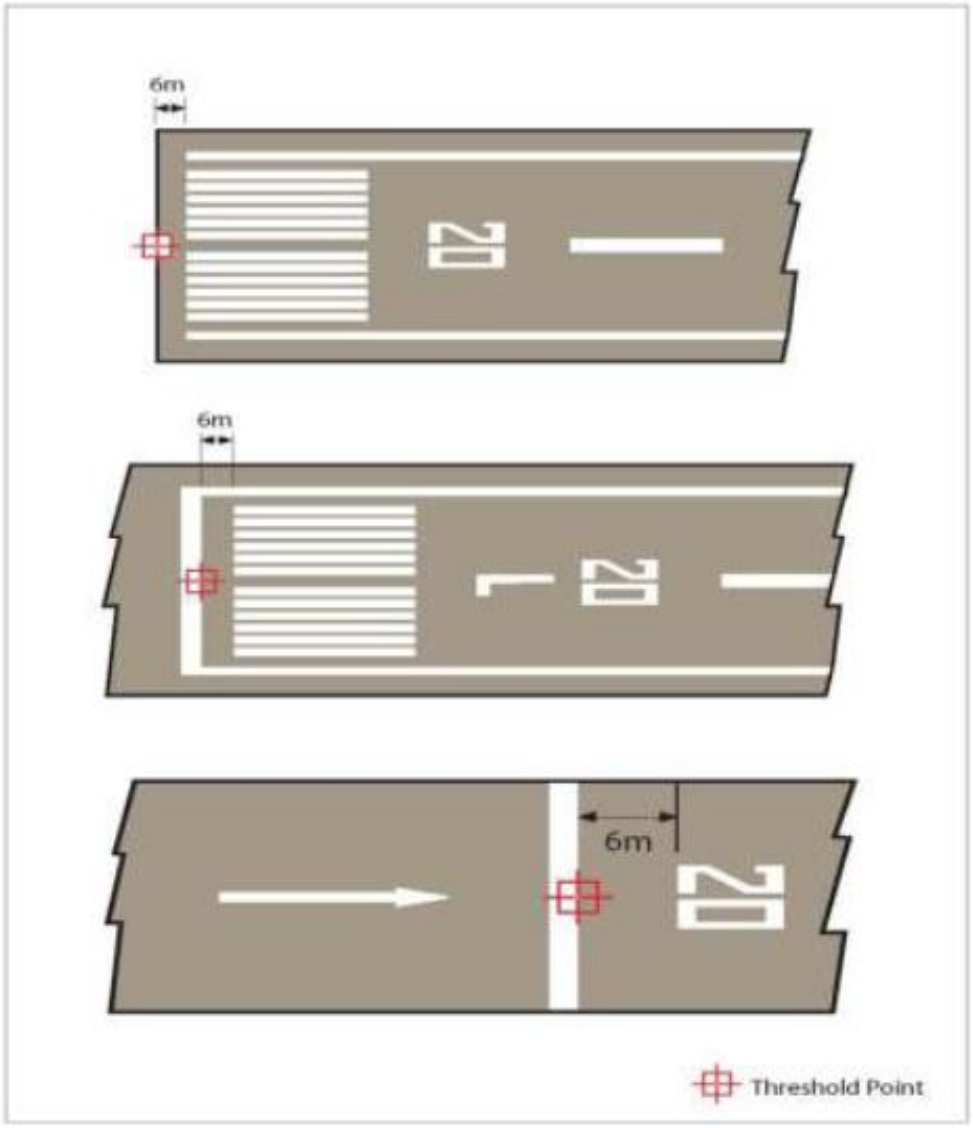

Figure 5.1 Survey Point for Runway Threshold

CHAPTER 6 GACAR SECTION 14/ANNEX 14 OBSTACLE LIMITATION SURFACES (OLS) SURVEY AREA

6.1 Purpose

6.1.1 The purpose of the OLS survey is to identify all obstacles that infringe the prescribed GACAR Section 14/Annex 14 Obstacle Limitation Surfaces appropriate to the existing or proposed runway coding.

6.1.2 Whilst ICAO Annex 15 (eTOD) Area 2 covers a similar geographical area, the accuracy requirements may not be deemed sufficient for the purposes of the GACAR Section14/Annex 14: Obstacle Limitation Surfaces.

6.1.3 The survey data enables the Aerodrome Certificate Holder to make safety evaluations and assists the GCAA to make assessments for the grant, retention or modification of an Aerodrome Certificate.

6.1.4 It is the responsibility of the Aerodrome Certificate Holder to promulgate selected significant obstacles within the Obstacle Limitation Surfaces as described in GACAR Section14/Annex 14: approach, take-off climb and circling areas in the Aeronautical Information Publication (AIP).

6.1.5 To aid this selection the Aerodrome Certificate Holders must ensure that the surveyor identifies all significant obstacles that infringe the surfaces, including extent of infringement. For guidance, identify and report the following:

a. First obstacles in the Take-Off Climb Surfaces
b. Lines of pylons close to the aerodrome surfaces
c. High ground that may affect the circuit height
d. Obstacles (chimney, mast, etc.) within the circling area that are significantly higher than the aerodrome elevation
e. Lit aerodrome features or large single objects that may not necessarily be infringements

6.2 Survey Specification

6.2.1 Physical Characteristics:

a. Runway Strip

b. Clearway (when applicable)

c. Stopway (when applicable)

d. Runway End Safety Area (RESA)

6.2.2 The Obstacle Limitation Surfaces are listed below:

a. Inner Transitional Surface

b. Transitional Surface

c. Inner Approach Surface

d. Approach Surface

e. Inner Horizontal Surface

f. Conical Surface

g. Outer Horizontal Surface

h. Baulked Landing Surface

i. Take-Off Climb Surface

6.2.3 The dimensions and slopes of the various surfaces are defined and illustrated in Annex 14 along with the Runway Classification requirements for each surface.

6.2.4 The Aerodrome Certificate Holder before the start of work will give the origin of each surface, relative to a particular runway, to the surveyor.

6.2.5 The survey requirement is to height all obstacles within the Obstacle Limitation Surfaces area that infringe the limitation surfaces.

6.2.6 Height above ground level (AGL) should also be measured where possible or derived by comparison with terrain data.

6.2.7 Special care must be exercised in the near environs of the approach and take-off climb area to ensure complete obstacle coverage.

6.2.8 Aerodrome Certificate Holders are reminded of their accountability for assessing the obstacle data as stated in Chapter 1.

6.3 Digital Data

6.3.1 All surveyed obstacles must form part of the Master Obstacles File depicted in Appendix D.

CHAPTER 7 ELECTRONIC TERRAIN & OBSTACLE DATA (eTOD)

7.1 Purpose

7.1.1 Electronic terrain and obstacle data is intended to be used in the following air navigation applications:

a. ground proximity warning system with forward looking terrain avoidance function and minimum safe altitude warning (MSAW) system;

b. determination of contingency procedures for use in the event of an emergency during a missed approach or take-off;

c. aircraft operating limitations analysis;

d. instrument procedure design;

e. determination of en-route "drift-down" procedure and en-route emergency landing location;

f. advanced surface movement guidance and control system (A-SMGCS); and

g. aeronautical chart production and on-board databases.

7.2 Coverage Areas

7.2.1 ICAO defines 4 coverage areas for e-TOD:

a. **Area 1:** the entire territory of a State.

b. **Area 2:** (Fig 7-1 and 7-2) terminal control area; within the vicinity of an aerodrome, sub-divided as follows:

- **Area 2a:** (Fig 7-3) This area represents a rectangular area around a runway that comprises the runway strip plus any clearway that exists.
- **Area 2b:** (Fig 7-4) This area represents an area extending from the ends of Area 2a in the direction of departure, with a length of 10km and a splay of 15% to each side and a slope of 1.2%.
- **Area 2c:** (Fig 7-5) This area represents an area extending outside Area 2a and Area 2b at a distance of not more than 10km from the boundary of Area 2a with a slope of 1.2%.

- **Area 2d:** This area represents an area outside the Areas 2a, 2b and 2c up to a distance of 45km from the aerodrome reference point or to an existing TMA boundary, whichever is nearest.

c. **Area 3:** (Fig 7-7) This area represents an aerodrome/heliport area and the area bordering an aerodrome movement area that extends horizontally from the edge of a runway to 90m from the runway centre line and 50m from the edge of all other parts of the aerodrome movement area.

d. **Area 4:** (Fig 7-8) This includes Category II or III operations approach areas. The area extending 900m prior to the runway threshold and 60m each side of the extended runway centre line in the direction of the approach on a precision approach runway, Category II or III.

7.3 Terrain Data Numerical Requirements

	Area 1	Area 2	Area 3	Area 4
Post Spacing	3 arc seconds	1 arc second	0.6 arc seconds	0.3 arc seconds
	(approx. 90m)	(approx. 30m)	(approx. 20m)	(approx. 9m)
Vertical Accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal Accuracy	50 m	5 m	0.5 m	2.5 m
Confidence Level	90%	90%	90%	90%
Data Classification	essential	essential	essential	essential
Integrity Level	1×10^{-3}	1×10^{-5}	1×10^{-5}	1×10^{-5}
Maintenance Period	as required	as required	as required	as required

7.4 Obstacle Data Numerical Requirements

	Area 1	Area 2	Area 3	Area 4
Vertical Accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal Accuracy	50 m	5 m	0.5 m	2.5 m
Confidence Level	90%	90%	90%	90%
Data Classification	essential	essential	essential	essential
Integrity Level	1×10^{-3}	1×10^{-5}	1×10^{-5}	1×10^{-5}
Maintenance Period	as required	as required	as required	as required

7.5 eTOD Survey Classifications

7.5.1 Refer to Chapter 1 – Table 1-1.

7.6 Survey Frequency

7.6.1 Refer to Chapter 1 - Table 1-3

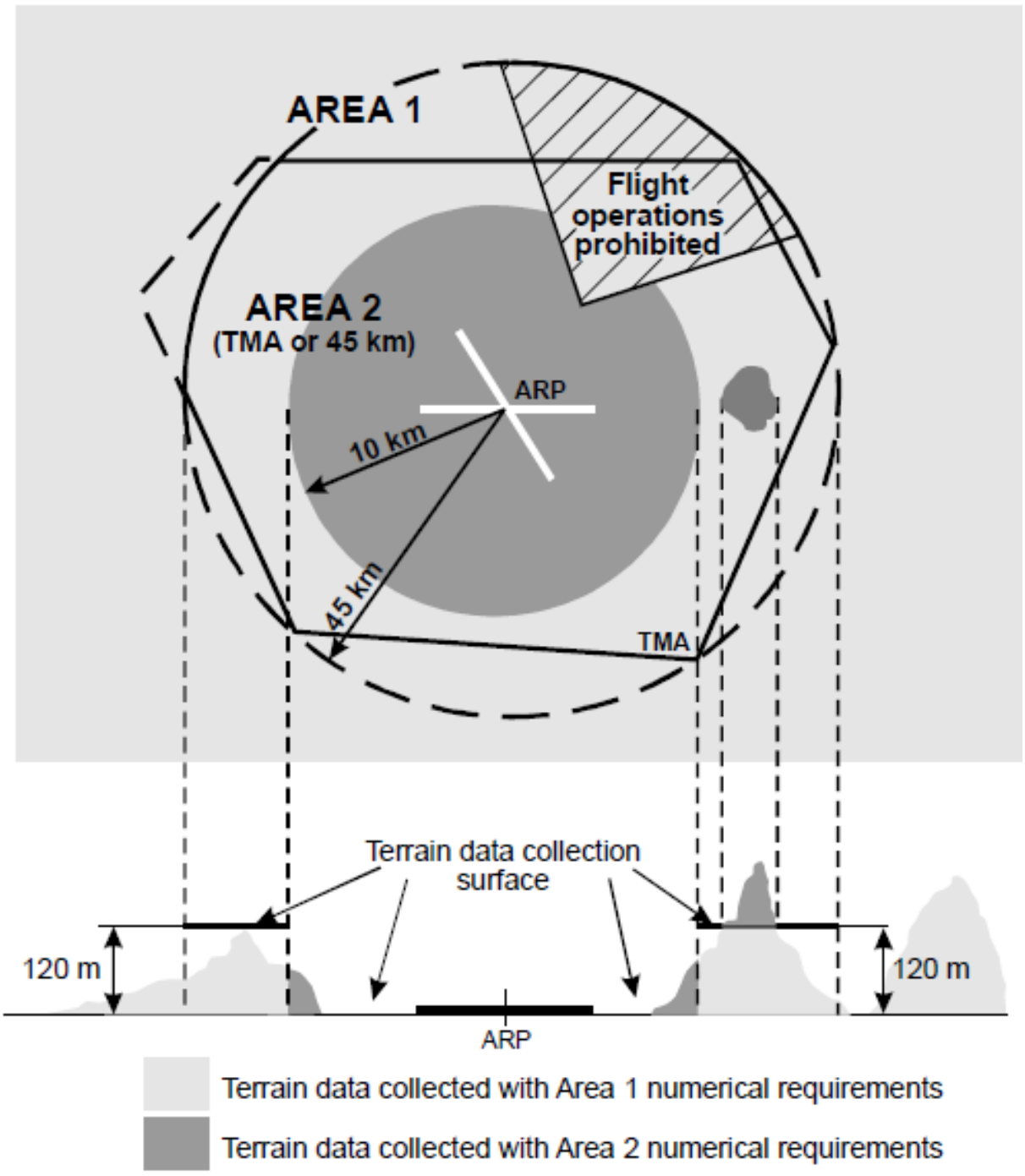

Figure 7-1: Terrain Data Collection Surfaces Area 1 and Area 2

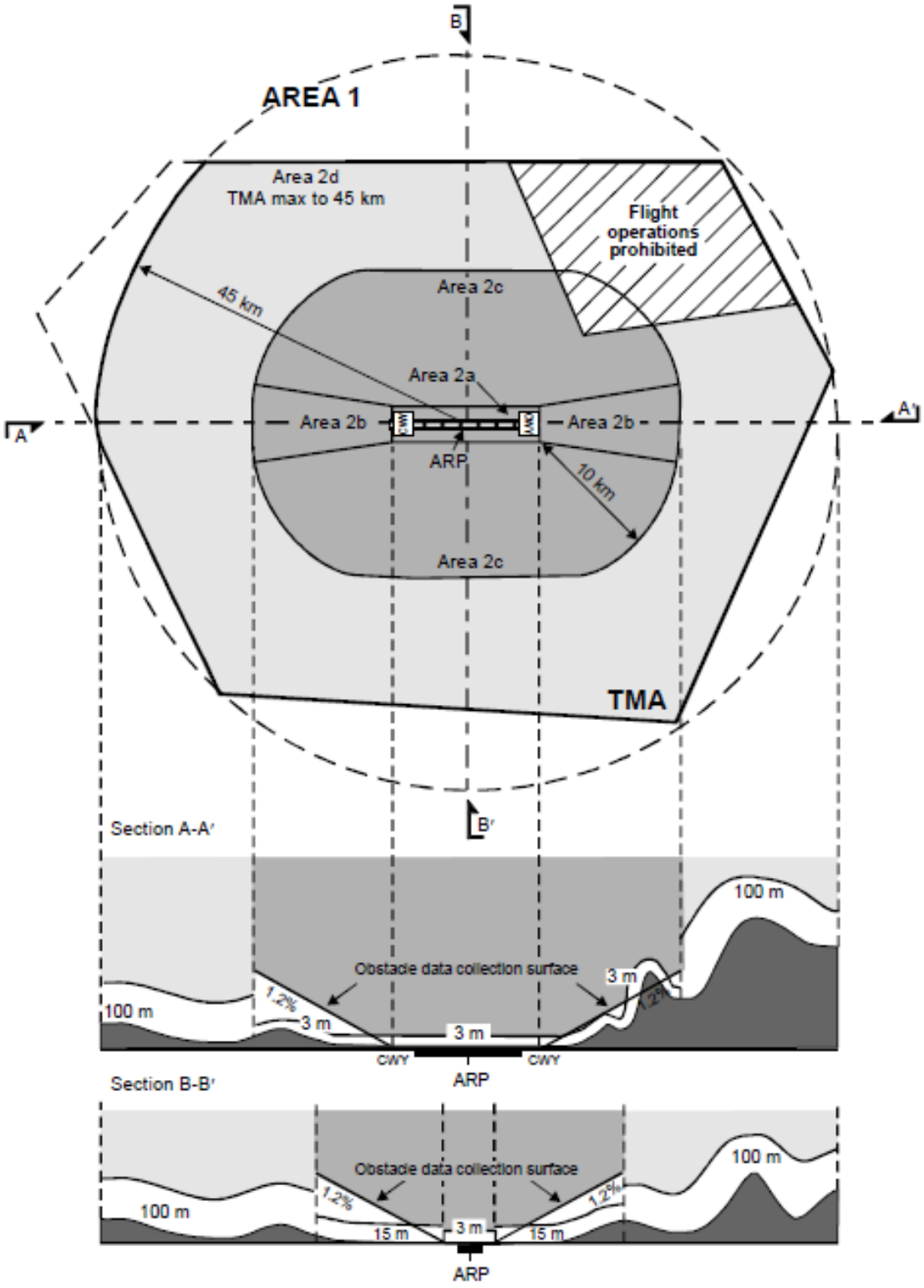

Figure 7-2: Obstacle Data Collection Surfaces Area 1 and Area 2

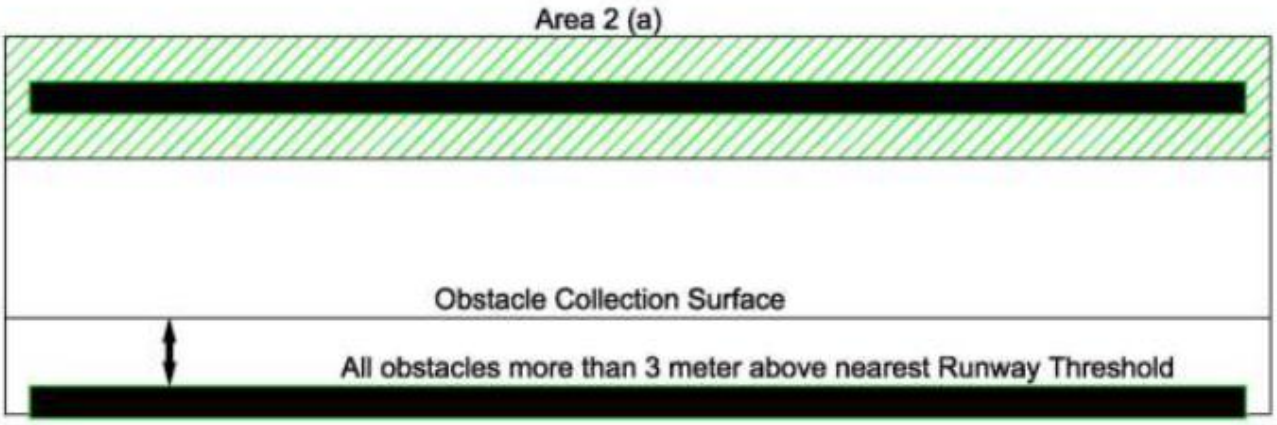

Figure 7-3: Area 2A

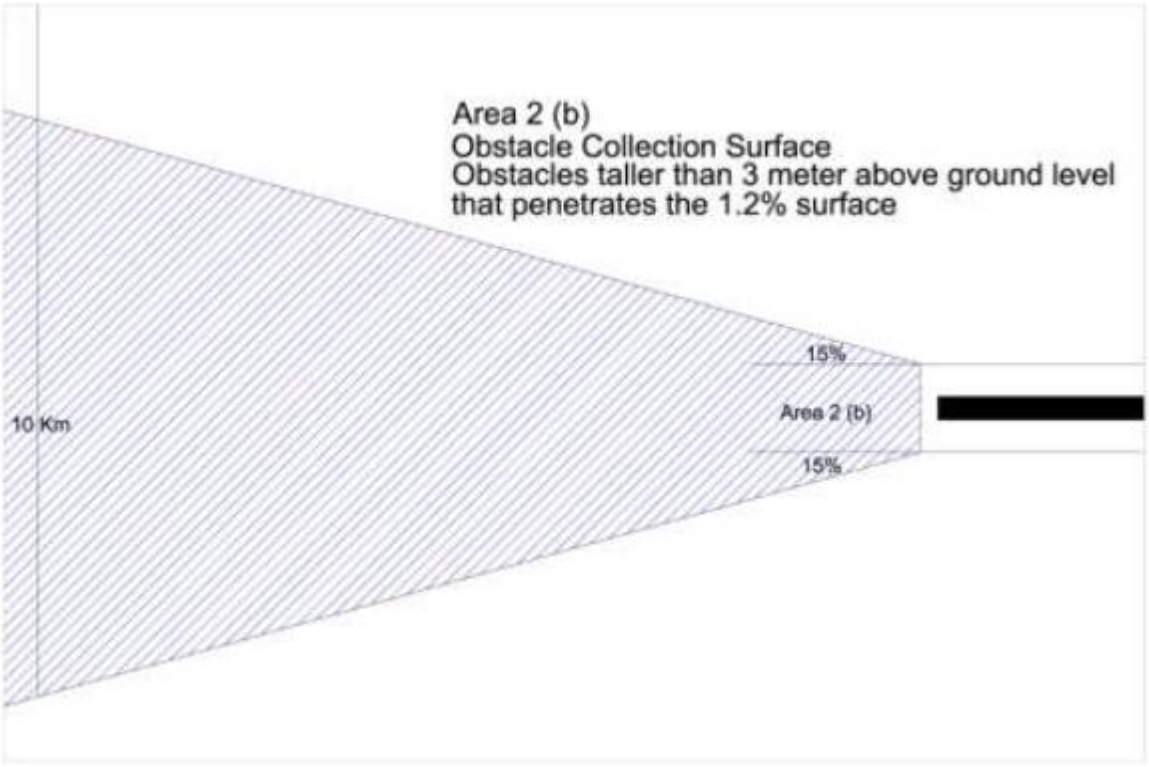

Figure 7-4: Area 2b

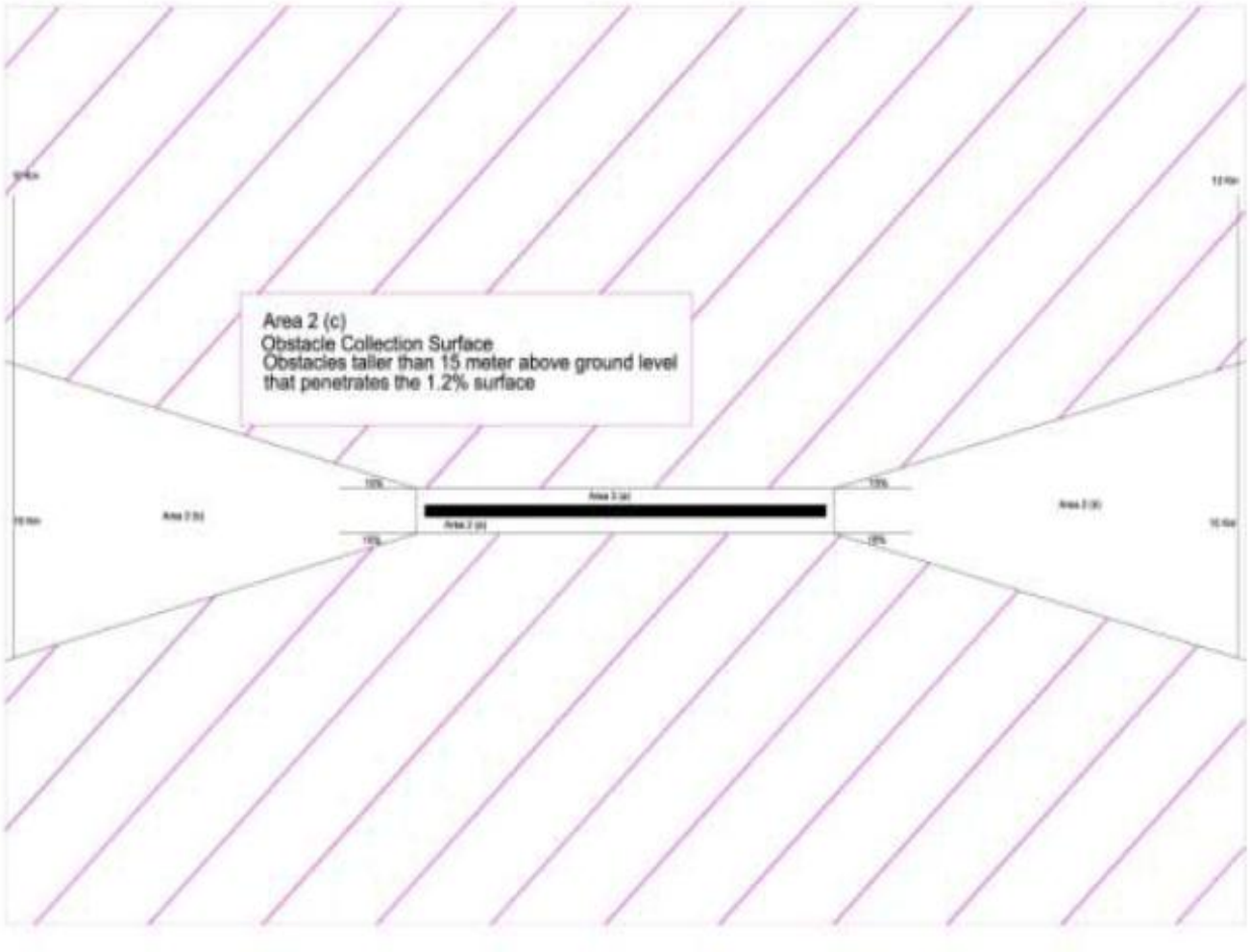

Figure 7-5: Area 2c

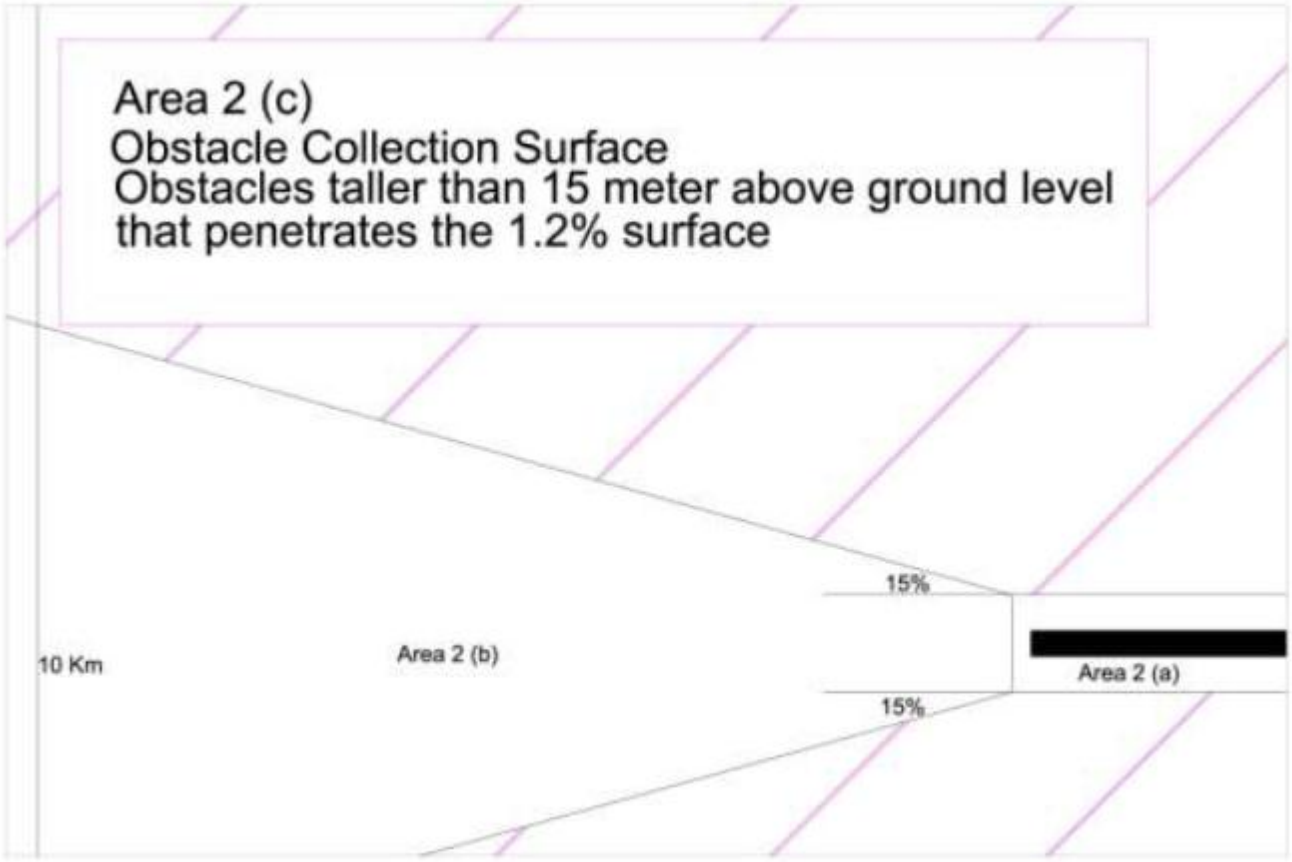

Figure 7-6: Area 2a, 2b and 2c

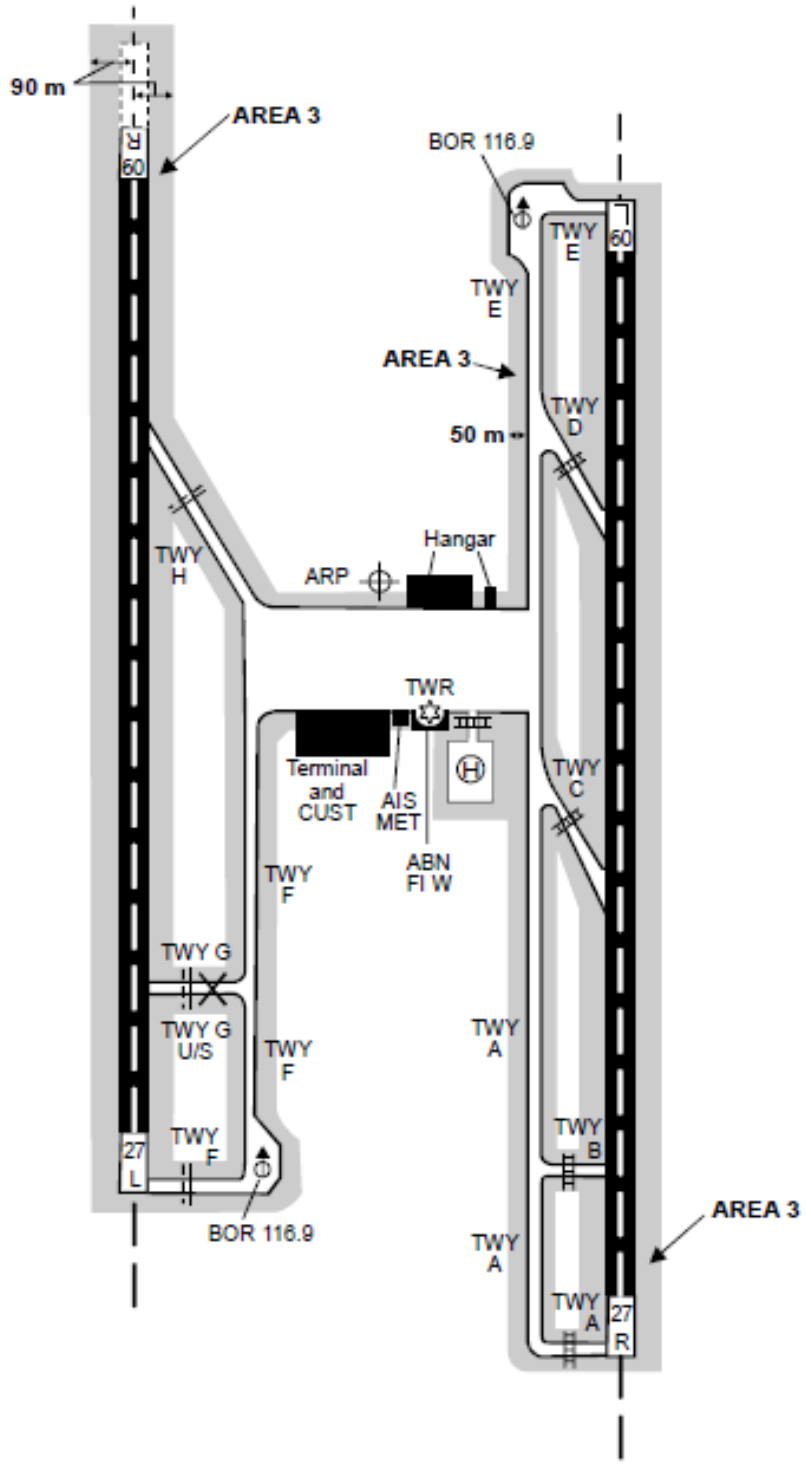

Figure 7-7: Terrain and Obstacle Data Collection Surfaces Area 3

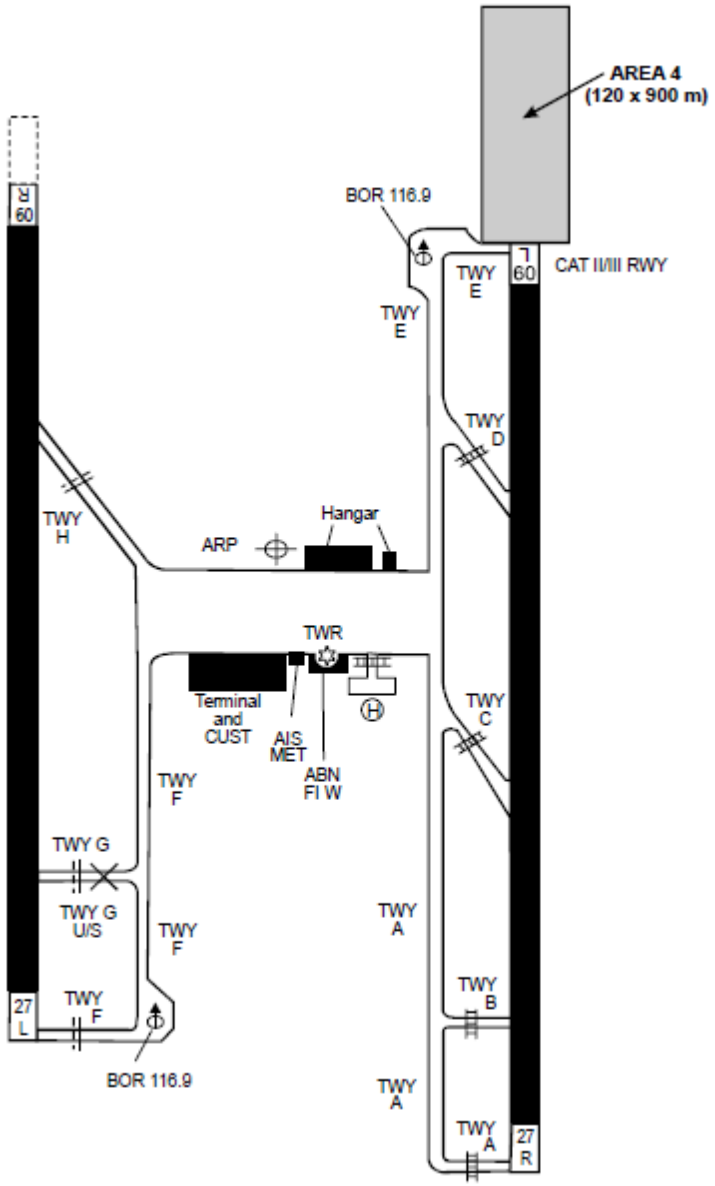

Figure 7-8: Terrain and Obstacle Data Collection Surfaces Area 4

CHAPTER 8 AERODROME OBSTACLE CHART - ICAO TYPE A SURVEY

8.1 Purpose

8.1.1 The Aerodrome Obstacle Chart - ICAO Type A (Operating Limitations) provides data necessary to enable the aircraft operator to comply with the operating limitations of ICAO Annex 6 - Operation of Aircraft.

8.1.2 Aerodrome Obstacle Charts - ICAO Type A (Operating Limitations) must be made available (as prescribed in ICAO Annex 4: Aeronautical Charts) for all runways used by Class A aeroplanes and for aerodromes used by international civil aviation. Runways that do not have obstacles in the take-off flight path (TOFP) areas must be recorded as not requiring an "ICAO Type A" chart.

8.1.3 Whilst ICAO Annex 15 (eTOD) Area 2b covers a similar geographical area and obstacle selection surface (1.2%), the accuracy requirements may not be deemed sufficient for the purposes of the "ICAO Type A" chart.

8.2 Survey Specification

8.2.1 Aerodrome Area

8.2.1.1 The elevation AMSL at the start and end of TORA, end of ASDA, and end of TODA - and at regular intervals (maximum 200 metres) along the runway and clearway centreline - must be provided.

8.2.1.2 The type of clearway and declared distances for TORA, TODA, ASDA and LDA must be stated in the Survey Report. If these have not already been agreed with GACA S&ER they must be submitted for acceptance before the Survey is started.

8.2.2 Take-Off Flight Path (TOFP) Area

8.2.2.1 The area to be surveyed originates at the end of the TODA. It is 180m wide at origin, symmetrical about the extended centreline and increases uniformly at a rate of 0.25D to a maximum width of 1800m, where D is the

distance from origin. At a distance of 6480m it extends at the maximum width to a distance of 10000m. The elevation of the origin is the elevation declared for the end of TODA (see Figure 8-1).

8.2.2.2 The flight path plane surface has an upward slope of 1.2% from the origin (see Figure 8-1).

8.2.2.3 All objects and terrain within the TOFP area must be comprehensively analyzed. All obstacles that penetrate the TOFP surface must be surveyed except where such obstacles are in the shadow of others. The shadow of an obstacle is considered to be a plane surface originating at a horizontal line passing through the top of the obstacle at right angles to the centreline of the TOFP, and extended to cover the complete width of the area. Frangible and mobile obstacles must not shadow other obstacles. If the obstacle creating a shadow is likely to be removed, objects that would become dominant by its removal must be surveyed. If the surveyor is unclear as to which obstacles are dominant then all obstacles penetrating the surface must be surveyed.

8.2.2.4 For runways serving aircraft having operational limitations that do not preclude the use of a gradient less than 1.2%, the TOFP area is increased to 12000m and the slope of the plane surface is reduced to 1% or less. Where the plane of the 1% slope does not touch any objects, it is to be reduced until it touches the first object.

8.2.2.5 The elevation AMSL of any road, track or water feature capable of supporting mobile obstacles greater than 4.8m AGL (for waterways the high and low water marks and the height of shipping) must be surveyed at a regular interval to its full linear extent, until shadowed by the next dominant obstacle if the combined elevation penetrates the TOFP surface. The combined elevation must be provided.

8.2.2.6 Where the TOFP is at an offset angle from the runway extended centreline in order to gain an operational advantage, the area to be surveyed must be determined by consultation between the Aerodrome Certificate Holder and aircraft operators concerned, and agreed with GACA S&ER and annotated in the survey report.

8.3 Digital Data

8.3.1 All surveyed obstacles must form part of the Master Listing depicted in Appendix D. Positional data and associated elevations that determine the extent of the declared distances and runway profile must be included in the Aerodrome Facilities File depicted in Appendix D.

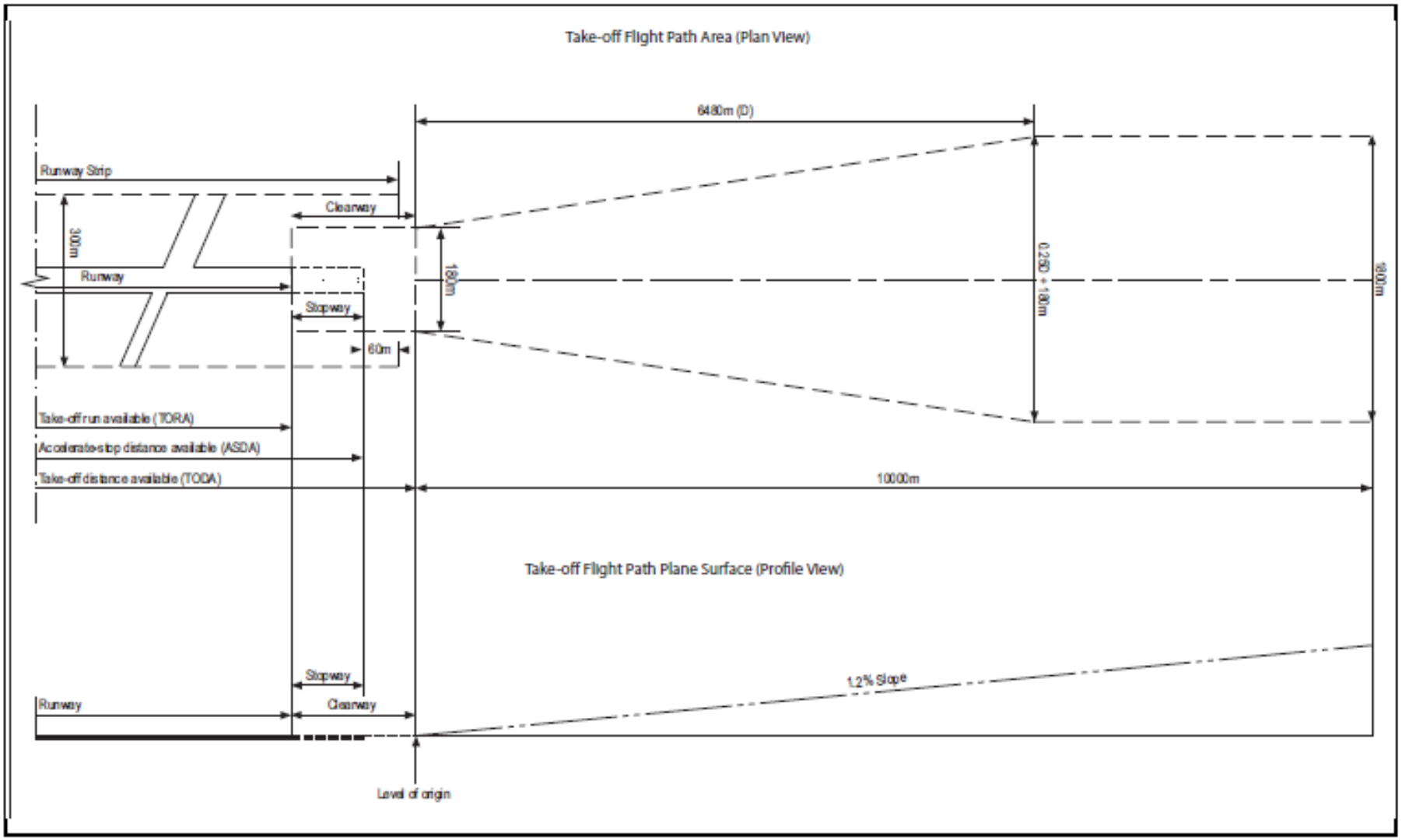

Fig 8-1: Aerodrome Obstacle Chart – ICAO Type A (operating limitations) – Take-off Flight Path Area and Plane Surface

CHAPTER 9 PRECISION APPROACH TERRAIN CHART SURVEY AREA

9.1 Purpose

9.1.1 The Precision Approach Terrain Chart (PATC) provides a detailed terrain profile of the final portion of a Precision Approach. It provides information to enable the evaluation of the effects of the terrain on decision height determination using radio altimeters.

9.1.2 It is a mandatory requirement for aerodromes that conduct Categories II and III precision approaches except where the requisite information is provided in the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) (GACAR Section 4/ICAO Annex 4).

9.2 Survey Specification

9.2.1 The area for survey starts at the runway threshold and extends for a distance of 900m into the approach, 60m either side of the extended runway centre line (see Figure 9-1). A longitudinal extension of this area might be required if the terrain undulates significantly. Any such requirement will be identified by GACAS&ER during the initial approval process for Category II and/or III operations.

9.2.2 Features to be surveyed:

a. Runway threshold and elevation;
b. Extended runway centre line terrain profile;
c. All features including mobile features that are 3m, or greater, above or below the extended runway centre line terrain level and with a horizontal dimension of more than 15m measured parallel to the runway centre line;
d. Terrain contours at 1m contour intervals related to the runway threshold height; and
e. Roads, tracks, river or water features must have sufficient levels to show their surface elevation, (in the case of a body of water subject to tides, high and low tidal variations are required) and the height of the highest mobile feature that could be expected on them.

9.2.3 The features must include vegetation, hard, mobile and temporary objects

9.2.4 This Chart can be produced from data captured for eTOD Area 4.

9.3 Survey Chart Presentation

9.3.1 The base map must be at a scale of 1:2500 or where the area has been extended it must be at 1:5000. The accepted format is listed in Chapter 3, paragraph 1.

9.3.2 The chart will show the survey area in plan view at either of the above scales and in cross section profile at a recommended scale of 1:500. If the area is flat, a larger profile scale may be used.

9.3.3 The chart must reflect the position, height and shape of all features that fall in the category as described in this chapter.

9.3.4 Terrain data should be made available in a digital format as per ICAO Annex 15, Chapter 10 – Area 4.

9.4 Published Chart

9.4.1 The survey information must be passed to the Aerodrome Certificate Holder for approval and publication.

9.5 Chart Maintenance

9.5.1 It is the responsibility of the Aerodrome Certificate Holder to monitor any changes in the approach terrain profile. If significant changes occur the Aerodrome Certificate Holder must promulgate by NOTAM.

9.5.2 All changes in the profile must be recorded:

a. Changes in slope of 12.5% or more over a distance of 15m or more

b. Changes in the contour height of 3m or more (increase or decrease) and over 15m to the defined approach area

c. All features as stated in paragraph 2.2

Note: *It is important that both increases and decreases in elevation are significant.*

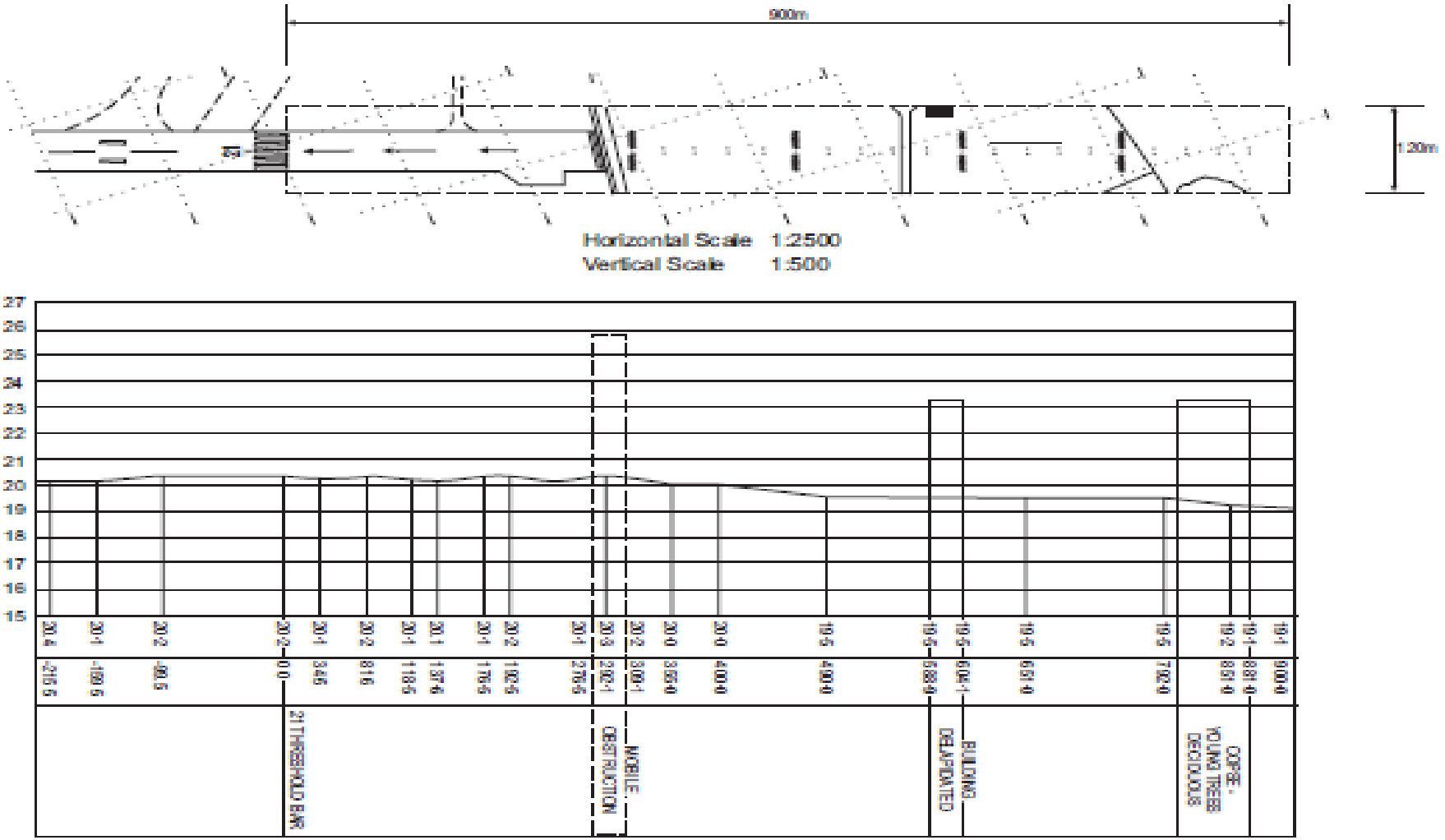

Fig 9-1: Precision Approach Terrain Chart

Appendix A Abbreviations

AGL	(Height) Above Ground Level
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
APV	Approach Procedure with Vertical Guidance
ARP	Aerodrome Reference Point
ASDA	Accelerate-Stop Distance Available
A-SMGCS	Advanced Surface Movement Guidance and Control System
CAAP	Civil Aviation Advisory Publication
CAR	Civil Aviation Regulation
CRC	Cyclic Redundancy Check
DCA	Department of Civil Aviation
eTOD / ETOD	Electronic Terrain and Obstacle Data
FATO	Final Approach and Take-Off area (helicopters)
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
LDA	Landing Distance Available
MSL	Mean Sea Level
MSAW	Minimum Safe Altitude Warning
NOTAM	Notice to Airmen
OLS	Obstacle Limitation Surfaces
PATC	Precision Approach Terrain Chart
RESA	Runway End Safety Area
SARPs	ICAO Standards and Recommended Practices
TLOF	Touchdown and Lift Off area (helicopters)
TMA	Traffic Management Area
TODA	Take-off Distance Available
TOFP	Take-Off Flight Path
TORA	Take off Run Available

Appendix B Definitions

Above Mean Sea Level. Orthometric Height or Elevation

Accelerate-Stop Distance Available. The length of the take-off run available plus the length of the stopway, if provided.

Aerodrome Elevation. The elevation of the highest point of the landing area.

Approach Procedure with Vertical Guidance. An instrument procedure which utilizes lateral and vertical guidance, but does not meet the requirements established for precision approach and landing operations.

Aerodrome Reference Point. The designated geographical location of an aerodrome.

Cyclic Redundancy Check. A mathematical algorithm applied to the digital expression of data that provides a level of assurance against loss or alteration of data.

EGM96. Earth Gravitational Model 1996.

Ellipsoid Height. The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

Geoid. The equipotential surface in the gravity field of the Earth which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.

Landing Area. That part of a movement area intended for the landing or take-off of aircraft.

Landing Distance Available. The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight or stand outside those defined surfaces and that have been assesses as being a hazard to air navigation.

Orthometric Height. Height of a point related to the geoid, generally presented as a MSL elevation. (Declaration of the orthometric height datum (MSL) is the responsibility of each Emirate).

Reference Ellipsoid. A geometric figure, usually determined by rotating an ellipse about its shorter (polar) axis, used as a surface of reference for geodetic surveys. The reference ellipsoid closely approximates to the dimensions of the geoid, with certain ellipsoids fitting the geoid more closely for various areas of the earth.

Survey Date. The date that fieldwork was carried out to obtain data for the survey. Where fieldwork was completed over more than one day the end date of fieldwork must be used.

Take-off Distance Available. The length of the take-off run available plus the length of the clear way if provided.

Take off Run Available. The length of the take-off run available.

Threshold. The beginning of that portion of the runway usable for landing.
Note: The survey point for the runway threshold must be the geometric centre of the runway at the beginning of the paved surface. For a displaced runway threshold this must be the beginning of the upwind (runway) side of the threshold bar. (Refer to Fig 5.1)

Appendix C Survey Declaration Form

SURVEY DECLARATION FORM

Aerodrome			
Surveying Company			
Aerodrome Survey Classification		**Initial/Last Full Survey Date**	
Geodetic Connection Date ***(if applicable)***		**Annual Validation Assessment Date** ***(if Applicable)***	
SURVEY AREA REQUIRED ***(tick boxes as appropriate)***		**No Change to Previous Survey**	**Change to Previous Survey**
Aerodrome Plan	☐	☐	☐
GACAR Section 14/ Annex 14 OLS	☐	☐	☐
Aerodrome Obstacle Chart – ICAO Type A	☐	☐	☐
Precision Approach Terrain Chart - ICAO	☐	☐	☐
Electronic Terrain and Obstacle Data (e-TOD)	☐	☐	☐

Declaration by Aerodrome Certificate Holder's Representative:
I certify that the information supplied meets the Aerodrome's Operational requirements in accordance with GACA Regulations. I also certify that the information supplied is complete and conforms to GACA S&ER Aerodrome Survey Requirements.

Name			
Position			
Signature		**Date**	

Appendix D Aerodrome Digital Data Specification

NOTES:

- The fields in the matrix describe the data format layout and should be used as a guideline to report data.
- Fields not applicable should be left blank.
- Master files of all surveyed facilities and obstacles must be created and supplied.
- Files of survey information must be in the form of a comma delimited ASCII text file containing all fields plus CRCV field as listed below.
- Aerodrome Facilities File must be named appropriately (e.g. OEJN_AD00.crc)
- Decimal places must not be rounded.
- Only decimal places, underscores and forward slashes must be used within fields (no hyphens, word spaces, commas or backslashes, etc.).
- All text must be upper case.
- All fields must be populated with the exception of the Aerodrome Facilities File Field 3, Field 4 and Field 10, which must be blank if there is no identification, association or description.
- Duplicate data in a record is not acceptable.

MASTER OBSTACLE FILE			*(e.g., OEJN_obst00.crc)*
Field 1	Site Name	XXXX	ICAO Aerodrome Location Indicator
Field 2	Type of Feature	For allowable values refer to Section B	
Field 3	Identification	CRASH BARRIER 3	A full textual description of the type of obstacle to supplement Field 2
Field 4	Association	For allowable values refer to Section B	
Field 5	Latitude	DDMMSS.ssssN/S	WGS-84 Latitude in DEG,MIN, SEC, 1/10000's SEC
Field 6	Longitude	DDMMSS.ssssE/W	WGS-84 Latitude in DEG,MIN, SEC, 1/10000's SEC
Field 7	Ellipsoidal Height (m)	000.00	Elevation in meters above WGS-84 ellipsoid to 2 decimal places
Field 8	Ellipsoidal Height (ft)	000.00	Elevation in feet above WGS-84 ellipsoid to 2 decimal places
Field 9	Lit or Unlit	Y/N	Y To be entered if the feature is lit N To be entered if the feature is unlit
Field 10	Mobile	Y/N	Y To be entered if the feature is mobile N To be entered if the feature is not mobile
Field 11	Frangible	Y/N	Y To be entered if the feature is frangible N To be entered if the feature is not frangible
Field 12	Easting	000000.00	Six figure easting grid reference to 2 decimal places for the UTM Grid declared in the Report
Field 13	Northing	000000.00	Six figure northing grid reference to 2 decimal places for the UTM Grid declared in the Report
Field 14	Orthometric Height (m)	0000.00	Elevation in meters AMSL to 2 decimal places
Field 15	Orthometric Height (ft)	0000.00	Elevation in feet AMSL to 2 decimal places
Field 16	Height Above Ground Level (m)	0000.00	Height above ground level in meters to 2 decimal places
Field 17	Height Above Ground Level (ft)	0000.00	Height above ground level in feet to 2 decimal places
Field 18	Aerodrome Control Network Horizontal	00.000	Horizontal accuracy in meters relative to the datum to 3 decimal places
Field 19	Aerodrome Control Network Vertical Accuracy (m)	00.000	Vertical accuracy in meters relative to the datum to 3 decimal places
Field 20	Horizontal Extent (m)	000.00	Horizontal extent (radius) of the surveyed entity in meters to 2 decimal places. (Obstacles only)
Field 21	Horizontal Accuracy (m)	00.000	Horizontal Accuracy in meters relative to the aerodrome control network to 3 decimal places at a 95% confidence level
Field 22	Vertical Accuracy (m)	00.000	Vertical Accuracy in meters relative to the aerodrome control network to 3 decimal places at a 95% confidence level
Field 23	Record Identifier	0000	Unique integer number
Field 24	Survey Date	dd/mm/yy	Date of field survey of record
Field 25	CRCV		32 bit CRC-32Q algorithm value (CRCV format = Hexadecimal)

AERODROME FACILITIES FILE			*(e.g., OEJN_AD00.crc)*
Field 1	Site Name	XXXX	ICAO Aerodrome Location Indicator
Field 2	Type of Feature	For allowable values refer to Section B	
Field 3	Identification	For allowable values refer to Section B	
Field 4	Association	For allowable values refer to Section B	
Field 5	Latitude	DDMMSS.ssssN/S	WGS-84 Latitude in DEG,MIN, SEC, 1/10000's SEC
Field 6	Longitude	DDMMSS.ssssE/W	WGS-84 Latitude in DEG,MIN, SEC, 1/10000's SEC
Field 7	Ellipsoidal Height (m)	000.00	Elevation in meters above WGS-84 ellipsoid to 2 decimal places
Field 8	Ellipsoidal Height (ft)	000.00	Elevation in feet above WGS-84 ellipsoid to 2 decimal places
Field 9	Lit or Unlit	Y/N	Y To be entered if the feature is lit N To be entered if the feature is unlit
Field 10	Lighting Description	FLASHING WHITE	A textual description of the lighting used
Field 11	Frangible	Y/N	Y To be entered if the feature is frangible N To be entered if the feature is not frangible
Field 12	Easting	000000.00	Six figure easting grid reference to 2 decimal places for the UTM Grid declared in the Report
Field 13	Northing	000000.00	Six figure northing grid reference to 2 decimal places for the UTM Grid declared in the Report
Field 14	Orthometric Height (m)	0000.00	Elevation in meters AMSL to 2 decimal places
Field 15	Orthometric Height (ft)	0000.00	Elevation in feet AMSL to 2 decimal places
Field 16	Height Above Ground Level (m)	0000.00	Height above ground level in meters to 2 decimal places
Field 17	Height Above Ground Level (ft)	0000.00	Height above ground level in feet to 2 decimal places
Field 18	Aerodrome Control Network Horizontal	00.000	Horizontal accuracy in meters relative to the datum to 3 decimal places
Field 19	Accuracy (m)	00.000	Vertical accuracy in meters relative to the datum to 3 decimal places
Field 20	Horizontal Extent (m)	000.00	Horizontal extent (radius) of the surveyed entity in meters to 2 decimal places. (Obstacles only)
Field 21	Horizontal Accuracy (m)	00.000	Horizontal Accuracy in meters relative to the aerodrome control network to 3 decimal places at a 95% confidence level
Field 22	Vertical Accuracy (m)	00.000	Vertical Accuracy in meters relative to the aerodrome control network to 3 decimal places at a 95% confidence level
Field 23	Record Identifier	0000	Unique integer number
Field 24	Survey Date	dd/mm/yy	Date of field survey of record
Field 25	CRCV		32 bit CRC-32Q algorithm value (CRCV format = Hexadecimal)

AERODROME FACILITIES FILE

Field 2	Field 3			Field 4		
Type of Feature	**Identification**	**Example**	**Rule**	**Association**	**Example**	**Rule**
ARP						
AEP						
ABN						
ANEMOMETER						
ASDA_END				(RWY DIR)	05	1
ATC						
CADF						
CENTRE_PT_TWY	IDENT	ABC	3	(TAXIWAY)	W	5
CENTRE_PT_RWY	IDENT	ABC	3	(RWY) Alphanumeric	05/23	2
DME	IDENT	ABC	3			
DME ILS	IDENT	ABC	3	(LLZ IDENT)	IABC	3
DME MLS	IDENT	ABC	3	(MLS AZM IDENT)	ABC	3
DRDF						
FATO				(FATO DIR)	05	1
GP	IDENT	IABC	3	(RWY DIR)	05	1
GP_MON				(RWY DIR)	05	1
HOLD	Alphanumeric	123A	4	(TAXIWAY)	W	5
HOLD_STOP_BAR	Alphanumeric	123A	4	(TAXIWAY)	W	5
IBN						
IRVR						
L	IDENT	ABC	3			
LDA_END				(RWY DIR)	05	1
LLZ	IDENT	IABC	3	(RWY DIR)	05	1
LLZ_MON				(RWY DIR)	05	1
MLS_AZM	IDENT		3	(RWY DIR)	05	1
MLS_ELEV	IDENT		3	(RWY DIR)	05	1
MM	IDENT		7			
NDB	IDENT		3			
OM	IDENT		7			
PAPI				(RWY DIR)	05	1
RADAR						
RADAR_MSSR						
RADAR_PAR						
RADAR_SSR						
RADAR_WATCHMAN						
ROP						
STAND	Alphanumeric	123A	4	(APRON)	MAIN	6
TACAN	IDENT	ABC	3			
TDZE				(RWY DIR)	05	1
THR				(RWY DIR)	05	1
TLOF	Alphanumeric					
TODA_END				(RWY DIR)	05	1
TORA_END				(RWY DIR)	05	1
TORA_START						
VDF						
VHF_RX						
VHF_TX						
VOR	IDENT	ABC	3			
VOR/DME	IDENT	ABC	3			
WINDSLEEVE						

OBSTACLES FILE		
FIELD 2 – TYPE OF FEATURE **VALUE (Example)**		
AG_EQUIP	FENCE	STACK
ANTENNA	FUEL_SYSTEM	STADIUM
ARCH	GATE	STORM_SYSTEM
BUILDING	HEAT_COOL_SYSTEM	TANK
BRIDGE	MAST	TETHERED_BALLOON
CABLE_CAR	MONUMENT	TOWER
COMPRESSED_AIR_SYSTEM	NATURAL_HIGH_POINT	TRANSMISSION_LINE
CONTROL_MONITORING_SYSTEM	NAVAID	VEGETATION
CONTROL_TOWER	POLE	WALL
COOLING TOWER	POWERPLANT	WASTEWATER_SYSTEM
CRANE	REFINERY	WATER_SYSTEM
DOME	RIG	WIND_FARM
ELECTRICAL_EXIST_LIGHT	SALTWATER_SYSTEM	OTHER
ELECTRICAL_SYSTEM	SIGN	
ELEVATOR	SPIRE	

OBSTACLES FILE	
FIELD 4 - ASSOCIATION	
Values	**Description**
OLS	ICAO Annex 14 Obstacle Limitation Surfaces
OIDS	Obstacle Identification Surface
MANAGED	A “virtual” area containing the Vertical Structures included in the data collection exercise, which do not qualify yet as Obstacles in any specific area
OTHER	Other