



# **CIVIL AVIATION REGULATIONS PART IX**

## **ADR**

### **AERODROMES**



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	<b>Amendments to CAR Part IX</b>
Initial Issue 1 January 2002	Introduction of Civil Aviation Regulation Part IX – Aerodrome Licensing based upon ICAO Annex 14 Volume I Amendment 4
Amendment 1 1 January 2005	Inclusion of SMS aerodrome briefing requirements; ICAO statistical and financial reporting; clarification of contents required in aerodrome emergency plan.
Amendment 2 1 January 2006	Comprehensive reformatting of CAR Part IX; Annex 14 Vol 1 SARPs, inclusive of Amendment 7, incorporated; quality assurance requirements included; requirements for reporting obstacle/terrain data included; reporting to aerodrome control tower included; aerodrome maintenance requirements clarified; requirements for nav aids operation and maintenance included; requirements for Authority approvals included; mandatory requirements for installation and use of stop bars Aerodrome Manual Part 2 – additional plans required; Aerodrome Manual Part 4 – requirements clarified; Aerodrome Manual Part 5 - SMS requirements clarified; RESA distances defined; clearance distances on aircraft stands defined; requirements for lighted closure marking included; Obstacle control standards clarified
Amendment 3 1 January 2008	Editorial changes to Appendix 9, 11 and 13 correcting incorrect references to Appendix Figures.
Amendment 4 1 July 2009	Amendment to Chapter 4, clause 4.7, including reference to new CAR Part X Safety Management System  Creation of Subparts 1 and 2, relocation and amendment of RFFS Rules into subpart 2 and relocation of Appendix 14 into Subpart 2.  Introduction of Appendices 2, 3 and 4 to Subpart 2.  Editorial changes to Subpart 1 as a result of above changes.



Revision Issue 2 December 2010	Complete revision of the full document. Subpart 2, RFFS Rules, removed and now in new CAR Part XI.
Revision Issue 3 February 2014 <i>NPA 16/2013</i>	<p>Incorporate changes previously subject to NPA or Directive: <b>NOTAC 01/2013</b> (NPA 05/2013) Aerodrome Data - Strength Of Pavement - July 2013, <b>NOTAC 02/2013</b> (NPA 06/2013) Aerodrome Management – Safety Programmes, <b>NOTAC 01/2012</b> (NPA 01/2012) – Obstacle Data – Terrain and Obstacle Data Collection, <b>NOTAC 02/2012</b> (NPA 02/2012) – Enhanced Taxiway Centre Line Marking, <b>NOTAC 03-2012</b> (NPA 03/213) – Wind Direction Indicators, <b>NOTAC 04-2012</b> (NPA 12/2012) – Code Letter F Requirements and Guidance, <b>DIR 01/2012</b> - Notifications of Accidents/Serious Incidents and NPA 15/2013 – Aerodrome Management - Aerodrome Post Holder Acceptance.</p> <p>Other NOTACs: <b>NOTAC 05-2012</b> - ANA Department On-Notice Process, <b>NOTAC 02/2011</b> - Aerodrome Certificate Holder Mandatory Reporting</p> <p>ICAO SARPs from Annex 14, Volume 1 regarding: Aeronautical Data (Chapter 2), Isolated Aircraft Parking Position (Chapter 3 -3.14), Landing Direction Indicators (Chapter 5, 5.1.2.1), Signalling Lamp (Chapter 5, 5.1.3.1)</p>
Issue 4 August 2014 <i>NPA 26/2014</i>	<p>Incorporate changes from ICAO State Letter (<b>AN 4/1.2.24-13/20</b>) dated 5 April 2013 with subject of Adoption of Amendment 11 to Annex 14, Volume I; <b>NPA 15-2014</b> - Personnel Requirements; <b>CAR Part IX, Temporary Revision 1</b>; guidance regarding Aerodrome Safeguarding (4.18), changes to support introduction of Landing Area Acceptance and certification of heliports further to AMC-30 revisions, Water Aerodromes (Appendix 22), Update of Appendix 4 regarding Aeronautical Studies, changed references from Aerodrome Emergency Services (AES) to Rescue Firefighting Services (RFS); specific elements regarding Aerodrome Operator training programme; additional guidance regarding Aerodrome Post Holders and training records; update of RESA and Runway Strip requirement to include non-instrument runways; included provision for severe weather notifications to ground operators further to AAIS Case No AIFN/0007/2013 (<b>SR 23/201</b>).</p>



Issue 5 Revision 00 April 2016 <i>NPA 01/2016</i>	<p>Incorporate changes following NPA 01/2016 with no comments introducing changes to:</p> <p><b>I. PERSONNEL REQUIREMENTS AND INTERNAL QUALITY ASSURANCE</b>  A. Personnel Requirements for Aerodrome Certificate Holders, introducing the requirement for Post Holder Quality Assurance (Section 2.7, Appendix 21)  B. Internal Quality Assurance (Section 4.6, Appendix 21)</p> <p><b>II. PHYSICAL CHARACTERISTICS</b>  A. Pre-Threshold Area (Runway Starter Extension) (Section 1.3, Appendix 8.3.9.10, Appendix 9.10.7, Appendix 9.12, Appendix 12.7)  B. Taxiway Minimum Separation Distance (Appendix 8.4)  C. Obstacle Limitation Surfaces (Appendix 13.1, Appendix 13.2)  D. Runway End Safety Areas (RESA) (Appendix 3.3.3, Appendix 8.3.9)</p>
Issue 5 Revision 01 May 2016	<p>This revision is made following observations that:</p> <ul style="list-style-type: none"> <li>- some changes introduced by NPA 01/2016 where not incorporated in Issue 5 Revision 00;</li> <li>- some mistakes and formatting errors appeared in Issue 5 Revision 00 while incorporating NPA 01/2016; and</li> <li>- amendment section for Issue 5 Revision 00 was not updated to highlight the amendment as listed in the NPA. out.</li> </ul> <p>The track changes against Issue 4 are shown in this revision.</p>
Issue 05 Revision 02 15 <sup>th</sup> February 2017	<p>Figure App 12-4A and Table 12 App 12-1A were missed out in Issue 5 Revision 01 from NPA 01-2016</p> <p>Figures under Appendix 8.4.13.1 rectified to ensure consistency with Table App 8-1</p>
Issue 05 Revision 02 (CORRECTED)	<p>Figures under Appendix 8.4.13.1 to ensure consistency with Table App 8-1 as stated are now rectified.</p>



15 <sup>th</sup> February 2017	
Issue 06 1 March 2019	<p>Incorporate Amendment 13A ICAO Annex 14 Vol 1, Seventh Edition.</p> <p>Incorporate ICAO Doc 9981 PANS Aerodrome First Edition</p> <p>Additional Obligations on the Aerodrome Operator.</p> <p>Addition of Appendix 6 Aerodrome Compatibility Study</p> <p>Editorial changes.</p>
Issue 07 1 September 2019	<p>Editorial changes made:</p> <p>8.3.9.10 f): numbering fixed</p> <p>9.1.2: Note deleted</p> <p>9.31.1 c) and 9.31.1 d): they are reserved;</p> <p>9.31.2 from a) to g): numbering fixed;</p> <p>11.4.2.2: "intermediate holding position" added;</p> <p>12.10.2: figure App 12-5 replaced by App 12-8;</p> <p>12.25.2 b): (&gt;6 hrs) replaced by (&lt;6 hrs);</p> <p>13.2.10.1.2: E added;</p> <p>13.2.11.2: "Markings" added before this section;</p> <p>13.2.11.3 e) Note: text deleted.</p>
<p>Issue 08</p> <p>Date of Issue: 08 February 2020</p> <p>Date of applicability: 1 March 2020</p> <p>(operators may elect to comply with this Issue</p>	<p>Incorporate changes stemming from NPA 2019-04 that include:</p> <ul style="list-style-type: none"> <li>• Amendment of ICAO Annex 14 Volume I Aerodrome Design and Operations</li> <li>• Addition of Outer Main Gear Wheel Span definition</li> <li>• Amendment to the Aerodrome Reference Code determination method</li> </ul>





08 prior to 1 <sup>st</sup> March 2020)	<ul style="list-style-type: none"> <li>Amendment to the Physical Characteristics of Runways, Runway Shoulders, Turn Pads, Runway Strips and Taxiways, Taxiway Shoulders, Taxiway Strips.</li> <li>Amendment of Table App 13-1 and Note e)</li> </ul>
Issue 09 Date of Issue: 12 October 2020	<p>Incorporate changes from NPA 2020-03 CAR – ADR Aerodromes that include:</p> <ul style="list-style-type: none"> <li>Amendment of definition of “Appropriate Authority”</li> <li>Addition of Global Reporting Format definitions and requirements to Chapter 4.11 Notifying and Reporting of Information Regarding Condition of Movement Area &amp; Related Facilities</li> <li>Addition of Global Reporting Format requirements to Chapter 4.16 Runway and Movement Area Inspections</li> <li>Editorial change to 4.24 Aerodrome Vehicle Operations</li> </ul> <p>Correction to formatting</p>
Issue 10 08 November 2020	References to CAAPs are replaced by references to new AMCs
Issue 11 10 January 2023	<p>Incorporate changes from NPA 2022-06 – CAR-ADR-AERODROMES-ISSUE 01 &amp; NPA 2021-03-CAR-ADR-AERODROMES-ISSUE01, including the adoption of ICAO amendment 15 to Annex 14 Vol. I.</p> <p>Revised definition of precision approach runway category III; airport master plan; aeroplanes equipped with folding wing tips; reporting of pavement strength; reporting of works in progress on movement areas; width of clearways; standardized taxiway nomenclature; runway guard lights; no-entry bars; minimum sizes of signs; autonomous aircraft detection system; visual aids for denoting closed runways and taxiways or part thereof; training of aerodrome personnel; procedures on management of wildlife, apron safety and establishment of airside driver permit;</p>



	GCAA revised requirements on validity of an aerodrome certificate and landing area acceptance, post holders, ground handling SMS requirements, reporting statistical information, fuel quality, PAPI maintenance.
Issue 11 (CORRECTED) 31 January 2023	Correction of ICAO Level 4 English requirements



## CHAPTER 1

### GENERAL

#### 1.1 GENERAL

- 1.1.1 Civil Aviation Regulations Part IX is issued by the Authority in pursuit of its obligations to ensure enforcement of accepted international regulations and standards at aerodromes of the United Arab Emirates (UAE) and to follow up their execution in coordination with the Appropriate Authorities/Aerodrome Operators. These regulations are based on NPA 26-2014. Further changes have been incorporated into these regulations based on the Comment Response Document (CRD).
- 1.1.2 The specifications contained herein are based upon the Standards and Recommended Practices (SARPs) of Annex 14 Volumes 1 and 2, Annex 15 and Annex 19 to the Convention on International Civil Aviation (Chicago Convention) in so far as they have been adopted by the UAE.
- 1.1.3 Design standards for fixed wing operations are based upon the Aerodrome Reference Code. Design standards for rotary wing aircraft are based upon the D Value. The intent of the Aerodrome Reference Code and D Value is to provide a simple method for interrelating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for aircraft that are intended to operate at the aerodrome.
- 1.1.4 These regulations have been framed in such a way that the specifications for physical infrastructure, visual aids and navigational aids can be adopted for use by all UAE aerodromes. The specifications contained herein are considered to be minimum acceptable standards.
- 1.1.5 Aerodrome Certificate or Landing Area Acceptance holders shall comply with the requirements and apply the information contained within CAR Part III (General Regulations) – Chapter 9, (Organisations/Personnel Certification Generic Requirements).
- 1.1.6 The grant of an Aerodrome Certificate obliges the Aerodrome Operator to ensure safety, regularity and efficiency of aircraft operations at the aerodrome.



## 1.2 APPLICABILITY

- 1.2.1 These regulations apply to all aerodromes in the UAE involved in civil aviation activities. Where reference is made to an aerodrome, this term relates both to an aerodrome and a heliport and to fixed wing and rotary wing operations.

*Note: Off-shore heliports and helidecks associated with the oil and gas industry may not require a Certificate or a Landing Area Acceptance. Refer to AMC-71 for the applicable requirements.*

- 1.2.2 An operator of an aerodrome served by aircraft conducting an Air Service and other aerodromes which provide facilities for operations using instrument approach or departure procedures, shall hold an Aerodrome Certificate under these regulations.
- 1.2.3 An operator of an aerodrome which is not intended for Air Service operations and does not use instrument approach or departure procedures shall hold a Landing Area Acceptance under these regulations.
- 1.2.4 An operator of an aerodrome which is not intended for Air Service operations and does not have instrument approach or departure procedures, may apply for an Aerodrome Certificate under these regulations.
- 1.2.5 The Aerodrome Operator will be subject to initial and on-going Service Fees.
- 1.2.6 These regulations represent the minimum requirements to achieve an acceptable level of safety.
- 1.2.7 Wherever a colour is referred to in these regulations, the specifications for that colour given in Appendix 9 shall apply.

## 1.3 DEFINITIONS

- 1.3.1 The use of the word “**shall**” in these regulations means the requirement is mandatory.
- 1.3.2 The use of the word “**should**” does not mean that compliance is optional but rather that, where insurmountable difficulties exist, the Authority may accept an Alternative Means of Compliance, provided that an acceptable safety assurance from the Aerodrome Operator shows that the safety requirements will not be reduced below that intended by the requirement.
- 1.3.3 The terms described below shall have the following meaning whenever they appear in these regulations. To the extent of any inconsistency between the



definitions in CAR Part I and these regulations, the definitions in this regulation shall prevail:

**Acceptable Means of Compliance (AMC).** Standards (but not necessarily the only standards) adopted by the Authority to illustrate means to establish compliance with the Civil Aviation Regulations. An entity/or a person wishing not to comply with the AMC must comply using an Alternative Means of Compliance accepted by the Authority.

**Accepted/Acceptable** means not objected to by the Authority as suitable for the purpose intended.

**Accepted Landing Area.** An aerodrome or heliport whose operator has been granted a Landing Area Acceptance.

**Accuracy.** A degree of conformance between the estimated or measured value and the true value.

*Note: For measured positional data, the accuracy is normally expressed in terms of a distance from a stated position within which there is a defined confidence of the true position falling.*

**Advanced Surface Movement Guidance and Control System (A-SMGCS).** A system providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required safety.

**Aerodrome.** A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

**Aerodrome Beacon.** Aeronautical beacon used to indicate the location of an aerodrome from the air.

**Aerodrome Certificate.** A certificate/licence issued by the Authority under Civil Aviation Law and Civil Aviation Regulation Part IX for the operation of an aerodrome.

**Aerodrome Certificate Verification Audit.** An inspection of the aerodrome facilities, equipment and services and audit of the safety manuals and Compliance Statements for certification conducted prior to the issue of an Aerodrome Certificate.

**Aerodrome Elevation.** The elevation of the highest point of the Landing Area.

**Aerodrome Facilities and Equipment.** Facilities and equipment, inside or outside the boundaries of the aerodrome, that are constructed or installed, operated and maintained for the arrival, departure and surface movement of aircraft.

**Aerodrome Identification Sign.** A sign placed on an aerodrome to aid in identifying the aerodrome from the air.

**Aerodrome Land Reserves.** Land currently adjacent to an aerodrome that needs securing and protecting to realize the final airports master design, e.g. new terminals, runways, hangars etc.

**Aerodrome Manual.** The manual that forms part of the application for an Aerodrome Certificate or Landing Area Acceptance and is maintained pursuant to these regulations.

*Note: The name of the Aerodrome Manual, as determined by the Aerodrome Operator, may reflect the nature of the operation or facility such as Operations Manual or Heliport Manual.*

**Aerodrome Mapping Data (AMD).** Data collected for the purpose of compiling aerodrome mapping information for aeronautical uses.

*Note: Aerodrome mapping data are collected for purposes that include the improvement of the user's situational awareness, surface navigation operations, training, charting and planning.*

**Aerodrome Mapping Database (AMDB).** A collection of aerodrome mapping data organized and arranged as a structured data set.

**Aerodrome Operator.** In relation to a Certified Aerodrome, the Aerodrome Certificate holder or in relation to an Accepted Landing Area, the Landing Area Acceptance holder.

**Aerodrome Post Holder.** Those positions required as part of Aerodrome Certification and identified in Chapter 2, 2.7.1 who are subject to acceptance by the Authority.



**Aerodrome Project.** A project that involves change to the aerodrome infrastructure including the following:

- a) **Developments:** Major upgrade/refurbishment of existing infrastructure which could affect operations during work-in-progress and new infrastructure including but not limited to buildings, taxiways, aprons, visual aids or navigational aids; and
- b) **Changes to Existing Infrastructure:** Changes to existing infrastructure or physical characteristics including but not limited to reconfiguration of stands or changes to the runway.

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

**Aerodrome Traffic Density.**

- a) **Light.** Where the number of movements in the mean busy hour is not greater than 15 per runway or typically less than 20 total aerodrome movements.
- b) **Medium.** Where the number of movements in the mean busy hour is of the order of 16 to 25 per runway or typically between 20 to 35 total aerodrome movements.
- c) **Heavy.** Where the number of movements in the mean busy hour is 26 or more per runway or typically more than 35 total aerodrome movements.

*Note 1: The number of movements in the mean busy hour is the arithmetic mean over the year of the number of movements in the daily busiest hour.*

*Note 2: Either a take-off or a landing constitutes a movement.*

**Aeronautical Beacon.** An aeronautical ground light visible at all azimuths, either continuously or intermittently, to designate a particular point on the surface of the earth.

**Aeronautical Ground Light.** Any light specially provided as an aid to air navigation, other than a light displayed on an aircraft.

**Aeronautical Information Service (AIS).** Generally, a service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity and efficiency of air navigation.

Specifically in this regulation, AIS refers to the Aeronautical Information Services, General Civil Aviation Authority, P.O. Box 666, Abu Dhabi, UAE.



**Aeronautical Study.** A study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety carried out in accordance with Appendix 4.

**Aeroplane Reference Field Length.** The minimum field length required for take-off at maximum certificated take-off mass, sea level, standard atmospheric conditions, still air and zero runway slope, as shown in the appropriate aeroplane flight manual prescribed by the certifying authority or equivalent data from the aeroplane manufacturer. Field length means balanced field length for aeroplanes, if applicable, or take-off distance in other cases.

*Note: ICAO Annex 14, Volume 1, Attachment A, Section 2 provides information on the concept of balanced field length and the ICAO Airworthiness Manual (Doc 9760) contains detailed guidance on matters related to take-off distance.*

**Aircraft.** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface. This comprises fixed-wing and variable-wing aircraft as well as balloons and the like, when used for civil purposes.

**Aircraft Classification Number (ACN) (applicable until 27 November 2024).** A number expressing the relative effect of an aircraft on a pavement for a specified standard subgrade category.

**Aircraft classification rating (ACR) (applicable as of 28 November 2024).** A number expressing the relative effect of an aircraft on a pavement for a specified standard subgrade category.

*Note: The aircraft classification number is calculated with respect to the centre of gravity (CG) position which yields the critical loading on the critical gear. Normally the aftmost CG position appropriate to the maximum gross apron (ramp) mass is used to calculate the ACN. In exceptional cases the forward most CG position may result in the nose gear loading being more critical.*

**Aircraft Stand.** A designated area on an apron intended to be used for parking an aircraft.

**Air Service.** An air service open to the public and performed by aircraft for the public transport of passengers, mail or cargo for remuneration or hire.



**Air Traffic Services Unit** - A generic term meaning variously, air traffic control unit, aerodrome flight information services unit, flight information centre or air traffic services reporting office.

**Alternative Means of Compliance.** Alternative means of compliance are those that propose an alternative to an existing Acceptable Means of Compliance (AMC) or those that propose new means to establish compliance with Civil Aviation Regulation for which no associated AMC have been adopted by the Authority.

**Appropriate Authority.** The concerned authorities of the respective Emirate.

**Approved by the Authority.** Documented by the Authority as suitable for the purpose intended.

**Apron.** A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

**Apron Management Service.** A service provided to regulate the activities and the movement of aircraft and vehicles on an apron.

**Arresting System.** A system beyond the end of a runway designed to predictably decelerate an aeroplane overrunning the runway.

**Autonomous runway incursion warning system (ARIWS):** A system which provides autonomous detection of a potential incursion or of the occupancy of an active runway and a direct warning to a flight crew or a vehicle operator.

**Authority.** The General Civil Aviation Authority (GCAA) of the United Arab Emirates is the competent body responsible for the safety regulation of civil aviation.

**Authority Publication.** Any applicable document published by the Authority including, but not limited to Civil Aviation Regulations (CARs), Safety Alerts, Standalone GM, Standalone AMC, Standards, Informational Bulletins, Notice to Aerodrome Certificate Holders (NOTAC); Operational Directives (DIR) or any other applicable document published as an e-Publication as part of the GCAA website.

**Balked Landing.** A landing manoeuvre that is unexpectedly discontinued at any point below the obstacle clearance altitude/height (OCA/H).



**Barrette.** Three or more aeronautical ground lights closely spaced in a transverse line so that from a distance they appear as a short bar of light.

**Calendar.** Discrete temporal reference system that provides the basis for defining temporal position to a resolution of one day (ISO 19108).

**Certified Aerodrome.** An aerodrome whose operator has been granted an Aerodrome Certificate.

**Clearway.** A defined rectangular area on the ground or water selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.

**Compatibility study:** A study undertaken by the aerodrome operator to address the impact of introducing an aeroplane type/model new to the aerodrome. A compatibility study may include one or several safety assessments.

**Compliance Statement.** A statement by the Aerodrome Operator to the Authority verifying compliance with all relevant UAE Civil Aviation Regulations.

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

**Data Quality.** A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution and integrity.

**Datum.** Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities (ISO 19104\*).

*\*ISO Standard 19104, Geographic information — Terminology*

**Delethalisation.** Below ground ramping to buried vertical face of construction designed to reduce risk of damage to aircraft running on cleared and graded area of strip.

**Declared Distances.**

- a) **Take-off Run Available (TORA).** The length of runway declared available and suitable for the ground run of an aeroplane taking off.
- b) **Take-off Distance Available (TODA).** The length of the Take-off Run Available plus the length of the clearway, if provided.



- c) **Accelerate-Stop Distance Available (ASDA).** The length of the Take-off Run Available plus the length of the stopway, if provided.
- d) **Landing Distance Available (LDA).** The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

**Dependent Parallel Approaches.** Simultaneous approaches to parallel or near-parallel Instrument Runways where radar separation minima between aircraft on adjacent extended runway centre lines are prescribed.

**Design Objective.** The friction level to be achieved or exceeded on a new or resurfaced runway within one year as specified in AMC- 32 - The Assessment of Runway Surface Friction Characteristics.

**Displaced Threshold.** A threshold not located at the extremity of a runway.

**Effective Intensity.** The effective intensity of a flashing light is equal to the intensity of a fixed light of the same colour which will produce the same visual range under identical conditions of observation.

**Elevated Heliport.** A heliport located on a raised structure on land.

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

**Fixed Light.** A light having constant luminous intensity when observed from a fixed point.

**Final approach and take-off area (FATO).** A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by helicopters operated in performance class 1, the defined area includes the rejected take-off area available.

**Foreign Object Debris (FOD).** An inanimate object within the airside boundary which has no operational or aeronautical function and which has the potential to be a hazard to aircraft operations.

**Frangible Object.** An object of low mass designed to break, distort or yield on impact so as to present the minimum hazard to aircraft.

*Note: Guidance on design for frangibility is contained in the ICAO Aerodrome Design Manual (Doc 9157) Part 6.*



**Geodetic Datum.** A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

**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.

*Note: The geoid is irregular in shape because of local gravitational disturbances (wind tides, salinity, current, etc.) and the direction of gravity is perpendicular to the geoid at every point.*

**Geoid Undulation.** The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.

*Note: In respect to the World Geodetic System — 1984 (WGS-84) defined ellipsoid, the difference between the WGS-84 ellipsoidal height and orthometric height represents WGS-84 geoid undulation.*

**Grading.** Means levelling of the ground surface to meet the applicable slope requirements and so prepared or constructed as to minimise hazards arising from differences in load bearing capacity to aircraft which a runway or taxiway is intended to serve, in the event of an aircraft excursion off the runway or taxiway.

**Gregorian Calendar.** Calendar in general use; first introduced in 1582 to define a year that more closely approximates the tropical year than the Julian calendar (ISO 19108\*).

*Note: In the Gregorian calendar, common years have 365 days and leap years 366 days divided into twelve sequential months.*

*\* ISO Standard 19108, Geographical Information – Temporal Schema*

**Hazard Beacon.** An aeronautical beacon used to designate a danger to air navigation.

**Helicopter air taxiway.** A defined path on the surface established for the air taxiing of helicopters.

**Helicopter clearway.** A defined area on the ground or water, selected and/or prepared as a suitable area over which a helicopter operated in performance class 1 may accelerate and achieve a specific height.

**Helicopter ground taxiway.** A ground taxiway intended for the ground movement of wheeled undercarriage helicopters.



**Helideck.** A heliport located on an off-shore structure such as an exploration or production platform used for the exploitation of oil or gas.

**Heliport.** An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.

**Heliport elevation.** The elevation of the highest point of the FATO.

**Holding Bay.** A defined area where aircraft can be held, or bypassed, to facilitate efficient surface movement of aircraft.

**Hot Spot.** A location on an aerodrome Movement Area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.

**Human Factors Principles.** Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

**Human Performance.** Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

**Identification Beacon.** An aeronautical beacon emitting a coded signal by means of which a particular point of reference can be identified.

**Independent Parallel Approaches.** Simultaneous approaches to parallel or near-parallel Instrument Runways where radar separation minima between aircraft on adjacent extended runway centre lines are not prescribed.

**Independent Parallel Departures.** Simultaneous departures from parallel or near-parallel Instrument Runways.

**Instrument Runway.** One of the following types of runways intended for the operation of aircraft using instrument approach procedures:

- a) **Non-precision Approach Runway.** A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1 000 m.



- b) **Precision Approach Runway, Category I.** A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach type B operations with a decision height (DH) not lower than 60 m (200 ft) and either a visibility not less than 800 m or a Runway Visual Range not less than 550 m.
- c) **Precision Approach Runway, Category II.** A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) lower than 60 m (200 ft) but not lower than 30 m (100 ft), and a Runway Visual Range not less than 300 m.
- d) **Precision Approach Runway, Category III.** A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operations type B with a decision height (DH) lower than 30 m (100 ft) or no decision height and a runway visual range less than 300 m, or no runway visual range limitations.

*Note 1: Visual aids need not necessarily be matched to the scale of non-visual aids provided. The criterion for the selection of visual aids is the conditions in which operations are intended to be conducted.*

*Note 2: Refer to ICAO Annex 6 for instrument approach operation types.*

*Note 3: Where decision height (DH) and Runway Visual Range (RVR) fall into different categories of operation, the instrument approach and landing operation would be conducted in accordance with the requirements of the most demanding category (e.g. an operation with a DH in the range of CAT II but with an RVR in the range of CAT I would be considered a CAT II operation).*

**Integrity (aeronautical data).** A degree of assurance that an aeronautical data and its value has not been lost nor altered since the data origination or authorised amendment.



**Integrity Classification (aeronautical data).** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data is classified as:

- a) routine data: there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;
- b) essential data: 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; and
- c) critical data: 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.

**Intermediate Holding Position.** A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the Air Traffic Services Unit.

**International Aerodrome.** Any aerodrome designated by the Authority for the arrival and departure of international air traffic, and where the formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.

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

**Landing Area Acceptance.** An acceptance issued by the Authority for the operation of an aerodrome or heliport in accordance with AMC-70 or AMC-72.

**Landing Direction Indicator.** A device to indicate visually the direction currently designated for landing and for take-off.

**Laser-beam Critical Flight Zone (LCFZ).** Airspace in the proximity of an aerodrome but beyond the LFFZ where the irradiance is restricted to a level unlikely to cause glare effects

**Laser-beam Free Flight Zone (LFFZ).** Airspace in the immediate proximity to the aerodrome where the irradiance is restricted to a level unlikely to cause any visual disruption.

*Note: See AMC-65 – Airspace User Requirements for further guidance regarding Flight Zones.*



**Laser-beam Sensitive Flight Zone (LSFZ).** Airspace outside, and not necessarily contiguous with, the LFFZ and LCFZ where the irradiance is restricted to a level unlikely to cause flash-blindness or after-image effects.

*Note: See AMC-65 – Airspace User Requirements for further guidance regarding Flight Zones.*

**Lighting System Reliability.** The probability that the complete installation operates within the specified tolerances and that the system is operationally usable.

**Low Visibility Conditions (LVC).** The meteorological conditions requiring approaches and landings in Category II and Category III, take offs in RVR less than 550 metres or for surface movements in meteorological conditions not permitting ATS to be carried out with visual reference.

**Low Visibility Procedures (LVP).** The measures required to support safe operations at an aerodrome in Low Visibility Conditions (LVC).

**Manoeuvring Area.** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

**Marker.** An object displayed above ground level in order to indicate an obstacle or delineate a boundary.

**Marking.** A symbol or group of symbols displayed on the surface of the Movement Area in order to convey aeronautical information.

**Minimum Friction Level (MFL).** The minimum friction level corresponding to particular test equipment as specified in AMC-32 - The Assessment of Runway Surface Friction Characteristics.

**Movement Area.** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the Manoeuvring Area and the apron(s).

**Near-parallel Runways.** Non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.





**Non-Instrument Runway.** A runway intended for the operation of aircraft using visual approach procedures or an instrument approach procedure to a point beyond which the approach may continue in visual meteorological conditions.

*Note: Visual meteorological conditions (VMS) are described in Chapter 3 of ICAO Annex 2.*

**Normal Flight Zone (NFZ).** Airspace not defined as LFFZ, LCFZ or LSFZ but which must be protected from laser radiation capable of causing biological damage to the eye.

**Obstacle.** All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

- a) are located on an area intended for the surface movement of aircraft; or
- b) extend above a defined surface intended to protect aircraft in flight; or
- c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

**Obstacle Free Zone (OFZ).** The airspace above the Inner Approach Surface, Inner Transitional Surfaces, and Balked Landing Surface and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted one required for air navigation purposes.

**Outer Main Gear Wheel Span (OMGWS).** The distance between the outside edges of the main gear wheels.

**Orthometric Height.** Height of a point related to the geoid, generally presented as an MSL elevation.

**Pavement Classification Number (PCN) (applicable until 27 November 2024).** A number expressing the bearing strength of a pavement.

**Pavement classification rating (PCR) (applicable as of 28 November 2024).** A number expressing the bearing strength of a pavement.

**Periodic Surveillance Audit.** An audit conducted at least annually at the discretion of the Authority confirming on-going compliance with the Civil Aviation Regulations.



**Point-in-space approach (PinS).** The Point-in-space approach is based on Global Navigation Satellite System (GNSS) and is an approach procedure designed for helicopter only. It is aligned with a reference point located to permit subsequent flight manoeuvring or approach and landing using visual manoeuvring in adequate visual conditions to see and avoid obstacles.

**Point-in-space (PinS) visual segment.** This is the segment of a helicopter PinS approach procedure from the MAPt to the landing location for a PinS “proceed visually” procedure. This visual segment connects the Point-in-space (PinS) to the landing location.

*Note: The procedure design criteria for a PinS approach and the detailed design requirements for a visual segment are established in the Procedures for Air Navigation Services — Aircraft Operations, (PANS-OPS, Doc 8168).*

**Precision Approach Runway.** See Instrument Runway.

**Primary Runway(s).** Runway(s) used in preference to others whenever conditions permit.

**Protected Flight Zones.** Airspace specifically designated to mitigate the hazardous effects of laser radiation.

**Road.** An established surface route on the Movement Area meant for the exclusive use of vehicles.

**Road-holding Position.** A designated position at which vehicles may be required to hold.

**Runway.** A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.



**Runway Condition Assessment Matrix (RCAM)** A matrix allowing the assessment of the runway condition code, using associated procedures, from a set of observed runway surface condition(s) and pilot report of braking action;

**Runway Condition Code (RWYCC).** A number describing the runway surface condition to be used in the runway condition report.

**Runway Condition Report (RCR).** A comprehensive standardised report relating to runway surface condition(s) and its effect on the aeroplane landing and take-off performance;

**Runway End Safety Area (RESA).** An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

**Runway Guard Lights.** A light system intended to caution pilots or vehicle drivers that they are about to enter an active runway.

**Runway-Holding Position.** A designated position intended to protect a runway, an obstacle limitation surface or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorised by the Air Traffic Services Unit.

**Runway Starter Extension:** A portion of a runway prior to the threshold used for take-off only and not for use in the opposite direction, with the exception of back-track manoeuvres.

**Runway Strip.** A defined area including the runway and stopway, if provided, intended:

- a) to protect aircraft flying over it during take-off or landing operations, and.
- b) to reduce the risk of damage to aircraft running off a runway.



**Runway Surface Condition(s).** A description of the condition(s) of the runway surface used in the runway condition report which establishes the basis for the determination of the runway condition code for aeroplane performance purposes;

- a) **Dry runway.** A runway is considered dry if its surface is free of visible moisture and not contaminated within the area intended to be used.
- b) **Wet runway.** The runway surface is covered by any visible dampness or water up to and including 3 mm deep within the intended area of use.
- c) **Slippery wet runway.** A wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded.
- d) **Contaminated runway.** A runway is contaminated when a significant portion of the runway surface area (whether in isolated areas or not) within the length and width being used is covered in standing water as per runway surface condition descriptors.
- e) **Runway surface condition descriptor.** Standing water of depth greater than 3 mm on the surface of the runway.

*Note 1: Running water of depth greater than 3 mm is reported as standing water by convention.*

*Note 2: For reasons of simplicity and better comprehension in filing the SNOWTAM, winter condition descriptors are not listed under definitions as they are not applicable in the UAE, being a wet and dry only region.*

**Runway Turn Pad.** A defined area on a land aerodrome adjacent to a runway for the purpose of completing a 180-degree turn on a runway.

**Runway Visual Range (RVR).** The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

**Safety Management System (SMS).** A systematic approach to managing safety including the necessary organisational structure, accountabilities, policies and procedures.

**Segregated Parallel Operations.** Simultaneous operations on parallel or near-parallel Instrument Runways in which one runway is used exclusively for approaches and the other runway is used exclusively for departures.

**Service Fees:** Those fees on the General Civil Aviation Authority website, as varied from time to time and in respect to a service delivered by the GCAA, which are required to be paid to the General Civil Aviation Authority pursuant to federal government decisions.



**Shoulder.** An area adjacent to the edge of a pavement so prepared as to provide a transition between the pavement and the adjacent surface.

**Sign.**

- a) **Fixed message sign.** A sign presenting only one message.
- b) **Variable message sign.** A sign capable of presenting several pre-determined messages or no message, as applicable.

**Signal area.** An area on an aerodrome used for the display of ground signals.

**SNOWTAM.** A special series NOTAM given in a standard format, which provides a surface condition report notifying the presence or cessation of hazardous conditions due to standing water on the movement area;

**Station Declination.** An alignment variation between the zero degree radial of a VOR and true north, determined at the time the VOR station is calibrated.

**Stopway.** A defined rectangular braking action area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

**Surface Movement Guidance and Control System (SMGCS).** A system for the provision of guidance to and control of, all aircraft, ground vehicles and personnel on the Movement Area of an aerodrome for the prevention of collisions and to ensure that traffic flows smoothly and freely.

*Note: Reference to SMGCS also includes A-SMGCS.*

**Switch-over Time (light).** The time required for the actual intensity of a light measured in a given direction to fall from 50 per cent and recover to 50 per cent during a power supply changeover, when the light is being operated at intensities of 25 per cent or above.

**Synopsis.** A brief statement that presents the main points in a concise form.

**Take-off Runway.** A runway intended for take-off only.

**Taxiway.** A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

- a) **Aircraft Stand Taxilane.** A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.
- b) **Apron Taxiway.** A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.
- c) **Rapid Exit Taxiway.** A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

**Taxiway Intersection.** A junction of two or more taxiways.

**Taxiway Strip.** An area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway.

**Threshold.** The beginning of that portion of the runway usable for landing.

**Touchdown and lift-off area (TLOF).** An area on which a helicopter may touch down or lift off.

**Touchdown Zone.** The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

**Unserviceable Area.** A part of the Movement Area that is unfit and unavailable for use by aircraft.

**Usability Factor.** The percentage of time during which the use of a runway or system of runways is not restricted because of the cross-wind component.

**Vehicle.** Any means used to transport people or goods

**Work Area.** Means a part of an aerodrome in which maintenance or construction works are in progress.

## 1.4 COMMON REFERENCE SYSTEMS

### 1.4.1 Horizontal Reference System

World Geodetic System - 1984 (WGS-84) shall be used as the horizontal (geodetic) reference system. Reported aeronautical geographical coordinates (indicating latitude and longitude) shall be expressed in terms of the WGS-84 geodetic reference datum.



*Note: Comprehensive guidance material concerning WGS-84 is contained in the World Geodetic System – 1984 (WGS-84) Manual (ICAO Doc 9674).*

#### 1.4.2 Vertical Reference System

Mean Sea Level (MSL) datum, which gives the relationship of gravity-related height (elevation) to a surface known as the geoid, shall be used as the vertical reference system.

*Note 1: The geoid globally most closely approximate MSL. It is defined as the equipotential surface in the gravity field of the Earth which coincides with the undisturbed MSL extended continuously through the continents.*

*Note 2: Gravity-related heights (elevations) are also referred to as orthometric heights while distances of points above the ellipsoid are referred to as ellipsoidal heights.*

#### 1.4.3 Temporal Reference System

The Gregorian calendar and Coordinated Universal Time (UTC) shall be used as the temporal reference system.

### 1.5 AERODROME DESIGN AND MASTER PLAN

A master plan for the long-term development of an aerodrome displays the ultimate development in a phased manner and reports the data and logic upon which the plan is based. Master plans are prepared to support modernization of existing aerodromes and creation of new aerodromes, regardless of size, complexity, and role. It is important to note that a master plan does not constitute a confirmed implementation programme. It provides information on the types of improvements to be undertaken in a phased manner. Guidance on all aspects of the planning of aerodromes is contained in the Airport Planning Manual (Doc 9184), Part 1.

- 1.5.1 A master plan containing detailed plans for the development of aerodrome infrastructure shall be established for aerodromes.

*Note 1: A master plan represents the development plan of a specific aerodrome. It is developed by the aerodrome operator based on economic feasibility, traffic forecasts, current and future requirements provided by, among others, aircraft operators (see 4.4.5).*

- 1.5.2 The master plan should:



- a. contain a schedule of priorities including a phased implementation plan; and
- b. be reviewed periodically to take into account current and future aerodrome traffic

1.5.3 Aerodrome stakeholders, particularly aircraft operators, should be consulted in order to facilitate the master planning process using a consultative and collaborative approach.

*Note 1: Provision of advanced planning data to facilitate the planning process include future aircraft types, characteristics and numbers of aircraft expected to be used, the anticipated growth of aircraft movements, number of passengers and amount of cargo projected to be handled.*

*Note 2: See Annex 9, Chapter 6 on the need for aircraft operators to inform aerodrome operators concerning the former's service, schedule and fleet plans to enable rational planning of facilities and services in relation to the traffic anticipated.*

*Note 3: See ICAO's Policies on Charges for Airports and Air Navigation Services (Doc 9082), Section 1, regarding consultation with users concerning provision of advance planning data and protection of commercially sensitive data.*

1.5.4 Architectural and infrastructure-related requirements for the optimum implementation of international civil aviation security measures shall be integrated into the design and construction of new facilities and alterations to existing facilities at an aerodrome.

1.5.5 The design of aerodromes shall take into account, where appropriate land-use, and environmental control measures and aerodrome land reserves safeguarding measures.

*Note: Guidance on land-use planning and environmental control measures is contained in the Airport Planning Manual (ICAO Doc 9184), Part 2.*

## 1.6 STANDARDS AND RECOMMENDED PRACTICES

1.6.1 The methodologies and specifications contained in the ICAO Airport Design Manuals and ICAO Airport Service Manuals shall be considered to represent an Acceptable Means of Compliance unless otherwise indicated by the Authority.

1.6.2 Material applicable to these regulations is contained in the following documents:

- ICAO Annex 4 – Aeronautical Charts
- ICAO Annex 10 - Aeronautical Telecommunications
- ICAO Annex 14 – Aerodromes - Volume I - Aerodrome Design and Operation





- ICAO Annex 14 – Aerodromes - Volume II - Heliports
- ICAO Annex 15 - Aeronautical Information Services
- ICAO Annex 19 – Safety Management
- ICAO Manual on Ground Handling (Doc 10121)
- PANS-ATM (ICAO Doc 4444) - Air Traffic Management
- ICAO Aerodrome Design Manual (Doc 9157)
  - Part 1 – Runways
  - Part 2 – Taxiways, Aprons and Holding Bays
  - Part 3 – Pavements
  - Part 4 – Visual Aids
  - Part 5 – Electrical Systems
  - Part 6 – Frangibility
- ICAO Airport Planning Manual (Doc 9184)
  - Part 1 – Master Planning*
  - Part 2 – Land Use and Environmental Control*
  - Part 3 – Guidelines for Consultant/Construction Services*
- ICAO Airport Services Manual (Doc 9137)
  - Part 1 – Rescue and Fire Fighting*
  - Part 2 – Pavement Surface Conditions*
  - Part 3 – Bird Control and Reduction*
  - Part 5 - Removal of Disabled Aircraft*
  - Part 6 – Control of Obstacles*
  - Part 7 – Airport Emergency Planning*
  - Part 8 – Airport Operational Services*
  - Part 9 – Airport Maintenance Practices*
- ICAO Heliport Manual (Doc 9261)
- ICAO Human Factors Training Manual (Doc 9683)
- ICAO Manual of All-Weather Operations (Doc 9365)



- ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)
- ICAO Manual on Certification of Aerodromes (Doc 9774)
- *ICAO Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) (Doc 9643)*
- ICAO Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332)
- *ICAO Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830) ICAO Safety Management Systems (Doc 9859) ICAO Manual on Testing of Radio Navigation Aids (Doc 8071)*
- *ICAO Aeronautical Information Services Manual (Doc 8126)*
- *ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)*
- ICAO PANS-OPS, Procedures for Air Navigation Services — Aircraft Operations (Doc 8168)

*Volume I — Flight Procedures*

*Volume II— Construction of Visual and Instrument Flight Procedures*

- ICAO World Geodetic System – 1984 (WGS-84) Manual (Doc 9674)
- *UAE Civil Aviation Law, Federal Law No. 20*
- *Civil Aviation Regulation (CAR) Part I – Definitions*
- *Civil Aviation Regulation (CAR) Part III – (General Regulations) Right of Way Rules, Water Operations*
- *Civil Aviation Regulation (CAR) Part VI – Aircraft Accident and Incident Investigation*
- *Civil Aviation Regulation (CAR) Part VII – Aviation Security Regulations*
- *Civil Aviation Regulation (CAR) Part VIII – Air Navigation Regulations*
- *Civil Aviation Regulation (CAR) Part X – Safety Management System Requirements*
- *Civil Aviation Regulation (CAR) Part XI – Aerodrome Emergency Service, Equipment and Facilities*
- *National Civil Aviation Security Programme*
- *Acceptable Means of Compliance (AMC) 22 – Safety Incident Reporting*



- *Acceptable Means of Compliance (AMC) 24 – Airport Briefing Requirements*
- *Acceptable Means of Compliance (AMC) 25 – Air Navigation Facilities*
- *Acceptable Means of Compliance (AMC) 30 – The Issue and Verification of an Aerodrome Certificate*
- *Acceptable Means of Compliance (AMC) 32 – The Assessment of Runway Surface Friction Characteristics*
- *Acceptable Means of Compliance (AMC) 36 – Runway and Movement Area Inspections*
- *Acceptable Means of Compliance (AMC) 43 – Foreign Object Debris*
- *Acceptable Means of Compliance (AMC) 44 – Low Visibility Procedures (LVP)*
- *Acceptable Means of Compliance (AMC) 57 – VORSY - Voluntary Reporting System*
- *Acceptable Means of Compliance (AMC) 59 – Aerodrome Projects*
- *Acceptable Means of Compliance (AMC) 61 – Aerodrome Survey Requirements*
- *Acceptable Means of Compliance (AMC) 70 – Heliports*
- *Acceptable Means of Compliance (AMC) 71 – Helidecks (Off-Shore)*
- *Acceptable Means of Compliance (AMC) 72 – Aircraft Landing Areas: Private Use (not Air Service)*
- *Operational Directive (DIR) 01/2012 – Notifications of Accidents/Serious Incidents*
- *Information Bulletin (IB) 02/2012 – Notifications of Accidents/Serious Incidents*
- *Recommendations for Surface Colours for Visual Signalling (Publication No. 39-2 (TC-106) 1983) by the International Commission on Illumination/ Commission Internationale de l'Eclairage (CIE)*
- *Radio Technical Commission for Aeronautics (RTCA) Document DO-200A*
- *Radio Technical Commission for Aeronautics (RTCA) Document DO-201A*
- *Radio Technical Commission for Aeronautics (RTCA) Document DO-272B*
- *European Organization for Civil Aviation Equipment (EUROCAE) Document ED-76A — Standards for Processing Aeronautical Data*
- *European Organization for Civil Aviation Equipment (EUROCAE) Document ED-77 - Industry Requirements for Aeronautical Information*
- *European Organization for Civil Aviation Equipment (EUROCAE) Document ED-99B — User Requirements for Aerodrome Mapping Information.*



- *National Fire Protection Association (NFPA) 418 Standards for Heliports*
- *The International Regulations for Preventing Collisions at Sea (Colregs) published by the International Maritime Organization (IMO)*
- *UK CAP 437 – Offshore Helicopter Landing Areas – Guidance on Standards*

1.6.3 Procedures for Air Navigation Services (PANS) shall be applied except where specifically deleted or modified in these regulations with similar mandatory status as for the SARPs.



## CHAPTER 2

### AERODROME CERTIFICATION OR LANDING AREA ACCEPTANCE PROCESS

*Note: Further explanation regarding the requirements and timelines for the application, processing, issue, amendment or transfer of an Aerodrome Certificate or for the application, processing, issue or amendment of an Landing Area Acceptance may be found within AMC-30.*

#### 2.1 PROCESS TO OBTAIN AN AERODROME CERTIFICATE OR LANDING AREA ACCEPTANCE

2.1.1 Further to the requirement of Chapter 1, 1.2.2, an operator of an aerodrome served by aircraft conducting an Air Service and other aerodromes which provide facilities for operations using instrument approach or departure procedures shall apply to the Authority for an Aerodrome Certificate.

**AMC 1 to Chapter 2, 2.1.1:** Operators of aerodromes required to hold an Aerodrome Certificate should refer to the following publications:

- a) AMC-30 - The Issue and Verification of an Aerodrome Certificate; and
- b) AMC-70 - Heliports.

2.1.2 Further to the requirement of Chapter 1, 1.2.3, an operator of an aerodrome which is not intended for Air Service operations and which does not have instrument approach or departure procedures, shall apply to the Authority for a Landing Area Acceptance or may apply for an Aerodrome Certificate.

**AMC 1 to Chapter 2, 2.1.2:** Operators of aerodromes required to hold a Landing Area Acceptance should refer to the following publications:

- a) AMC-30 – The Issue and Verification of an Aerodrome Certificate;
- b) AMC-70 – Heliports; and
- c) AMC-72 – Aircraft Landing Areas: Private Use (not Air Service).

2.1.3 An application for an Aerodrome Certificate or Landing Area Acceptance shall be submitted to the Authority in a form prescribed in the applicable AMC.

#### 2.2 GRANT OF AN AERODROME CERTIFICATE OR LANDING AREA ACCEPTANCE

2.2.1 Subject to the provisions in 2.2.2 the Authority may approve the application submitted under 2.1.1 or 2.1.2 and grant an Aerodrome Certificate or Landing Area Acceptance to the applicant.



2.2.2 Before granting an Aerodrome Certificate or Landing Area Acceptance, the Authority must be satisfied that:

- a) The aerodrome's facilities, services and equipment are in accordance with the Civil Aviation Regulations and other relevant ICAO Standards and Recommended Practices further to review, inspection or Aerodrome Certificate Verification Audit;
- b) For an Aerodrome Certificate, the Aerodrome Manual prepared for the applicant's aerodrome contains all pertinent information on the aerodrome site, facilities, services, equipment, operating procedures, organization and management;
- c) For an Aerodrome Certificate, the aerodrome's Safety Management System and supporting operating procedures make satisfactory provision for the safety of aircraft;

*Note: The Safety Management System shall be in accordance with CAR Part IX – Aerodromes, and CAR Part X – Safety Management System. Further guidance maybe found in ICAO Safety Management Manual (SMM) (Doc 9859), and the ICAO Manual on Certification of Aerodromes (Doc 9774).*

- d) The aerodrome Rescue Firefighting Service is staffed, trained, equipped, operated and organised to the meet the applicable requirements;

*Note: Requirements for the Rescue Firefighting Service are given in CAR Part XI - Aerodrome Emergency Service, Equipment and Facilities; AMC-70 - Heliports: and AMC-72 – Aircraft Landing Areas: Private Use (Not Air Service).*

- e) The applicant will be able to operate and maintain the aerodrome properly;
- f) For an Aerodrome Certificate, the applicant meets the Personnel Requirements in 2.7;
- g) Payment of any required Service Fees has been received;

*Note: Payment of the Services Fees does not guarantee the issue of an Aerodrome Certificate or Landing Area Acceptance.*

- h) In addition to the application for an Aerodrome Certificate or Landing Area Acceptance, applicants may be required to apply for other certificates or approvals from the Authority; this will be dependent upon the scale and



type of operations the aerodrome is intended to be used. Other areas that may require certification or approval are:

- i) Air Navigation Services: Air Navigation and Aerodrome Department;
  - ii) Flight Operations: Flight Operations Department; and
  - iii) Aerodrome Security: Aviation Security Affairs Sector; and
- i) Applicants may also require approvals from other relevant authorities (i.e. municipalities, Civil Defence, local departments of civil aviation, Appropriate Authorities, etc.); it is the responsibility of the applicant to obtain such approvals or permissions, prior to the submission of an application for an Aerodrome Certificate or Landing Area Acceptance.

2.2.3 The Authority may impose operating restrictions and/or sanctions at a licenced/certified/accepted aerodrome. In the event of non-compliance with the licence/certification/acceptance requirements or unresolved safety deficiencies/concerns, the Authority may refuse to grant an Aerodrome Certificate or Landing Area Acceptance and in such cases shall notify the applicant in writing of its reasons.

2.2.4 After successful completion of the processing of the application, the Authority while granting the Aerodrome Certificate or Landing Area Acceptance, may endorse the conditions of the type of use of the aerodrome and other details as shown in the Aerodrome Certificate or Landing Area Acceptance.

2.2.5 Aerodrome Operators shall confirm that supporting resources and facilities required by aviation security services are made available at airports serving civil aviation.

*Note: CAR Part VII - Aviation Security Regulations contains requirements regarding aviation security.*

## **2.3 VALIDITY OF AN AERODROME CERTIFICATE OR LANDING AREA ACCEPTANCE**

2.3.1 The validity of the Aerodrome Certificate or Landing Area Acceptance is based upon the physical characteristics, type of use of the aerodrome and continued operation in accordance with the Authority Publications.

2.3.2 Any change made to the physical characteristics or use of the aerodrome, as documented in the Aerodrome Manual that is not accepted by the Authority shall invalidate an Aerodrome Certificate.



2.3.3 The Aerodrome Certificate shall remain valid subject to:

- a) the payment of applicable renewal Service Fees; and
- b) the operator remaining in compliance with the relevant requirements of CAR ADR and the aerodrome remaining in compliance with the certifications basis, taking into account the provisions related to the handling of findings;
- c) the GCAA being granted access to the aerodrome operator's organisation to determine continued compliance with the relevant requirements of CAR ADR; and
- d) the certificate not being surrendered, suspended, transferred or revoked.

2.3.4 The Landing Area Acceptance shall remain valid subject to:

- a) Not exceeding, if applicable, the expiration date;
- b) The payment of applicable renewal Service Fees;
- c) The operator remaining in compliance with the relevant requirements of CAR ADR and the aerodrome remaining in compliance with the certification basis, taking into account the provisions related to the handling of findings;
- d) The GCAA being granted access to the aerodrome operator's organisation to determine continued compliance with the relevant requirements of CAR ADR; and
- e) The LAA not being surrendered, suspended, transferred or revoked.

2.3.5 Upon revocation or surrender, the certificate or landing area acceptance shall be returned to the GCAA without delay.

**2.4 SURRENDER OF AN AERODROME CERTIFICATE OR LANDING AREA ACCEPTANCE**

An Aerodrome Operator must give the Authority not less than 3 months written notice of the date on which the Aerodrome Certificate or Landing Area Acceptance is to be surrendered in order that suitable promulgation action can be taken. The Authority will revoke the Aerodrome Certificate or Landing Area Acceptance on the date specified in the notice.





## **2.5 TRANSFER OF AN AERODROME CERTIFICATE**

The Authority may approve the transfer of an Aerodrome Certificate to a transferee where

- a) the current holder of the Aerodrome Certificate notifies the Authority in writing before ceasing aerodrome operations of its intention and proposed date to cease operations;
- b) the current holder of the Aerodrome Certificate notifies the Authority in writing of the name of the proposed transferee;
- c) the proposed transferee applies to the Authority further to requirements of 2.1.1 or 2.1.2 as applicable; and
- d) the proposed transferee meets the requirements set out in 2.2.2.

## **2.6 RESTRICTION, SUSPENSION OR REVOCATION OF AN AERODROME CERTIFICATE OR LANDING AREA ACCEPTANCE**

- 2.6.1 The Authority may restrict, suspend or revoke an Aerodrome Certificate or Landing Area Acceptance with reference to the UAE Civil Aviation Law.
- 2.6.2 The Authority may restrict, suspend or revoke an Aerodrome Certificate or Landing Area Acceptance, in the event of non-compliance with the licence/certification/acceptance requirements or unresolved safety deficiency/concern and in such cases shall notify the Aerodrome Operator in writing of its reasons.

*Note: See Appendix 19 for details of Aerodrome On-Notice Process.*

## **2.7 PERSONNEL REQUIREMENTS FOR AERODROME OPERATORS**

- 2.7.1 Each Aerodrome Operator prior to the grant of an Aerodrome Certificate and on an on-going basis shall engage, employ or contract:
  - a) sufficient and qualified personnel for the planned tasks and activities to be performed related to the operation, maintenance and management of the aerodrome in accordance with the applicable requirements and the Aerodrome Operator's training programme; and
  - b) sufficient number of supervisors to defined duties and responsibilities, taking into account the structure of the organisation and the number of personnel employed.

### **2.7.2 Aerodrome Management**



- 2.7.2.1 ***The Aerodrome Operator shall*** appoint an Accountable Manager who shall have full control of the resources, final authority over operations under the certificate/approval of the organisation and ultimate responsibility and accountability for the establishment, implementation and maintenance of management systems, policies, and resolution of all safety issues.
- 2.7.2.2 The Aerodrome Operator shall nominate Post Holders, acceptable to the Authority, who are responsible for the management and supervision of safety critical aspects for the aerodrome operation, and have direct access to the Accountable Manager.
- 2.7.2.3 The Aerodrome Operator shall ensure the 'Post Holder' roles are continually occupied by appropriate and experienced persons:
- a. **An 'Aerodrome Safety Post Holder' who shall:**
    - I. have appropriate Safety Management System knowledge and experience;
    - II. be responsible for the overall performance of the Safety Management System, including implementation, maintenance, documentation, performance, effectiveness and oversight of the organisation in accordance with these regulations and CAR PART X;
    - III. be a principal communicator with the Authority in relation to Safety Management System; and
    - IV. be directly responsible to the Accountable Manager on the performance of SMS and on any need for improvement.
  - b. **An 'Aerodrome Operations Post Holder' who shall:**
    - I. be responsible for ensuring that the aerodrome and its operation comply with the requirements of these regulations; and
  - c. **An 'Aerodrome Maintenance Post Holder' who shall:**
    - I. be responsible for ensuring that the aerodrome's maintenance programmes for safety critical infrastructure comply with the requirements of these regulations; and
  - d. **An 'Aerodrome Rescue Firefighting Service (Chief Fire Officer) Post Holder' who shall:**



- I. be responsible for establishing and effectively managing all aspects of Rescue and Firefighting Services as per the requirements of these regulations and CAR Part XI; and

e. **An 'Aerodrome Quality Assurance Post Holder' who shall:**

- I. have appropriate Quality Management System knowledge and experience;
- II. be responsible for overall performance of the Compliance Monitoring and Quality Assurance System, including implementation, maintenance, documentation, effectiveness and oversight of the organisation;
- III. be a principle communicator with the Authority in relation to audits and Quality Management System and compliance issues; and
- IV. be directly responsible to the Accountable Manager on matters affecting the adequacy, accuracy and timeliness of the quality assurance requirements in accordance with CAR Part IX.

*Note: See Appendix 21 for assessment criteria.*

**GM 1 to Chapter 2, 2.7.2.1 and 2.7.2.3: Assessment of Post Holders:** *The Authority will assess each nominated Aerodrome Post Holder based on the Assessment Criteria in Appendix 21, conduct an interview with the nominee and may call for additional evidence of his/her suitability before deciding upon his/her acceptability.*

**GM 1 to Chapter 2, 2.7.3: Post Holder Expectations:**

- a) *The Post Holder positions form an essential component of the organisations safety, quality and operational effectiveness and sustainability.*
- b) *The Post Holders of an Aerodrome Operator are expected to be senior management who are directly responsible for the proper functioning of the management system. They should have decision making authority and financial control over the relevant part of the management system. While accountability is non-transferable, responsibilities, may be delegated, and therefore the authority may accept delegation of certain Post Holder responsibilities with evidence that this delegation is formalised and clearly defined.*



- c) *The Aerodrome Operator will normally require additional management personnel to support the functions of the organisation Post Holders. The organisation is required to maintain post holders responsible for the effective functioning of the management systems throughout the organisation (eg. SMS or QMS), this does not however prevent an appropriate hierarchical structure which effectively manages the activities within the Aerodrome Operators organisation. As such, the structure of the Aerodrome Operator is subject to acceptance by the Authority under 2.7.10.*
- d) *In any case, it is important that the management system of the Aerodrome Operator, particularly with regards to quality and safety management, is cohesive and is not fragmented due to commercial arrangements or geographical diversity.*
- e) *The Aerodrome Operator is no longer in compliance with the applicable requirements when one of these positions becomes vacant (e.g. resignation). In such cases, a permanent or interim replacement person is expected to be immediately appointed by the Aerodrome Operator for acceptance by the Authority.*

**GM 2 to Chapter 2, 2.7.2: Aerodrome Operator Point of Contacts:**

- a) *The Authority will send all general correspondence to the Accountable Manager.*
- b) *The Quality Post Holder is considered as primary point of contact for oversight activities.*
- c) *The Safety Post Holder is considered the primary point of contact for safety performance activities.*
- d) *It is the responsibility of the Aerodrome Operator to ensure correspondence is adequately disseminated within their own organisation.*
- e) *While the Authority may on various occasions communicate directly with Post Holders or other positions within the Aerodrome, this does not negate the need for the Aerodrome Operator to ensure all information they receive has been adequately distributed to the necessary persons.*

**GM 3 to Chapter 2, 2.7.2.1: Accountable Manager:**

- a) *The Accountable Manager will normally be the chief executive officer (CEO) of the organisation.*



- b) While accountability is non-transferable, responsibilities may be delegated, and therefore the Authority may accept delegation of certain responsibilities to a senior management official of the organisation with evidence that this delegation is formalised and clearly defined. The ultimate accountability will always remain with the Accountable Manager.*

**GM 3 to Chapter 2, 2.7.2.3 (e): Compliance monitoring arrangements:**

- a) Compliance monitoring is usually performed by the Quality Assurance Post Holder to ensure that the activities of the Aerodrome Operator are monitored for compliance with the applicable regulatory requirements and any additional requirements established by the Aerodrome Operator. Such compliance monitoring activities ensure that activities are being carried out properly under the supervision of nominated Post Holders and line managers.*
- b) The person responsible for compliance monitoring may perform all audits and inspections himself/herself or appoint one or more auditors by choosing personnel having the related competence, either from within or outside the Aerodrome Operator.*
- c) Regardless of the option chosen, it needs to be ensured that the independence of the audit function is not affected, in particular in cases where those performing the audit or inspection are also responsible for other activities within the Aerodrome Operator.*
- d) In case external personnel are used to perform compliance audits or inspections:*
- a. any such audits or inspections are performed under the responsibility of the Quality Assurance Post Holder; and*
  - b. the Quality Assurance Post Holders remains responsible for ensuring that the external personnel have relevant knowledge, background and experience as appropriate to the activities being audited or inspected, including knowledge and experience in compliance monitoring.*
- e) The Quality Assurance Post Holder retains the ultimate responsibility for the effectiveness of the compliance monitoring function, in particular for the effective implementation and follow-up of all corrective actions.*

2.7.3 The roles, authority, responsibilities and accountabilities of the person or group of persons occupying the above mentioned positions shall be reflected in their respective job description.

2.7.4 A person shall not be permitted to occupy one of the positions mentioned under 2.7.2.3 without the acceptance of the Authority.



- 2.7.5 The Authority may, at any time, restrict, suspend, or revoke, the acceptance of a Post Holder.
- 2.7.6 A vacancy, or potential vacancy, of any position mentioned under 2.7.2.3 shall be notified to the Authority immediately.
- Initial notification of a vacancy shall, within 5 working days, be followed by an action plan via the management of change process, to manage and replace the vacant position.

**AMC 1 to Chapter 2, 2.7.6- Changes to Aerodrome Post Holders:** *The Aerodrome Operator should apply for a change to the nominated Aerodrome Post Holder by submitting an application for a change of Aerodrome Post Holder, with required supporting documentation to the Authority through the ANA e-Services certification application, available on the GCAA website [www.gcaa.gov.ae](http://www.gcaa.gov.ae). The application should additionally include evidence of management of change. See also applicable GM 1 to Chapter 2, 2.7.2.1 and 2.7.2.3: Assessment of Post Holders.*

- 2.7.7 The Aerodrome Operator shall allocate Post Holder roles to personnel in a manner that ensures effective internal oversight and avoids conflict of interest.
- The Safety Post Holder and Quality Post Holder shall be senior management positions and shall not report to the Operations, Maintenance, or Rescue Fire Fighting Service Post Holder.
  - The combination of post holder positions shall not be permitted unless an unexpected vacancy necessitates the combination of roles as a temporary contingency measure, and this is subject to acceptance by the Authority and shall be immediately notified to the Authority for review.
  - The personnel in Post Holder roles should be management positions and these persons shall not hold other positions that may conflict or impair their roles unless specifically accepted by the authority.
  - Where insurmountable difficulties exist, the authority may consider an alternative means of compliance for the distribution of Post Holder roles.

**GM 1 to Chapter 2, 2.7.7 c – Exceptional Circumstances:** *The application should satisfy at least the following criteria:*



- a) *Demonstrate the rationale for insurmountable difficulties;*
- b) *Ensure that with regard to competence in different areas of responsibility, there should not be any difference from the requirements applicable to persons holding only one post.*
- c) *Verify the capacity of all proposed Post Holder individuals to meet their responsibilities; and*
- d) *Ensure that there is no possibility for conflict of interest*

**AMC 2 to Chapter 2, 2.7.7 - Temporary Aerodrome Post Holders:** *When an Aerodrome Post Holder is unavailable for lengthy periods, or has left the organisation, the Aerodrome Operator should notify the Authority of a replacement or temporary Aerodrome Post Holder through the application process referenced in AMC 1 to Chapter 2, 2.7.6. The Authority may request an interview with a proposed temporary Aerodrome Post Holder.*

## 2.7.8 Short term absence of Post Holders

### 2.7.8.1 Planned short term absences such as annual leave is not considered vacancies, however:

- a) The Aerodrome Operator should ensure that the accountabilities, responsibilities, and duties of the relevant Post Holder are adequately re-assigned to an alternate to ensure continued effectiveness of the management system;
- b) The Aerodrome Operator should have a comprehensive handover process to ensure all relevant tasks are transferred to the alternate; and
- c) The Post Holder should notify the Authority Principal Inspector of their planned absence and contact details of the alternate.

## 2.7.9 Reserved

### 2.7.10 The Aerodrome Operator shall update its Aerodrome Manual including the organisational structure with respect to the accepted Aerodrome Post Holders. The organizational structure of the Aerodrome Operator shall be acceptable to the Authority.

**GM 1 to Chapter 2, 2.7.12 – Acceptance of Organizational Structure:** *Acceptance of the organizational structure is achieved through the acceptance of the Aerodrome Manual. In the review of the structure, the authority will normally consider if the proposed structure ensures the following:*





- a) *that Post Holders have access to the Accountable Manager;*
- b) *that Post Holders have clear reporting lines and responsibilities; and*
- c) *that there is no conflict of interest.*

2.7.11 The Aerodrome Operator shall establish and implement a training programme to maintain the competency of the safety critical personnel.

**AMC 1 to Chapter 2, 2.7.11: Training Programmes**

- a) *The training programme should cover all personnel:*
  - i) *involved in the operation, maintenance and management of the aerodrome (supervisors, managers, senior managers, and the Accountable Manager); and*
  - ii) *operating unescorted on the Movement Area, and other operational areas of the aerodrome, and which are related to the aerodrome operator, or other organisations which operate or provide services at the aerodrome,*  
*regardless of their level in the organisation.*
- b) *The training of persons mentioned in paragraph a) should be completed prior to the initial performance of their duties, or allowing them unescorted access on the Movement Area and other operational areas of the aerodrome, as appropriate.*
- c) *The training programme should include Safety Management System training whose level of detail should be appropriate to the individual's responsibility and involvement in the Safety Management System and should also include human and organisational factors; for those persons referred to in paragraph under a) ii) employed by other organisations operating, or providing services at the aerodrome, the Safety Management System training may cover only the necessary elements (e.g. relevant procedures, safety reporting system, aerodrome safety programmes, FOD awareness, etc.).*
- d) *The training programme should consist of the following:*
  - i) *a process to identify training standards, including syllabi, and frequency for each type of training and area of activity for the persons mentioned in paragraph a), including for instructors and assessors, and track completion of required training;*





- ii) *a validation process that measures the effectiveness of training;*
  - iii) *initial job-specific training;*
  - iv) *on-the-job training; and*
  - v) *recurrent training.*
- e) *The training programme should identify training responsibilities and contain procedures:*
  - i) *for training and checking of the trainees;*
  - ii) *to be applied in the event that personnel do not achieve or maintain the required standards.*
- f) *Training contents and syllabi should comply with the training requirements described in the Aerodrome Manual.*
- g) *A training file should be developed for each employee, including management, to assist in identifying and tracking employee training requirements, and verifying that personnel have received the planned training.*

**AMC 2 to Chapter 2, 2.7.11: Training Programmes – Checking of Trainees**

- a) *Checking required for each training course should be accomplished by the method appropriate to the training element to be checked.*
- b) *Training elements that require individual practical participation may be combined with practical checks.*

**GM 1 to Chapter 2, 2.7.11: Training Programme – Checking of Trainees**

*The methods to be used for the checking of the trainees could include:*

- a) *practical demonstration,*
- b) *computer-based assessment,*
- c) *oral or written tests,*

*or combinations of such methods, as appropriate.*

- 2.7.12 The Aerodrome Operator shall maintain appropriate qualification training and proficiency check records to demonstrate compliance with the requirement in 2.7.8.

**GM 1 to Chapter 2, 2.7.12: Training Records**



- a) *Training Programme: The aerodrome operator should maintain records of the training sessions that it has provided, including as a minimum the following:*
  - i) *area of training and subjects covered;*
  - ii) *names of participants/signed list of participants;*
  - iii) *date and duration of training; and*
  - iv) *name of the instructor.*
- b) *Training Records of Individuals: The training records maintained for each individual should include as a minimum:*
  - i) *the name of the trainee;*
  - ii) *the date(s) and the duration of the training;*
  - iii) *the place where the training was received;*
  - iv) *the name of the organisation that provided the training;*
  - v) *the subjects covered, and the methodology of the course;*
  - vi) *any comments made by the instructor if applicable;*
  - vii) *performance evaluation of the trainee if applicable; and*
  - viii) *the name and signature of the instructor.*

#### **GM 2 to Chapter 2, 2.7.12: Proficiency Check Records**

*The proficiency check records maintained for each individual should include as a minimum:*

- a) *the name of the person checked;*
- b) *the date(s) and the duration of the proficiency check;*
- c) *the methodology of the check conducted;*
- d) *any comments made by the assessor;*
- e) *the performance evaluation of the person checked; and*
- f) *the name and signature of the assessor.*



## CHAPTER 3

### AERODROME MANUAL

#### 3.1 PURPOSE AND SCOPE

3.1.1 The Aerodrome Manual is a fundamental requirement of the Aerodrome Certification process. It shall contain all the pertinent information concerning aerodrome site, facilities, services, equipment, operating procedures, organisation, standards, conditions and the levels of services and management including Safety Management System. The information presented in the Aerodrome Manual shall demonstrate that the aerodrome conforms to regulation and that there are no apparent shortcomings that would adversely affect the safety of aircraft operations.

3.1.2 The Aerodrome Manual shall be used as a reference document and provides a checklist of Aerodrome Certificate standards to be maintained and the level of airside services at the aerodrome. Information provided in the Aerodrome Manual will enable the Authority to assess the suitability of the aerodrome for the aircraft operations proposed. It is the basic reference guide for the Authority to utilise when conducting site inspections for granting an Aerodrome Certificate and for subsequent safety audits and inspections.

3.1.3 An applicant for an Aerodrome Certificate shall develop and maintain an Aerodrome Manual acceptable to the Authority.

**GM 1 to Chapter 3, 3.1.3:** The Aerodrome Manual is subject to amendment, in order to ensure that it provides current and accurate information at all times. The Aerodrome Operator is responsible for maintaining the currency and accuracy in this respect.

**GM 2 to Chapter 3, 3.1.3:** Aerodrome Operators are responsible for submitting the initial Aerodrome Manual and subsequent amendments to the Authority for acceptance using the “Documents” module in the GCAA Q-Pulse System.

#### 3.2 PREPARATION OF THE AERODROME MANUAL

3.2.1 The Aerodrome Manual shall:

- a) be type written
- b) signed by the Accountable Manager;
- c) be submitted electronically;



- d) be in a format that is easy to revise;
- e) have a system for recording the currency of pages and amendments, thereto, and should include a page for logging revisions;
- f) be organised in a manner that will facilitate the preparation, review and acceptance process; and
- g) be supported by a completed Aerodrome Manual Checklist.

*Note: Aerodrome Manual Checklist (ANF-ADC-004) is available upon request from the GCAA.*

### 3.3 LOCATION OF THE AERODROME MANUAL

- 3.3.1 The Aerodrome Operator shall provide the Authority with one complete and current electronic .pdf version of the Aerodrome Manual.
- 3.3.2 The Aerodrome Operator shall keep at least one complete and current copy of the Aerodrome Manual at the aerodrome and one copy at the Aerodrome Operator's principal place of business if different from the aerodrome.
- 3.3.3 The Aerodrome Operator shall make the Aerodrome Manual available to all relevant aerodrome personnel and for inspection by the Authority. This can be via hard copy or alternatively by electronic format contingent upon the staff member having immediate access to the information.

### 3.4 INFORMATION TO BE INCLUDED IN THE AERODROME MANUAL

- 3.4.1 The Aerodrome Operator of a Certified Aerodrome shall include in an Aerodrome Manual, the particulars as specified in Appendix 3, to the extent these are applicable to the aerodrome, under the following parts:

- Part 1: General Information
- Part 2: Particulars of the Aerodrome Site
- Part 3: Particulars of the Aerodrome Required to be Reported to the Aeronautical Information Service
- Part 4: Synopsis of the Aerodrome Operating Procedures and Safety Measures
- Part 5: RFS Aerodrome Manual Requirements
- Part 6: Aerodrome Administration and Safety Management System



- 3.4.2 If a particular is not included in an Aerodrome Manual because it is not applicable to the aerodrome, the Aerodrome Operator shall state in the Aerodrome Manual:
- a) that the particular is not applicable; and
  - b) why the particular is non-applicable.

### 3.5 AMENDMENT OF AERODROME MANUAL

- 3.5.1 The Aerodrome Operator shall amend and update the Aerodrome Manual whenever necessary in order to maintain the accuracy of the manual and the validity of the Aerodrome Certificate using a defined process that includes a record of all amendment, effective dates and amendment approvals.
- 3.5.2 To maintain the accuracy of the Aerodrome Manual, the Authority may issue written directions to an Aerodrome Operator requiring the Aerodrome Operator to amend the manual in accordance with the directions.
- 3.5.3 An Aerodrome Operator shall provide the Authority, as soon as practicable, with an amended version the Aerodrome Manual.
- GM 1 to Chapter 3, 3.5.3: Aerodrome Operators are responsible for submitting amended versions of the Aerodrome Manual to the Authority for acceptance using the "Documents" module in the GCAA Q-Pulse System.***
- 3.5.4 The Authority shall accept Aerodrome Manuals for Certified Aerodromes and any amendments thereto, provided these meet the requirements of these regulations.



## CHAPTER 4

### OBLIGATIONS OF THE AERODROME OPERATOR

#### 4.1 GENERAL

4.1.1 The Aerodrome Operator shall require all the users of the aerodrome including fixed-base operators and organisations which perform activities independently at the aerodrome related to, or in direct support of, the safe operation of aircraft to comply with the requirements laid down by the Aerodrome Operator with regard to safety and order at the aerodromes, and shall monitor such compliance.

4.1.2 Aerodrome Operators shall ensure that they:

- a) maintain their safety responsibilities over safety related activities conducted by those third party organisations related to, or in direct support of, the safe and secure operation of aircraft;
- b) have the power to access and inspect any third party organisations providing a service related to, or in direct support of, the safe and secure operation of aircraft operating from the aerodrome including its facilities and records to determine continued compliance with the relevant requirements through safety audits or inspections. The power to access and inspect shall be included in the contractual arrangement; and
- c) are able to impose operating restrictions in the event of non-compliance with the applicable safety and security requirements or unresolved safety or security deficiencies or concerns.
- d) Stipulate requirements for ground handling service providers to implement and maintain a safety management system commensurate with the size and complexity of their operation and to actively participate in the aerodrome operator's SMS where required.

*Note: Further information on the coordination of aerodrome operators and ground handling service providers can be found in ICAO DOC 10121 Manual on Ground Handling.*



## **4.2 COMPLIANCE**

The Aerodrome Operator shall comply with all applicable Authority Publications. The Aerodrome Operator shall also comply with any conditions that may be endorsed in the Aerodrome Certificate or Landing Area Acceptance pursuant to Chapter 2, 2.2.3, 2.2.4 and 2.6.

## **4.3 CONFORMANCE WITH AERODROME MANUAL**

Subject to any directions that the Authority may issue, an Aerodrome Operator holding an Aerodrome Certificate shall operate and maintain the aerodrome in accordance with the Aerodrome Manual and associated procedures and methodologies.

## **4.4 PROVISION OF APPROPRIATE INFRASTRUCTURE AND SERVICES**

4.4.1 The Aerodrome Operator shall provide appropriate infrastructures (including but not limited to) physical characteristics of the aerodrome; obstacle limitation surfaces; visual aids for navigation and for denoting obstacles and restricted use areas; and the equipment, installations and services required for the aerodrome are commensurate with the following:

- a) the characteristics of the aircraft that the aerodrome is intended to serve;
- b) the operating modality of the runway;
- c) the lowest meteorological minima intended for each runway; and
- d) the ambient light conditions intended for the operation of aircraft.

4.4.2 The requirements of (a) to (d) shall comply with the minimum specifications outlined in the appendices to these regulations and/or ICAO Annex 10 - Aeronautical Telecommunications as applicable.

## **4.5 OPERATING LIMITATIONS**

The Aerodrome Operator shall when necessary for the safety of aircraft operations at their aerodrome, establish any limitations on the use of the aerodrome that arise from the aerodrome design or the facilities or services provided at the aerodrome. Aerodrome Operators holding an Aerodrome Certificate shall document these in Part 1 of the Aerodrome Manual.



#### 4.6 INTERNAL QUALITY ASSURANCE

4.6.1 Each Aerodrome Operator holding an Aerodrome Certificate shall establish an internal quality assurance system to ensure compliance with, and the adequacy of, the procedures required by these regulations, and for the continued improvement of safety levels.

4.6.2 The internal quality assurance system shall include:

- a) A quality assurance policy and procedures that are relevant to the Aerodrome Operator's organisational goals. The Aerodrome Operator shall ensure that the quality assurance policy and procedures are understood, implemented and maintained at all levels of the organisation.
- b) Procedures to ensure that aeronautical data submitted to the Aeronautical Information Service as part of the Integrated Aeronautical Information Package, is at any moment:
  - i) checked and coordinated with relevant parties before it is submitted to the Aeronautical Information Service, in order to make certain that all necessary information has been included and that it is correct in detail prior to submission to the Authority;
  - ii) traceable to its origin to allow any data anomalies or errors, detected during production/maintenance phases or in operational use, to be corrected; and
  - iii) validated and verified to ensure that quality requirements (accuracy resolution, integrity) and traceability of aeronautical data as specified in Appendix 2, 2.1 are met.
- c) A procedure to ensure quality indicators, including defect and incident reports, and personnel and customer feedback, are monitored to identify existing problems or potential causes of problems within the system;
- d) A procedure for corrective action to ensure any problems that have been identified within the system are corrected in a timely manner; The procedure for corrective action shall specify how:
  - i) to correct any identified problem;
  - ii) to follow up a corrective action in a timely manner to ensure the action is effective; and
  - iii) management will measure the effectiveness of any corrective action taken.





- e) A procedure for preventive action to ensure that potential causes of problems that have been identified within the system are remedied. The procedure for preventive action shall specify how:
  - i) to correct a potential problem;
  - ii) to follow up a preventive action to ensure the action is effective;
  - iii) to amend any procedure required by these regulations as a result of a preventive action; and
  - iv) management will measure the effectiveness of any preventive action taken.
- f) An internal quality audit programme to audit the Aerodrome Operator's organisation for compliance monitoring of its quality management system with the procedures in its Aerodrome Manual and associated documentation and achievement of the goals set in its quality assurance policy; and

**AMC to 4.6.2 f) Internal Quality Assurance**

*Quality Audit Programme: The internal quality audit programme should:*

- a) specify the section, item, frequency and location of the audits taking into account the nature of the activity to be audited;
- b) ensure audits are carried out by trained auditing personnel who are independent of those having direct responsibility for the activity being audited;
- c) ensure the results of audits are reported to the personnel responsible for the activity being audited and the manager responsible for internal audits;
- d) require preventive or corrective action to be taken by the personnel responsible for the activity being audited if problems are found by the audit;
- e) ensure follow up audits to review the effectiveness of any preventive or corrective action has been taken in a timely manner; and
- f) ensure all audit findings and observations are evidenced and properly recorded
- g) Management review procedures that shall include the use of statistical analysis, to ensure the continuing suitability and



effectiveness of the internal quality assurance system in satisfying the requirements of these regulations.

#### **4.7 SAFETY MANAGEMENT SYSTEM (SMS)**

4.7.1 An Aerodrome Operator holding an Aerodrome Certificate shall establish a Safety Management System (SMS) for the aerodrome as required by CAR Part X, that as a minimum:

- a) identifies safety hazards;
- b) ensures remedial action necessary to maintain an acceptable level of safety is implemented;
- c) provides for continuous monitoring and regular assessment of the safety level achieved;
- d) aims to make continuous improvement to the overall level of safety; and
- e) clearly defines lines of safety accountability through the Aerodrome Operator's organisation, including direct accountability for safety on the part of senior management;
- f) assesses the impact of the aerodrome compatibility whenever introducing an aeroplane type/model new to the aerodrome irrespective of the size of the aeroplane in accordance with Appendix 6 of this regulation by conducting an aerodrome compatibility study; and
- g) assess the impact of proposed changes or deviations to Civil Aviation Regulations in accordance with Appendix 4 of this regulation by conducting an impact assessment.

4.7.2 An Aerodrome Operator holding an Aerodrome Certificate shall as part of their SMS establish defined levels of safety for the following safety events in which the aerodrome's staff, systems, training, procedures, licensing programs, maintenance, facilities, services and/or infrastructure were a contributory factor:

- a) Accidents and incidents involving aircraft on the ground including, but not limited to the following:
  - i) Runway Incursion - CAT A/CAT B;
  - ii) Runway Incursion - CAT C/CAT D;



- iii) Manoeuvring Area Excursion - CAT A/CAT C (related to Runway); and
- iv) Aircraft Damage - CAT A/CAT B;
- b) Accidents and incidents involving airside ground vehicles;
- c) Runway friction measurements;
- d) AGL reliability (as it affects airport operation);
- e) FOD materials found on airport pavements and runway/taxiway strip areas;
- f) Bird and wildlife strikes with aircraft (Bird & Wildlife Hazard - CAT A/CAT B); and
- g) Fuel spills and fuel handling accidents and incidents.

*Note: Refer to guidance included in AMC-22 – Safety Incident Reporting for definitions of reporting categories.*

4.7.3 The defined levels of safety shall be expressed in the following two terms:

- a) Safety Performance Indicators;
- b) Safety Performance Targets.

4.7.4 Safety Performance Targets shall be supported by an action plan.

4.7.5 Aerodrome Operators holding an Aerodrome Certificate shall define annual Safety Performance Targets for each of the following incident classifications:

- a) Runway Incursions - CAT A/CAT B;
- b) Runway Incursion - CAT C/CAT D;
- c) Manoeuvring Area Excursion - CAT A/CAT C (related to Runway); and
- d) FOD Incident resulting in Aircraft Damage (any category).

4.7.6 An Aerodrome Operator holding an Aerodrome Certificate shall conduct an analysis of Achieved Levels of Safety at the end of each calendar year. The analysis shall include a reassessment of current defined Safety Performance Targets and any required amendments required to maintain or improve safety levels.



- 4.7.7 The annual Achieved Safety Assessment analysis report for the items in 4.7.5, together with an action plan if required, shall be forwarded to the Authority for acceptance before the 31<sup>st</sup> of January of each year.
- 4.7.8 Reserved.
- 4.7.9 The Aerodrome Operator shall require all the users of the aerodrome including fixed-base operators and organisations, to fully support the programme to promote safety at the aerodrome by attending and contributing to the aerodrome's various safety committees, immediately informing the Aerodrome Operator of accidents, incidents, defects and faults which have the potential to effect safety.
- 4.7.10 **Reporting**
- The Aerodrome Operator shall establish procedures for the notification, investigation, and reporting of safety events in accordance with these regulations.
- 4.7.11 The Aerodrome Operator shall establish a system for immediate notification of accidents/serious incidents/unlawful interference to the Authority. The system shall include the following as a minimum:
- a) Contain a list of occurrences that shall be immediately notified to the Authority;
  - b) Be adequate to assure that the accident/serious incident/unlawful interference is notified to the GCAA Duty Investigator, as soon as possible, by the most expeditious means, and with sufficient information;
  - c) Ensure concerned personnel are educated to meet the immediate notification requirement;
  - d) Ensure concerned personnel are tested and trained through pre-determined exercises; and
  - e) Be documented in the organisation's applicable manuals which are subject to acceptance by the Authority.
- Note: Guidance concerning information to be provided to the GCAA Duty Investigator is available in AMC-22 – Safety Incident Reporting.*
- 4.7.12 In addition to the requirements in 4.7.11, an Aerodrome Operator holding an Aerodrome Certificate shall also ensure accidents, serious incidents, and other reportable occurrences are notified and reported in a form and manner established by the GCAA. Reports shall contain all pertinent information about the condition and evaluation results known to the person or organisation and details of the investigation and actions it intends to take to prevent similar occurrences in the future.



**AMC 1 to Chapter 4, 4.7.12:** Definitions, examples of reportable occurrences, and established notification and reporting timeframes are provided in AMC-22 – Safety Incident Reporting.

- 4.7.13 The Aerodrome Operator shall ensure that information provide under 4.7.12 is accurate, unambiguous and complete and additional information regarding safety events including the details and outcome of the investigation undertaken further to aerodrome's Safety Management System, are uploaded to the relevant ROSI file.
- 4.7.14 An Aerodrome Operator shall establish a system to educate their personnel of how to report an actual or potential safety deficiency through the Voluntary Reporting System.

*Note: Guidance regarding VORSY is available in AMC-57 – Voluntary Reporting System.*

#### 4.8 AERODROME MANAGEMENT SAFETY PROGRAMMES

An Aerodrome Operator holding an Aerodrome Certificate shall:

- a) establish, lead and implement safety programmes to promote safety and the exchange of safety-relevant information; and
- b) require the organisations operating or providing services at the aerodrome to be involved in such programmes.

*Note: Acceptable Means of Compliance and Guidance Material regarding Aerodrome Management Safety Programmes is available in Appendix 20 – Acceptable Means of Compliance Guidance on Aerodrome Management – Safety Programmes.*

#### 4.9 COMPETENCE OF OPERATIONAL AND MAINTENANCE PERSONNEL

*Note: See Chapter 2, 2.7 for related Personnel Requirements.*

#### 4.10 NOTIFYING AND REPORTING INFORMATION TO THE AERONAUTICAL INFORMATION SERVICE

- 4.10.1 An Aerodrome Operator holding an Aerodrome Certificate should notify and report aeronautical data to the Aeronautical Information Service.
- 4.10.2 To ensure that the Aeronautical Information Service obtains information to enable them to provide up-to-date pre-flight information and to meet the need for in-flight information, arrangements shall be made between the Aeronautical Information Service and the Aerodrome Operator or its designated unit



responsible for aerodrome services to report to the Aeronautical Information Service, with a minimum of delay:

- a) information on the status of certification of aerodromes and aerodrome conditions in accordance with Chapter 2; Chapter 4, 4.10 and 4.11; and Appendix 2, 2.8;
- b) the operational status of associated facilities, services and navigation aids within their area of responsibility; and
- c) any other information considered to be of operational significance.

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

4.10.4 Of a particular importance are changes to aeronautical information that affect 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 6 and Appendix 4. The predetermined, internationally agreed AIRAC effective dates in addition to 14 days postage time shall be observed by the responsible aerodrome services when submitting the raw information/data to aeronautical information services.

4.10.5 The aerodrome services responsible for the provision of raw aeronautical information/data to the Aeronautical Information Service shall do that while taking into account accuracy and integrity requirements for aeronautical data as specified in Appendix 5.

*Note 1: Specifications for the issue of NOTAM are contained in ICAO Annex 15, Chapter 5 and Appendices 6 and 2, respectively.*

*Note 2: AIRAC information is distributed by the Aeronautical Information Service 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 and guidance for the AIRAC use are contained in the ICAO Aeronautical Information Services Manual (Doc 8126)*



4.10.6 Aerodromes Operator shall notify and report aeronautical data to the Aeronautical Information Service according to the following specifications including in CAR Part VIII - Air Navigation Regulations, Subpart 2,

- a) Specifications for Aeronautical Charts; and
- b) Specifications for NOTAM.

4.10.7 **Notification of Inaccuracies in Aeronautical Information Service Publications**

An Aerodrome Operator shall review all issues of Aeronautical Information Publication (AIP), AIP Supplements, AIP Amendments, Notices to Airmen (NOTAMS), Pre-flight Information Bulletins and Aeronautical Information Circulars issued by the Aeronautical Information Service on initial receipt, thereof, and at regular intervals thereafter. Immediately after such reviews, an Aerodrome Operator shall notify the Aeronautical Information Service of any inaccurate information contained therein that pertains to the aerodrome.

4.10.8 **Notification of Changes in Aerodrome Facilities, Equipment and Level of Service Planned in Advance**

In addition to the approval process in 4.19, an Aerodrome Operator shall submit notification of any change to the aerodrome facility or equipment or the level of service at the aerodrome that has been planned in advance and that is likely to affect the accuracy of the information contained in any of the elements comprising the Integrated Aeronautical Information Package to the Aeronautical Information Service.

*Note 1: Acceptance for publication of information in any of the elements comprising the Integrated Aeronautical Information Package does not equate to regulatory approval.*

*Note 2: Regulatory approval for proposed changes to airside physical infrastructure and air navigation equipment is required. Requirements for regulatory approval are in 4.19 as well as AMC-59 – Aerodrome Projects, CAR Part VIII – Air Navigation Regulations and AMC-25 – Air Navigation Facilities.*

4.10.9 **Issues Requiring Immediate Notification to the Aeronautical Information Service**

An Aerodrome Operator shall, give to the Aeronautical Information Service and cause to be received at the Air Traffic Services Unit and the flight operations unit, immediate notice (NOTAM request) giving details of any of the circumstances listed in CAR VIII – Air Navigation Regulations, Subpart 2 – CAR 2.29.

4.10.10 **Obstacle Data**



An Aerodrome Operator shall notify the Aeronautical Information Service, the geographical coordinates and the top elevation of all obstacles that penetrate the obstacle limitation surfaces as defined in Appendix 13. The information shall be kept up to date by periodic survey.

*Note: See AMC-61 – Aerodrome Survey Requirements for required periodicity of surveys.*

#### **4.11 NOTIFYING AND REPORTING INFORMATION REGARDING CONDITION OF MOVEMENT AREA & RELATED FACILITIES**

4.11.1 Information on the condition of the Movement Area and the operational status of related facilities shall be provided to the Aeronautical Information Service, and similar information of operational significance to the Air Traffic Services Unit, 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.

*Note: The nature, format and conditions of the information to be provided are specified in UAE CAR PART VIII Subpart II. Further details are specified in ICAO PANS\_AIM (DOC 10066) and PANS-ATM (Doc 4444). Specific procedures pertaining to work in progress on movement area and to the reporting of such works are specified in the PANS Aerodromes (DOC 9981)*

4.11.2 The condition of the Movement Area and the operational status of related facilities shall be monitored and reports on matters of operational significance affecting aircraft and aerodrome operations shall be provided in order to take appropriate action, particularly in respect of the following:

- a) Construction or maintenance work;
- b) Rough or broken surfaces on a runway, a taxiway or an apron;
- c) Water on a runway, a taxiway or an apron;
- d) Other contaminants on a runway, taxiway or apron;
- e) Other temporary hazards, including parked aircraft;
- f) Failure or irregular operation of part or all of the aerodrome visual aids;
- g) Failure or irregular operation of the primary or secondary power supply;
- h) Reduction in category of Rescue Fire Service;





- i) Evacuation of a passenger terminal;
- j) Significant changes in aerodrome lighting and other visual aids;
- k) Erection or removal of obstructions to air navigation, and erection or removal of significant obstacles in take-off, climb or approach areas; and
- l) Any other information of operational significance.

*Note 1: Other contaminants may include mud, dust, sand, volcanic ash, oil and rubber. Procedures for monitoring and reporting the conditions of the movement area are included in PANS-Aerodromes (Doc 9981)*

*Note 2: The Aeroplane Performance Manual (Doc 10064) provides guidance on aircraft performance calculation requirements regarding the description of runway surface conditions in 2.9.2 c).*

*Note 3: Origin and evolution of data, assessment process and the procedures are prescribed in the PANS-Aerodrome (Doc 9981). These procedures are intended to fulfil the requirements to achieve the desired level of safety for aeroplane operations prescribed in Annex 6 and Annex 8 and to provide the information fulfilling the syntax requirements for dissemination specified in Annex 15 and the PANS-ATM (Doc 4444).*

- 4.11.3 To facilitate compliance with 4.11.1 and 4.11.2, inspections of the Movement Area shall be carried as per 4.16.4.

**AMC 1 to Chapter 4, 4.11.3** *Personnel assessing and reporting runway surface conditions required in 4.11.2 and 4.11.4 shall be trained and competent to perform their duties.*

*Note 1: Procedures on carrying out daily inspections of the movement area are given in AMC-36 and in the PANS-Aerodromes (Doc 9981). Further guidance is available in the Airport Services Manual (Doc 9137), Part 8, in the Manual of Surface Control Systems (A-SMGCS) Manual (Doc 9830)*

*Note 2: The PANS – Aerodromes (Doc 9981) contains clarifications on the scope of a significant change in the runway surface conditions.*

*Note 3: Guidance on training of personnel is given in AMC-36 and ICAO Annex 14, Attachment A, Section 6.*

*Note 4: Information on training for personnel assessing and reporting runway surface conditions is available in the PANS-Aerodromes (Doc 9981) ICAO Circular 355 AN/211 Assessment, Measurement and Reporting of Runway Surface Conditions Appendix H*



- 4.11.3.1 Information that a runway or portion thereof may be slippery when wet shall be made available.

*Note: The determination of a runway or portion thereof may be slippery when wet is not based solely on the friction measurement obtained using a continuous friction measuring device. Supplementary tools to undertake this assessment are described in the ICAO Airport Services Manual (Doc 9137), Part 2.*

- 4.11.3.2 Notification shall be given to aerodrome users when the friction level of a paved runway or portion thereof is less than the Minimum Friction Level

*Note 1: Guidance on determining and expressing the Minimum Friction Level and types of friction measuring devices is provided in AMC-32 – The Assessment of Runway Surface Friction Characteristics.*

*Note 2: Guidance on conducting a runway surface friction characteristics evaluation programme that includes determining and expressing the minimum friction level is provided in ICAO Annex 14, Volume 1, Attachment A, Section 7.*

#### 4.11.4. Runway Surface Condition(s)

- 4.11.4.1 The runway surface condition shall be assessed and reported through a runway condition report including a runway condition code (RWYCC) and a description using the following terms:

- (1) DRY
- (2) STANDING WATER
- (3) WET

*Note 1: The conditions, either singly or in combination with other observations, are criteria for which the effect on aeroplane performance is sufficiently deterministic to allow assignment of a specific runway condition code.*

#### **AMC 1 to Chapter 4.11.4.1 - Reporting**

- a) The aerodrome operator shall disseminate a RCR through the aeronautical information services and air traffic services, when the runway is wholly or partly contaminated by standing water. When the runway is wet, not associated with the presence of standing water the assessed information shall be disseminated using the RCR through the air traffic services only.



- b) Reporting, in compliance with the runway condition report, shall commence when a significant change in runway surface condition occurs due to water.*
- c) Reporting of the runway surface condition shall continue to reflect significant changes until the runway is no longer contaminated. When this occurs, the aerodrome shall issue a runway condition report that states the runway is wet or dry as appropriate.*

**AMC 2 to Chapter 4.11.4.1 – Runway Condition Code (RWYCC)**

- a) The RWYCC shall be reported for each third of the runway assessed.*
- b) The assessment process shall include:*
  - 1. Assessing and reporting the condition of the movement area;*
  - 2. Providing the assessed information in the correct format; and*
  - 3. Reporting significant changes without delay.*
- c) The information to be reported shall be compliant with the RCR which consists:*
  - 1. Aeroplane performance calculation sections; and*
  - 2. Situational awareness section.*
- d) The information shall be included in an information string in the following order using only AIS compatible characters in a Runway Condition Report. The Runway Condition Report consist of the:*
  - 1. Aeroplane performance calculation sections:*
    - i) aerodrome location indicator;*
    - ii) date and time of assessment;*
    - iii) lower runway designation number;*
    - iv) RWYCC for each runway third;*
    - v) per cent coverage contaminant for each runway third;*
    - vi) depth of loose contaminant for each runway third;*



vii) condition description for each runway third; and

viii) width of runway to which the RWYCCs apply if less than published width.

1. *situational awareness section:*

i) *reduced runway length;*

ii) *taxiway conditions;*

iii) *apron conditions;*

iv) *plain language remarks.*

e) *For aerodromes with multiple runways the aeroplane performance section for each individual runway shall be reported from the date and time of the assessment for each runway before the information in the situational awareness section (see d) 1. - items ii – viii above).*

f) *The syntax requirement shall be strictly adhered to when provided the assessed information through the RCR.*

*Note 1: Elements in the situational awareness section should end with a full stop.*

*Note 2: Elements in the situational awareness section for which no information exists, or where the conditional circumstances for publication are not fulfilled, should be left out completely.*

*Note 3: For item B – i) reduced runway length the applicable runway designator and available length in metres should be inserted (e.g. RWY nn [L] or nn [C] or nn [R] REDUCED TO [n]nnn). This information is conditional when a NOTAM has been published with a new set of declared distances.*

**GM1 to Chapter 4.11.4.1 - General**

a) *It is recognized that information provided by the aerodrome's personnel assessing and reporting runway surface condition is crucial to the effectiveness of the runway condition report. A misreported runway condition alone should not lead to an accident or incident. Operational margins should cover for a reasonable error in the assessment, including unreported changes in the runway condition. But a misreported runway condition can mean that the margins are no longer available to cover for other operational variance (such as unexpected*



*tailwind, high and fast approach above threshold or long flare). This is further amplified by the need for providing the assessed information in the proper format for dissemination.*

- b) Assessing and reporting the condition of the movement area and related facilities is necessary in order to provide the flight crew with the information needed for safe operation of the aeroplane. The RCR is used for reporting assessed conditions through the issuance of SNOWTAM, when necessary.*
- c) Generally, movement areas are exposed to a multitude of climatic conditions and consequently a significant difference in the condition to be reported. The RCR describes a basic structure applicable for all these climatic variations. Assessing the runway surface condition relies on a great variety of techniques and no single solution can apply to every situation.*
- d) The philosophy of the RCR is that the aerodrome operator assesses the runway surface condition whenever water is present on an operational runway. From this assessment, a RWYCC and a description of the runway surface are reported, which can be used by the flight crew for aeroplane performance calculations. This format, based on the type, depth and coverage of contaminants, is the best assessment of the runway surface condition by the aerodrome operator; however, all other pertinent information is taken into consideration and kept up to date, and changes in conditions are reported without delay.*
- e) The RWYCC reflects the runway braking capability as a function of the surface conditions. With this information, the flight crew can derive, from the performance information provided by the aeroplane manufacturer, the necessary stopping distance of an aircraft on the approach under the prevailing conditions.*

#### **AMC3 to Chapter 4.11.4.1**

##### **COMPLETE INFORMATION STRING**

*An example of a complete information string prepared for dissemination is as follows:*

*[COM header and abbreviated header] (Completed by AIS)*

GG EADBZQZX EADNZQZX EADSZQZX

070645 EADDYNYX



SWEA0151 OMDD 02170055

SNOWTAM 0151

*[Aeroplane performance calculation section] (Completed by the Aerodrome Operator)*

OMUA 02170055 12L 2/2/2 100/100/100 4/4/4 STANDING WATER/STANDING  
WATER/STANDING WATER

OMUA 02170135 12R 5/5/5 100/100/100 NR/NR/NR WET/WET/WET

*[Situational awareness section] Completed by the Aerodrome Operator)*

TWY B POOR. APRON NORTH POOR.

### **GM2 to Chapter 4.11.4.1 Runway Condition Report**

#### **AEROPLANE PERFORMANCE CALCULATION SECTION**

- a) *The aeroplane performance calculation section is a string of grouped information, separated by a space ' ' ending with a return and a two-line feed '<<≡', in order to distinguish the aeroplane performance calculation section from the following situational awareness section or the following aeroplane performance calculation section of another runway.*
- b) *The information to be included in this section consists of the following:*
  - (1) *Aerodrome location indicator: a four-letter ICAO location indicator in accordance with ICAO Doc 7910, Location Indicators. This information is mandatory.  
Format: nnnn*
  - (2) *Date and time of the assessment: date and time (UTC) when the assessment was performed. This information is mandatory.  
Format: MMDDhhmm*
  - (3) *Lower runway designation number: a two- or three-character number identifying the runway for which the assessment is carried out and reported. This information is mandatory.  
Format: nn[L] or nn[C] or nn[R]*
  - (4) *Runway condition code for each runway third: a one-digit number identifying the RWYCC assessed for each runway third. The codes are reported in a three-character group separated by a '/' for*



*each third. The direction for listing the runway thirds is the direction as seen from the lower designation number.*

*This information is mandatory.*

*When transmitting information on the runway surface condition by air traffic services to flight crews, the sections are, however, referred to as the first, second or third part of the runway. The first part always means the first third of the runway as seen in the direction of landing or take-off as illustrated in Figures 1 and 2.*

*Format: n/n/n*

*Example: 5/5/2*

- (5) *Per cent coverage contaminant for each runway third: a number identifying the percentage coverage. The*

*percentages are to be reported in an up-to nine-character group separated by a '/' for each runway third. The assessment is based upon an even distribution within the runway thirds using Table 1.*

*This information is conditional. It is not reported for any runway third that is dry or covered with less than 10 per cent.*

*Format: [n]nn/[n]nn/[n]nn*

*Example: 25/50/100*

*In case of uneven distribution of the contaminants, additional information is given in the plain language remark part of the situational awareness section of the RCR. Where possible, a standardised text is used.*

*When no information is to be reported, 'NR' is inserted at the relevant position of the message, to indicate to the user that no information exists.*

- (6) *Depth of loose contaminant: standing water for each runway third: a two- or three-digit number representing the assessed depth (mm) of the contaminant for each runway third. The depth is reported in a six- to nine-character group separated by a '/' for each runway third as defined in Table YYY. The assessment is based upon an even distribution within the runway thirds following an assessment. If measurements are included as part of the assessment process, the reported values are still reported as assessed depths.*



*This information is conditional. It is reported only for STANDING WATER.*

*Format: [n]nn/[n]nn/[n]nn*

- (7) *Condition description for each runway third: to be reported in capital letters using the terms specified in 4.11.4.1. The condition types are separated by an oblique stroke '/'.*

*This information is mandatory.*

*Format: nnnn/nnnn/nnnn*

- (8) *Width of runway to which the RWYCCs apply if less than the published width: two digit number representing the width of cleared runway in metres.*

*Format: nn*

*If the cleared runway width is not symmetrical along the centre line, additional information is given in the plain language remark part of the situational awareness section of the RCR.*

#### SITUATIONAL AWARENESS SECTION

- a) *All individual messages in the situational awareness section end with a full-stop sign, in order to distinguish the message from subsequent message(s).*

- b) *The information to be included in this section consists of the following:*

- (1) *Reduced runway length*

*The information is conditional when a NOTAM has been published with a new set of declared distances affecting the landing distance available (LDA).*

*Format: Standardised fixed text – RWY nn [L] or nn [C] or nn [R]  
LDA REDUCED TO [n]nnn*

- (2) *Taxiway conditions*

*This information is optional.*

*Format: TWY [nn]n POOR*

- (3) *Apron conditions*

*This information is optional.*

*Format: APRON [nnnn] POOR*





*(4) Plain language remarks using only allowable characters in capital letters*

*Where possible, standardised text is used. 'UPGRADED or DOWNGRADED' is used whenever assessed RWYCC differs from what follows directly from RCAM.*

*This information is optional.*

*Format: Combination of allowable characters where use of full stop '.' marks the end of the message.*

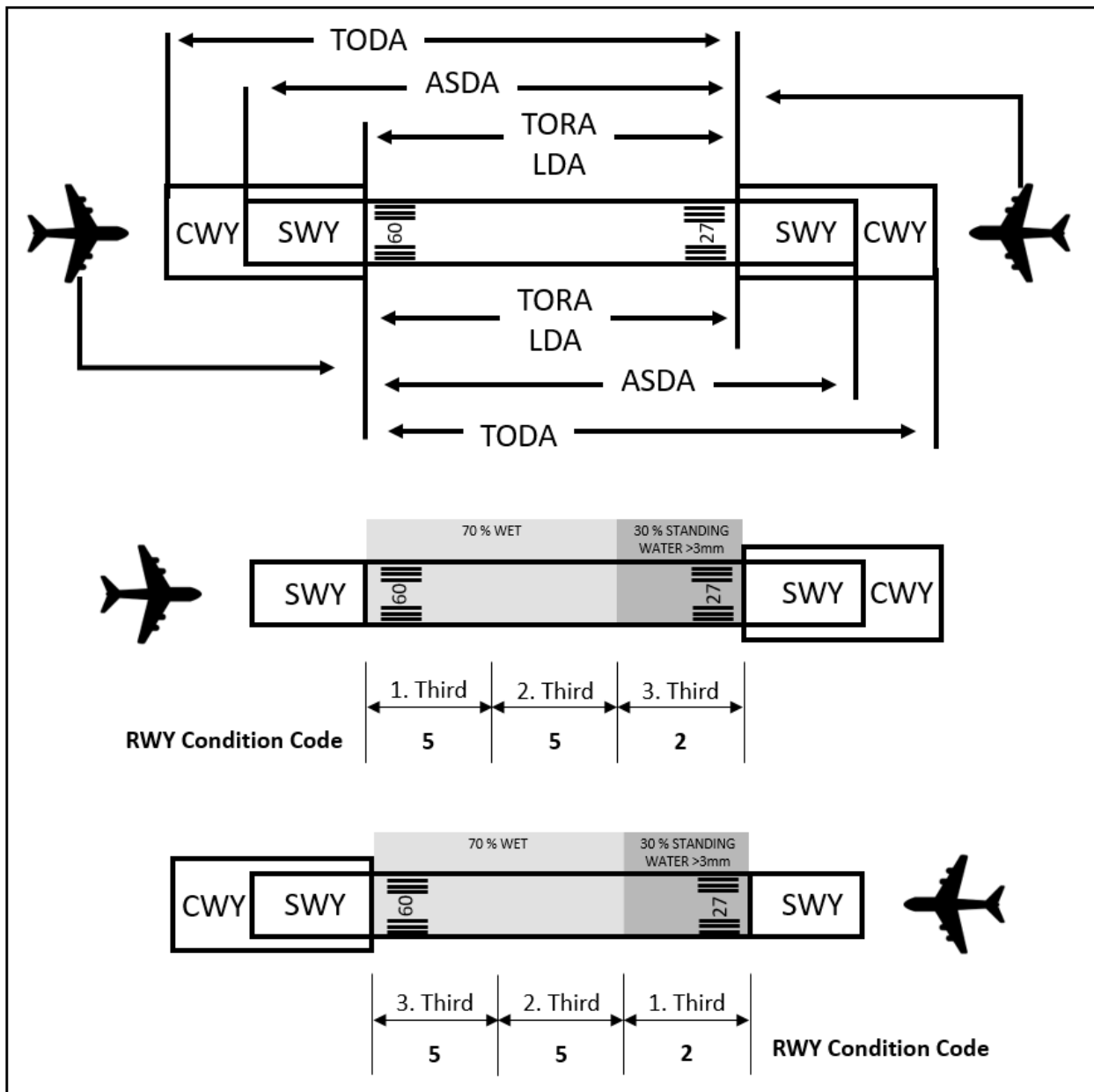
*Allowable characters:*

*A B C D E F G H I J K L M N O P Q R S T U V W X Y Z*

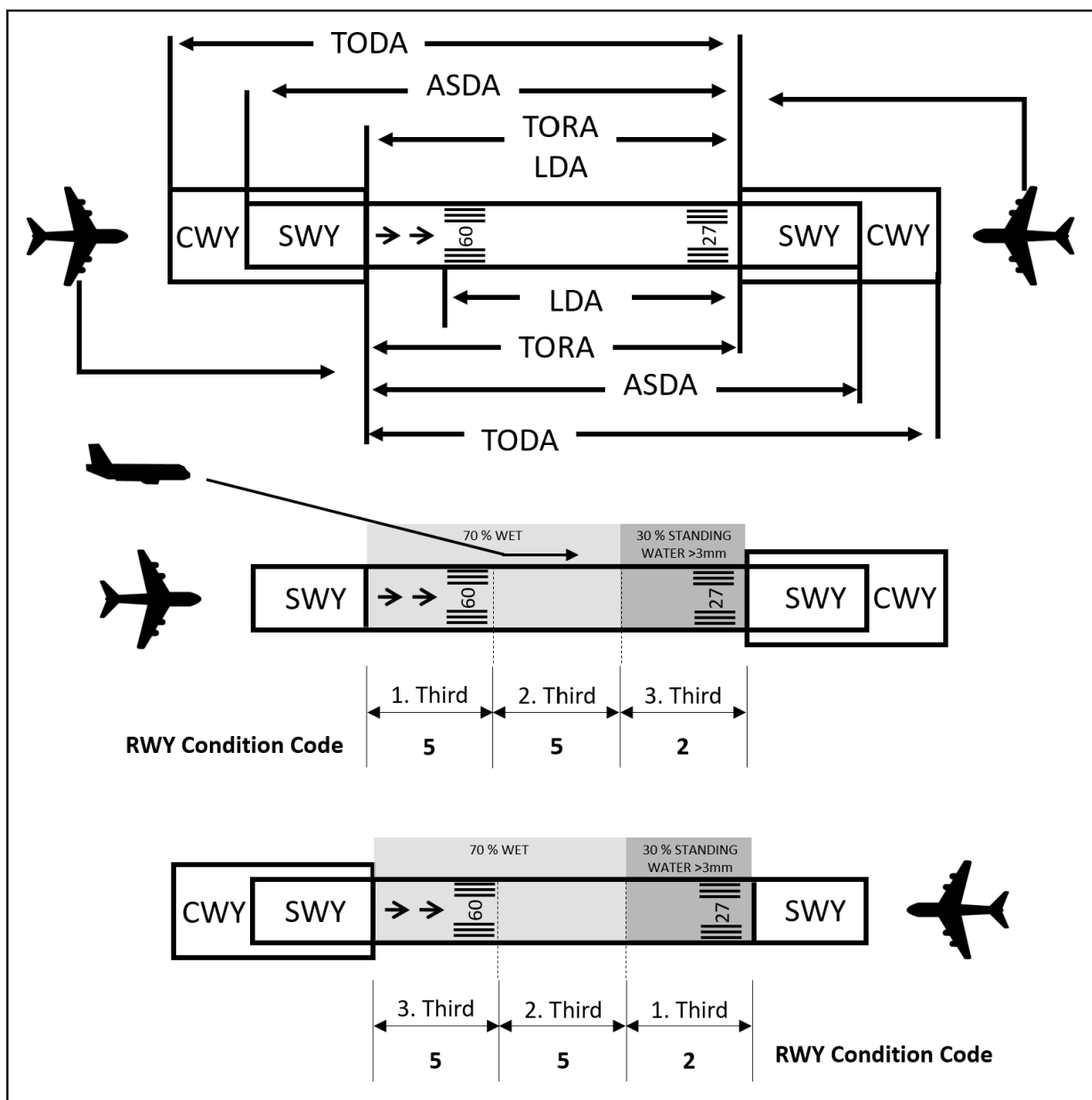
*0 1 2 3 4 5 6 7 8 9*

*/ [oblique stroke] '.' [period] ' ' [space]*

*Note: For reasons of simplicity winter condition items have not been amended to UAE regulations. For detailed information refer to ICAO Annex 14, Attachment A, ICAO Circular 355 AN/211 Assessment, Measurement and Reporting of Runway Surface Conditions and ICAO PANS Aerodromes (Doc 9981).*



**Figure 4-1 – Reporting of RWYCC**  
from air traffic services to flight crew for runway thirds



**Figure 4-2 – Reporting of RWYCC for runway thirds from air traffic services to flight crew on a runway with displaced threshold**

#### AMC4 to Chapter 4.11.4.1 – Significant Changes

A change in the runway surface condition used in the RCR is considered significant whenever there is any:



- a) *change in the RWYCC;*
- b) *change in the contaminant type;*
- c) *change in reportable contaminant coverage according to Table 4-1;*
- d) *change in contaminant depth according to Table 4-2; and*
- e) *other information, for example a pilot report of runway braking action, which according to assessment techniques used, are known to be significant.*

Assessed per cent	Reported per cent
10-25	25
26-50	50
51-75	75
76-100	100

**Table 4-1 – Percentage of coverage for contaminants**

Contaminant	Valid values to be reported	Significant change
Standing Water	04, then assessed value	3mm

**Table 4-2 – Depth assessments for contaminant**

*Note 1: For STANDING WATER, 04 (4 mm) is the minimum depth value at and above which the depth should be reported. From 3 mm and below, the runway third should be considered WET.*

*Note 2: Above 4 mm for STANDING WATER an assessed value should be reported and a significant change relates to the observed change from this assessed value.*



*Note 3: Table 2 is reduced to wet and dry aerodromes only. For full table refer to ICAO Doc 9981.*

**GM3 to Chapter 4.11.4.1 – Example of Reporting Depth of Contaminant Whenever there is a Significant Change**

- a) *After the first assessment of runway condition, a first RCR is generated. The initial report is:*

*5/5/5 100/100/100 NR/NR/NR WET/WET/WET*

*Note — The full information string is not used in this example.*

- b) *With continuing precipitation, a new RCR is required to be generated as a subsequent assessment reveals the depth of contamination has increased from 2 mm to 5 mm along the entire length of the runway and therefore a change in the RWYCC is needed. A second RCR is therefore created as:*

*2/2/2 100/100/100 05/05/05 STANDING WATER/STANDING WATER/STANDING WATER*

- c) *With even more precipitation, a further assessment reveals the depth of contamination has increased from 5 mm to 7 mm along the entire length of the runway. However, a new RCR is not required because the RWYCC has not changed (change in depth is less than the significant change threshold of 3 mm).*

- d) *A final assessment of the contamination reveals that the depth has increased to 10 mm. A new RWYCC is required because the change in depth from the last RCR (second RWYCC), i.e. from 5 mm to 10 mm is greater than the significant change threshold of 3 mm. A third RCR is thus created as below:*

*2/2/2 100/100/100 10/10/10 STANDING WATER/STANDING WATER/STANDING WATER*

*For runway conditions other than STANDING WATER, the depth is not reported. The position of this type of information in the information string is then identified by /NR/.*

*When the depth of the contaminants varies significantly within a runway third, additional information is to be given in the language remark part of the situational awareness section of the RCR.*



- 4.11.4.2 Whenever an operational runway is contaminated, an assessment of the contaminant depth and coverage over each third of the runway shall be made and reported.

*Note: Procedures on depth and coverage reporting are found in the PANS-Aerodromes (Doc 9981)*

**AMC 1 to Chapter 4.11.4.2 – Runway Condition Assessment Matrix (RCAM)**

*The aerodrome operator shall use the following RCAM in order to assign the RWYCC (ref. Table 4-3: Runway Condition Assessment Matrix – WET and DRY Aerodromes only).*



**Table 4-3: Runway Condition Assessment Matrix - WET and DRY Aerodromes only.**

RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	• DRY	---	---
5	• WET (the runway surface is covered by any visible dampness or water up to and including 3 mm depth)	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4		Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	• WET ("slippery wet" runway)	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	MEDIUM
2	<b>More than 3 mm depth of water:</b> • STANDING WATER	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1		Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0		Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

*Note: Runway Condition Assessment Matrix for reasons of simplicity reduced to wet and dry aerodromes only, as winter conditions do not apply to UAE aerodromes. For complete table including winter conditions refer to PANS-Aerodromes, Doc 9981*

**GM1 to Chapter 4.11.4.2 Available Means used to Determine the RWYCC**



- a) *The visual inspection of the movement area to assess the surface condition is the core method to determine the RWYCC. An overall assessment however implies more than that. The continuous monitoring of the development of the situation and the prevailing weather conditions is essential to ensure safe flight operations. Other factors that might have influence on the assessment result are the outside air temperature, the surface temperature, the dew point, the wind speed and direction, the effect of surface treatment, control and deceleration of the inspection vehicle, the pilot reports of braking action, the output from friction measuring devices, the weather forecast, etc. Due to interaction between them, a deterministic method on how these factors affect the RWYCC to be reported cannot be precisely defined.*
- b) *The RCAM supports the classification of runway surface conditions by their effect on aeroplane braking performance using a set of criteria identified and quantified based on the best industry knowledge, built on dedicated flight testing and in-service experience. The thresholds at which a criterion changes the classification of a surface condition are intended to be reasonably conservative, without being excessively pessimistic.*
- c) *The following describe why the primary classification criteria in the RCAM have been set this way, and why it is important for aerodrome personnel to monitor and accurately report conditions when operating close to the boundaries of each RWYCC:*

1. *Percentage of coverage with contamination in each runway third.*

*A runway is considered contaminated whenever the extent of the coverage is more than a quarter of the surface of at least one third of the runway. It is important to note that whenever coverage is assessed to be below the 25 per cent threshold in each third, the computation assumption made by flight crew will be a dry runway (uniformly bare of moisture, water and contamination). It has been demonstrated that in conditions of contamination just below the reporting threshold but concentrated in the most unfavourable location, this assumption of dry runway still provides positive stop margins.*





## 2. Type of contaminant

*Different contaminants affect the contact area between tyre and runway surface, where the stopping force is generated, in different ways. A water film of any depth leads to the partial (viscous aquaplaning) or total separation (dynamic aquaplaning) of the tyre from the surface. The smaller the surface, the smaller the force of adhesion, the less braking is available. This is why the maximum braking force decreases at higher speed and depends on contaminant depth. Other fluid contaminants have a similar effect. Hard contaminants, such as ice or compacted snow, prevent the contact between tyre and runway surface completely and at any speed, effectively providing a new surface that the tyre rolls on. A deterministic classification of the stopping performance can be made only for the contaminants listed in the RCAM. For other reportable contaminants (oil, mud, ash, etc.), a large variance in the aeroplane performance effect exists, or insufficient data is available to permit a deterministic classification. An exception is rubber contamination, for which in-service data indicates that an assumption of RWYCC 3 provides a satisfactory performance margin. Runway surface treatments with sand, grit or chemicals may be very effective or even detrimental depending on the conditions of the application, and no credit can be attributed to such treatment without verification and validation.*

## 3. Depth of the contamination.

*The industry accepts that the threshold for the effect of depth of fluid contaminants on aeroplane performance is at 3 mm. Below this threshold, any type of fluid contaminant can be removed from the tyre/runway contact zone either by forced drainage or by compressing it into the macrotexture of the surface, thus allowing adhesion between tyre and surface to exist, albeit on less than the full footprint surface area. This is the reason that contamination depths up to 3 mm are expected to provide similar stopping performance as a wet runway. It should be noted that the physical effects causing reduced friction forces begin to take effect from very small film thickness, therefore damp conditions are considered to provide no better braking action than a wet runway. Aerodrome personnel should be aware of the fact that the capability to generate friction in wet (or with thin layers of fluid contaminants) conditions is very dependent upon the inherent qualities of the runway surface (friction characteristics) and may be less than*



*normally expected on poorly drained, polished or rubber contaminated surfaces. Above the 3 mm threshold, the impact on friction forces is more significant, leading to classification in lower RWYCCs. Above this depth, and depending on the density of the fluid, additional drag effects start to apply, due to displacement or compression of the fluid and impingement on the airframe of the aeroplane. These latter effects depend on the depth of the fluid and affect the ability of the aeroplane to accelerate for take-off.*

#### **AMC2 to Chapter 4.11.4.2 Assignment of Runway Condition Code**

- a) *The aerodrome operator shall:*
  1. *assign a RWYCC 6, if 25 per cent or less area of a runway third is wet or covered by contaminant*
  2. *describe in the plain language remarks part of the situational awareness section of the RCR the location of the area that is wet or covered by the contaminant, if the distribution of the contaminant is not uniform;*
  3. *assign a RWYCC based on the contaminant that will most likely affect the aeroplane's performance, if multiple contaminants are present and the total coverage is more than 25 per cent but no single contaminant covers more than 25 per cent of any runway third;*
  4. *not upgrade an assigned RWYCC 5, 4, 3, or 2; and*
  5. *not upgrade beyond RWYCC 3 an assigned RWYCC 1 or 0.*
- b) *The aerodrome operator may upgrade an assigned RWYCC 1 or 0 when all available means of assessing runway slipperiness, including properly operated and calibrated measuring devices, if available, have been used to support the decision.*
- c) *The aerodrome operator, when RWYCC 1 or 0 is upgraded, should assess the runway surface frequently during the period the higher RWYCC is in effect, to ensure that the runway surface condition does not deteriorate below the assigned code.*
- d) *The aerodrome operator, if sand or other runway treatments are used to support upgrading of the RWYCC, should assess the runway surface frequently to ensure the continued effectiveness of the treatment.*



- e) *The aerodrome operator should appropriately downgrade the RWYCC taking into consideration all available means of assessing runway slipperiness, including pilot reports.*

#### **GM2 to Chapter 4.11.4.2 Single and Multiple Contaminants**

*When single or multiple contaminants are present, the RWYCC for any third of the runway is determined as follows:*

- a) *When the runway third contains a single contaminant, the RWYCC for that third is based directly on that contaminant in the RCAM as follows:*
1. *If the contaminant coverage for that third is less than 10 per cent, a RWYCC 6 is to be generated for that third, and no contaminant is to be reported. If all thirds have less than 10 per cent contaminant coverage, no report is generated; or*
  2. *If the contaminant coverage for that third is greater than or equal to 10 per cent and less than or equal to 25 per cent, a RWYCC 6 is to be generated for that third and the contaminant reported at 25 per cent coverage; or*
  3. *If the contaminant coverage for that third is greater than 25 per cent, the RWYCC for that third is based on the contaminant present.*
- b) *If multiple contaminants are present where the total coverage is more than 25 per cent but no single contaminant covers more than 25 per cent of any runway third, the RWYCC is based upon the judgement of the runway inspector, considering what contaminant will most likely be encountered by the aeroplane and its likely effect on the aeroplane's performance. Typically, this would be the most widespread contaminant, but this is not an absolute.*
- c) *The structure of the RCAM is ranging the contaminants in the column 'Runway surface description' from top to bottom and is having the most slippery contaminants at the bottom. However, this ranging is not an absolute, as the RCAM by design is landing oriented and if judged in a take-off scenario, the ranging could be different due to drag effects of loose contaminants.*

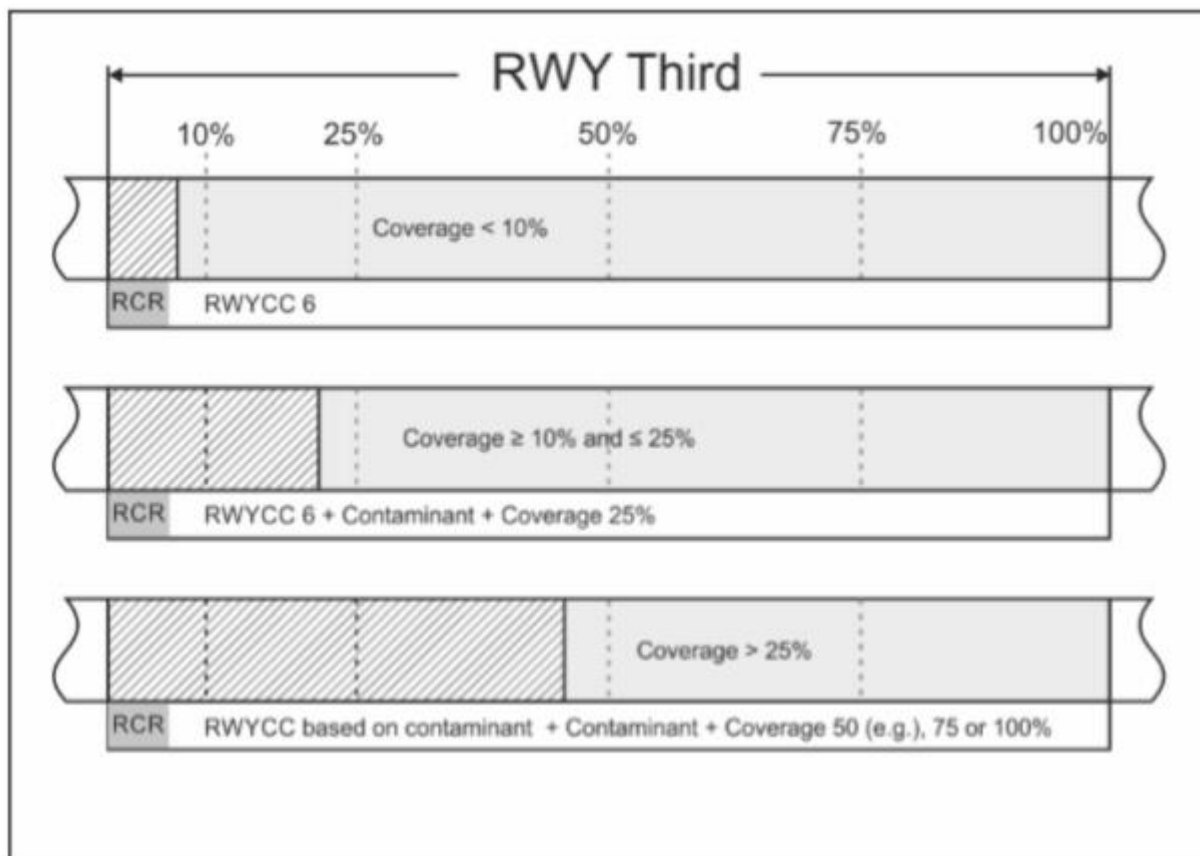


Figure 4-3 – Single contaminant

#### AMC3 to Chapter 4.11.4.2 Use of Special Air Reports

a) The aerodrome operator should:

1. re-assess the runway surface condition if RWYCC 2 or better has been reported and two consecutive SPECIAL AIR-REPORTS of POOR runway braking action are received; and
2. re-assess the runway surface condition and consider the suspension of operations on that runway when one pilot has reported a LESS THAN POOR runway braking action.

b) The aerodrome operator may use a SPECIAL AIR-REPORT of runway braking action for upgrading purposes only if it is used in combination with other information qualifying for upgrading.



### **GM3 to Chapter 4.11.4.2**

#### **USE OF SPECIAL AIR-REPORTS**

*Pilot SPECIAL AIR-REPORTS typically provide aerodrome personnel and other pilots with an observation that can confirm the ground-based assessment of or alert to degraded conditions experienced in terms of braking capability and/or lateral control during the landing roll. The braking action observed is dependent on the type of aircraft, aircraft weight, runway portion used for braking, and other factors. Pilots will use the terms GOOD, GOOD TO MEDIUM, MEDIUM, MEDIUM TO POOR, POOR and LESS THAN POOR. When receiving a SPECIAL AIR-REPORT, the recipient should consider that it rarely applies to the full length of the runway and is limited to the specific sections of the runway surface in which sufficient wheel braking was applied. As SPECIAL AIR-REPORTS are subjective and contaminated runways may affect the performance of different aeroplane types in a different way, the reported braking action may not be directly applicable to another aeroplane.*

4.11.4.3 Friction measurements made on runway surfaces conditions should not be reported.

4.11.4.4 Information that a runway or portion thereof is slippery wet shall be made available.

*Note 1: The surface friction characteristics of a runway or a portion thereof can be degraded due to rubber deposits, surface polishing, poor drainage or other factors. The determination that a runway or portion thereof is slippery wet stems from various methods used solely or in combination. These methods may be functional friction measurements, using a continuous friction measuring device, that fall below a minimum standard as defined in AMC-32 – The Assessment on Runway Friction Characteristics, observations by aerodrome maintenance personnel, repeated reports by pilots and aircraft operators based on flight crew experience, or through analysis of aeroplane stopping performance that indicates a substandard surface. Supplementary tools to undertake this assessment are described in PANS Aerodromes (Doc 9981).*

*Note 3: Guidance on conducting a runway surface friction characteristics evaluation programme that includes determining and expressing the minimum friction level is provided in AMC-32 and ICAO Annex 14, Volume 1, Attachment A, Section 7.*

4.11.4.5 Notification shall be given to relevant aerodrome users when the friction level of a paved runway or portion thereof is less than the minimum friction level



specified in AMC-32. This shall be done by issuing a NOTAM and shall describe the location of the affected portion.

*Note 1: Guidance on determining and expressing the minimum friction level is provided in AMC-32 and Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 329).*

*Note 2: Procedures on conducting a runway surface friction characteristics evaluation programme are provided in the PANS-Aerodromes (Doc 9981).*

*Note 3: Information to be promulgated in a NOTAM includes specifying which portion of the runway is below the minimum friction level and its location on the runway.*

#### 4.12 ISOLATED AIRCRAFT PARKING POSITION

An Aerodrome Operator holding an aerodrome certificate shall ensure that the Air Traffic Services Unit is advised of an area or areas suitable for the parking of an aircraft which is known or believed to be the subject of unlawful interference, or which for other reasons needs isolation from normal aerodrome activities.

**AMC 1 to Chapter 4, 4.12:** *The isolated aircraft parking position should be located at the maximum distance practicable and in any case never less than 100 m from other parking positions, buildings or public areas, etc.*

**GM 1 to Chapter 4, 4.12:** *Care should be taken to ensure that the position is not located over underground utilities such as gas and aviation fuel and, to the extent feasible, electrical or communication cables.*

#### 4.13 NOTIFYING AND REPORTING INFORMATION TO AIRCRAFT OPERATORS

An Aerodrome Operator shall develop and implement procedures for briefing Aircraft Operators of the necessary safety and regulatory requirements for aircraft before operating in the United Arab Emirates Flight Information Region (FIR) or from UAE Territory. The Airport Briefing shall include but not be limited to at least the following requirements:

- a) provision of up to date aerodrome information as contained in the AIP to be available to the flight crew;
- b) requirement for the aircraft operator to follow correct ICAO flight planning principles including the provision of aircraft registration and correct ICAO designators;



- c) requirement for the aircraft operator to report either flight or ground based incidents to the Authority, including bird or wildlife strikes or near misses;
- d) requirement for the aircraft to be adequately equipped in accordance with the rules and regulations governing the airspace in which it will be flying.

*Note: Guidance to Aerodrome Operators concerning Airport Briefings is contained within AMC-24 - Airport Briefing Requirements.*

#### **4.14 OBLIGATIONS TO RESTRICT CERTAIN AIRCRAFT**

4.14.1 In respect to 4.13, the Aerodrome Operator or their agent shall ensure that procedures are developed to negate aircraft operators from operating at their aerodrome when such aircraft operators cannot meet the UAE regulatory requirements, or are subject to:

- a) a ban based upon the origin of registry as notified by the Authority;
- b) a cease and desist order as notified by the Authority; or
- c) when the aircraft is subject to a grounding order as notified by the Authority.

4.14.2 The procedures above shall include immediate notification to the Authority of actions taken against such aircraft or aircraft operators.

4.14.3 The Aerodrome Operator shall monitor and ensure that third parties at the aerodrome comply with such procedures.

4.14.4 The provision of weigh scales appropriate to the task to random check of aircraft payload shall be immediately available at the aerodrome.

#### **4.15 REPORTING STATISTICAL INFORMATION**

An Aerodrome Operator holding an Aerodrome Certificate shall provide statistical information in support of ICAO's Statistical Programme.

##### **AMC to 4.15 Reporting Statistical Information**

The Aerodrome Operator shall provide the following statistical information to the ICAO with copy Authority:

- ICAO Form I shall be completed and forwarded via e-mail on a monthly basis
- ICAO Form I-S shall be completed and forward via e-mail on an annual basis
- Forms shall be sent to [stats@aci.aero](mailto:stats@aci.aero) with a copy to [stats@gcaa.gov.ae](mailto:stats@gcaa.gov.ae)





**GM to 4. 15 Reporting Statistical Information:**

- Templates for the ICAO forms are located at <https://www.icao.int/sustainability/Pages/eap-sta-excel.aspx>
- ICAO and Airports Council International (ACI) have a joint statistics programme. Aerodrome operators, regardless of their standing with ACI, are required to provide the statistics as per the AMC.

**4.16 AERODROME OPERATION AND MAINTENANCE PROGRAMME**

**4.16.1 General**

The Aerodrome Operator shall establish and implement a maintenance programme, including preventative maintenance, to maintain the aerodrome facilities such as pavements, visual aids, fencing, drainage electrical systems and buildings in a condition that does not impair the safety, security, regularity or efficiency of aircraft operations.

**GM 1 to Chapter 4, 4.16.1** - Preventative maintenance is programmed maintenance work done in order to prevent a failure or degradation of facilities.

- 4.16.2 The design and application of the maintenance programme should observe Human Factors Principles.

*Note 1: Guidance material on Human Factors Principles can be found in the ICAO Human Factors Training Manual (Doc 9683) and in the ICAO Airport Services Manual (Doc 9137), Part 8.*

*Note 2: General principles and procedures on the training of aerodrome personnel, including training programmes and competence checks, are specified in the PANS-Aerodrome (DOC 9981)*

- 4.16.3 The Aerodrome Operator shall ensure that all maintenance records are documented, including information on the design and construction of aircraft pavements and aerodrome lighting. A system for easy retrieval of such documentation shall be implemented.

**4.16.4 Runway and Movement Area Inspections**

- 4.16.4.1 Inspections of the Movement Area to assess its operational status shall be carried out each day at least twice at a Certified Aerodrome.

**GM 1 to Chapter 4, 4.16.4.1** - Where there is a potential for an increase in FOD, the inspection rate should be increased.





- 4.16.4.2 The minimum number of inspections shall be increased by one where Aerodrome Traffic Density is considered to be Medium or Heavy.

*Note: Guidance on carrying out daily inspections of the Movement Area is given in AMC-36 – Runway and Movement Area Inspections.*

- 4.16.4.3 An Aerodrome Operator shall inspect an aerodrome, as the circumstances require, to ensure aviation safety:
- a) as soon as practicable, after any Aircraft Accident or Incident within the meaning of these terms defined in CAR Part VI, Chapter 3 – Aircraft Accident and Incident Investigation;
  - b) during any period of construction or repair of the aerodrome facilities or equipment that is critical to the safety of aircraft operation;
  - c) after any period of adverse weather; or
  - d) at any other time when there are conditions at the aerodrome that could affect aviation safety.
  - e) For the runway(s), inspections in addition to the above whenever the runway surface conditions may have changed significantly due to meteorological conditions.
  - f) Special air reports received pilots

**4.16.5 Foreign Object Debris (FOD)**

- 4.16.5.1 Aerodrome Operators shall develop and implement specific procedures for the elimination of the risk of FOD. They shall also ensure that any third party on the aerodrome can demonstrate a satisfactory level of FOD awareness and that their working procedures do not increase the likelihood of FOD.
- 4.16.5.2 Aerodrome and aircraft operators, maintenance and ground handling organisations shall include FOD prevention in their induction and continuation training programmes, for all airside, maintenance and hangar staff.
- 4.16.5.3 Aerodrome Operators holding an Aerodrome Certificate shall ensure that FOD is a standing agenda item for all safety related committees.

*Note: Guidance to Aerodrome Operators concerning FOD is contained within AMC-43 – Foreign Object Debris.*



#### 4.16.6 Pavement Maintenance Programme

- 4.16.6.1 The surfaces of all Movement Areas including pavements (runways, taxiways and aprons) and adjacent areas shall be inspected and their condition monitored regularly as part of an aerodrome preventive and corrective maintenance programme with the objective of avoiding and eliminating any foreign object debris that might cause damage to aircraft or impair the operation of aircraft systems.

*Note 1: See clause 4.16.4 for Runway and Movement Area Inspections.*

*Note 2: Guidance on carrying out daily inspections of the Movement Area is given in given in AMC-36 – Runway and Movement Area Inspections, the ICAO Airport Services Manual (Doc 9137), Part 8, the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and the ICAO Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830).*

*Note 3: Additional guidance on sweeping/cleaning of surfaces is contained in the Airport Services Manual (ICAO Doc 9137), Part 9.*

*Note 4: Guidance on precautions to be taken in regard to the surface of shoulders is given in ICAO, Annex 14, Volume 1, Attachment A, Section 8, and the ICAO Aerodrome Design Manual (Doc 9157), Part 2.*

*Note 5: Where the pavement is used by large aircraft or aircraft with tire pressures in the upper categories referred to in Appendix 2, 2.6.6(c), particular attention should be given to the integrity of light fittings in the pavement and pavement joints.*

- 4.16.6.2 The surface of a runway shall be maintained in a condition such as to preclude formation of harmful irregularities.

*Note: See ICAO Annex 14, Volume 1, Attachment A, Section 5*

- 4.16.6.3 When a taxiway is used by jet turbine powered aeroplanes, the surface of the taxiway shoulders should be maintained so as to be free of any loose stones or other objects that could be ingested by the aeroplane engines.

*Note: Guidance on this subject is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 2.*



#### 4.16.7 Pavement Surface Inspections

In addition to the inspections detailed in 4.16.4, all pavements within the Movement Area shall be subject to inspection and evaluation by appropriate and competent pavement engineers for the preparation/upkeep of a pavement management system and maintenance schedule. These detailed pavement inspections shall be undertaken at least once a year.

*Note: Guidance to Aerodrome Operators concerning Runway and Movement Area Inspections is contained within AMC-36 – Runway and Movement Area Inspections.*

#### 4.16.8 Runway Surface Friction

- 4.16.8.1 A paved runway shall be maintained in a condition so as to provide surface friction characteristics at or above the Minimum Friction Level.

*Note: Guidance on evaluating the friction characteristics of a runway is provided in AMC-32 – The Assessment of Runway Surface Friction Characteristics and the ICAO Airport Services Manual (Doc 9137), Part 2, contain further information on this subject, on improving surface friction characteristics of runways.*

**AMC 1 to Chapter 4, 4.16.8.1:** Evaluation tests of runway surface friction characteristics shall be conducted when runways are first constructed or after resurfacing.

**AMC 2 to Chapter 4, 4.16.8.1:** Runway surface friction characteristics for maintenance purpose shall be periodically measured with a continuous friction measuring device using self-wetting features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface friction characteristics of the runway.

**GM 1 to Chapter 4, 4.16.8.1:** When there is reason to believe that the drainage characteristics of a runway, or portions thereof, are poor due to slopes or depressions, then the runway surface friction characteristics should be assessed under natural or simulated conditions that are representative of local rain, and corrective maintenance action should be taken as necessary.

*Note 1: Guidance on evaluating the friction characteristics of a runway is provided in AMC-32 – The Assessment of Runway Surface Friction Characteristics. Additional guidance is included in the ICAO Airport Services Manual (Doc 9137), Part 2.*



*Note 2: The objective of 4.16.8.1 to 4.16.8.5 is to ensure that the surface friction characteristics for the entire runway remain at or above the Minimum Friction Level.*

*Note 3: Guidance for the determination of the required frequency is provided in ICAO Annex 14, Volume 1, Attachment A, Section 7 and in the ICAO Airport Services Manual (Doc 9137), Part 2, Appendix 5.*

- 4.16.8.2 Corrective maintenance action shall be taken to prevent the runway surface friction characteristics for any portion thereof from falling below Minimum Friction Level. A NOTAM shall be issued in accordance with 4.11.4.2 when the readings are below Minimum Friction Level.

*Note: A portion of runway in the order of 100 m long may be considered significant for maintenance or reporting action.*

#### 4.16.9 Removal of Contaminants

- 4.16.9.1 Standing water, mud, dust, sand, oil, rubber deposits and other contaminants shall be removed from the surface of runways in use as rapidly and completely as possible to minimise accumulation.

*Note: Guidance on removal of contaminants is given in the ICAO Aerodrome Services Manual (Doc 9137), Parts 2 and 9.*

- 4.16.9.2 A taxiway should be kept clear of contaminants to the extent necessary to enable aircraft to be taxied to and from an operational runway.
- 4.16.9.3 Aprons should be kept clear of contaminants to the extent necessary to enable aircraft to manoeuvre safely or, where appropriate, to be towed or pushed.
- 4.16.9.4 Whenever the clearance of contaminants from the various parts of the Movement Area cannot be carried out simultaneously, the order of priority should be set in consultation with the affected parties such as Aerodrome Emergency Services and documented.
- 4.16.9.5 Chemicals which may have harmful effects on aircraft or pavements, or chemicals which may have toxic effects on the aerodrome environment, shall not be used.

*Note: Guidance on the use of chemicals for aerodrome pavements is given in the ICAO Airport Services Manual (Doc 9137), Part 2."*



#### 4.16.10 Runway Pavement Overlays

*Note: The following specifications are intended for runway pavement overlay projects when the runway is to be returned temporarily to an operational status before resurfacing is complete. This may necessitate a temporary ramp between the new and old runway surfaces. Guidance on overlaying pavements and assessing their operational status is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*

4.16.10.1 The longitudinal slope of the temporary ramp, measured with reference to the existing runway surface or previous overlay course, shall be:

- a) 0.5 to 1.0 per cent for overlays up to and including 5 cm in thickness; and
- b) not more than 0.5 per cent for overlays more than 5 cm in thickness.

4.16.10.2 Overlaying shall proceed from one end of the runway toward the other end so that based on runway utilization most aircraft operations will experience a down ramp.

4.16.10.3 The entire width of the runway shall be overlaid during each work session.

4.16.10.4 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the specifications in Appendix 12 shall be provided. Additionally, the location of any temporary threshold shall be identified by a 3.6 m wide transverse stripe.

4.16.10.5 The overlay shall be constructed and maintained above the Minimum Friction Level.

#### 4.16.11 Electrical Power Supply Systems for Air Navigation Facilities

*Note: The safety of operations at aerodromes depends on the quality of the supplied power. The total electrical power supply system may include connections to one or more external sources of electric power supply, one or more local generating facilities and to a distribution network including transformers and switchgear. Many other aerodrome facilities supplied from the same system need to be taken into account while planning the electrical power system at aerodromes.*

4.16.11.1 Adequate primary power supply shall be available at aerodromes for the safe functioning of air navigation facilities.

4.16.11.2 The design and provision of electrical power systems for aerodrome visual and radio navigation aids shall be such that an equipment failure will not leave the pilot with inadequate visual and non-visual guidance or misleading information.



*Note: The design and installation of the electrical systems need to take into consideration factors that can lead to malfunction, such as electromagnetic disturbances, line losses, power quality, etc. Additional guidance is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

- 4.16.11.3 Electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.
- 4.16.11.4 The time interval between failure of the primary source of power and the complete restoration of the services required by 4.16.11.10 should be as short as practicable, except that for visual aids associated with non-precision, precision approach or take-off runways the requirements of Appendix 10 for maximum Switch-over Times should apply.

*Note: A definition of Switch-over Time is given in Chapter 1, 1.3, Definitions*

4.16.11.5 **Visual Aids**

For a secondary power supply installed after 4 November 1999, the electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are capable of meeting the requirements of Appendix 10 for maximum Switch-over Times as defined in Chapter 1, 1.3, Definitions.

- 4.16.11.6 For a Precision Approach Runway, a secondary power supply capable of meeting the requirements of Appendix 10 for the appropriate category of Precision Approach Runway shall be provided. Electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.
- 4.16.11.7 For a runway meant for take-off in runway visual range conditions less than a value of 800 m, a secondary power supply capable of meeting the relevant requirements of Appendix 10 shall be provided.
- 4.16.11.8 At an aerodrome where the primary runway is a Non-precision Approach Runway, a secondary power supply capable of meeting the requirements of Appendix 10 should be provided except that a secondary power supply for visual aids need not be provided for more than one Non-precision Approach Runway.
- 4.16.11.9 At an aerodrome where the primary runway is a Non-instrument Runway, a secondary power supply capable of meeting the requirements of 4.16.11.4 should be provided, except that a secondary power supply for visual aids need not be



provided when an emergency lighting system in accordance with the specification of Appendix 9, 9.2 is provided and capable of being deployed in 15 minutes.

4.16.11.10 The following aerodrome facilities shall be provided with a secondary power supply capable of supplying power when there is a failure of the primary power supply:

- a) the signalling lamp, voice communication management system and minimum lighting necessary to enable air traffic services personnel to carry out their duties;

*Note: The requirement for minimum lighting may be met by other than electrical means.*

- b) radio navigation aids and ground elements of communication systems;
- c) meteorological equipment;
- d) approach, runway and taxiway lighting as specified in 4.16.11.6 to 4.16.11.9;
- e) all obstacle lights which, in the opinion of the Appropriate Authority, are essential to ensure the safe operation of aircraft;
- f) essential equipment and facilities for the aerodrome responding emergency agencies;
- g) illumination of apron areas over which passenger aircraft are being handled;
- h) essential security equipment including but not necessarily limited to access control facilities, security screening equipment, lighting; and
- i) floodlighting on a designated isolated aircraft parking positions if provided in accordance with Appendix 9, 9.24.1.

*Note: Specifications for secondary power supply for radio navigation aids and ground elements of communications systems are given in ICAO Annex 10, Volume I, Chapter 2.*

4.16.11.11 Requirements for a secondary power supply shall be met by either of the following:

- a) independent public power, which is a source of power supplying the aerodrome service from a substation other than the normal substation



through a transmission line following a route different from the normal power supply route and such that the possibility of a simultaneous failure of the normal and independent public power supplies is extremely remote; or

- b) standby power unit(s), which are engine generators, batteries, etc., from which electric power can be obtained.

*Note: Guidance on electrical systems is included in the Aerodrome Design Manual (Doc 9157), Part 5.*

#### 4.16.12 Electrical System Design

- 4.16.12.1 For a runway meant for use in runway visual range conditions less than a value of 550 m, the electrical systems for the power supply, lighting and control of the lighting systems included in Appendix 10 shall be so designed that an equipment failure will not leave the pilot with inadequate visual guidance or misleading information.

*Note: Guidance on means of providing this protection is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

- 4.16.12.2 Where the secondary power supply of an aerodrome is provided by the use of duplicate feeders, such supplies shall be physically and electrically separate so as to ensure the required level of availability and independence.
- 4.16.12.3 Where a runway forming part of a standard taxi-route is provided with runway lighting and taxiway lighting, the lighting systems shall be interlocked to preclude the possibility of simultaneous operation of both forms of lighting.

#### 4.16.12.4 Maintenance of Visual Aids

*Note 1: These specifications are intended to define the maintenance performance level objectives. They are not intended to define whether the lighting system is operationally out of service.*

*Note 2: The energy savings of light emitting diodes (LEDs) are due in large part to the fact that they do not produce the infra-red heat signature of incandescent lamps.*

*Note 3: Enhanced vision systems (EVS) technology relies on the infra-red heat signature provided by incandescent lighting. ICAO Annex 15 protocols provide an appropriate means of notifying aerodrome users of EVS when lighting systems are converted to LED.*





- 4.16.12.5 A light shall be deemed to be unserviceable when the main beam average intensity is less than 50 per cent of the value specified in the appropriate figure in Appendix 9. For light units where the designed main beam average intensity is above the value shown in Appendix 9, the 50 per cent value shall be related to that design value.
- 4.16.12.6 A system of preventive maintenance of visual aids shall be employed to ensure lighting and marking system reliability.
- 4.16.12.7 Maintenance Checks to be Included
- a) The system of preventive maintenance employed for a Precision Approach Runway Category I shall include at least the following checks:
    - i) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and
    - ii) control of the correct functioning of light intensity settings used by air traffic control.
  - b) The system of preventive maintenance employed for a Precision Approach Runway Category II or III shall include at least the following checks:
    - i) visual inspection and in-field measurement of the intensity, beam spread and orientation of lights included in the approach and runway lighting systems;
    - ii) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and
    - iii) control of the correct functioning of light intensity settings used by air traffic control.
  - c) In-field measurement of intensity, beam spread and orientation of lights included in approach and runway lighting systems for a Precision Approach Runway Category II or III should be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 9.
  - d) Measurement of intensity, beam spread and orientation of lights included in approach and runway lighting systems for a Precision Approach Runway Category II or III shall be undertaken using a mobile measuring unit of sufficient accuracy to analyse the characteristics of the individual lights.



- e) The frequency of measurement of lights for a Precision Approach Runway Category II or III should be based on traffic density, the local pollution level, the reliability of the installed lighting equipment and the continuous assessment of the results of the in-field measurements but in any event shall not be less than twice a year for in-pavement lights and not less than once a year for other lights.

#### 4.16.12.8 Maintenance Objectives for Lighting

- a) The system of preventive maintenance employed for a Precision Approach Runway Category I shall have as its objective that, during any period of Category I operations, all approach and runway lights are serviceable, and that in any event at least 85 per cent of the lights are serviceable in each of the following:
  - i) Precision Approach Category I lighting system;
  - ii) runway threshold lights;
  - iii) runway edge lights; and
  - iv) runway end lights.

In order to provide continuity of guidance an unserviceable light shall not be permitted adjacent to another unserviceable light unless the light spacing is significantly less than that specified.

*Note: In barrettes and crossbars, guidance is not lost by having two adjacent unserviceable lights.*

- b) The system of preventive maintenance employed for a runway meant for take-off in Runway Visual Range conditions of a value of 550 m or greater, shall have as its objective that, during any period of operations, all runway lights are serviceable and that, in any event, at least 85 per cent of the lights are serviceable in the runway edge lights and runway end lights.

In order to provide continuity of guidance, an unserviceable light shall not be permitted adjacent to another unserviceable light

- c) The system of preventive maintenance employed for a Precision Approach Runway Category II or III shall have as its objective that, during any period of Category II or III operations, all approach and runway lights are serviceable, and that in any event at least:



- i) 95 per cent of the lights are serviceable in each of the following particular significant elements:
  - A) Precision Approach Category II and III lighting system, the inner 450 m;
  - B) runway centre line lights;
  - C) runway threshold lights; and
  - D) runway edge lights;
- ii) 90 per cent of the lights are serviceable in the Touchdown Zone lights;
- iii) 85 per cent of the lights are serviceable in the approach lighting system beyond 450 m; and
- iv) 75 per cent of the lights are serviceable in the runway end lights.

In order to provide continuity of guidance, the allowable percentage of unserviceable lights shall not be permitted in such a way as to alter the basic pattern of the lighting system. Additionally, an unserviceable light shall not be permitted adjacent to another unserviceable light, except in a barrette or a crossbar where two adjacent unserviceable lights may be permitted.

*Note: With respect to barrettes, crossbars and runway edge lights, lights are considered to be adjacent if located consecutively and:*

- laterally: in the same barrette or crossbar; or
- longitudinally: in the same row of edge lights or barrettes.

- d) The system of preventive maintenance employed for a stop bar provided at a runway-holding position used in conjunction with a runway intended for operations in Runway Visual Range conditions less than a value of 550 m, (i.e. CAT II or III conditions), shall have the following objectives:
  - i) no more than two lights will remain unserviceable; and
  - ii) two adjacent lights will not remain unserviceable unless the light spacing is significantly less than that specified.
- e) The system of preventive maintenance employed for a taxiway intended for use in Runway Visual Range conditions less than a value of 550 m (i.e. Cat II or III conditions) shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.



- f) The system of preventive maintenance employed for a runway meant for take-off in Runway Visual Range conditions less than a value of 550 m, (i.e. Cat II or III condition), shall have as its objective that, during any period of operations, all runway lights are serviceable and that in any event:
  - i) at least 95 per cent of the lights are serviceable in the runway centre line lights (where provided) and in the runway edge lights; and
  - ii) at least 75 per cent of the lights are serviceable in the runway end lights.

In order to provide continuity of guidance, an unserviceable light shall not be permitted adjacent to another unserviceable light.

- g) During low visibility procedures the Aerodrome Operator should restrict construction or maintenance activities in the proximity of aerodrome electrical systems.

#### 4.16.12.9 Monitoring of Lighting Systems

- a) A system of monitoring shall be employed to indicate the operational status of the lighting systems.
- b) Where lighting systems are used for aircraft control purposes, such systems shall be monitored automatically so as to provide an indication of any fault which may affect the control functions. This information shall be automatically relayed to the Air Traffic Services Unit.
- c) Where a change in the operational status of lights has occurred, an indication shall be provided within two seconds for a stop bar at a runway-holding position and within five seconds for all other types of visual aids.
- d) For a runway meant for use in Runway Visual Range conditions less than a value of 550 m, the lighting systems detailed in Appendix 10 shall be monitored automatically so as to provide an indication when the serviceability level of any element falls below the minimum serviceability level specified in clause 4.16.12.4. This information shall be automatically relayed to the maintenance department.
- e) For a runway meant for use in Runway Visual Range conditions less than a value of 550 m, the lighting systems detailed in Appendix 10 shall be monitored automatically to provide an indication when the serviceability level of any element falls below the minimum level as specified in 4.16.12.4 below which operations shall not continue. This information shall be



automatically relayed to the aerodrome maintenance department and Air Traffic Services Unit and displayed in a prominent position.

#### **4.17 OPERATION, MAINTENANCE AND TESTING OF NAVIGATION AIDS**

4.17.1 An Aerodrome Operator, who operates and maintains radio navigation aids, shall do so in accordance with the requirements of CAR Part VIII - Air Navigation Regulations, Subpart 5.

4.17.2 The Aerodrome Operator shall:

- a) Prevent the construction of facilities on the aerodrome that would adversely affect the operation of any electronic or visual navigation aid or air traffic service facility on the aerodrome; and
- b) Prevent, as far as it is within the Aerodrome Operator's authority, any interruption of visual or electronic signals of navigation aids.

#### **4.18 SAFEGUARDING OF AERODROME SURROUNDINGS**

4.18.1 The Aerodrome Operator shall monitor on the aerodrome and its surroundings, taking into account the planned or intended mode of operation for the runway:

- a) obstacle limitation and protection surfaces as established in accordance with Appendix 13, and other surfaces and areas associated with the aerodrome, in order to take, within the safeguarded area associated with the aerodrome, appropriate action to mitigate the risks associated with the penetration of those surfaces and areas;
- b) marking and lighting of obstacles in order to be able to take action within the safeguarded area associated with the aerodrome, as appropriate; and
- c) hazards related to human activities and land use in order to take action within the safeguarded area associated with the aerodrome, as appropriate.

4.18.2 The Aerodrome Operator shall have:

- a) procedures in place for assessing and mitigating the risks associated with obstacles, developments and other activities within the monitored areas that could impact on the safe operations of aircraft operating at, to or from the aerodrome;
- b) agreements in place with applicable local authorities and municipalities for the continuous assessment of developments, land use and activities



surrounding the aerodrome that may jeopardise the safe operation of aircraft; and

- c) procedures in place for the inspection of obstacles to ensure that they remain in compliance with the requirements of Appendix 13.

**AMC 1 to Chapter 4, 4.18: Safeguarding of aerodrome surrounding**

- a) *The Aerodrome Operator should have procedures to monitor the changes in the obstacle environment, marking and lighting, and in human activities or land use on the aerodrome and the areas around the aerodrome, as defined in coordination with the Appropriate Authority. The scope, limits, tasks and responsibilities for the monitoring should be defined in coordination with the relevant air traffic services providers, and with the Appropriate Authority and other relevant authorities.*
- b) *The scope, limits, tasks and responsibilities for the mitigation of risks associated to obstacles or hazards outside the perimeter fence of the aerodrome should be defined in coordination with the relevant air traffic services providers, and with the Appropriate Authority and other relevant authorities.*
- c) *The risks caused by human activities and land use which should be assessed and mitigated should include but not limited to:*
  - i. *obstacles and the possibility of induced turbulence;*
  - ii. *the use of hazardous, confusing, and misleading lights;*
  - iii. *the dazzling caused by large and highly reflective surfaces;*
  - iv. *sources of non-visible radiation, or the presence of moving, or fixed objects which may interfere with, or adversely affect, the performance of aeronautical communications, navigation and surveillance systems; and*
  - v. *non-aeronautical ground light near an aerodrome which may endanger the safety of aircraft and which should be extinguished, screened, or otherwise modified so as to eliminate the source of danger.*
  - vi. *waste disposal facilities, establishment of land or water features or any other activity or development that may attract birds/wildlife and contribute to creating a hazard to aircraft.*



**AMC 2 to Chapter 4, 4.18.2(c) Safeguarding of aerodrome surroundings**

- a) *These inspections should be conducted on a quarterly basis.*
- b) *These inspections should be conducted from both within and outside the aerodrome boundary.*
- c) *Records of the inspections should be maintained along with reports of any follow-up action that may have been conducted following the identification of a non-serviceable obstacle light.*

**GM 1 to Chapter 4, 4.18.1 - Other Surfaces to be Monitored:** *Other surfaces associated with the aerodrome are surfaces that need to be monitored when operating in accordance with ICAO PANS-OPS Doc 8168, Volume II.*

**GM 2 to Chapter 4, 4.18.1 - Other Areas to be Monitored and Protected:** *Aeronautical communications, navigation and surveillance systems should be established and protected in accordance with the requirements of ICAO Annex 10.*

**GM 3 to Chapter 4, 4.18.1:** *The limits of the aerodrome surroundings that should be monitored by the Aerodrome Operator are defined in coordination with the Appropriate Authority and should include the areas that can be visually monitored during the inspections of the manoeuvring area.*



- 4.18.3 Responsibility for control of obstacles may be delegated to a third party subject to an agreed and clearly defined set of criteria, noting accountability remains with the Aerodrome Operator.
- 4.18.4 An Aerodrome Operator shall ensure that the runway and taxiway strip areas are free from obstacles or objects which are considered hazardous to aircraft operations unless required to be there for air navigation purposes.
- 4.18.5 An Aerodrome Operator holding an Aerodrome Certificate shall ensure the conduct of an obstacle survey by a competent surveyor to establish the initial coordinates and details of obstacles and periodic survey thereafter.

**AMC 1 to Chapter 4, 4.18.5:** *The periodicity of the survey should not exceed 5 years. Survey information should be supported by an Annual Validation Assessment which should confirm change/no change of the obstacle environment in relation to the Obstacle Limitation Surfaces in accordance with the process described in AMC-61 – Aerodrome Survey Requirements.*

- 4.18.6 **Terrain and Obstacle Data Collection:** To satisfy requirements necessary to accommodate air navigation systems or functions, sets of electronic terrain and obstacle data shall be collected and recorded in databases by the Aerodrome Operator, and reported to the Aeronautical Information Service.

**AMC 1 to Chapter 4, 4.18.6:** *The geographical coordinates of terrain and obstacles in Area 2, and Area 3 shall be measured, as well as terrain data in Area 4, and reported to the Aeronautical Information Service in degrees, minutes, seconds. In addition the top elevation, type, marking and lighting (if any) of obstacles shall be reported to the Aeronautical Information Service.*

*Note: See Appendix 2, 2.1 for requirement regarding determination and reporting of aeronautical data.*

#### **4.19 AERODROME OPERATING APPROVALS**

##### **4.19.1 Aerodrome Infrastructure**

- 4.19.1.1 An Aerodrome Operator holding an Aerodrome Certificate shall adhere to the guidance within AMC-59 – Aerodrome Projects including but not limited to the provision of required submissions, documentation and evidence.
- 4.19.1.2 An Aerodrome Operator holding an Aerodrome Certificate shall obtain acceptance from the Authority in regard to the project and management of change/control of works prior to undertaking the following:

- a) extensions to pavement areas for use by aircraft;





- b) installation of new aerodrome lighting including approach lighting system;  
or
- c) any changes in the physical characteristics of the aerodrome including the erection of new buildings and alterations to existing buildings or to visual aids/navigational facilities.

*Note: Guidance on requirements for required acceptances are detailed in AMC-59 – Aerodrome Projects.*

- 4.19.1.3 An Aerodrome Operator holding an Aerodrome Certificate shall obtain an Operational Approval from the Authority for changes to the aerodrome infrastructure as noted in the preceding paragraph, upon the completion of the project and prior to use in an operating environment.

*Note: Guidance on required approval is detailed in AMC-59 – Aerodrome Projects.*

- 4.19.1.4 An Aerodrome Operator shall establish documented arrangements with the GCAA Aviation Security (AVSEC) Sector and supporting procedures to notify the GCAA AVSEC Sector about any impending temporary or permanent changes or modifications, which are made on or off the aerodrome, which have a direct or indirect impact on Aviation Security.

#### 4.19.2 **Changes to Air Navigation Facilities and Equipment**

- 4.19.2.1 In addition to the requirements in paragraph 4.19.1, an Aerodrome Operator shall prior to undertaking:

- a) installation of new or replacement navigation aids;
- b) installation of new or replacement radar equipment;
- c) installation of new or replacement display monitors used for purposes of controlling and/or assisting with the movement of aircraft; or
- d) construction or refurbishment of an air traffic control tower

obtain a Letter of No Objection from the Authority prior to issuing a Request for Proposal or Tender document in accordance with requirements in AMC-25 – Air Navigation Facilities.

- 4.19.2.2 An Aerodrome Operator shall obtain an Operational Approval from the Authority for changes to the aerodrome infrastructure, equipment or facilities as noted in



the immediately preceding paragraph, prior to its use in accordance with requirements in AMC-25 – Air Navigation Facilities.

*Note: Any change to an air navigation facility that results in a physical change to the aerodrome is also subject to the provisions of paragraph 4.19.1 including acceptance (4.19.1.2), approval (4.19.1.3) and any relevant notification to AVSEC (4.19.1.4).*

#### 4.19.3 Operational Use of Runways which are less than Required Code

4.19.3.1 Proposals for operations on runways which are less than the required code (i.e. Code F operations on a Code E runway) shall be supported by an Aeronautical Study with a statement of the limited use. Approval by the Authority will be provided on a case-by-case basis, dependent not solely on frequency, but also regarding the complexity of the operating environment and the outcome of the Aerodrome Operators risk management process.

4.19.3.2 A programme of inspections of the shoulders and runway shall be implemented to confirm continuing serviceability and ensure that there is no deterioration that could create a risk of FOD or other hazards to aircraft operations.

#### 4.20 MANAGING UNSAFE CONDITIONS

4.20.1 The Aerodrome Operator shall establish and implement procedures intended to restrict aircraft operations where an unsafe condition exists on an aerodrome.

**AMC 1 to Chapter 4, 4.20:** *The Aerodrome Operator shall develop a safety plan for all development / maintenance works on the aerodrome.*

4.20.2 Unserviceability markers shall be displayed wherever any portion of a taxiway, apron or holding bay is unfit for the movement of aircraft but it is still possible for aircraft to bypass the area safely. On a Movement Area used at night, unserviceability lights shall be used.

*Note: Unserviceability markers and lights are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, that is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.*

4.20.3 Closure markings and unserviceability lights shall be displayed on a runway or taxiway, or portion thereof, which is closed to the use of aircraft.



*Note: When the area is temporarily closed, frangible barriers or markings utilising materials other than paint, or other suitable means may be used to identify a closed area.*

- 4.20.4 Lighting on a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes, but under no circumstances shall such lighting be operated during low visibility operations.

#### **4.21 SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEMS**

- 4.21.1 A surface movement guidance and control system shall be provided at an aerodrome to assist in the prevention of inadvertent incursions of aircraft and vehicles onto an active runway and to assist in the prevention of collisions between aircraft, and between aircraft and vehicles or objects, on any part of the Movement Area.

*Note: Guidance on control of stop bars through induction loops and on a visual taxiing guidance and control system is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

- 4.21.2 The design of a surface movement guidance and control system shall take into account:
- a) the density of air traffic;
  - b) the visibility conditions under which operations are intended;
  - c) the need for pilot orientation;
  - d) the complexity of the aerodrome layout; and
  - e) movements of vehicles.
- 4.21.3 The visual aid components of a surface movement guidance and control system, i.e. markings, lights and signs shall be designed to conform with the relevant specifications in Appendices 9, 11 and 12 respectively.
- 4.21.4 Where a surface movement guidance and control system is provided by selective switching of stop bars and taxiway centre line lights, the following requirements shall be met:
- a) taxiway routes which are indicated by illuminated taxiway centre line lights shall be capable of being terminated by an illuminated stop bar;



- b) the control circuits shall be so arranged that when a stop bar located ahead of an aircraft is illuminated, the appropriate section of taxiway centre line lights beyond it is suppressed; and
- c) the taxiway centre line lights are activated ahead of an aircraft when the stop bar is suppressed.

*Note: Guidance on installation of stop bars and taxiway centre line lights in surface movement guidance and control systems is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

- 4.21.5 Where stop bars are installed at runway holding positions, these stop bars shall be operated when the taxiway lighting system is switched on, except when taxiway centre line lighting is not provided, the stop bars shall be operated when the runway lighting is switched on.
- 4.21.6 The runway and taxiway lighting system shall be operated in low ambient light or low visibility conditions, to assist the pilot with navigating on the aerodrome.
- 4.21.7 The Aerodrome Operator shall ensure that Human Factors Principles and human machine interface issues are taken into account with design and implementation of the airfield lighting console in the aerodrome control tower. The number of key strokes/actions taken by the controller to operate the airfield lighting system and stop bars in particular shall be reduced to a minimum.
- 4.21.8 Surface movement surveillance system for the Manoeuvring Area should be provided at an aerodrome:
  - a) intended for use in Runway Visual Range conditions less than a value of 300 m; or
  - b) in the absence of visual observation of all or part of the Manoeuvring Area from an aerodrome control tower.
- 4.21.9 Surface movement surveillance system, when provided shall be utilized to:
  - a) monitor the movements of aircraft and vehicles on the Manoeuvring Area;
  - b) provide directional information to pilots and vehicle drivers as necessary; and
  - c) provide advice and assistance for the safe and efficient movement of aircraft and vehicles on the Manoeuvring Area.



- 4.21.10 Surface movement surveillance system for the Manoeuvring Area shall be provided at an aerodrome when traffic density and operating conditions are such that regularity of traffic flow cannot be maintained by alternative procedures and facilities.

*Note: Guidance on the use of surface movement surveillance system is given in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and in the Air Traffic Services Planning Manual (Doc 9426).*

**4.21.11 Fallback Procedures**

- 4.21.12 When an essential component of the surface movement equipment is temporarily unserviceable or does not meet the minimum performance or technical requirements, the Aerodrome Operator shall restrict the operational use of the aerodrome and, as a consequence, the traffic movement rate will be limited.

- 4.21.12.1 Detailed fallback procedures shall be established to address failures of essential components of the SMGCS.

**4.22 LOW VISIBILITY PROCEDURES**

- 4.22.1 An Aerodrome Operator shall not permit:

- a) approaches and landings in Category II and Category III meteorological conditions;
- b) take offs in RVR less than 550 metres; or
- c) control of surface movements in meteorological conditions not permitting ATS to be carried out with visual reference

unless the supporting services, procedures equipment and facilities have been accepted/approved by the Authority.

*Note 1: Guidance to Aerodrome Operators as to what should be included in the policy and procedures for operations during Low Visibility Conditions at their aerodrome is included in AMC-44 - Low Visibility Procedures (LVP).*

*Note 2 - AMC-44 - Low Visibility Procedures (LVP), Appendix A provides guidance for the Aerodrome Operator in conducting a Low Visibility safety assessment.*

- 4.22.2 The measures required to support safe operations at an airport in Low Visibility Conditions (LVC) shall be specified in local procedures as LVP.



- 4.22.3 The Aerodrome Operator shall maintain any LVP used at their aerodromes.
- 4.22.4 LVP table top exercises shall be conducted annually for any LVP.
- 4.22.5 Reserved.
- 4.22.6 Intersection take-offs shall not be permitted in LVC.
- 4.22.7 Operational runways shall not be used as taxi routes in LVC.
- 4.22.8 Except as required for essential operational reasons vehicles shall not be permitted on the Manoeuvring Area in LVC.
- 4.22.9 **Low Visibility Taxi Routes**
- a) Low visibility taxi routes shall be established and enforced in LVC to facilitate navigation, reduce traffic complexity and minimise risk of runway incursions;
  - b) Low visibility taxi routes shall minimise manoeuvring between runway and apron;
  - c) SMGCS and signs shall support standard LVP taxi routes; and
  - d) Low visibility taxi routes shall be indicated on charts.
- 4.22.10 **Communications**
- 4.22.10.1 Operations during LVC shall be supported by adequate and reliable communications to enable immediate dissemination of essential information such as RVR, and prompt intervention to address contingency situations.
- 4.22.10.2 Communication facilities shall encompass all branches of the aerodrome services and agencies concerned with operations during LVC.
- 4.22.10.3 The general requirements listed in ICAO Annex 11, Chapter 6, Air Traffic Services Requirements for Communications apply to communications under LVC, except as amplified herein.
- 4.22.10.4 Communication facilities shall be provided with standby power supply.
- 4.22.11 **Requirements for Direct Speech Circuits within Air Traffic Services**
- 4.22.11.1 Direct speech circuits shall be provided between the Air Traffic Services Unit and:
- a) The unit providing approach control services;



- b) Apron Control;
- c) The Meteorological Office;
- d) Maintenance personnel responsible for navigation aids;
- e) Maintenance personnel responsible for visual aids;
- f) Rescue and Fire services; and
- g) AIS / Briefing.

4.22.11.2 Direct speech circuits shall be supplemented by fallback speed dial facilities.

#### 4.22.12 Requirements for Radiotelephony (RTF)

4.22.12.1 Ground vehicles shall use frequencies separate from those used for control of aircraft, however a vehicle operating on a runway shall operate on the appropriate aerodrome control frequency.

4.22.12.2 Separate RTF channels shall be provided for control of aircraft and vehicular traffic on the aerodrome Movement Areas.

4.22.12.3 Separate portable hand held radios shall be provided for all drivers and working parties operating on the Movement Area.

4.22.12.4 All RTF frequencies used for control of aircraft or vehicles shall be supported by dual transmitters and dual receivers for operation through main headphone/speaker and microphone facilities.

4.22.12.5 A battery powered emergency transceiver shall be available and selectable to any frequency used by Aerodrome Control.

#### 4.22.13 Visual Aids

4.22.13.1 The notification of the status of visual aids is essential for the safe operation of aircraft during LVC. Changes to critical facilities and associated limitations shall be disseminated to users without delay.

4.22.13.2 Continuous guidance shall be provided from the taxiway until adequate guidance by the docking / parking system is assured.

4.22.13.3 Aircraft stand markings, signage and AGL including approach lights shall be in compliance with the relevant sections within this document.



- 4.22.13.4 Each taxiway holding position utilised in LVC on the same taxiway shall be provided with a location sign consisting of the taxiway designation and a number.
- 4.22.13.5 On the selected taxi-routes for ground operations during LVC, the signs essential to the ground operations shall be lighted internally.
- 4.22.13.6 For operations with an RVR less than 300 metres, taxiway intersection and Intermediate Holding Position lights shall be implemented along defined taxi routes to ensure adequate distances between taxiing aircraft
- 4.22.13.7 Lighting on a closed runway or taxiway or portion thereof shall not be operated during LVC.
- 4.22.13.8 A Surface Movement Guidance and Control System (SMGCS) shall be installed at aerodromes intended for use during LVC to assist in prevention of incursions of aircraft and vehicles on active runways and associated critical and sensitive areas for ILS components.
- 4.22.13.9 SMGCS and signs shall support standard taxi routes.
- 4.22.13.10 Dedicated low visibility taxi routes shall be indicated on aeronautical charts.
- 4.22.13.11 Detailed fallback procedures shall be established to address failures of essential lighting components of the SMGCS.
- 4.22.13.12 During operations in LVC remote controlled stop bars, made up of red lights across the width of the taxiway, shall be provided at all taxiways giving access to active runways whether at the holding position or at its entrance.

#### 4.22.14 **Meteorology**

The Aerodrome Operator shall provide a meteorological service in accordance with CAR Part VIII, Air Navigation Regulations, Subpart 7 commensurate with level of operations at the aerodrome.

#### 4.22.15 **Surface Movement Surveillance System**

A surface movement surveillance system should be provided for the manoeuvring area:

- a) At aerodromes intended for use in runway visual range conditions less than 300 metres;





- b) Where the aerodrome layout is complex and/or visual guidance makes surveillance required to protect the runway(s) and sensitive areas from incursion; or
- c) Where traffic density and operating conditions are such that regularity of traffic flow cannot be maintained by alternative procedures and facilities.

#### 4.22.16 Security during LVC

Co-ordination procedures with airport security services shall be established to ensure that only authorised personnel or vehicles gain access to the Movement Area during LVC.

#### 4.23 APRON MANAGEMENT SERVICE

4.23.1 An appropriate Apron Management Service shall be provided on an apron by the Aerodrome Operator, in order to:

- a) regulate movement with the objective of preventing collisions between aircraft, and between aircraft and obstacles;
- b) regulate entry of aircraft into, and coordinate exit of aircraft from, the apron with the Aerodrome Control Tower; and
- c) ensure safe and expeditious movement of vehicles and appropriate regulation of other activities.

4.23.2 When the Aerodrome Control Tower does not participate in the Apron Management Service, procedures shall be established to facilitate the orderly transition of aircraft between the apron management unit and the Aerodrome Control Tower.

*Note: Procedures on apron safety are specified in the PANS-Aerodrome (DOC 9981) Guidance on an apron management service is given in the ICAO Airport Services Manual (Doc 9137), Part 8, and in the ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

4.23.3 An Apron Management Service shall be provided with radiotelephony communications facilities. All vehicles/personnel involved with the facilitating the movement of aircraft shall be equipped with a serviceable receive/transmit airband radio.

4.23.4 Where low visibility procedures are in effect, persons and vehicles operating on an apron shall be restricted to the essential minimum.



*Note: Guidance on related special procedures is given in the ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

- 4.23.5 An emergency vehicle responding to an emergency shall be given priority over all other surface movement traffic.
- 4.23.6 A vehicle operating on an apron shall give way to:
- a) an aircraft taxiing, about to taxi, or being pushed or towed;
  - b) an emergency vehicle; or
  - c) to other vehicles in accordance with local airport regulations.
- 4.23.7 An aircraft stand shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand and to ensure the stand is clear of FOD.

*Note: Procedures on the training of operational personnel and on apron safety and operations, are specified in the PANS-Aerodromes (Doc 9981).*

#### **4.24 AERODROME VEHICLE OPERATIONS**

*Note 1: Procedures on the establishment of an airside driver permit (ADP) scheme and vehicle/equipment safety requirements, including detailed personnel training, are specified in CAR Part IX, Appendix 16 Airside Driving Permit Scheme, further information is contained in GCAA GM 01 Airside Safety Management and ICAO PANS Aerodromes (Doc 9981). Additional guidance on aerodrome vehicle operations is contained in ICAO Annex 14, Volume 1, Attachment A, and on traffic rules and regulations for vehicles in the ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

##### **4.24.1 Airside Driving Rules**

- a) The Aerodrome Operator shall ensure that the movement of vehicles on the Movement Area is safely managed.
- b) The Aerodrome Operator shall establish and implement driving rules, and monitor and enforce their application:
  - 1) A vehicle shall be operated:
    - i. on a Manoeuvring Area only as authorized by Aerodrome Control Tower or an authority as defined by the Aerodrome Operator; and
    - ii. on an apron only as authorized by the-Aerodrome Operator.



- 2) The driver of a vehicle on the Movement Area shall comply with all mandatory instructions conveyed by aerodrome markings and signs, unless otherwise authorized by:
    - i. the Aerodrome Control Tower when on the manoeuvring area; or
    - ii. the Aerodrome Operator when on the apron.
  - 3) The driver of a vehicle on the Movement Area shall comply with all mandatory instructions conveyed by lights.
  - 4) The driver of a radio-equipped vehicle shall establish satisfactory two-way radio communication with the Aerodrome Control Tower before entering the manoeuvring area and with the appropriate authorization before entering the apron. The driver shall maintain a continuous listening watch on the assigned frequency when on the Movement Area.
- c) The Aerodrome Operator shall establish vehicle driving routes, as appropriate, and install and maintain proper signs and markings.
- 1) Roads located on the Movement Area shall be restricted to the exclusive use of aerodrome personnel and other authorized persons.

#### **4.24.2 Airside Driving Permit Scheme and Training Programme**

- a) An Aerodrome Operator shall establish a system for issuing and revoking airside driver permits and vehicle airside authorizations. Airside driver permits and vehicle authorizations shall have a defined validity period and the Aerodrome Operator shall specify the conditions for their renewal.
- b) The driver of a vehicle on the Movement Area shall be appropriately trained, qualified and competent for the tasks to be performed and unless unsafe to do so shall comply with the instructions issued by:
  - 1) the Aerodrome Control Tower, when on the Manoeuvring Area; and
  - 2) the Aerodrome Operator, when on the apron.
- c) The Aerodrome Operator shall establish and implement a formal driver training assessment and permit scheme for all drivers operating on the airside.
- d) The airside driving training programme shall include the following, as a minimum;
  - 1) a generic airside vehicle driver training programme which covers the safety of operating vehicles and equipment on the airside area, such as runways, taxiways, aprons, stands, airside roads and areas adjacent to the movement area;
  - 2) additional training on the hazards associated with runways and taxiways; and
  - 3) the correct use of RTF and standard phraseology to operate on the manoeuvring area, by means of a R/T course and assessment.



#### 4.24.3 Airside Vehicle Requirements

- a) The aerodrome operator shall develop, maintain and ensure that specific requirements for the authorization, condition and maintenance of vehicles operating airside are in place. The authorization to operate a vehicle airside may be issued if the vehicle is used in activities related to the operation of the aerodrome and:
  - 1) Is serviceable and fit for the intended operation;
  - 2) Complies with the marking and lighting requirements of Appendix 13.2.10;
  - 3) Is equipped with a radio allowing two-way communications on the appropriate Aerodrome Control Tower frequency and any other frequency necessary, if it is intended to be operated on:
    - i. The manoeuvring area; or
    - ii. Other operational areas where communication with the Aerodrome Control Tower Unit or other operational units of the aerodrome is necessary; and
  - 4) Is fitted with a transponder or other equipment that supports surveillance, if it is intended to be operated:
    - i. On the manoeuvring area; and
    - ii. The aerodrome is equipped with a surface movement guidance and control system whose operation requires the use of a transponder or other equipment supporting surveillance fitted on the vehicles.
  - 5) meets the specifications for regular vehicle safety inspections; and
  - 6) meets the specifications for the rectification of faults.
- b) The aerodrome operator shall limit the number of vehicles authorised to operate on the movement area and other operational areas to the minimum number required for the safe and efficient operation of the aerodrome.
- c) An authorization issued in accordance with (a) shall:
  - 1) specify the parts of movement area or other operational areas where the vehicle may be operated; and
  - 2) remain valid as long as the requirements of (a) are met.
- d) The aerodrome operator shall assign a call sign to a vehicle authorized in accordance with (a) to operate at the aerodrome, if that vehicle is required to be radio-equipped. The call sign assigned to a vehicle shall:



- 1) not cause confusion regarding its identity;
  - 2) be appropriate to its function; and
  - 3) for vehicles that operate in the manoeuvring area, be coordinated with the air traffic services unit, and disseminated to the relevant organisations at the aerodrome.
- e) The aerodrome operator shall:
- 1) establish and implement procedures for:
    - i. issuing vehicle authorisations and temporary permitting the entry to the aerodrome and operation of vehicles;
    - ii. assigning call signs to vehicles; and
    - iii. monitoring the compliance of vehicles with these provisions and for taking appropriate action, including the suspension and revocation of vehicle authorisations or permissions to temporarily operate a vehicle; and
  - 2) maintain relevant records.

#### **4.25 GROUND SERVICING OF AIRCRAFT**

- 4.25.1 Fire extinguishing equipment suitable for at least initial intervention in the event of a fuel fire and personnel trained in its use shall be readily available during the ground servicing of an aircraft, and there shall be a means of quickly summoning the rescue and firefighting service in the event of a fire or major fuel spill.
- 4.25.2 While passengers are embarking or disembarking an aircraft, ground equipment shall be positioned so as to allow:
- a) unrestricted access/egress of exit routes for the expeditious evacuation of passengers and fuelling vehicles; and
  - b) a ready escape route from each of the exits to be used in an emergency.

#### **4.26 WILDLIFE HAZARD MANAGEMENT PLAN**

An Aerodrome Operator holding an Aerodrome Certificate shall, establish and implement a Wildlife Hazard Management Plan to minimise or eliminate wildlife hazards.

##### **4.26.1 Wildlife Strike Hazard Reduction**



*Note: The presence of wildlife (birds and other animals) on and in the aerodrome vicinity poses a serious threat to aircraft operational safety.*

4.26.1.1 The Aerodrome Operator/Appropriate Authority shall take action to decrease the risk to operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft to include:

- a) eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem; and
- b) where the elimination of existing sites is not possible ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

*Note 1: Refer to Chapter 4, 4.18.2(b): Safeguarding of Aerodrome Surroundings for additional requirements regarding the monitoring of activities outside the aerodrome boundary.*

Note 2: Procedures on the management of wildlife hazards on and within the vicinity of aerodromes, including the establishment of a wildlife hazard management programme (WHMP), wildlife risk assessment, land-use management and personnel training, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 6. Further guidance is given in the Airport Services Manual (Doc 9137), Part 3.

4.26.1.2 A Wildlife Hazard Management Plan shall be developed to:

- a) assess the potential bird strike risk;
- b) reduce wildlife infestation on the aerodrome as much as practicable;
- c) implement a safeguarding system to identify, and, where possible, address existing and planned developments within the vicinity of the aerodrome (within 13 kilometres from the Aerodrome Reference Point) that may have the potential to increase the birdstrike risk;
- d) monitor and address wildlife activity, strike events and;
- e) strive to improve the effectiveness of the plan through on-going evaluation by competent personnel.

*Note: See ICAO Annex 15, Chapter 8.*

4.26.2 Details of or reference to the Wildlife Hazard Management Plan shall be included within the Aerodrome Manual.



4.26.3 A Wildlife Hazard Management Plan shall include at a minimum:

- a) Description for assessing any wildlife hazards;
- b) Description for preventative/corrective action to mitigate risks;
- c) Description for bird hazard/risk management;
- d) Description for preventative/corrective action for bird risks;
- e) Description for reporting bird strikes to the GCAA assess the potential bird strike risk;
- f) Bird Hazard Circle Map radiating outward 13 km from the Aerodrome Reference Point; and
- g) Procedure for promulgating information to Aeronautical Information Services in regard to the presence of birds constituting a potential hazard to aircraft operations.

4.26.4 **Birdstrike Reporting**

In the event of a wildlife strike (including birdstrike), the Aerodrome Operator shall use the ROSI system to make mandatory reports to the Authority. In the event of ROSI system unavailability, the Aerodrome Operator may submit the Bird Strike and Wildlife Hazard Reporting Form (Appendix 15) as per the instructions of the form.

*Note: Guidance regarding ROSI is available in AMC-22 – Safety Incident Reporting.*

4.27 **AVIATION SECURITY**

An Aerodrome Operator shall in addition to meeting the obligations required these regulations, satisfy the requirements of CAR Part VII, The National Civil Aviation Security Programme and operate in accordance with the procedures stipulated in the Airport Security Programme.

4.27.1 **Fencing**

4.27.1.1 A fence or other suitable barrier shall be provided on an aerodrome to prevent the entrance to the Movement Area of animals large enough to be a hazard to aircraft, and to deter the inadvertent or premeditated access of an unauthorised person onto a non-public area of the aerodrome.

*Note 1: This is intended to include the barring of sewers, ducts, tunnels, etc., where necessary to prevent access.*



*Note 2: Special measures may be required to prevent the access of an unauthorised person to runways or taxiways which overpass public roads.*

4.27.1.2 The fence or barrier shall be located so as to separate the Movement Area and other facilities or zones on the aerodrome vital to the safe operation of aircraft from areas open to public access.

4.27.1.3 Suitable means of protection shall be provided to deter the inadvertent or premeditated access of unauthorised persons into ground installations and facilities essential for the safety of civil aviation located off the aerodrome.

#### 4.27.2 Access to the Aerodrome

4.27.2.1 Personnel authorised by the Authority may inspect and carry out tests on the aerodrome facilities, services and equipment, inspect Aerodrome Operator's documents and records and verify the Aerodrome Operator's Safety Management System before the Aerodrome Certificate is granted and, subsequently, at any other time, for the purpose of ensuring safety and order at the aerodrome.

4.27.2.2 An Aerodrome Operator shall issue permanent security passes to personnel authorised by the Authority to enable access to any part of the aerodrome or any aerodrome facility including, but not limited to, aircraft, tenant company premises, equipment, records, documents and operators' personnel for the purpose referred to in paragraph 4.27.2.1.

4.27.2.3 The Aerodrome Operator shall cooperate in conducting the activities referred to in paragraph 4.27.2.1.

#### 4.27.3 Photography on the Aerodrome

4.27.3.1 Personnel authorised by the Authority may take photographs of the Aerodrome Facilities and Equipment for certification, audit and approval purposes.

4.27.3.2 An Aerodrome Operator shall issue photography permits/authorisation to personnel authorised by the Authority.

#### 4.27.4 Warning Notices

4.27.4.1 Where low flying aircraft, at or near an aerodrome, or taxiing aircraft are likely to be hazardous to people or vehicular traffic, the Aerodrome Operator shall:

- a) Post notices warning of the hazard on any public way that is adjacent to the Manoeuvring Area; or





- b) If such a public way is not controlled by the Aerodrome Operator, inform the authority responsible for posting the notices on the public way that there is a hazard.

4.27.4.2 Where navigation aids are installed, signs warning of hazardous microwave radiation shall be erected by the Aerodrome Operator where appropriate.

#### **4.28 RUNWAY INCURSION AWARENESS**

4.28.1 Proactive measures shall be taken by Aerodrome Operators to reduce the likelihood of a runway incursion occurring at their aerodrome and to raise awareness of the hazards associated with runway incursions to all aerodrome users.

4.28.2 Aerodrome Operators shall regularly review those areas of their aerodrome Safety Management System relevant to the effectiveness and adequacy of the prevention measures in place at their aerodrome.

#### **4.29 AERODROME EMERGENCY SERVICES**

Aerodrome Operators shall adhere to the requirements for Rescue and Firefighting Services and Aerodrome Emergency Planning as detailed in CAR Part XI - Aerodrome Emergency Service, Equipment and Facilities.

#### **4.30 ADVERSE WEATHER CONDITIONS**

Aerodrome Operators should develop methodologies, contingency plans and notification systems or procedures to ensure that ground based stakeholders such as ground handling agencies and maintenance organisations are aware of forecasted adverse weather such as high winds, heavy rain, sandstorms, etc.

#### **4.31 FUEL QUALITY**

4.31.1 As part of the compliance oversight activity the aerodrome operator shall verify that organisations involved in storing and dispensing of fuel to aircraft have procedures to ensure that aircraft are provided with uncontaminated fuel and of the correct specification.

4.31.2 The aerodrome operator should verify, either by itself or through arrangements with third parties, that organisations involved in storing and dispensing of fuel to aircraft, implement procedures to:

- a) maintain the installations and equipment for storing and dispensing the fuel in such conditions so as not to render unfit for use in aircraft;



- b) mark such installations and equipment in a manner appropriate to the grade of the fuel;
- c) take fuel samples at appropriate stages during the storage and dispensing of fuel to aircraft, and maintain records of such samples; and
- d) use adequately qualified and trained staff in storing, dispensing, and otherwise handling fuel on the aerodrome

4.31.3 The aerodrome operator, in order to ensure compliance, could use:

- a) Audit reports to organisations involved in storing and dispensing of fuel to aircraft, or
- b) Relevant national procedures providing for the assurance of fuel quality.



## APPENDIX 1

### Regulatory oversight of heliports, helidecks and Private Use aerodromes

1.1 Regulatory guidance regarding the application and issue of an Aerodrome Certificate or Landing Area Acceptance for on-shore heliports and private use aerodromes is provided within AMC-30, AMC-70 and AMC-72, available on the GCAA website at [www.gcaa.gov.ae](http://www.gcaa.gov.ae)

1.2 Regulatory guidance and information for helideck operating companies and to operators of helidecks on offshore installations is provided in AMC-71 - Helidecks (Off-Shore), available on the GCAA website at [www.gcaa.gov.ae](http://www.gcaa.gov.ae)



## APPENDIX 2

### Aerodrome Data

#### 2.1 GENERAL

- 2.1.1 Determination and reporting of aerodrome-related aeronautical data shall be in accordance with the accuracy and integrity requirements set forth in Appendix 5 while taking into account the established quality system procedures. Accuracy requirements for aeronautical data are based upon a 95 per cent confidence level and in that respect, three types of positional data shall be identified: surveyed points (e.g. runway threshold), calculated points (mathematical calculations from the known surveyed points of points in space, fixes) and declared points (e.g. flight information region boundary points).

*Note: Specifications governing the quality system are given in ICAO Annex 15, Chapter 3.*

- 2.1.2 Aerodrome Mapping Data should be made available to the aeronautical information services for aerodromes deemed relevant by the Authority where safety and/or performance-based operations suggest possible benefits.

*Note: Aerodrome mapping databases related provisions are contained in ICAO Annex 15, Chapter 11.*

- 2.1.3 Where made available in accordance with 2.1.2, the selection of the Aerodrome Mapping Data features to be collected shall be made with consideration of the intended applications.

*Note: It is intended that the selection of the features to be collected match a defined operational need.*

- 2.1.4 Where made available in accordance with 2.1.2, Aerodrome Mapping Data shall comply with the accuracy and integrity requirements in Appendix 5.

*Note: Aerodrome Mapping Databases can be provided at one of two levels of quality - fine or medium. These levels and the corresponding numerical requirements are defined in RTCA Document DO-272B and European Organization for Civil Aviation Equipment (EUROCAE) Document ED-99B — User Requirements for Aerodrome Mapping Information.*

- 2.1.5 The Operator shall ensure that integrity of aeronautical data is maintained throughout the data process from survey/origin to the next intended user. Based



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on the applicable integrity classification, the validation and verification procedures shall:

- a) for routine data: avoid corruption throughout the processing of the data;
- b) for essential data assure corruption does not occur at any stage of the entire process and may include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level; and
- c) for critical data: assure corruption does not occur at any stage of the entire process and include additional integrity assurance procedures to fully mitigate the effects of faults identified by thorough analysis of the overall system architecture as potential data integrity risks.

*Note: Guidance material in respect to the processing of aeronautical data and aeronautical information is contained in RTCA Document DO-200A and European Organization for Civil Aviation Equipment (EUROCAE) Document ED-76A — Standards for Processing Aeronautical Data.*

2.1.6 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 Appendix 2, Clause 2.1.5, a 32- or 24-bit CRC algorithm shall apply respectively.

2.1.7 To achieve protection of the integrity level of routine aeronautical data as classified in Appendix 2, Clause 2.1.5, a 16-bit CRC algorithm shall apply.

*Note: Guidance material on the aeronautical data quality requirements (accuracy, resolution, integrity, protection and traceability) is contained in the World Geodetic System — 1984 (WGS-84) Manual (Doc 9674). Supporting material in respect of the provisions of Appendix 5 related to accuracy and integrity of aeronautical data is contained in RTCA Document DO-201A and European Organization for Civil Aviation Equipment (EUROCAE) Document ED-77, entitled Industry Requirements for Aeronautical Information.*

2.1.8 Geographical coordinates indicating latitude and longitude shall be determined and reported to 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 Appendix 5, Table App 5-1.



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2.1.9 The order of accuracy of the field work shall be such that the resulting operational navigation 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 Appendix 5.

2.1.10 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 Appendix 5 shall be determined and reported to 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 AERODROME REFERENCE POINT**

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

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.

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

**2.3 AERODROME AND RUNWAY ELEVATIONS**

2.3.1 The aerodrome elevation and geoid undulation at the aerodrome elevation position shall be measured to the accuracy of one-half metre or foot and reported to the Aeronautical Information Service.

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 or foot and reported to the Aeronautical Information Service.

2.3.3 For precision approach runway, 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 or foot and reported to the Aeronautical Information Service.



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

**2.4 AERODROME REFERENCE TEMPERATURE**

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

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.

**2.5 AERODROME DIMENSIONS AND RELATED INFORMATION**

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 or foot, 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 and stopway -- length, width to the nearest metre or foot, surface type; and arresting system – location (which runway end) and description;
- 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 or foot, 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 taxi-holding positions and stopbars, and location and type of visual docking guidance systems;
- h) location and radio frequency of any VOR aerodrome checkpoint;
- i) location and designation of standard taxi-routes; and



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

- 2.5.2 The geographical coordinates of each threshold shall be measured and reported to the Aeronautical Information Service in degrees, minutes, seconds and hundredths of seconds.
- 2.5.3 The geographical coordinates of appropriate taxiway centre line points shall be measured and reported to the Aeronautical Information Service in degrees, minutes, seconds and hundredths of seconds.
- 2.5.4 The geographical coordinates of each aircraft stand shall be measured and reported to the Aeronautical Information Service in degrees, minutes, seconds and hundredths of seconds.
- 2.5.5 The geographical coordinates of obstacles in Area 2 (the part within the aerodrome boundary) and in Area 3 shall be measured and reported to the Aeronautical Information Services in degrees, minutes, seconds and tenths of seconds. In addition, the top elevation, type, marking and lighting (if any) of obstacles shall be reported to the Aeronautical Information Service.

*Note 1: PANS-AIM (DOC 10066), Appendix 8 provides requirements for obstacle data determination in Areas 2 and 3.*

*Note 2: Implementation of ICAO Annex 15, provision 10.6.1.2, concerning the availability of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data.*

**2.6 STRENGTH OF PAVEMENTS (APPLICABLE UNTIL 27 NOVEMBER 2024)**

- 2.6.1 The bearing strength of a pavement shall be determined.
- 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 for ACN-PCN determination;
  - c) subgrade strength category;





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- 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.*

- 2.6.3 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.*

- 2.6.4 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 (Doc 9157), Part 3. For convenience several aircraft types currently in use have been evaluated on rigid and flexible pavements founded on the four subgrade categories in 2.6.6 b) below and the results tabulated in that manual.*

- 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.

- 2.6.6 Information on pavement type for ACN-PCN determination, subgrade strength category, maximum allowable tire pressure category and evaluation method shall be reported using the following codes:

- a) Pavement Type for ACN-PCN Determination:

	Code
Rigid pavement	R
Flexible pavement	F

*Note: If the actual construction is composite or non-standard, include a note to that effect.*

- b) Subgrade Strength Category:

Code



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High strength: characterized by $K = 150 \text{ MN/m}^3$ and representing all $K$ values above $120 \text{ MN/m}^3$ for rigid pavements, and by $\text{CBR} = 15$ and representing all $\text{CBR}$ values above 13 for flexible pavement.	A
Medium Strength: characterized by $K = 80 \text{ MN/m}^3$ and representing a range in $K$ of 60 to $120 \text{ MN/m}^3$ for rigid pavements, and by $\text{CBR} = 10$ and representing a range in $\text{CBR}$ of 8 to 13 for flexible pavements.	B
Low Strength: characterized by $K = 40 \text{ MN/m}^3$ and representing a range in $K$ of 25 to $60 \text{ MN/m}^3$ for rigid pavements, and by $\text{CBR} = 6$ and representing a range in $\text{CBR}$ of 4 to 8 for flexible pavements.	C
Ultra low Strength: characterized by $K = 20 \text{ MN/m}^3$ and representing all $K$ values below $25 \text{ MN/m}^3$ for rigid pavements, and by $\text{CBR} = 3$ and representing all $\text{CBR}$ values below 4 for flexible pavements.	D

c) Maximum Allowable Tire Pressure Category:

		Code
Unlimited:	no pressure limit	W
High:	pressure limited to $1.75 \text{ MPa}$	X
Medium:	pressure limited to $1.25 \text{ MPa}$	Y
Low:	pressure limited to $0.50 \text{ MPa}$	Z

*Note: See Note 5 to Chapter 4, 4.16.6.1 where the pavement is used by aircraft with tire pressures in the upper categories.*

Evaluation Method:	Code
Technical evaluation: representing a specific study of the pavement characteristics and application of pavement behaviour technology.	T
Using aircraft experience: representing a knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use.	U

*Note: The following examples illustrate how pavement strength data are reported under the ACN-PCN method.*



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*Example 1: If the bearing strength of a rigid pavement, resting on a medium strength subgrade, has been assessed by technical evaluation to be PCN 80 and there is no 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 subgrade, has been assessed by using aircraft experience to be PCN 50 and the maximum tire pressure allowable is 1.25 MPa, then the reported information would be:*

*PCN 50 / F / A / Y / U*

*Note: Composite construction.*

*Example 3: If the bearing strength of a flexible pavement, resting on a medium strength subgrade, 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 390000 kg, then the reported information would include the following note:*

*Note: The reported PCN is subject to a B747-400 all-up mass limitation of 390000 kg.*

- 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 2.6.2 and 2.6.3 above.

*Note: Refer to ICAO Annex 14, Volume I, Attachment A, Guidance Material Supplementary to ICAO Annex 14, Volume I, Section 19 which details a simple method for regulating overload operations while the ICAO Aerodrome Design Manual (Doc 9157), Part 3, includes the descriptions of more detailed procedures for evaluation of pavements and their suitability for restricted overload operations.*



**GM 1 to Appendix 2, 2.6.7: Overload Operations**

- a) *Pavement forming part of the Movement Area needs to be of sufficient strength to allow aircraft to operate without risk of damage either to the pavement or to the aircraft. Pavements subject to overload conditions should deteriorate at an increasing rate depending upon the degree of overload. To control this, it is necessary to classify both pavement and aircraft under a system whereby the load-bearing capacity of the pavement and the loads imposed by the aircraft can be compared. The method used is the Aircraft Classification Number - Pavement Classification Number (ACN/PCN) method. The ACN/PCN method has been developed by ICAO as an international method of reporting the bearing strength of pavements.*
- b) *All pavements forming part of the Movement Area should be of adequate bearing strength for the types of aircraft expected to use the aerodrome. All pavements should be regularly examined by a suitably qualified person. Any pavements which have been subjected to overload conditions should be closely monitored by suitably qualified staff for a period of several weeks or until it is clear that no rapid deterioration of the pavement has been triggered.*
- c) *Reporting pavement bearing strength:*
  - i) *The ACN/PCN method of classifying the bearing strength of pavements considers the load imposed on the pavement by the aircraft. In this respect, the load rating of the aircraft is most significantly affected by the subgrade support strength of the pavement. ACNs are, therefore, numbers giving a relative load rating of the aircraft on pavements for certain specified subgrade strengths. ACN values for most aeroplanes have been calculated by ICAO and are published in Aeronautical Information Publications. The PCN is also a number which represents the load-bearing strength of the pavement in terms of the highest ACN which can be accepted on the pavement for unrestricted use.*
  - ii) *A PCN can also be identified and reported without a technical evaluation of the pavement by means of an assessment of the results of aircraft using the pavement. Providing the type and subgrade support strength of the pavement are known, the ACN of the most demanding aircraft successfully using the pavement can be reported as the PCN.*
  - iii) *A PCN is reported in a five-part format. Apart from the numerical value, notification is also required of the pavement type (rigid or flexible) and the subgrade support category. Additionally, provision is*



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*made for the Aerodrome Operator to limit the maximum allowable tire pressure. A final indication is whether the assessment has been made by a technical evaluation or from past experience of aircraft using the pavement.*

- d) **Overload Operations:** *Overloading of pavements can result either from loads too large, or from a substantially increased application rate, or both. Loads larger than the defined (design or evaluation) load shorten the design life, whilst smaller loads extend it. With the exception of massive overloading, pavements in their structural behaviour are not subject to a particular limiting load above which they suddenly or catastrophically fail. Behaviour is such that a pavement can sustain a definable load for an expected number of repetitions during its design life. As a result, occasional minor overloading is acceptable, when expedient, with only limited loss in pavement life expectancy and relatively small acceleration of pavement deterioration. For those operations in which magnitude of overload and/or the frequency of use do not justify a detailed analysis, the following criteria are suggested:*
- i) *for flexible pavements, occasional movements by aircraft with ACN not exceeding 10 per cent above the reported PCN should not adversely affect the pavement;*
  - ii) *for rigid or composite pavements, in which a rigid pavement layer provides a primary element of the structure, occasional movements by aircraft with ACN not exceeding 5 per cent above the reported PCN should not adversely affect the pavement;*
  - iii) *if the pavement structure is unknown, the 5 per cent limitation should apply; and*
  - iv) *the annual number of overload movements should not exceed approximately 5 per cent of the total annual aircraft movements.*
- e) *Where operations are outside the criteria defined above, then Aerodrome Operators should arrange a detailed analysis by suitably qualified personnel. The result may be such that operations are limited or restricted. In any event, Aerodrome Operators must be cognizant of the fact that pavement rehabilitation measures may be required earlier than planned due to an acceleration rate of pavement deterioration and shortened service life.*
- f) *Overload movements should not normally be permitted on pavements exhibiting signs of distress or failure. Furthermore, overloading should be avoided when the strength of the pavement or its subgrade could be*



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*weakened by water. Where overload operations are conducted, the relevant pavement condition should be reviewed regularly by suitably qualified personnel. Also the criteria for overload operations should be reviewed periodically since excessive repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of pavement.*

- 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.*

**2.6 STRENGTH OF PAVEMENTS (APPLICABLE AS OF 28 NOVEMBER 2024)**

- 2.6.1 The bearing strength of a pavement shall be determined.

- 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 rating — pavement classification—rating (ACR-PCR) method by reporting all of the following information:

- a) the pavement classification rating (PCR) and numerical value;
- b) pavement type for ACR-PCR determination;
- c) subgrade strength category;
- d) maximum allowable tire pressure category or maximum allowable tire pressure value; and
- e) evaluation method.

*Note: Guidance on reporting and publishing of PCRs is contained in the Aerodrome Design Manual (Doc 9157, Part 3)*

- 2.6.3 The pavement classification rating (PCR) reported shall indicate that an aircraft with an aircraft classification rating (ACR) equal to or less than the reported PCNR 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 PCNRs may be reported if the strength of the pavement is subject to significant seasonal variation.*



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- 2.6.4 The ACR of an aircraft shall be determined in accordance with the standard procedures associated with the ACR-PCR method.

*Note: The standard procedures for determining the ACR of an aircraft are given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3. For convenience dedicated software is available on the ICAO website, for computing any aircraft ACRs at any mass on rigid and flexible pavements for the four standard subgrade strength categories detailed in 2.6.6 b) below.*

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

- 2.6.6 Information on pavement type for ACR-PCR determination, subgrade strength category, maximum allowable tire pressure category and evaluation method shall be reported using the following codes:

d) Pavement Type for ACR-PCR Determination:

	Code
Rigid pavement	R
Flexible pavement	F

*Note: If the actual construction is composite or non-standard, include a note to that effect.*

e) Subgrade Strength Category:

	Code
High strength: Characterized by $E=200$ MPa, and representing all $E$ values equal to or above 150 MPa for rigid and flexible pavements	A
Medium Strength: Characterized by $E=120$ MPa, and representing a range of $E$ values equal to or above 100 MPa and strictly less than 150 MPa, for rigid and flexible pavements	B
Low Strength: Characterized by $E=80$ MPa, and representing a range of $E$ values equal to or above 60 MPa and strictly less than 100 MPa, for rigid and flexible pavements	C



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Ultra low Strength: Characterized by  $E=50$  MPa, and representing strictly less than 60 MPa, for rigid and flexible pavements

D

f) Maximum Allowable Tire Pressure Category:

		Code
Unlimited:	no pressure limit	W
High:	pressure limited to 1.75 MPa	X
Medium:	pressure limited to 1.25 MPa	Y
Low:	pressure limited to 0.50 MPa	Z

*Note: See Note 5 to Chapter 4, 4.16.6.1 where the pavement is used by aircraft with tire pressures in the upper categories.*

Evaluation Method:	Code
Technical evaluation: representing a specific study of the pavement characteristics and the types of aircraft which the pavement is intended to serve.	T
Using aircraft experience: representing a knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use.	U

*Note: The following examples illustrate how pavement strength data are reported under the ACR-PCR method. Further guidance on this topic is contained in the Aerodrome Design Manual (Doc 9157), Part 3 – Pavements.*

*Example 1: If the bearing strength of a rigid pavement, resting on a medium strength subgrade, has been assessed by technical evaluation to be PCR ~~80~~ 760 and there is no tire pressure limitation, then the reported information would be:*

*PCR~~80~~ 760 / 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 subgrade, has been assessed by using aircraft experience to be PCR 550 and the maximum tire pressure allowable is 1.25 MPa, then the reported information would be:*

*PCR 550 / F / A / Y / U*

*Note: Composite construction.*





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- 2.6.7 Criteria shall be established to regulate the use of a pavement by an aircraft with an ACR higher than the PCR reported for that pavement in accordance with paragraphs 2.6.2 and 2.6.3 above.

*Note: Refer to ICAO Annex 14, Volume I, which details a simple method for regulating overload operations while the ICAO Aerodrome Design Manual (Doc 9157), Part 3, includes the descriptions of more detailed procedures for evaluation of pavements and their suitability for restricted overload operations.*

**GM 1 to Appendix 2, 2.6.7: Overload Operations**

- a) *Pavement forming part of the Movement Area needs to be of sufficient strength to allow aircraft to operate without risk of damage either to the pavement or to the aircraft. Pavements subject to overload conditions should deteriorate at an increasing rate depending upon the degree of overload. To control this, it is necessary to classify both pavement and aircraft under a system whereby the load-bearing capacity of the pavement and the loads imposed by the aircraft can be compared. The method used is the Aircraft Classification Rating /. Pavement Classification Rating (ACR/PCR) method. The ACR/PCR method has been developed by ICAO as an international method of reporting the bearing strength of pavements.*
- b) *All pavements forming part of the Movement Area should be of adequate bearing strength for the types of aircraft expected to use the aerodrome. All pavements should be regularly examined by a suitably qualified person. Any pavements which have been subjected to overload conditions should be closely monitored by suitably qualified staff for a period of several weeks or until it is clear that no rapid deterioration of the pavement has been triggered.*
- c) *Reporting pavement bearing strength:*
  - i) *The ACR/PCR-method of classifying the bearing strength of pavements considers the load imposed on the pavement by the aircraft. In this respect, the load rating of the aircraft is most significantly affected by the subgrade support strength of the pavement. ACRs are, therefore, numbers giving a relative load rating of the aircraft on pavements for certain specified subgrade strengths. ACR values for most aeroplanes have been calculated by ICAO and are published in Aeronautical Information Publications. The PCR is also a number which represents the load-bearing strength of the pavement in terms of the highest ACR which can be accepted on the pavement for unrestricted use.*



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- ii) *A PCR can also be identified and reported without a technical evaluation of the pavement by means of an assessment of the results of aircraft using the pavement. Providing the type and subgrade support strength of the pavement are known, the ACR of the most demanding aircraft successfully using the pavement can be reported as the PCR.*
- iii) *A PCR is reported in a five-part format. Apart from the numerical value, notification is also required of the pavement type (rigid or flexible) and the subgrade support category. Additionally, provision is made for the Aerodrome Operator to limit the maximum allowable tire pressure. A final indication is whether the assessment has been made by a technical evaluation or from past experience of aircraft using the pavement.*
- d) **Overload Operations:** *Overloading of pavements can result either from loads too large, or from a substantially increased application rate, or both. Loads larger than the defined (design or evaluation) load shorten the design life, whilst smaller loads extend it. With the exception of massive overloading, pavements in their structural behaviour are not subject to a particular limiting load above which they suddenly or catastrophically fail. Behaviour is such that a pavement can sustain a definable load for an expected number of repetitions during its design life. As a result, occasional minor overloading is acceptable, when expedient, with only limited loss in pavement life expectancy and relatively small acceleration of pavement deterioration. For those operations in which magnitude of overload and/or the frequency of use do not justify a detailed analysis, the following criteria are suggested:*
  - i) *for flexible and rigid pavements, occasional movements by aircraft with ACR not exceeding 10 per cent above the reported PCR should not adversely affect the pavement;*
  - ii) *the annual number of overload movements should not exceed approximately 5 per cent of the total annual movements, excluding light aircraft.*
- e) *Where operations are outside the criteria defined above, then Aerodrome Operators should arrange a detailed analysis by suitably qualified personnel. The result may be such that operations are limited or restricted. In any event, Aerodrome Operators must be cognizant of the fact that pavement rehabilitation measures may be required earlier than planned due to an acceleration rate of pavement deterioration and shortened service life.*



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- f) *Overload movements should not normally be permitted on pavements exhibiting signs of distress or failure. Furthermore, overloading should be avoided when the strength of the pavement or its subgrade could be weakened by water. Where overload operations are conducted, the relevant pavement condition should be reviewed regularly by suitably qualified personnel. Also the criteria for overload operations should be reviewed periodically since excessive repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of pavement.*

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:

- c) maximum allowable aircraft mass; and
- d) maximum allowable tire pressure.

*Example: 4800 kg/0.60MPa.*

## 2.7 PRE-FLIGHT ALTIMETER CHECK LOCATION

2.7.1 One or more pre-flight altimeter check locations shall be established for an aerodrome.

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

*Note 1: Locating a pre-flight altimeter check 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.*

2.7.3 The elevation of a pre-flight altimeter check location shall be given as the average elevation, rounded to the nearest metre or foot, of the area on which it is located. The elevation of any portion of a pre-flight altimeter check location shall be within 3 m (10 ft) of the average elevation for that location.

## 2.8 DECLARED DISTANCES

2.8.1 The following distances shall be calculated to the nearest metre for each paved and unpaved runway intended for use by aircraft flying for the purpose of Air Service:

- a) Take-Off Run Available (TORA);

- b) Take-Off Distance Available (TODA);
- c) Accelerate-Stop Distance Available (ASDA); and
- d) Landing Distance Available (LDA).

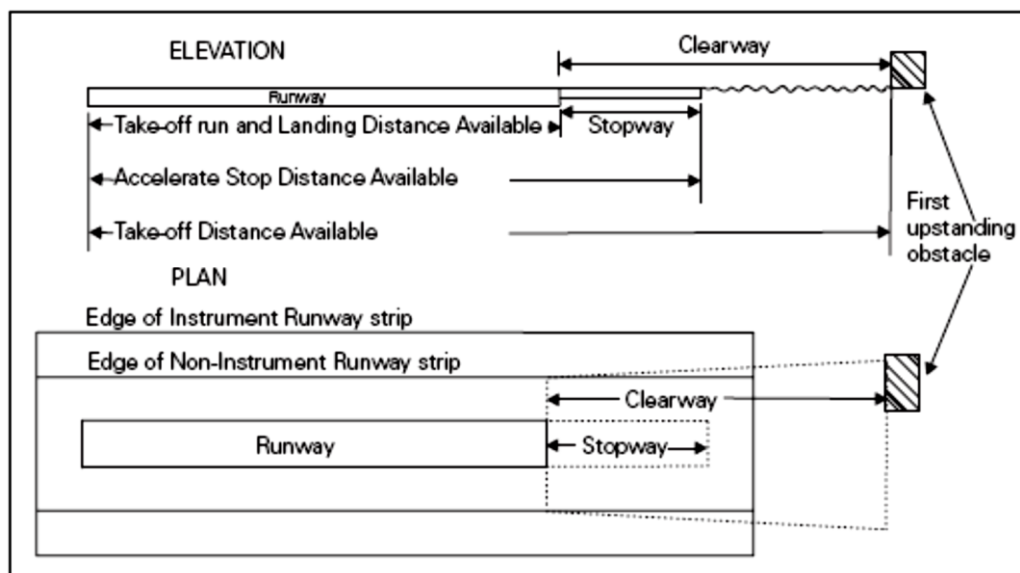
*Note 1: The distances are illustrated in Figure App 2-1.*

*Note 2: Guidance on calculation of declared distances is given in Annex 14, Volume 1, Attachment A, Section 3.*

- 2.8.2 The distances are measured along the centre line of the runway and of any associated stopway and clearway. Declared distances may be reduced due to obstacles or operational requirements. They may only be increased with the prior approval of the Authority. For this purpose unpaved runways are to be marked.

**Figure App 2-1**

### Illustration of Declared Distances



### 2.8.3 Intersection Departure Declared Distances

Declared distances from a runway intersection shall be calculated from the downwind edge of the taxiway. Figure App 2-2 illustrates how to determine the origin of intersection departures.

- 2.8.4 Aerodrome Operators shall use this method to determine the origin of the Take-Off Run Available, in order to measure the distances for the intersection departure accurately.

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- 2.8.5 For each take-off intersection departure, the Runway Designator, Taxiway designator along with TORA, TODA and ASDA shall be promulgated within AIP.

*Note: See Table App 2-1 for illustration on how to format the information for submission to the Aeronautical Information Service.*

- 2.8.6 Where intersection departures are provided, information signs advising the available TORA shall be provided at each taxiway permitting a departure. The information signs must be in accordance with Appendix 11, 11.4 and Figure App 11-8.

Figure App 2-2

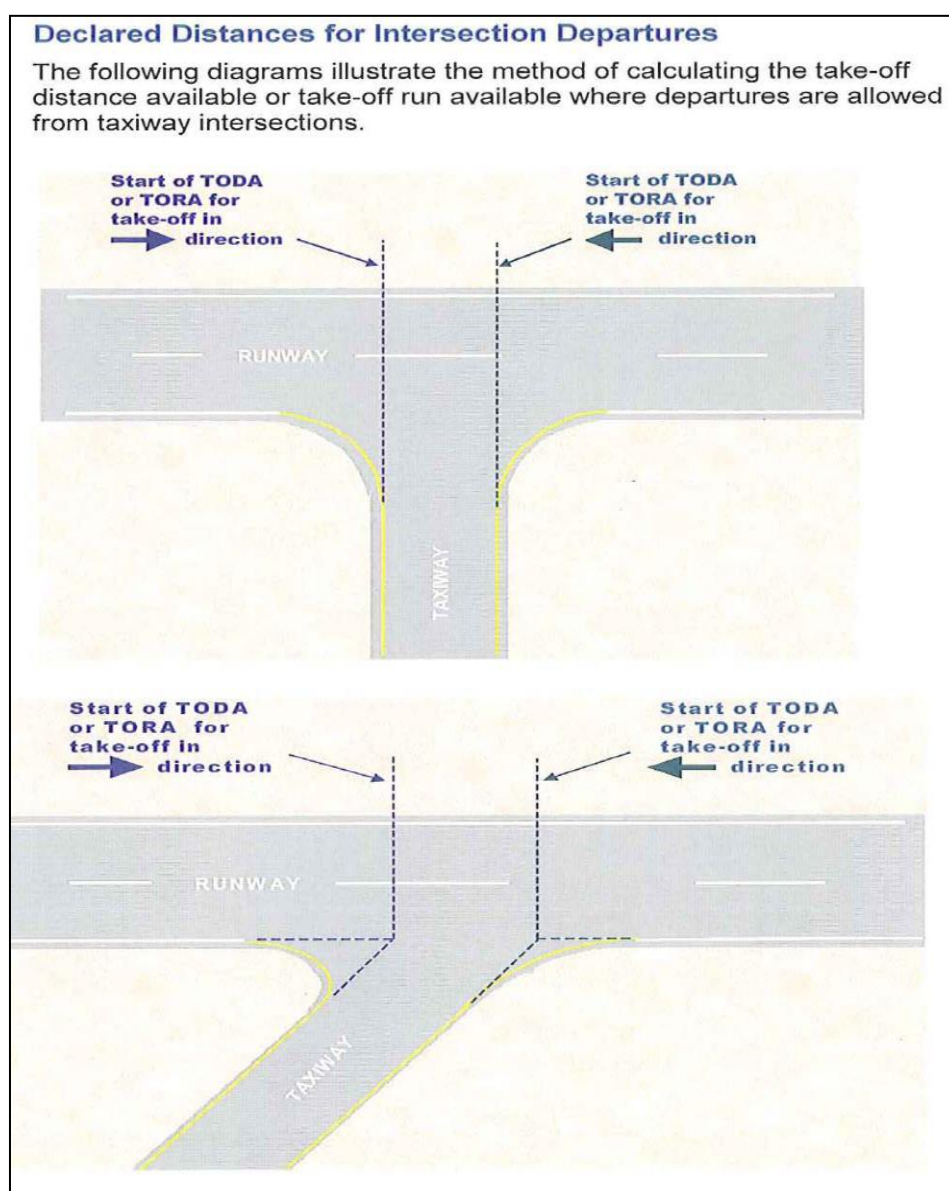




Table App 2-1

Illustration of how to format Declared Distances for AIP

Runway Designator	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	Remarks
1	2	3	4	5	6
09L	3901	3901	3901	3595+	+ 09L landing threshold displaced by 306 m
27R	3884	3961	3884	3884	
09R	3660	3660	3660	3353+	+ 09R landing threshold displaced by 307 m
27L	3660	3660	3660		
09L	3365	3365	3365	-	Take-off from intersection with A12
09L	2840	2840	2840	-	Take-off from intersection with A11
27R	3555	3632	3555	-	Take-off from intersection with A4

## 2.9 CONDITION OF THE MOVEMENT AREA AND RELATED FACILITIES

*Note: See Chapter 4, 4.11 - Notifying and Reporting Information regarding Condition of Movement Area and Related Facilities*

## 2.10 DISABLED AIRCRAFT REMOVAL

*Note: See ICAO Annex 14, Volume 1, Chapter 9, 9.3 for information on disabled aircraft removal.*

2.10.1 The telephone/telex 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 should be made available, on request, to aircraft operators.

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.*





## 2.11 RESCUE AND FIREFIGHTING

*Note: See CAR Part XI - Aerodrome Emergency Service, Equipment and Facilities for information on rescue and firefighting services.*

- 2.11.1 Information concerning the level of protection provided at an aerodrome for aircraft rescue and firefighting purposes shall be made available.
- 2.11.2 The level of protection normally available at an aerodrome should be expressed in terms of the category of the rescue and firefighting services as described in CAR XI - Aerodrome Emergency Service, Equipment and Facilities and in accordance with the types and amounts of extinguishing agents normally available at the aerodrome.
- 2.11.3 Changes in the level of protection normally available at an aerodrome for rescue and firefighting shall be notified to the appropriate Air Traffic Services Unit and the Aeronautical Information Service 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: Changes in the level of protection from that normally available at the aerodrome could result from a change in the availability of extinguishing agents, equipment to deliver the agents or personnel to operate the equipment, etc.*

- 2.11.4 A change should be expressed in terms of the new category of the rescue and firefighting service available at the aerodrome.

## 2.12 VISUAL APPROACH SLOPE INDICATOR SYSTEMS

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 Appendix 9, 9.6.1.2. For a PAPI or APAPI installation, the side of the runway on which the lights are installed, i.e. left, right or both 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 PAPI and an APAPI shall be angle  $(A + B) \div 2$ , as in Appendix 9, Figure App 9-7; and



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- e) minimum eye height(s) over the threshold of the on-slope signal(s) for a PAPI 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'.

**2.13 COORDINATION BETWEEN AIS AND AERODROME AUTHORITIES**

*Note: See Chapter 4, 4.10 - Notifying and Reporting Information to the Aeronautical Information Service*





## APPENDIX 3

### Particulars to be included in an Aerodrome Manual

#### 3.1 PART 1 - GENERAL

- 3.1.1 Table of contents, list of amendments and a distribution list
- 3.1.2 Purpose and scope of the Aerodrome Manual and how it is to be used by operating staff and other stakeholders;
- 3.1.3 Statement of legal requirements for an Aerodrome Certificate or Landing Area Acceptance and the Aerodrome Manual as prescribed in these regulations;
- 3.1.4 Conditions for use of the aerodrome including:
  - a) a statement of the Aerodrome Reference Code, as identified from Appendix 7, indicating the largest aircraft type the aerodrome intends to serve; and type of traffic;
  - b) category of the runway(s) provided (non-instrument, instrument including non-precision and precision);
  - c) the different runways and their associated level of service;  
*Note: Level of service is a description of the RVR for each runway.*
  - d) the nature of aviation activities (commercial, passenger, air transport, cargo, aerial work, general aviation etc.);
  - e) the type of traffic permitted to use the aerodrome (international/national, IFR/VFR, scheduled/non-scheduled); and
  - f) the lowest meteorological conditions or RVR permitted for aircraft arrivals and departures at the aerodrome;
- 3.1.5 Any limitations on the operation of the aerodrome, including areas excluded from use by commercial aircraft;
- 3.1.6 The name, position and telephone numbers of the Post Holders, including the duties and responsibilities of each person, and also matters for which they have responsibility to deal directly with the Authority on behalf of the organisation.
- 3.1.7 Statement of the obligations of the Aerodrome Operator.



### 3.2 PART 2 – PARTICULARS OF THE AERODROME SITE

*Note 1: Aerodrome Operators are encouraged to provide the following diagrams in a format that will permit the Authority to produce charts in accordance with the specifications of ICAO Annex 4. The use of AutoCad files in DWG or DXF format and geographically aligned and georeferenced to WGS84 is preferable.*

*Note 2: The size of the plans should be commensurate with the size and complexity of the aerodrome, however ideally an A3 or A4 size drawing should be included in the Aerodrome Manual. The scale of the plans shall be sufficiently large to show clearly all the elements listed in the following clauses.*

*Note 3: Where, due to the size and complexity of the aerodrome, it is not practicable to include the plans in the Aerodrome Manual, the Aerodrome Manual should contain a reference to the plan and its location.*

#### 3.2.1 Location Plan

Plan of the aerodrome location showing the aerodrome as expressly set aside for aerodrome purposes, including any Aerodrome Facilities and Equipment outside the boundaries of the aerodrome proper.

*Note: The aerodrome location plan should be presented on a background showing the significant and general topographical features of the area i.e. wadi, hills, etc.; features such as roads, nearest town/city or other populous areas; and the location of any Aerodrome Facilities and Equipment outside the boundaries of the aerodrome.*

#### 3.2.2 Boundary Plan

A plan showing the boundaries of the aerodrome and permanent survey points. This would normally be shown on a Title Deed. If the boundaries of the aerodrome are not defined in the documents of the Title - provide details of claim to land or interest in, the property on which the aerodrome is located and a plan showing the boundaries and position of the aerodrome.

*Note 1: A linear scale shall be shown.*

*Note 2: Guidance on survey points is included AMC-61 – Aerodrome Survey Requirements*

#### 3.2.3 Aerodrome Plan



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Plan of the aerodrome showing the aerodrome facilities for the operation of the aerodrome including (where applicable):

- a) Aerodrome Reference Point with elevation and geographical coordinate (WGS84) labelled;
- b) runways with dimensions labelled;
- c) runway surface types (concrete, asphalt, gravel, etc. ) labelled ;

*Note: Bearing strengths or aircraft type restrictions may be shown in tabular form.*

- d) runway end elevations;
- e) runway strip with dimensions labelled;
- f) stopway with stopway end elevation;
- g) clearway with dimensions labelled, and clearway end elevations;
- h) Runway End Safety Area ;
- i) approach lighting;
- j) taxiways with names;

- k) taxiway surface types (concrete, asphalt, gravel, etc.) labelled;

*Note: Bearing strengths or aircraft type restrictions may be shown in tabular form.*

- l) apron with names (T1, T2, Cargo etc.);
- m) navigational aids labelled with type (VOR, DME, etc.) showing critical and sensitive areas identified where possible;
- n) localiser array aerals (with critical and sensitive areas shown);
- o) glide path aerals (with critical and sensitive areas shown);
- p) airside roads;
- q) terminal buildings;
- r) airport fire stations;



- s) aerodrome control tower;
- t) power supply buildings;
- u) other main buildings relevant to the operation of the aerodrome;
- v) airside/landside perimeter fence;
- w) airside/landside perimeter gates (with gate numbers labelled);
- x) meteorological facilities including wind indicators;
- y) boundary of the air traffic control service; and
- z) any part of the Movement Area permanently unsuitable for aircraft and clearly marked as such.

*Note 1: A linear scale shall be shown*

*Note 2: Guidance on an Aerodrome Plan for in relation to survey requirements is available in AMC-61 – Aerodrome Survey Requirements*

#### 3.2.4 Apron Plan

Plan of the apron areas including (where applicable):

- a) apron with identifying names;
- b) bearing strengths or aircraft type restrictions;  
*Note: Bearing strengths or aircraft type restrictions may be shown in tabular form.*
- c) apron markings associated with the movement and parking of aircraft;
- d) aircraft parking bay designations clearly labelled;
- e) apron markings associated with the parking of vehicles and equipment;
- f) apron markings associated with the operation of vehicles;
- g) location of any nose in guidance system;
- h) any run-up bays or engine start points;
- i) the limits of the apron area;



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- j) the boundary of the air traffic control service;
- k) any buildings that front onto the apron;
- l) access gates to the airside area;
- m) a table showing the maximum aircraft code, type, or size permitted to park on each aircraft stand ;
- n) helicopter landing sites and helicopter aiming points; and
- o) any part of the apron area permanently unsuitable for aircraft and clearly marked as such.

*Note: A linear scale shall be shown*

### 3.2.5 Ground Movement Plan

Plan of ground markings used for aircraft guidance showing

- a) all runway markings;
- b) markings in pre threshold areas; and
- c) taxiway and taxilane markings.

### 3.2.6 Lighting Plan

Plan of the airfield lighting showing, where applicable

- a) approach lights;
- b) runway threshold lights;
- c) runway threshold identification lights;
- d) runway edge lighting;
- e) runway end lighting;
- f) stopway lights;
- g) visual landing aids (e.g. PAPI);
- h) turning bay lights;
- i) runway guard lights;



- j) stop bar and intermediate taxiway holding position lighting;
- k) taxiway lighting;
- l) apron flood lighting;
- m) obstacle lights on the aerodrome; and
- n) illuminated windsocks.

### 3.3 PART 3 – PARTICULARS OF THE AERODROME REQUIRED TO BE REPORTED TO AIS

*Note 1: Accuracy of the information is critical to aircraft safety. Information requiring engineering survey and assessment should be gathered or verified by qualified technical persons.*

*Note 2: Data quality standards are contained in Appendix 5.*

3.3.1 A description of the procedures used for obtaining aeronautical data, ensuring it meets quality standards, promulgation to the Aeronautical Information Service and review of the published information.

#### 3.3.2 General Information

- a) name of the aerodrome;
- b) location of the aerodrome;
- c) geographical coordinates of the Aerodrome Reference Point determined in terms of World Geodetic System - 1984 (WGS-84 – ITRF93) reference datum;
- d) aerodrome elevation and geoid undulation;
- e) the elevation of each threshold and Geoid Undulation, the elevation of the runway end and any significant high and low points along the runway, and the highest elevation of the Touchdown Zone of a precision approach runway;
- f) aerodrome reference temperature;
- g) details of the aerodrome beacon; and
- h) name of the Aerodrome Operator and the address and telephone numbers at which the Aerodrome Operator may be contacted at all times.



### 3.3.3 Aerodrome Dimensions and Related Information

- 3.3.3.1 Runway - true bearing, designation number, length, width, displaced threshold location, slope, surface type, type of runway, and for a precision approach runway, the existence of an Obstacle Free Zone;
- 3.3.3.2 Other elements
  - a) Length, width and surface type of strip, stopways, clearway; and
  - b) Dimensions of Runway End Safety Areas; location (which runway end) and descriptions of arresting systems (if any).
- 3.3.3.3 Width and surface type of taxiways;
- 3.3.3.4 Apron surface type and aircraft stands;
- 3.3.3.5 Length and ground profile of clearway;
- 3.3.3.6 Visual aids for approach procedures i.e. approach lighting type and precision approach path indicator system (PAPI); marking and lighting of runways, taxiways, and aprons; other visual guidance and control aids on taxiways (including runway holding positions, Intermediate Holding Positions and stop bars) and aprons, location and type of visual docking guidance system; availability of standby power for lighting;
- 3.3.3.7 Location and radio frequency of VOR aerodrome checkpoint;
- 3.3.3.8 Location and designation of standard taxi-routes;
- 3.3.3.9 The geographical co-ordinates of each threshold;
- 3.3.3.10 The geographical coordinates of appropriate taxiway centre line points;
- 3.3.3.11 The geographical co-ordinates of each aircraft stand;
- 3.3.3.12 the geographical coordinates and the top elevation of significant obstacles in the approach and take-off areas, in the circling area and in the vicinity of the aerodrome. (The information may best be shown in the form of charts such as those required for the preparation of aeronautical information publications as specified in ICAO Annexes 4 and 15);
- 3.3.3.13 (Applicable until 27 November 2024)
  - Pavement surface type and bearing strength using Aircraft Classification Number and Pavement Classification Number (CAN-PCN) method;



(Applicable as of 28 November 2024)

Pavement surface type and bearing strength using Aircraft Classification Rating - Pavement Classification Rating (ACR-PCR) method;

3.3.3.14 One or more pre-flight altimeter check locations established on an apron and their elevation;

**3.3.3.15 Declared Distances:**

- a) Take-off Run Available (TORA);
- b) Take-off Distance Available (TODA);
- c) Accelerate-Stop Distance Available (ASDA); and
- d) Landing Distance Available (LDA).

*Note: Declared Distances for Intersection Take-offs must also be included. See Appendix 2, 2.8 for additional guidance.*

**3.3.3.16 Disabled Aircraft Removal Plan**

- a) the telephone/telex/facsimile numbers and e-mail address of the aerodrome coordinator for the removal of a disabled aircraft on or adjacent to the Movement Area; and
- b) information on the capability to remove a disabled aircraft, expressed in terms of the largest type of aircraft which the aerodrome is equipped to remove.

**3.3.3.17 Rescue and Firefighting Services**

Level of protection provided, expressed in terms of the category of the rescue and firefighting services, which should be in accordance with the longest aircraft normally using the aerodrome and the type and amounts of extinguishing agents normally available at the aerodrome. Nominate the Fire Command call frequency as 121.6 MHZ.

**3.4 PART 4 – SYNOPSIS OF THE AERODROME OPERATING PROCEDURES AND SAFETY MEASURES**

*Note: For each procedure:*

- a) the responsibilities of the Aerodrome Operator should be clearly described;
- b) the tasks that are to be achieved by the Aerodrome Operator or its subcontractors are listed; and





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- c) *the means and procedures required to complete the tasks are described or appended, together with the necessary details such as frequency or application and operating modes.*

**3.4.1 Reporting Aerodrome Information**

3.4.1.1 Synopsis of the procedures for reporting aerodrome information, or any changes to the aerodrome information as set out in the UAE Aeronautical Information Publication and procedures for requesting the issue of NOTAMS, including the following:

- a) Procedures for checking the accuracy of information, both prior to and following promulgation;
- b) Procedures for issuing NOTAM during and outside normal hours of aerodrome operation;
- c) Procedures for changing information in the AIP; and
- d) Procedures for providing aerodrome briefing to aircraft operators as required by Chapter 4, 4.13;

*Note: Guidance to Aerodrome Operators concerning Airport Briefings is contained within AMC-24 - Airport Briefing Requirements.*

3.4.1.2 Names and roles of persons responsible for notifying the changes and their telephone number during and outside the normal hours of aerodrome operations; and

3.4.1.3 The location and telephone numbers, as provided in the UAE Aeronautical Information Publication (Part 1 – Gen 3.1), of the place at which changes are to be reported to Aeronautical Information Services.

**3.4.2 Access to Aerodrome Movement Area**

3.4.2.1 Synopsis of the procedures developed and to be followed in coordination with the agency responsible to prevent unlawful interference in civil aviation at the aerodrome, for preventing unauthorised entry of persons, vehicles, equipment, animals or other things, into the Movement Area including the following:

- a) The role of each agency with a key responsibility for aerodrome security;
- b) Control of access of personnel and contractors;



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- c) Control of access of vehicles and equipment, including issuing of “approval” for vehicles to operate airside.

3.4.2.2 The names and roles of the aerodrome personnel responsible for controlling access to the aerodrome and the telephone number for contacting those personnel during and after working hours.

3.4.3 **Aerodrome Movement Area Inspections**

3.4.3.1 Synopsis of the procedures for the daily inspection of the aerodrome Movement Area and obstacle limitation surfaces, including the following:

3.4.3.2 Description of the inspections undertaken, and frequency (including timing), to ensure the Movement Area is clear of FOD, harmful irregularities, temporary obstructions or hazardous conditions. A copy of the inspection checklists used must also be provided;

3.4.3.3 Details of record keeping arrangements and location of the records, including corrective actions taken;

3.4.3.4 Description of means of communicating with the aerodrome air traffic services and Apron Management Service during the inspection;

3.4.3.5 Procedures for reporting the results of the runway, taxiway and apron inspections to unit(s) responsible for control of aircraft on the Movement Area, and parties responsible for rectification of any deficiencies found;

3.4.3.6 Procedures for restricting aircraft operations on portions of the aerodrome where an unsafe condition exists.

3.4.3.7 The names and roles of persons responsible for carrying out Movement Area inspections and their telephone numbers during and after working hours.

*Note: Guidance to Aerodrome Operators concerning aerodrome Movement Area inspections is contained within AMC-36 – Runway and Movement Area Inspections.*

3.4.4 **Aerodrome Electrical System and Visual Aids**

3.4.4.1 Synopsis of facilities and procedures for the inspection and maintenance of the aerodrome electrical system, aeronautical lights (including obstacle lighting), signs, and marking, including the following:



**a) Electrical**

- i) Description of the aerodrome electrical distribution system, including secondary power supply;
- ii) A single line diagram showing as built system;
- iii) Description of method of testing, including frequency, of secondary power supply;

**b) Airfield Lighting**

- i) Description of airfield ground lighting at the aerodrome, including VDGS;
- ii) Description of lighting circuitry;
- iii) Details of inspection schedule, type of inspection/calibration conducted;
- iv) A copy of the checklists used;
- v) Details of record keeping arrangements, including corrective actions taken;
- vi) Procedures for reporting the results of the inspection to unit(s) responsible for control of aircraft on the Movement Area, and parties responsible for rectification of any deficiencies found;
- vii) Description of preventative maintenance measures undertaken;
- viii) Description of emergency maintenance procedures;
- ix) Details of the number of personnel involved including shift structure to maintain airfield lighting;

**c) Signs and Markings**

- i) Details of inspection schedule and type of inspection conducted;
- ii) A copy of the checklists used;
- iii) Details of record keeping arrangements, including corrective actions taken;



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- iv) Procedures for reporting the results of the inspection to unit(s) responsible for control of aircraft on the Movement Area, and parties responsible for rectification of any deficiencies found;
- v) Description of preventative maintenance measures undertaken;

**d) The names and roles of persons responsible for the operation and maintenance of the**

- i) Electrical system;
- ii) Airfield lighting;
- iii) Airfield signs;
- iv) Pavement markings;

including their telephone numbers for contacting these persons during and after working hours.

**3.4.5 Aerodrome Movement Area Maintenance**

**3.4.5.1 Synopsis of pavement maintenance programme (preventative and reactive measures) and pavement management system used for the maintenance of the Movement Area, including:**

- a) Pavement inventory: Details of paved areas including year of construction, pavement type and strength and year of most recent major rehabilitation for each applicable area;
- b) Inspection schedule and type of inspections/surveys/assessments conducted for paved and unpaved areas including runway and taxiway strips;
- c) Details of record keeping arrangements, including corrective actions taken;
- d) Arrangements for maintaining the paved areas clear of FOD;
- e) Details concerning friction testing, assessment and corrective programme for removal of rubber build up or surface rehabilitation on the runway;
- f) Details for maintaining aerodrome drainage system and ensuring it is adequate and serviceable;
- g) Details of how overweight operations are regulated in relation to Appendix 2, 2.6.7 (if applicable); and



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- h) Details or reference to plan stating priority of contaminant removal with reference to 4.16.9.4.

3.4.5.2 The names and roles of persons responsible for the maintenance of the aerodrome Movement Area and their telephone numbers during and after working hours.

3.4.6 **Aerodrome Works Safety**

3.4.6.1 Synopsis of the procedures for planning and carrying out works safely, on or in the vicinity of the Movement Area or those areas that may extend above the obstacle limitation surfaces, including the following:

- a) Description of methodology used for the development of a safety plan, including the development of checklists and control of contractors working airside;
- b) Description of methodology used for implementing works safety plan including use of works notification systems and work authority permits;
- c) Description of procedures used for closing off, reopening areas for aircraft use and the formal acceptance of Work Areas prior to returning them to serviceability on a daily basis;
- d) Description of the supervision arrangements for early detection of deviations from intended practices or procedures or systems, if applicable;
- e) Arrangement for communicating with the Air Traffic Services Unit and/or Apron Management Service Unit during the progress of such works;

3.4.6.2 Names, telephone numbers and roles of the persons responsible for planning and implementing aerodrome works safety plans including telephone numbers to contact those persons during and after work hours

3.4.7 **Apron Management**

3.4.7.1 Synopsis of the procedures used for apron management, including the following interaction between the Air Traffic Services Unit and the Apron Management Service including the following;

- a) Description of geographical area of responsibility, i.e. point of transfer of control of aircraft between aerodrome air traffic unit and Apron Management Service/Unit;
- b) Details of procedures for transfer of control for arriving and departing aircraft between service units (if applicable);



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- c) Arrangements for allocating aircraft parking positions;
- d) Arrangements for ensuring that the aircraft stand is available, equipment serviceable and the stand clear of FOD, obstructions/vehicles prior to entry by aircraft, and relaying that information to the service unit responsible for the control of the aircraft onto the aircraft stand;
- e) Details of procedures/systems used for guidance of aircraft onto the aircraft stand and to/from the Manoeuvring Area;
- f) Arrangements for initiating engine start and ensuring clearance of aircraft from mobile or fixed objects during push-back; and
- g) Details of who provides follow me (vehicle) service if required, and how instructions are relayed between the control service/vehicle/aircraft.

3.4.7.2 The names and roles of person(s) responsible for the Apron Management Service/Aircraft Stand Allocation including their telephone numbers during and after working hours.

3.4.8 **Apron Safety Management**

3.4.8.1 Synopsis of procedures and facilities used to ensure apron safety, including

- a) Protection from jet blast;
- b) Protection from foreign object debris;
- c) Description of contingency measures in place for response to spillages of hydrocarbon substances including cleaning of apron surfaces;
- d) Enforcement of apron safety precautions during refuelling operations;
- e) Details for reporting incidents/accidents on the apron and investigation and analysis of such occurrences;
- f) Details for auditing the safety compliance by all personnel working on the apron; and
- g) Details of any apron/ground safety committee established for promoting apron safety at the aerodrome.

3.4.8.2 The names and roles of person(s) responsible for apron safety oversight including their telephone numbers during and after working hours.



### 3.4.9 **Airside Vehicle Control**

#### 3.4.9.1 Synopsis of the procedures for the control of surface vehicles operating on, or in the vicinity of, the Movement Area, including the following:

- a) Details of the applicable traffic rules (including speed limits and the means of enforcement of the rules);
- b) Details of requirements for vehicle serviceability requirements;
- c) A description of the method for issuing driving permits for operating vehicles in the Movement Area; and
- d) A description of the method for issuing vehicle permits/authorisation for vehicles and ground service equipment. Special attention needs to be given for the types of vehicles/equipment that will remain airside.

#### 3.4.9.2 The names and roles of person(s) responsible for airside driving including their telephone numbers during working hours.

### 3.4.10 **Wildlife Hazard Management**

#### 3.4.10.1 Synopsis of the methodologies to deal with danger to aircraft operations caused by the presence of bird or mammals on the aerodrome or in the flight pattern, following should be detailed within the Aerodrome Operator's Wildlife Hazard Management Plan.

#### 3.4.10.2 Names and roles of the persons responsible for dealing with wildlife hazards, and their telephone numbers during and after working hours.

### 3.4.11 **Obstacle Control**

#### 3.4.11.1 Synopsis of the system used to control and remove obstacles at the aerodrome and its environs including:

- a) Description of the methodology used to determine the existence of obstacles on the aerodrome and in its environs, including the frequency of assessment or confirmation;
- b) Description of the methodology used to control new obstacles at the aerodrome or in its environs; including new building developments;
- c) Description of the system in place to remove existing obstacles from the aerodrome and its environs;



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- d) Details of the procedures used for notifying the Authority of the nature and location of obstacles and any subsequent addition or removal of obstacle for action as necessary including amendment of the Aeronautical Information Service publications; and
- e) Description of the system in place to obtain and report obstacles and terrain data to the Authority in the applicable data collection areas.

3.4.11.2 Names and roles of the persons responsible for aerodrome safeguarding and the management and control of obstacles at the aerodrome, and their telephone numbers during and after working hours.

3.4.12 **Handling of Hazardous Material**

Synopsis of the procedures used for the safe handling and storage of hazardous material on the aerodrome, including the following:

- a) Details of special areas on the aerodrome set-up for the storage of flammable liquids (including aviation fuels) and any other hazardous material;
- b) The method to be followed for the delivery, storage, dispensing and handling of hazardous materials;
- c) Description of the system in place to test the quality of aviation fuel prior to dispensing into aircraft; and
- d) Description of the procedures in place on the apron to ensure safety during aircraft refuelling/defuelling operations.

*Note: Further regulation is provided in CAR Part VI, Chapter 2, Transport of Dangerous Goods.*

3.4.13 **Adverse Weather and Low Visibility Conditions**

3.4.13.1 Synopsis of procedures to be introduced for operations in Low Visibility Conditions, including:

- a) A statement of operation providing detail as to what the lowest limit (meteorological condition) aircraft approaches and/or departures has been accepted by the Authority for the aerodrome,
- b) Details of how measurement and reporting of Runway Visual Range is made;





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- c) A description of measures undertaken prior to the commencement of operations in low visibility conditions and at what stage(s) they are implemented; and at what stage(s) they are implemented; and
- d) Description of system used to control aircraft and vehicles during low visibility operations.

*Note: Further guidance on Low Visibility Procedures is available in AMC-44*

3.4.13.2 Synopsis of procedures for notification of adverse weather conditions, including:

- a) Overview of the methodology in determining adverse weather conditions such as high-winds, heavy rains or sandstorms; and
- b) Description of procedure or system used to notify aerodrome stakeholders (ground based) of adverse weather conditions.

3.4.13.3 Names and roles of the persons responsible for control of the procedures related to Adverse Weather Conditions at the aerodrome, and their telephone numbers during and after working hours.

3.4.14 **Protection of Radar and Navigational Sites**

3.4.14.1 Synopsis of the procedures for the protection and operations and maintenance of radar and radio navigational aids located on the aerodrome to ensure that their performance will not be degraded, including the following:

- a) Description of aerodrome navigation aids;
- b) Details of inspection schedule, type of inspection/calibration conducted;
- c) A copy of the checklists used;
- d) Details of record keeping arrangements, including corrective actions taken;
- e) Procedures for reporting the results of the inspection to unit(s) responsible for control of aircraft on the Movement Area, and parties responsible for rectification of any deficiencies found, and follow up;
- f) Description of preventative maintenance measures undertaken;
- g) Details of the number of personnel involved including shift structure to maintain the navigation aids for the aerodrome;
- h) A description of the maintenance schedule programme;



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- i) The arrangement for the control of activities in the vicinity of radar and nav aids installations to ensure that there is no interference of signal;
- j) arrangements for ground maintenance in the vicinity of these installations; and
- k) arrangements for the supply and installation of signs warning of hazardous microwave radiation.

3.4.14.2 Names and roles of persons responsible for operations and maintenance of radio navigation aids on the aerodrome including telephone numbers for contact during and after work hours.

3.4.15 **Aerodrome Briefing**

A description of the system implemented to brief Air Transport Operators and Air Carriers, of the necessary safety and regulatory requirements for aircraft before operating in the Emirates FIR or from UAE Territory as required by Chapter 4, 4.13.

3.4.16 **Handling of Blacklisted Aircraft**

Details of the procedures adopted to negate aircraft operators from operating at their aerodrome when such aircraft operators cannot meet the UAE regulatory requirements (Chapter 4, 4.14), or are subject to:

- a) a ban based upon the origin of registry as notified by the Authority;
- b) a cease and desist order as notified by the Authority; or
- c) when the aircraft is subject to a grounding order as notified by the Authority.

3.5 **PART 5 – RFS AERODROME MANUAL REQUIREMENTS**

3.5.1 The name and role of the person responsible for the provision of the Aerodrome Rescue Fire Service including the telephone number for contacting that person during and after working hours.

3.5.2 High-level Policy statement of the RFS category(s) to be provided.

3.5.3 At aerodromes where a higher category is available by prior arrangement the Manual should clearly state the actions necessary to upgrade the facility.

3.5.4 The Aerodrome Operator objectives for each RFS category provided should be defined.

3.5.5 This should include a chart of:



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- a) Amounts of media provided;
- b) Discharge rates;
- c) Number of foam-producing appliances;
- d) Manning levels; and
- e) Levels of supervision.

*Note: When the objectives are higher than those set out in these regulations, Aerodrome Operators may also wish to indicate the operational levels acceptable under their safety policies.*

- 3.5.6 Indicating how the adequacy of the response time capability throughout their functions and locations is monitored and maintained.
- 3.5.7 Indicating how RFS personnel engaged in extraneous duties are managed to ensure that response capability is not affected.
- 3.5.8 Where the aerodrome provides specialist equipment such as water tankers, rescue craft, emergency tenders, hose layers, appliances with aerial capability, etc., details should be included in the Aerodrome Manual. Procedures to be followed if these facilities are temporarily unavailable should also be included.
- 3.5.9 Where the aerodrome is reliant upon other organisations to provide equipment which is essential for ensuring safe operation of the aerodrome (perhaps water rescue), policies or letters of agreement should be included in the Aerodrome Manual.
- 3.5.10 Where necessary, contingency plans in the event of non-availability should be described.
- 3.5.11 A high-level statement describing the process by which Aerodrome Operators to select and retain RFS personnel.
- 3.5.12 A high-level statement describing the process by which Aerodrome Operators ensure the initial and continued competence of their RFS personnel.
- 3.5.13 Procedures indicating how accidents within 1000 m of the threshold of each runway are to be accessed. Where other difficult environs exist the Manual should indicate how these are to be accessed.



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- 3.5.14 Where Aerodrome Operators expect the RFS facility to respond to domestic fires or special services, procedures for managing the impact of this upon the normal aircraft RFS response should be included.
- 3.5.15 Where Aerodrome Operators expect the RFS facility to respond to aircraft accidents landside/off aerodrome, the policy should be clearly described. This should include procedures to manage the effects on continued aircraft operations.
- 3.5.16 The availability of additional water supplies following an aircraft accident should be described. Details of the policy to be followed in the event of contractual work which requires isolation or depletion of supplies should be included.
- 3.5.17 An indication of the scale of the medical equipment available. Where medical equipment is held other than on the RFS vehicles a statement indicating its location and how it is to be transported to an incident should be included.
- 3.5.17.1 The Aerodrome Operator shall provide aeronautical data regarding Rescue and Firefighting in accordance with Appendix 2, 2.11.
- 3.5.18 **Integrated Emergency Planning**
- 3.5.18.1 The Aerodrome Operators arrangements for determining and implementing plans that ensure the integrated management of response to an aircraft incident/accident. These arrangements should take account of the complexity and size of the aircraft operations.
- 3.5.18.2 Policy statement of distance airport would respond to an aircraft accident off aerodrome.
- 3.5.18.3 Additional information/instructions within the Emergency Plan shall be described based upon the hazard/risk registry undertaken by the Aerodrome Operator.
- 3.5.19 **Disabled Aircraft Removal**
- 3.5.19.1 The Aerodrome Operators arrangements and implementing plans that ensure the integrated management of aircraft recovery and business continuity following an aircraft incident/accident. These arrangements should take account of the complexity and size of the aircraft operations and based on the largest aircraft using the aerodrome.
- 3.5.19.2 The full provision of Rescue, Fire-Fighting and Emergency Planning for all categories of aerodrome shall be in accordance with CAR Part XI - Aerodrome Emergency Service, Equipment and Facilities.



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- 3.5.19.3 The Aerodrome Operator shall provide aeronautical data regarding disable aircraft removal in accordance with Appendix 2, Section 2.10.

**3.6 PART 6 – AERODROME ADMINISTRATION AND SAFETY MANAGEMENT SYSTEM (SMS)**

**3.6.1 Aerodrome Administration**

An organisational chart showing the names and positions, and lines of responsibility of accepted aerodrome post holders including:

- a) the name, position and telephone number of the person who has overall accountability for aerodrome safety;
- b) A description of their responsibilities including safety accountabilities, and
- c) A description of the safety management group/committee including published safety accountabilities.

**3.6.2 Safety Management System (SMS)**

- 3.6.2.1 A description of the aerodrome Safety Management System established for ensuring compliance with all safety requirements and achieving continuous improvement in safety performance, including the following essential features:

- a) A statement of safety policies, insofar as applicable, on the process of safety management and its relation to the operational and maintenance process;
- b) A description of how planning and strategy is undertaken including, allocating priority for implementing safety initiatives, and the setting of safety performance targets and assessment of achievement against these targets;
- c) A description of the aerodrome quality assurance system including internal safety audit and review schedule, and methodology for ensuring compliance with these regulations and quality control on safety;
- d) A description of the system employed for the documentation of all safety related airport facilities as well as airport operational and maintenance records including information on the design and construction of aircraft pavements and aerodrome lighting, and their easy retrieval;
- e) A description of the methodology used to identify risks; and mitigating and controlling those risks to a level as low as reasonably practicable keeping always in view the requirements of these regulations and ICAO Annexes and other documentation;



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- f) A description of the system used in identifying critical safety areas which require a higher level of safety management integrity, and the adoption of a Safety Measures Programme (e.g. works safety plan, airside driver licensing; low visibility operations);
- g) A description of the system for reporting occurrences, complaints, defects, faults, discrepancies and failures including the handling and investigation of reports as well as continuing safety monitoring and analysis of trends;
- h) A description of the methods and procedures used for effective communications of safety messages and enforcement of safety requirements; and
- i) A description of the system implemented for recruitment, staff training and competency testing including review and evaluation of the adequacy of training provided to staff on safety related duties and of the certification system for testing their competency.

3.6.2.2 The Safety Policy should include:

- a) A statement of intent about maintaining or improving current safety performance.
- b) A statement of intent to minimise the risks of an accident occurring – probably with a “as far as reasonable practicable caveat;
- c) A statement of intent to implement an effective formal safety system
- d) A statement about individual and management accountability and responsibility for safety performance
- e) A statement about the priority ascribed to flight safety relative to commercial, operational, environmental and working practice pressures
- f) A statement about compliance with safety standards and regulatory requirements
- g) A statement about ensuring sub-contractors meet company safety standards and requirements.



## APPENDIX 4

### AERONAUTICAL STUDIES

#### 4.1 PURPOSE

An Aeronautical Study is conducted to assess the impact of proposed change or deviations to Civil Aviation Regulations; present alternative means of ensuring safety of aircraft operations; assess the effectiveness of each alternative or proposed change and to recommend procedures or mitigating measures to compensate for any safety risks that have been identified.

*Note: An Aeronautical Study (risk analysis) is a mechanism, part of a Safety Management System, used to assess the risk (combination of event or hazard severity and probability of occurrence) posed by a particular set of circumstances. It is used to compare the outcome of such an analysis against the intended outcome of a particular regulatory requirement so that a solution can be selected that will not degrade safety below that which is intended.*

#### 4.2 APPLICABILITY

4.2.1 An Aerodrome Operator shall monitor operations and conduct an Aeronautical Study prior to a significant change that may affect the safety of aerodrome operations.

4.2.2 For the purpose of paragraph 4.2.1, a change requiring prior approval referred to by Civil Aviation Regulations includes:

- a) any change affecting the Conditions, Scope of Operations, Specific Conditions or Deviations of the Aerodrome Certificate;
- b) any change significantly affecting elements of the Aerodrome Operator's management system;
- c) any change where certification requirements cannot be met; and
- d) where specified within these regulations.

4.2.3 An Aerodrome Operator shall conduct an Aeronautical Study where referred to by regulation.

**GM 1 to Appendix 4, 4.2 - Applicability:** *The following listing contains examples from regulation where an Aeronautical Study is required or referred to. Aerodrome Operators should consider additional circumstances where it may be applicable*



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*and beneficial to conduct an Aeronautical Study, which may be dependent upon the level and scale of operations:*

- a) *Where prior approval is required for proposals for operations on runways which are less than the required code (i.e. Code F operations on a Code E runway).*
- b) *Where agreement is required for changes to minimum staffing levels of the rescue and firefighting services.*
- c) *Where it is proposed to operate with lower taxiway minimum separation distances at an existing aerodrome, than that required by these regulations.*
- d) *Where it is proposed to omit a location sign, which is required by these regulations to be provided in conjunction with a direction sign.*
- e) *Where new or extensions of existing obstacles should not be permitted above an obstacle protection surface or obstacle limitation surface, as referred to by regulation unless it is determined that the object would not adversely affect safety.*
- f) *Where the presence of objects must be lighted with reference to these regulations.*
- g) *Where the wheel clearance over the threshold does not meet the requirements for the installation for a PAPI and (A)PAPI.*
- h) *Where there are changes to any obstacles, developments and other activities within the areas monitored by the Aerodrome Operator in accordance with regulation, which may endanger safety and adversely affect the operation of an aerodrome.*

### 4.3 ASSESSMENT

4.3.1 As part of its management system, the Aerodrome Operator proposing a change to the aerodrome, its operation, its organisation, its management system, equipment or proposing a deviation from Civil Aviation Regulation shall:

- a) determine the interdependencies with any affected parties, plan and conduct an Aeronautical Study in coordination with these organisations;
- b) align assumptions and mitigations with any affected parties, in a systematic way;





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- c) ensure a comprehensive assessment of the change including any necessary interactions; and
- d) ensure that complete and valid arguments, evidence and safety criteria are established and documented to support the Aeronautical Study, and that the change supports the improvement of safety whenever reasonably practicable.

**AMC 1 to Appendix 4, 4.3 - Assessment Process:** *As part of the process for the management of change or for an assessment where conformance to regulatory requirements cannot be met, reference should be made to “Safety Risk Management” within CAR Part X - Safety Management System.*

*Safety management is centred on a systematic approach to hazard identification and risk management. The process of moving from hazard identification to risk assessment and risk mitigation is detailed within CAR Part X.*

**AMC 2 to Appendix 4, 4.3.1 a) – Assessment Process:**

*When a safety concern, change or a deviation has an impact on several aerodrome stakeholders, consideration shall be given to the involvement of all stakeholders affected in the safety assessment process. In some cases, the stakeholders impacted by the change will need to conduct a separate safety assessment themselves in order to fulfil the requirements of their SMS and coordinate with other relevant stakeholders.*

**AMC 3 to Appendix 4, 4.3.1 a) c) – Assessment Process:**

*When a change has an impact on multiple stakeholders, a collaborative safety assessment should be conducted to ensure compatibility of the final solutions*

**GM 1 to Appendix 4, 4.3 - Assessment Process:** *Changes on an aerodrome can include changes to procedures, equipment, infrastructures, safety works, special operations, regulations, organisation, etc.*

*The assessment process should include:*

- a) *identification of the scope of the change;*
- b) *identification of hazards;*
- c) *determination of the safety criteria applicable to the change;*
- d) *risk assessment in relation to the harmful effects or improvements in safety related to the change;*
- e) *risk evaluation and, if required, risk mitigation for the change to meet the applicable safety criteria;*



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- f) *verification that the change conforms to the scope that was subject to safety assessment, and meets the safety criteria, before the change is put into operation; and*
- g) *the specification of the monitoring requirements necessary to ensure that the aerodrome and its operation will continue to meet the safety criteria after the change has taken place.*
- h) *Consideration of the impact of the safety concern on all relevant factors determined to be safety-significant. The list below provides a number of items that may need to be considered when conducting a safety assessment. The items in this list are not exhaustive and in no particular order:*
  - 1) *aerodrome layout, including runway configurations; runway length; taxiway, taxilane and apron configurations; gates; jet bridges; visual aids; and the RFF services infrastructure and capabilities;*
  - 2) *types of aircraft, and their dimensions and performance characteristics, intended to operate at the aerodrome;*
  - 3) *traffic density and distribution;*
  - 4) *aerodrome ground services;*
  - 5) *air-ground communications and time parameters for voice and data link communications;*
  - 6) *type and capabilities of surveillance systems and the availability of systems providing controller support and alert functions;*
  - 7) *flight instrument procedures and related aerodrome equipment;*
  - 8) *complex operational procedures, such as collaborative decision-making (CDM);*
  - 9) *aerodrome technical installations, such as advanced surface movement guidance and control systems (A-SMGCS) or other air navigation aids;*
  - 10) *obstacles or hazardous activities at or in the vicinity of the aerodrome;*
  - 11) *planned construction or maintenance works at or in the vicinity of the aerodrome;*
  - 12) *any local or regional hazardous meteorological conditions (such as wind shear); and*



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- 13) *airspace complexity, ATS route structure and classification of the airspace, which may change the pattern of operations or the capacity of the same airspace.*

**GM 2 to Appendix 4, 4.3 - Scope:** *The scope of the Aeronautical Study should include the following elements and their interaction:*

- a) *the aerodrome, its operation, management, and human elements being changed or introduced;*
- b) *interfaces and interactions between the elements being changed or introduced and the remainder of the system;*
- c) *interfaces and interactions between the elements being changed or introduced and the environment in which it is intended to operate; and*
- d) *the full lifecycle of the change or introduction of systems, procedures, equipment from definition to operations.*

**GM 3 to Appendix 4, 4.3 - Safety Criteria:** *The safety criteria used should be defined in accordance with the procedures for the management of change contained in the Aerodrome Manual.*

*The safety criteria used should, depending on the availability of data, be specified with reference to explicit quantitative acceptable safety risk levels, recognised standards, and/or codes of practice, the safety performance of the existing system, or a similar system.*

**GM 4 to Appendix 4, 4.3 - Supporting Evidence:** *The Aeronautical Study should include all details, data and records which are considered to be related to the assessment process and study.*

*As a minimum, the Aeronautical Study should include supporting evidence, safety assessments, actions, exercises to demonstrate compliance, compliance statements, inspections, tests, results from the risk management process (hazard identification, and risk assessment and mitigation processes) and aerodrome management accountability.*

*An Aeronautical Study will only be approved (where applicable) on the basis of a robust rationale. Therefore, aeronautical study techniques should be developed, as part of a Safety Management System (SMS), at the appropriate level.*

*The responsibility for justifying, either qualitatively or quantitatively, an alternative means of compliance lies with the Aerodrome Operator.*

**GM 5 to Appendix 4, 4.3 – Check List:** *A suggested check list for the reviewing of an Aeronautical Study is as shown below. Aerodrome Operators may use this check list as a guide for developing an Aeronautical Study tailored to their individual situation.*



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	Yes	No	Remarks
Does the aim of the study:			
a) Address safety concerns	<input type="checkbox"/>	<input type="checkbox"/>	
b) Identify safety measures	<input type="checkbox"/>	<input type="checkbox"/>	
c) Reference specific regulations	<input type="checkbox"/>	<input type="checkbox"/>	
Is there evidence of consultation with Stakeholders, Senior management and any affected departments or other authorities?	<input type="checkbox"/>	<input type="checkbox"/>	
Has the study been approved by senior management?	<input type="checkbox"/>	<input type="checkbox"/>	
Is there background information on the current situation?	<input type="checkbox"/>	<input type="checkbox"/>	
Is there a proposed date of compliance with regulation if study is due to development of the aerodrome?	<input type="checkbox"/>	<input type="checkbox"/>	
Does the safety assessment include:			
a) Identification of hazards and consequences	<input type="checkbox"/>	<input type="checkbox"/>	
b) Risk management	<input type="checkbox"/>	<input type="checkbox"/>	
Does the study show the safety assessment used e.g. hazard log, risk probability and severity, risk assessment matrix, risk tolerability and risk control/mitigation?	<input type="checkbox"/>	<input type="checkbox"/>	
Are there recommendations that include operating procedures/restrictions or other measures to address safety concerns identified by the study, and how any proposed deviation will not pose a reduction in the level of safety?	<input type="checkbox"/>	<input type="checkbox"/>	
Are there estimations of the effectiveness of each recommendation listed in the study?	<input type="checkbox"/>	<input type="checkbox"/>	
Is there a notification procedure that includes process flow, time frame and the publication used to promulgate any deviation?	<input type="checkbox"/>	<input type="checkbox"/>	
Does the study include a conclusion?	<input type="checkbox"/>	<input type="checkbox"/>	
Are there details on how any operating procedures/restrictions or other measures put in place to address safety concerns will be monitored?	<input type="checkbox"/>	<input type="checkbox"/>	

#### 4.4 RECORD KEEPING – DOCUMENT CONTROL

The Aeronautical Study shall be retained for the lifetime of the system, the procedure or the activity.



**APPENDIX 5**

**AERONAUTICAL DATA QUALITY REQUIREMENTS**

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**Table App 5-1**

**Latitude and Longitude**

(A) Aerodrome only

(H) Heliport only

<b>Elevation/Altitude/Height</b>	<b>Accuracy Data Type</b>	<b>Integrity Classification</b>
Aerodrome/Heliport reference point	30 m surveyed/calculated	routine
Nav aids located at the aerodrome/heliport	3 m surveyed	essential
Obstacles in Area 3	0.5 m surveyed	essential
Obstacles in Area 2 (the part within the aerodrome/heliport boundary)	5 m surveyed	essential
Geometric centre of TLOF or FATO thresholds (H)	1 m surveyed	critical
Runway thresholds (A)	1 m surveyed	critical
Runway end (flight path alignment point) (A)	1 m surveyed	critical
Runway centre line points (A)	1 m surveyed	critical
Runway-holding position (A)	0.5 m surveyed	critical
Taxiway centre line/parking guidance line points (A)	0.5 m surveyed	essential
Helicopter ground taxiway centre line points and helicopter air taxiway points (H)	0.5 m surveyed/calculated	essential
Intermediate holding position marking line (A)	0.5 m surveyed	essential
Helicopter ground taxiway intersection marking line (H)	0.5 m surveyed	essential
Exit guidance line	0.5 m surveyed	essential
Apron boundaries (polygon)	1 m surveyed	routine
Aircraft /Helicopter stand points/INS checkpoints	0.5 m surveyed	routine

*Note 1: See ICAO Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.*

*Note 2: Implementation of ICAO Annex 15, provisions 10.1.4 and 10.1.6, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data*



**Table App 5-2**

**Elevation/Altitude/Height**

(A) Aerodrome only

(H) Heliport only

<b>Elevation/Altitude/Height</b>	<b>Accuracy Data Type</b>	<b>Integrity Classification</b>
Heliport crossing height, PinS approaches (H)	0.5 m surveyed	essential
Aerodrome/Heliport elevation	0.5 m surveyed	essential
WGS-84 geoid undulation at aerodrome/heliport elevation position	0.5 m surveyed	essential
Runway threshold, non-precision approaches (A)	0.5 m surveyed	essential
FATO threshold, for heliports with or without a PinS approach (H)	0.5 m surveyed	essential
WGS-84 geoid undulation at runway threshold, non-precision approaches (A)	0.5 m surveyed	essential
WGS-84 geoid undulation at FATO threshold, TLOF geometric centre, for heliports with or without a PinS approach (H)	0.5 m surveyed	essential
Runway threshold, precision approaches (A)	0.25 m surveyed	critical
WGS-84 geoid undulation at runway threshold, precision approaches (A)	0.25 m surveyed	critical
FATO threshold, for instrument heliports with non-precision and/or precision approaches. (H)	0.25 m surveyed	critical
WGS-84 geoid undulation at FATO threshold, TLOF geometric centre, for instrument heliports with non-precision and/or precision approaches. (H)	0.25 m surveyed	critical
Runway centre line points (A)	0.25 m surveyed	critical
Taxiway centre line/parking guidance line points (A)	1 m surveyed	essential
Helicopter ground taxiway centre line points and helicopter air taxiway points (H)	1 m surveyed	essential
Obstacles in Area 2 (the part within the aerodrome/heliport boundary)	3 m surveyed	essential
Obstacles in Area 3	0.5 m surveyed	essential
Distance measuring equipment/precision (DME/P)	3 m surveyed	essential

*Note 1: See ICAO Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.*

*Note 2: Implementation of ICAO Annex 15, provisions 10.1.4 and 10.1.6, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data.*



**Table App 5-3**

**Declination and Magnetic Variation**

<b>Declination/Variation</b>	<b>Accuracy Data Type</b>	<b>Integrity Classification</b>
Aerodrome/Heliport magnetic variation	1 degree surveyed	essential
ILS localizer antenna magnetic variation	1 degree surveyed	essential
MLS azimuth antenna magnetic variation	1 degree surveyed	essential

**Table App 5-4**

**Bearing**

(A) Aerodrome only  
(H) Heliport only

<b>Bearing</b>	<b>Accuracy Data Type</b>	<b>Integrity Classification</b>
ILS localizer alignment	1/100 degree surveyed	essential
MLS zero azimuth alignment	1/100 degree surveyed	essential
Runway bearing (True) (A)	1/100 degree surveyed	routine
FATO bearing (True) (H)	1/100 degree surveyed	routine





**Table App 5-5**

**Length/Distance/Dimension**

(A) Aerodrome only

(H) Heliport only

<b>Length/Distance/Dimension</b>	<b>Accuracy Data Type</b>	<b>Integrity Classification</b>
Runway length (A)	1 m surveyed	critical
Runway width (A)	1 m surveyed	essential
FATO length, TLOF dimensions (H)	1 m surveyed	essential
Displaced threshold distance (A)	1 m surveyed	routine
Stopway length and width (A)	1 m surveyed	critical
Clearway length and width	1 m surveyed	essential
Landing distance available	1 m surveyed	critical
Take-off run available (A)	1 m surveyed	critical
Take-off distance available	1 m surveyed	critical
Accelerate-stop distance available (A)	1 m surveyed	critical
Helicopter rejected take-off distance available (H)	1 m surveyed	critical
Runway shoulder width (A)	1 m surveyed	essential
Taxiway width (A)	1 m surveyed	essential
Helicopter ground or air taxiway/taxi-route width (H)	1 m surveyed	essential
Taxiway shoulder width (A)	1 m surveyed	essential
ILS localizer antenna-runway end, distance (A)	3 m calculated	routine
ILS localizer antenna-FATO end, distance (H)	3 m calculated	routine



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Length/Distance/Dimension	Accuracy Data Type	Integrity Classification
ILS glide slope antenna-threshold, distance along centre line	3 m calculated	routine
ILS marker-threshold distance	3 m calculated	essential
ILS DME antenna-threshold, distance along centre line	3 m calculated	essential
MLS azimuth antenna-runway end, distance (A)	3 m calculated	routine
MLS azimuth antenna-FATO end, distance (H)	3 m calculated	routine
MLS elevation antenna-threshold, distance along centre line	3 m calculated	routine
MLS DME/P antenna-threshold, distance along centre line	3 m calculated	essential



## APPENDIX 6

### AERODROME COMPATABILITY STUDY

#### 6.1 PURPOSE

- 6.1.1 Introducing new types of aeroplanes into existing aerodromes may have an impact on the aerodrome facilities and services, in particular, when the aeroplane characteristics exceed the parameters that were used for planning the aerodrome.
- 6.1.2 In order to adequately assess aerodrome compatibility, aeroplane operational characteristics should be included in the evaluation process. The operational characteristics can include the infrastructure requirements of the aeroplane as well as ground servicing requirements.
- 6.1.3 This appendix also addresses situations where compliance with the design provisions is either impractical or physically impossible.

#### 6.2 APPLICABILITY

- 6.2.1 A compatibility study should be performed collaboratively between affected stakeholders, which includes the aerodrome operator, the aeroplane operator, and ground handling agencies as well as the various air navigation service providers (ANSPs) whenever introducing an aeroplane type/model new to the aerodrome irrespective of the size of the aeroplane.
- 6.2.2 Following the outcome of a compatibility study, an aeronautical study may be performed if the impact of the proposed changes involves deviations to Civil Aviation Regulations or present alternative mean of compliance.

#### 6.3 ASSESSMENT

##### 6.3.1 Aerodrome Compatibility Process

- 6.3.1.1 This section outlines a methodology and procedure to assess the compatibility between aeroplane operations and aerodrome infrastructure and operations when an aerodrome accommodates an aeroplane that does not suit the certificated characteristics of the aerodrome.
- 6.3.1.2 The following steps describe the arrangement, to be appropriately documented, between the aeroplane operator and aerodrome operator for the introduction of an aeroplane type/subtype new to the aerodrome:



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- a) the aeroplane operator submits a request to the aerodrome operator to operate an aeroplane type/subtype new to the aerodrome;
- b) the aerodrome operator identifies possible means of accommodating the aeroplane type/subtype including access to movement areas and, if necessary, considers the feasibility and economic viability of upgrading the aerodrome infrastructure; and
- c) the aerodrome operator and aircraft operator discuss the aerodrome operator's assessment, and whether operations of the aeroplane type/subtype can be accommodated and, if permitted, under what conditions.

6.3.1.3 The following procedures should be included in the aerodrome compatibility study:

- a) identify the aeroplane's physical and operational characteristics
- b) identify the applicable regulatory requirements;
- c) establish the adequacy of the aerodrome infrastructure and facilities vis-à-vis the requirements of the new aeroplane;
- d) identify the changes required to the aerodrome;
- e) document the compatibility study; and
- f) perform the required safety assessments identified during the compatibility study (see Appendix 4).

*Note 1.— A compatibility study may require a review of the obstacle limitation surfaces at an aerodrome.*

*Note 2.— For aerodrome operations in low visibility conditions, additional procedures may be implemented in order to safeguard the operation of aeroplanes.*

*Note 3.— Additional processes that ensure suitable measures are in place to protect the signal produced by the ground-based radio navigation equipment may be necessary at aerodromes with precision instrument approaches.*

6. 3.1.4 The result of the compatibility study should enable decisions to be made and should provide:

- a) the aerodrome operator with the necessary information in order to make a decision on allowing the operation of the specific aeroplane at the given aerodrome;
- b) the aerodrome operator with the necessary information in order to make a decision on the changes required to the aerodrome infrastructure and



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facilities to ensure safe operations at the aerodrome with due consideration to the harmonious future development of the aerodrome; and

- c) the GCAA with the information which is necessary for its safety oversight and the continued monitoring of the conditions specified in the aerodrome certification.

*Note 1. — Each compatibility study is specific to a particular operational context and to a particular type of aeroplane.*

6.3.1.5 The aeroplane's physical characteristics may influence the aerodrome dimensions, facilities and services in the movement area.

6.3.1.6 In order to adequately assess the aeroplane's compatibility, aerodrome physical characteristics should be included in the evaluation process.

### 6.3.2 **Aeroplane Physical Characteristics**

This is the list of aeroplane characteristics that may have an impact on the relevant aerodrome characteristics, facilities and services in the movement area.

#### **FUSELAGE LENGTH**

The fuselage length may have an impact on:

- a) the dimensions of the movement area (taxiway, holding bays and aprons), passenger gates and terminal areas;
- b) the aerodrome category for RFF;
- c) ground movement and control (e.g. reduced clearance behind a longer aeroplane holding at an apron or a
- d) runway/intermediate holding position to permit the passing of another aeroplane); and
- e) clearances at the aircraft stand.

#### **FUSELAGE WIDTH**

The fuselage width is used to determine the aerodrome category for RFF.

#### **DOOR SILL HEIGHT**

The door sill height may have an impact on:

- a) the operational limits of the air bridges;
- b) mobile steps;
- c) catering trucks;



- d) persons with reduced mobility; and
- e) dimensions of the apron.

#### **AEROPLANE NOSE CHARACTERISTICS**

The aeroplane nose characteristics may have an impact on the location of the runway-holding position of the aeroplane which should not infringe the OFZ.

#### **TAIL HEIGHT**

The tail height may have an impact on:

- a) the location of the runway-holding position;
- b) ILS critical and sensitive areas: In addition to the tail height of the critical aeroplane, tail composition, tail position, fuselage height and length can have an effect on ILS critical and sensitive areas;
- c) the dimensions of aeroplane maintenance services;
- d) aeroplane parking position (in relation to aerodrome OLS);
- e) runway/parallel taxiway separation distances; and
- f) the clearance of any aerodrome infrastructure or facilities built over stationary or moving aeroplanes.

#### **WINGSPAN**

The wingspan may have an impact on:

- a) taxiway/taxilane separation distances (including runway/taxiway separation distances);
- b) the dimensions of the OFZ;
- c) the location of the runway-holding position (due to the impact of the wingspan on OFZ dimensions);
- d) the dimensions of aprons and holding bays;
- e) wake turbulence;
- f) gate selection;
- g) aerodrome maintenance services around the aeroplane; and
- h) equipment for disabled aeroplane removal.

In the case of an aeroplane equipped with folding wing tips, its reference code letter may change as a result of the folding/extending of the wing tips. Consideration should be given to the wingspan configuration and resultant operations of the aeroplane at an aerodrome.



### **WING TIP VERTICAL CLEARANCE**

The wing tip vertical clearance may have an impact on:

- a) taxiway separation distances with height-limited objects;
- b) apron and holding bay clearances with height-limited objects;
- c) aerodrome maintenance services;
- d) airfield signage clearances; and
- e) service road locations.

### **COCKPIT VIEW**

The relevant geometric parameters to assess the cockpit view are cockpit height, cockpit cut-off angle and the corresponding obscured segment. The cockpit view may have an impact on:

- a) runway visual references (aiming point);
- b) runway sight distance;
- c) taxiing operations on straight and curved sections;
- d) markings and signs on runways, turn pads, taxiways, aprons and holding bays;
- e) lights: in low visibility conditions, the number and spacing of visible lights when taxiing may depend on the cockpit view; and
- f) calibration of PAPI/VASIS (pilot eye height above wheel height on approach).

*Note.— Cockpit view with reference to the obscured segment is also affected by the attitude of the aeroplane on approach.*

### **DISTANCE FROM THE PILOT'S EYE POSITION TO THE NOSE LANDING GEAR**

The design of taxiway curves is based on the cockpit-over-centre-line concept. The distance from the pilot's eye position to the nose landing gear is relevant for:

- a) taxiway fillets (wheel track);
- b) the dimensions of aprons and holding bays; and
- c) the dimensions of turn pads.

### **LANDING GEAR DESIGN**

The aeroplane landing gear design is such that the overall mass of the aeroplane is distributed so that the stresses transferred to the base material through a well-designed pavement are within the bearing capacity of the base course. The landing gear layout also has an effect on the maneuverability of the aeroplane and the aerodrome pavement system.

### **OUTER MAIN GEAR WHEEL SPAN**

The outer main gear wheel span may have an impact on:

- a) runway width;
- b) the dimensions of turn pads;
- c) taxiway width;
- d) taxiway fillets;
- e) the dimensions of aprons and holding bays; and
- f) the dimension of the OFZ.

### **WHEELBASE**

The wheelbase may have an impact on:

- a) the dimensions of turn pads;
- b) taxiway fillets;
- c) the dimensions of aprons and holding bays; and
- d) terminal areas and aeroplane stands.

### **GEAR STEERING SYSTEM**

The gear steering system may have an impact on the dimensions of turn pads and the dimensions of aprons and holding bays.

### **MAXIMUM AEROPLANE MASS**

The maximum mass may have an impact on:

- a) the mass limitation on existing bridges, tunnels, culverts and other structures under runways and taxiways;
- b) disabled aeroplane removal;
- c) wake turbulence; and
- d) arresting systems when provided as an element of kinetic energy.

**Applicable unit 27 November 2024**

### **LANDING GEAR GEOMETRY, TIRE PRESSURE AND AIRCRAFT CLASSIFICATION NUMBER (ACN) VALUES**

Landing gear geometry, tire pressure and ACN values may have an impact on the airfield pavement and associated shoulders.

**Applicable as of 28 November 2024**



APPENDIX 6

**LANDING GEAR GEOMETRY, TIRE PRESSURE AND AIRCRAFT CLASSIFICATION RATING (ACR) VALUES**

Landing gear geometry, tire pressure and ACR values may have an impact on the airfield pavement and associated shoulders.

**ENGINE CHARACTERISTICS**

The engine characteristics include engine geometry and engine airflow characteristics, which may affect aerodrome infrastructure as well as ground handling of the aeroplane and operations in adjacent areas which are likely to become affected by jet blast.

The engine geometry aspects are:

- a) the number of engines;
- b) the location of engines (span and length);
- c) the vertical clearance of engines; and
- d) the vertical and horizontal extent of possible jet blast or propeller wash.

Engine airflow characteristics are:

- a) idle, breakaway and take-off thrust exhaust velocities;
- b) thrust reverser fitment and flow patterns; and
- c) inlet suction effects at ground level.

The engine characteristics may be relevant for the following aerodrome infrastructure and operational aspects:

- a) runway shoulder width and composition (jet blast and ingestion issues during take-off and landing);
- b) shoulder width and composition of runway turn pads;
- c) taxiway shoulder width and composition (jet blast and ingestion issues during taxiing);
- d) bridge width (jet blast under the bridge);
- e) the dimensions and location of blast protection fences;
- f) the location and structural strength of signs;
- g) the characteristics of runway and taxiway edge lights;
- h) the separation between aeroplanes and adjacent ground service personnel, vehicles or passengers;
- i) the design of engine run-up areas and holding bays;
- j) the design and use of functional areas adjacent to the manoeuvring area;
- k) the design of air bridges; and



- l) the location of refuelling pits on the aircraft stand.

**MAXIMUM PASSENGER AND FUEL CARRYING CAPACITY**

Maximum passenger- and fuel-carrying capacity may have an impact on:

- a) terminal facilities;
- b) fuel storage and distribution;
- c) aerodrome emergency planning;
- d) aerodrome rescue and fire fighting; and
- e) air bridge loading configuration.



### 6.3.3 Flight performance

Flight performance may have an impact on:

- a) runway width;
- b) runway length;
- c) the OFZ;
- d) runway/taxiway separation;
- e) wake turbulence;
- f) noise; and
- g) aiming point marking.

### 6.3.4 Aeroplane Ground Servicing Requirements

The following list of aeroplane ground servicing characteristics and requirements may affect the available aerodrome infrastructure. This list is not exhaustive; additional items may be identified by the stakeholders involved in the compatibility assessment process:

- a) ground power;
- b) passengers embarking and disembarking;
- c) cargo loading and unloading;
- d) fuelling;
- e) pushback and towing;
- f) taxiing and marshalling;
- g) aeroplane maintenance;
- h) RFF;
- i) equipment areas;
- j) stand allocation; and
- k) disabled aircraft removal.



## APPENDIX 7

### AERODROME REFERENCE CODE

*Introductory Note: The intent of the reference code is to provide a simple method for interrelating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for the aircraft that are intended to operate at the aerodrome. The code is not intended to be used for determining runway length or pavement strength requirements. The code is composed of two elements which are related to the aircraft performance characteristics and dimensions. Element 1 is a number based on the Aeroplane Reference Field Length and element 2 is a letter based on the aircraft wing span. The Code Letter or number within an element selected for design purposes is related to the critical aircraft characteristics for which the facility is provided. When applying ICAO Annex 14, Volume I, the aircraft which the aerodrome is intended to serve and then determine the two elements of the code.*

- 7.1 An Aerodrome Reference Code — Code Number and letter — which is selected for aerodrome planning purposes shall be determined in accordance with the characteristics of the aircraft for which an aerodrome facility is intended.
- 7.2 The Aerodrome Reference Code Numbers and letters shall have the meanings assigned to them in Table App 7-1.
- 7.3 The Code Number for element 1 shall be determined from Table App 7-1, by selecting the Code Number corresponding to the highest value of the Aeroplane Reference Field Lengths of the aircraft for which the runway is intended.

*Note: The determination of the Aeroplane Reference Field Length is solely for the selection of a Code Number and is not intended to influence the actual runway length provided.*

- 7.4 The Code Letter for element 2 shall be determined from Table App 7-1, by selecting the Code Letter which corresponds to the greatest wing span of the aircraft for which the facility is intended.

*Note 1: Guidance to Aerodrome Operator concerning determination of the Aerodrome Reference Code is given in the Aerodrome Design Manual (ICAO Doc 9157), Parts 1 and 2.*

*Note 2: Procedures on conducting aerodrome compatibility study to accommodate aeroplanes with folding wing tips spanning two code letters are given in the Procedures for Air Navigation Services Aerodromes (PANS-Aerodromes, Doc 9981). Further guidance can be found in the manufacturer's aircraft characteristics for airport planning manual.*



**Table App 7-1**

**Aerodrome Reference Code**

CODE ELEMENT ONE	
Code Number	Aeroplane reference field length
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over

CODE ELEMENT TWO	
Code Letter	Wing Span
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

*Note: Guidance on planning for aeroplanes with wingspans greater than 80 m is given in the ICAO Aerodrome Design Manual (Doc 9157), Parts 1 and 2.*



## APPENDIX 8

### PHYSICAL CHARACTERISTICS

#### 8.1 AERODROME DESIGN

*Note: Refer to Chapter 1, Section 1.5, for provisions on Aerodrome Design and Master Plan.*

#### 8.2 AERODROME REFERENCE POINT

The Aerodrome Reference Point shall be established in accordance with Appendix 2, 2.2.

#### 8.3 RUNWAYS

*Note: The general requirements for runways are contained in ICAO Annex 14 Volume 1, Chapter 3; ICAO Annex 14 Volume 1, Attachment A and the Aerodrome Design Manual (ICAO Doc 9157) Part 1.*

##### 8.3.1 Number and Orientation of Runways

*Introductory Note: Many factors affect the determination of the orientation, siting and number of runways.*

*One important factor is the Usability Factor, as determined by the wind distribution, which is specified hereunder. Another important factor is the alignment of the runway to facilitate the provision of approaches conforming to the approach surface specifications of Chapter 4. In ICAO Annex 14, Attachment A, Section 1, information is given concerning these and other factors.*

*When a new instrument runway is being located, particular attention needs to be given to areas over which aeroplanes will be required to fly when following instrument approach and missed approach procedures, so as to ensure that obstacles in these areas or other factors will not restrict the operation of the aeroplanes for which the runway is intended.*

8.3.1.1 The number and orientation of runways at an aerodrome should be such that the Usability Factor of the aerodrome is not less than 95 per cent for the aircraft that the aerodrome is intended to serve.

8.3.1.2 The siting and orientation of runways at an aerodrome should where possible, be such that the arrival and departure tracks minimise interference with areas approved for residential use and other noise sensitive areas close to the aerodrome in order to avoid future noise problems.



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*Note: Guidance to the Aerodrome Operator on how to address noise problems is provided in the Airport Planning Manual (ICAO Doc 9184), Part 2, and in Guidance on the Balanced Approach to Aircraft Noise Management (ICAO Doc 9829).*

### 8.3.2 Choice of Maximum Permissible Cross-Wind Components

In the application of 8.3.1 it should be assumed that landing or take-off of aircraft is, in normal circumstances, precluded when the cross-wind component exceeds:

- a) 37 km/h (20 kt) in the case of aircraft whose reference field length is 1 500 m or over, except that when poor runway braking action owing to an insufficient longitudinal coefficient of friction is experienced with some frequency, a cross-wind component not exceeding 24 km/h (13 kt) should be assumed;
- b) 24 km/h (13 kt) in the case of aircraft whose reference field length is 1 200 m or up to but not including 1 500 m; and
- c) 19 km/h (10 kt) in the case of aircraft whose reference field length is less than 1 200 m.

*Note: In ICAO Annex 14, Attachment A, Section 1, guidance is given on factors affecting the calculation of the estimate of the Usability Factor and allowances which may have to be made to take account of the effect of unusual circumstances.*

### 8.3.3 Data to be Used

The selection of data to be used for the calculation of the Usability Factor should be based on reliable wind distribution statistics that extend over as long a period as possible, preferably of not less than five years. The observations used should be made at least eight times daily and spaced at equal intervals of time.

*Note: These winds are mean winds. Reference to the need for some allowance for gusty conditions is made in ICAO Annex 14, Attachment A, Section 1.*

### 8.3.4 Friction Level Design Objective

- 8.3.4.1 When designing new paved runways, or resurfacing existing paved runway surfaces, good friction characteristics shall be taken into account.
- 8.3.4.2 The Design Objective shall be as specified in AMC-32 – The Assessment of Runway Surface Friction Characteristics, corresponding to the particular test equipment type.



### 8.3.5 Location of Threshold

- 8.3.5.1 A threshold should normally be located at the extremity of a runway unless operational considerations justify the choice of another location.

*Note: Guidance on the siting of the threshold is given in ICAO Annex 14, Attachment A, Section 10.*

- 8.3.5.2 When it is necessary to displace a threshold, either permanently or temporarily, from its normal location, account should be taken of the various factors which may have a bearing on the location of the threshold. Where this displacement is due to an unserviceable runway condition, a cleared and graded area of at least 60 m in length should be available between the Unserviceable Area and the displaced threshold. Additional distance should also be provided to meet the requirements of the Runway End Safety Area as appropriate (see 8.3.9.11).

*Note: Guidance on factors which may be considered in the determination of the location of a displaced threshold is given in ICAO Annex 14, Attachment A, Section 10.*

### 8.3.6 Actual Length of Runways

#### 8.3.6.1 Primary Runway

Except as provided in 8.3.6.3, the actual runway length to be provided for a primary runway should be adequate to meet the operational requirements of the aircraft for which the runway is intended and should be not less than the longest length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant aircraft.

*Note 1 - This specification does not necessarily mean providing for operations by the critical aeroplane at its maximum mass.*

*Note 2 - Both take-off and landing requirements need to be considered when determining the length of runway to be provided and the need for operations to be conducted in both directions of the runway.*

*Note 3 - Local conditions that may need to be considered include elevation, temperature, runway slope, humidity and the runway surface characteristics.*

*Note 4 - When performance data on aeroplanes for which the runway is intended are not known, guidance on the determination of the actual length of a primary runway by application of general correction factors is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

#### 8.3.6.2 Secondary Runway





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The length of a secondary runway should be determined similarly to primary runways except that it needs only to be adequate for those aeroplanes which require to use that secondary runway in addition to the other runway or runways in order to obtain a Usability Factor of at least 95 per cent.

8.3.6.3 **Runways with Stopways or Clearways**

Where a runway is associated with a stopway or clearway, an actual runway length less than that resulting from application of 8.3.6.1 or 8.3.6.2, as appropriate, may be considered satisfactory, but in such a case any combination of runway, stopway and clearway provided should permit compliance with the operational requirements for take-off and landing of the aeroplanes the runway is intended to serve.

*Note: Guidance on use of stopways and clearways is given in ICAO Annex 14, Attachment A, Section 2.*

8.3.7 **Width of Runways**

8.3.7.1 When new or rehabilitated runways are planned, then each shall be designed based on the Aerodrome Reference Code for the largest aircraft type intended to operate.

8.3.7.2 The width of a runway shall be not less than the appropriate dimension specified in the following tabulation:

Code Number	Outer Main Gear Wheel Span (OMGWS)			
	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15
1 <sup>a</sup>	18 m	18 m	23 m	—
2 <sup>a</sup>	23 m	23 m	30 m	—
3	30 m	30 m	30 m	45 m
4	—	—	45 m	45 m
a. The width of a precision approach runway should be not less than 30 m where the code number is 1 or 2.				

*Note 1: The combinations of code numbers and OMGWS for which widths are specified have been developed for typical aeroplane characteristics.*

*Note 2: Factors affecting runway width are given in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*



### 8.3.8 Minimum Distance between Parallel Runways

8.3.8.1 Where parallel Non-Instrument Runways are intended for simultaneous use, the minimum distance between their centre lines shall be:

- a) 210 m where the higher Code Number is 3 or 4;
- b) 150 m where the higher Code Number is 2; and
- c) 120 m where the higher Code Number is 1.

*Note: Procedures for wake turbulence categorization of aircraft and wake turbulence separation minima are contained in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM), Doc 4444, Chapter 4, 4.9 and Chapter 5, 5.8, respectively.*

8.3.8.2 Where parallel Instrument Runways are intended for simultaneous use subject to conditions specified in the PANS-ATM (ICAO Doc 4444) and the PANS-OPS (ICAO Doc 8168), Volume I, the minimum distance between their centre lines shall be not less than:

- a) 1,035 m for independent parallel approaches;
- b) 915 m for dependent parallel approaches;
- c) 760 m for independent parallel departures;
- d) 760 m for segregated parallel operations;

except that:

- a) for segregated parallel operations the specified minimum distance:
  - i) may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and
  - ii) shall be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft;
- b) for independent parallel approaches, combinations of minimum distances and associated conditions other than those specified in the PANS-ATM (Doc 4444) may be applied when it is determined that such combinations would not adversely affect the safety of aircraft operations.

*Note: Procedures and facilities requirements for simultaneous operations on parallel or near-parallel instrument runways are contained in the PANS-ATM*



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*(Doc 4444), Chapter 6 and the PANS-OPS (Doc 8168), Volume I, Part III, Section 2, and Volume II, Part I, Section 3; Part II, Section 1; and Part III, Section 3, and relevant guidance is contained in the ICAO Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) (Doc 9643).*

### 8.3.9 Slopes on Runways

#### 8.3.9.1 Longitudinal Slopes

The slope computed by dividing the difference between the maximum and minimum elevation along the runway centre line by the runway length should not exceed:

- a) 1 per cent where the Code Number is 3 or 4; and
- b) 2 per cent where the Code Number is 1 or 2.

Along no portion of a runway should the longitudinal slope exceed:

- a) 1.25 per cent where the Code Number is 4, except that for the first and last quarter of the length of the runway the longitudinal slope should not exceed 0.8 per cent;
- b) 1.5 per cent where the Code Number is 3, except that for the first and last quarter of the length of a Precision Approach Runway Category II or III the longitudinal slope should not exceed 0.8 per cent; and
- c) 2 per cent where the Code Number is 1 or 2.

#### 8.3.9.2 Longitudinal Slope Changes

Where slope changes cannot be avoided, a slope change between two consecutive slopes should not exceed:

- a) 1.5 per cent where the Code Number is 3 or 4; and
- b) 2 per cent where the Code Number is 1 or 2.

*Note: Guidance on slope changes before a runway is given in ICAO Annex 14, Attachment A, Section 4.*

The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:

- a) 0.1 per cent per 30 m (minimum radius of curvature of 30,000 m) where the Code Number is 4;



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- b) 0.2 per cent per 30 m (minimum radius of curvature of 15,000 m) where the Code Number is 3; and
- c) 0.4 per cent per 30 m (minimum radius of curvature of 7,500 m) where the Code Number is 1 or 2.

8.3.9.3 ***Sight Distance***

Where slope changes cannot be avoided, they should be such that there will be an unobstructed line of sight from:

- a) any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where the Code Letter is C, D, E or F.
- b) any point 2 m above a runway to all other points 2 m above the runway within a distance of at least half the length of the runway where the Code Letter is B; and
- c) any point 1.5 m above a runway to all other points 1.5 m above the runway within a distance of at least half the length of the runway where the Code Letter is A.

*Note: Consideration will have to be given to providing an unobstructed line of sight over the entire length of a single runway where a full-length parallel taxiway is not available. Where an aerodrome has intersecting runways, additional criteria on the line of sight of the intersection area would need to be considered for operational safety. See the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

8.3.9.4 ***Distance between Slope Changes***

Undulations or appreciable changes in slopes located close together along a runway should be avoided. The distance between the points of intersection of two successive curves should not be less than:

- a) the sum of the absolute numerical values of the corresponding slope changes multiplied by the appropriate value as follows:
  - i) 30 000 m where the Code Number is 4;
  - ii) 15 000 m where the Code Number is 3; and
  - iii) 5 000 m where the Code Number is 1 or 2; or



b) 45 m

whichever is greater.

*Note: Guidance to the Aerodrome Operator on application is given within ICAO Annex 14, Volume 1, Attachment A, Section 4.*

#### 8.3.9.5 **Transverse Slopes**

a) To promote the most rapid drainage of water, the runway surface should, if practicable, be cambered except where a single crossfall from high to low in the direction of the wind most frequently associated with rain would ensure rapid drainage. The transverse slope should ideally be:

i) 1.5 per cent where the Code Letter is C, D, E or F; and

ii) 2 per cent where the Code Letter is A or B;

but in any event should not exceed 1.5 per cent or 2 per cent, as applicable, nor be less than 1 per cent except at runway or taxiway intersections where flatter slopes may be necessary.

b) For a cambered surface the transverse slope on each side of the centre line should be symmetrical.

*Note: On wet runways with crosswind conditions the problem of aquaplaning from poor drainage is apt to be accentuated. In ICAO Annex 14, Volume 1, Attachment A, Section 7, information is given concerning this problem and other relevant factors.*

c) The transverse slope should be substantially the same throughout the length of a runway except at an intersection with another runway or a taxiway where an even transition should be provided taking account of the need for adequate drainage.

*Note: Guidance on transverse slope is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*



#### 8.3.9.6 **Strength of Runways**

A runway should be capable of withstanding the traffic of aeroplanes the runway is intended to serve. The Authority does not specify a standard for a runway bearing strength, however, the bearing strength must be such that it will not cause any safety problems to aircraft. The published PCN (from 28 November 2024 PCR) value should be suitable for the aircraft that regularly use the runway.

*Note 1: Further guidance is given in the ICAO Design Manual (Doc 9157), Part 3 – Pavements.*

*Note 2: Guidance on strength of pavements is provided in Appendix 2, clause 2.6*

#### 8.3.9.7 **Surface of Runways**

- a) The surface of a runway shall be constructed without irregularities that would impair the runway surface friction characteristics or otherwise adversely affect the take-off or landing of an aeroplane.

*Note 1: Surface irregularities may adversely affect the take-off or landing of an aeroplane by causing excessive bouncing, pitching, vibration, or other difficulties in the control of an aeroplane.*

*Note 2: Guidance on design tolerances and other information is given in ICAO Annex 14, Volume 1, Attachment A, Section 5. Additional guidance is included in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*

- b) A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the Minimum Friction Level.
- c) The surface of a paved runway should be evaluated when constructed or resurfaced to determine that the surface friction characteristics achieve the Design Objectives.

*Note: Guidance on surface friction characteristics of a new or resurfaced runway is given in ICAO Annex 14, Volume 1, Attachment A, Section 7. Additional guidance is included in the ICAO Airport Services Manual, Part 2.*

- d) Where the runway code is 3 or 4, measurements of the friction characteristics of a new or resurfaced paved runway shall be made with a continuous friction measuring device using self-wetting features.



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- e) Where the runway is code 1 or 2, measurements of the friction characteristics of a new or resurfaced paved runway should be made with a continuous friction measuring device using self-wetting features.

*Note: Guidance on surface friction characteristics of new runway surfaces is given in ICAO Annex 14, Volume 1, Attachment A, Section 7. Additional guidance is included in the ICAO Airport Services Manual (Doc 9137), Part 2.*

- f) The average surface texture depth of a new surface should be not less than 1.0 mm.

*Note 1: Macrotexture and microtexture are taken into consideration in order to provide the required surface friction characteristics. Guidance on surface design is given in Annex 14, Volume 1, Attachment A, Section 8.*

*Note 2: Guidance on methods used to measure surface texture is given in the ICAO Airport Services Manual (Doc 9137), Part 2.*

*Note 3: Guidance on design and methods for improving surface texture is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*

- g) When the surface is grooved or scored, the grooves or scorings shall be either perpendicular to the runway centre line or parallel to non-perpendicular transverse joints, where applicable.

*Note: Guidance on methods for improving the runway surface texture is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*

8.3.9.8 **Runway Shoulders**

**a) General**

*Note: Guidance on characteristics and treatment of runway shoulders is given in ICAO Annex 14, Volume 1, Attachment A, Section 8, and in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

Runway shoulders shall be provided for a runway where the Code Letter is D, E or F.

**b) Width of runway shoulders**

For aeroplanes with OMGWS from 9 m up to but not including 15 m, the runway shoulders shall extend symmetrically on each side of the runway so that the overall width of the runway and its shoulders is not less than:



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- A) 60 m where the Code Letter is D or E;
- B) 60 m where the code letter is F with two or three engine aeroplanes; and
- C) 75 m where the Code Letter is F with four (or more) engine aeroplanes.

**c) Surface of Runway Shoulders**

- i) The surface of a runway shoulder shall be prepared or constructed so as to resist erosion and prevent the ingestion of the surface material by aeroplane engines.
- ii) Runway shoulders for code letter F aeroplanes shall be paved to a minimum overall width of runway and shoulder of 60m.

**d) Slopes on Runway Shoulders**

The surface of the shoulder that abuts the runway shall be flush with the surface of the runway and its transverse slope should not exceed 2.5 per cent.

**e) Strength of Runway Shoulders**

The portion of a runway shoulder between the runway edge and a distance of 30 m from the runway centre line shall be prepared or constructed so as to be capable, in the event of an aircraft running off the runway, of supporting the aircraft without inducing structural damage to the aeroplane and of supporting ground vehicles which may operate on the shoulder.

*Note: Guidance on strength of runway shoulders is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*



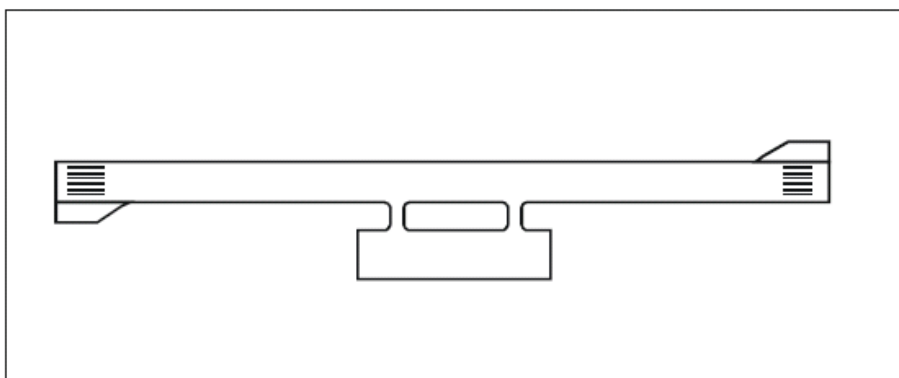
### 8.3.9.9 **Runway Turn Pads**

#### a) **General**

- i) Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the Code Letter is D, E or F, a runway turn pad shall be provided to facilitate a 180-degree turn of aeroplanes. (See Figure App 8-1.)

**Figure App 8-1**

**Typical Turn Pad Layout**



- ii) Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the Code Letter is A, B or C, a runway turn pad should be provided to facilitate a 180-degree turn of aeroplanes.

*Note 1: Such areas may also be useful if provided along a runway to reduce taxiing time and distance for aeroplanes which may not require the full length of the runway.*

*Note 2: Guidance on the design of the runway turn pads is available in the ICAO Aerodrome Design Manual (Doc 9157), Part 1. Guidance on taxiway turnaround as an alternate facility is available in the ICAO Aerodrome Design Manual (Doc 9157), Part 2.*

- iii) The runway turn pad may be located on either the left or right side of the runway and adjoining the runway pavement at both ends of the runway and at some intermediate locations where deemed necessary.

*Note: The initiation of the turn would be facilitated by locating the turn pad on the left side of the runway, since the left seat is the normal position of the pilot-in-command.*



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- iv) The intersection angle of the runway turn pad with the runway shall not exceed 30 degrees.
- v) The nose wheel steering angle to be used in the design of the runway turn pad should not exceed 45 degrees.
- vi) The design of a runway turn pad shall be such that, when the cockpit of the aeroplane for which the turn pad is intended remains over the turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the turn pad shall be not less than that given by the following tabulation:

Outer main gear wheel span			
Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
1.5 m	2.25 m	3 m <sup>a</sup> or 4 m <sup>b</sup>	4 m
a if the turn pad is intended to be used by aeroplanes with a wheel base less than 18 m.			
b if the turn pad is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.			

*Note: Wheel base means the distance from the nose gear to the geometric centre of the main gear.*

**b) Slopes on Runway Turn Pads**

The longitudinal and transverse slopes on a runway turn pad should be sufficient to prevent the accumulation of water on the surface and facilitate rapid drainage of surface water. The slopes should be the same as those on the adjacent runway pavement surface.

**c) Strength of Runway Turn Pads**

The strength of a runway turn pad shall be at least equal to that of the adjoining runway which it serves, due consideration being given to the fact that the turn pad will be subjected to slow-moving traffic making hard turns and consequent higher stresses on the pavement.

*Note: Where a runway turn pad is provided with flexible pavement, the surface would need to be capable of withstanding the horizontal shear forces exerted by the main landing gear tires during turning manoeuvres.*

**d) Surface of Runway Turn Pads**



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- i) The surface of a runway turn pad shall not have surface irregularities that may cause damage to an aircraft using the turn pad.
- ii) The surface of a runway turn pad should be so constructed or resurfaced as to provide surface friction characteristics at least equal to that of the adjoining runway..

**e) Shoulders for Runway Turn Pads**

- i) The runway turn pads should be provided with shoulders of such width as is necessary to prevent surface erosion by the jet blast of the most demanding aeroplane for which the turn pad is intended, and any possible foreign object damage to the aircraft engines.

*Note: As a minimum, the width of the shoulders would need to cover the outer engine of the most demanding aeroplane and thus may be wider than the associated runway shoulders.*

- ii) The strength of runway turn pad shoulders should be capable of withstanding the occasional passage of the aircraft it is designed to serve without inducing structural damage to the aeroplane and to the supporting ground vehicles that may operate on the shoulder.



#### 8.3.9.10 **Runway Strips**

##### **a) General**

A runway and any associated stopways shall be included in a strip.

##### **b) Length of Runway Strips**

- i) Except for a runway starter extension, a strip shall extend before the threshold and beyond the end of the runway or stopway for a distance of at least:
  - A. 60 m where the Code Number is 2, 3 or 4;
  - B. 60 m where the Code Number is 1 and the runway is an instrument one; or
  - C. 30 m where the Code Number is 1 and the runway is a non-instrument one.
- ii) Where a runway starter extension is provided, a strip shall extend before the end of a starter extension for the distance specified in 8.4.13, width of taxiway strips.

##### **c) Width of Runway Strips**

- i) A strip including a precision approach runway shall, extend laterally to a distance of at least:
  - A) 140 m where the Code Number is 3 or 4; and
  - B) 70 m where the Code Number is 1 or 2;on each side of the centre line of the runway and its extended centre line throughout the length of the strip.
- ii) A strip including a non-precision approach runway shall extend laterally to a distance of at least:
  - A) 140 m where the Code Number is 3 or 4; and
  - B) 70 m where the Code Number is 1 or 2;on each side of the centre line of the runway and its extended centre line throughout the length of the strip.



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- iii) A strip including a non-Instrument Runway shall extend on each side of the centre line of the runway and its extended centre line throughout the length of the strip, to a distance of at least:

- A) 75 m where the Code Number is 3 or 4;
- B) 40 m where the Code Number is 2; and
- C) 30 m where the Code Number is 1.

**d) Objects on Runway Strips**

*Note: See Appendix 13, 13.2.6 for information regarding siting of equipment and installations on runway strips.*

- i) An object situated on a runway strip which may endanger aeroplanes should be regarded as an obstacle and should, as far as practicable, be removed.

*Note 1.— Consideration will have to be given to the location and design of drains on a runway strip to prevent damage to an aeroplane accidentally running off a runway. Suitably designed drain covers may be required. For further guidance, see the Aerodrome Design Manual (Doc 9157), Part 1.*

*Note 2.— Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure does not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1 to 8.3.9.10 f) iii) B).*

*Note 3.— Particular attention needs to be given to the design and maintenance of an open-air storm water conveyance in order to prevent wildlife attraction, notably birds. If needed, it can be covered by netting or other suitable means. Procedures on wildlife management are specified in PANS-Aerodromes (DOC 9981). Further guidance can be found in the Airport Services Manual (Doc 9137), Part 3.*

- ii) No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes and which must be sited on the runway strip, satisfying the relevant frangibility requirements of these regulations, shall be permitted on any part of a runway strip of a precision approach runway delineated by the lower edges of the inner transitional surfaces:

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- iii) No mobile object shall be permitted on this part of the runway strip during the use of the runway for landing or take-off.

Note: See Appendix 13 for characteristics of inner transitional surface.

### e) Grading of Runway Strips

- i) That portion of a strip of an Instrument Non-Precision Approach Runway within a distance of at least:

75 m where the Code Number is 3 or 4

from the centre line of the runway and its extended centre line shall provide a graded area for aircraft which the runway is intended to serve in the event of an aeroplane running off the runway.

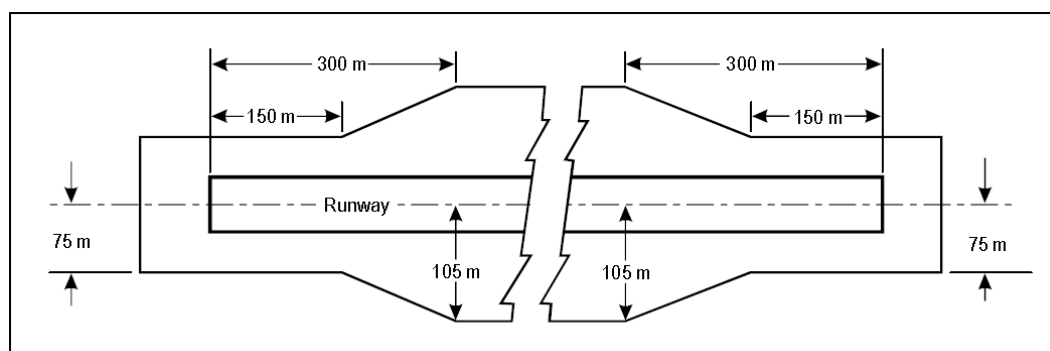
- ii) That portion of a strip of an Precision Approach Runway within a distance of at least:

105 m where the Code Number is 3 or 4

from the centre line of the runway and its extended centre line as shown in Figure App 8-2 shall provide a graded area for aircraft which the runway is intended to serve in the event of an aeroplane running off the runway.

*Note: Guidance on grading of a greater area of a strip including a precision approach runway where the code number is 3 or 4 is given in ICAO Annex 14, Volume 1, Attachment A, Section 8. Figure App 8-2*

#### Graded Portion of a Strip including a Precision Approach Runway where the Code Number is 3 or 4





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- iii) That portion of a strip of an Instrument Runway within a distance of at least:

40 m where the Code Number is 1 or 2;

from the centre line of the runway and its extended centre line shall provide a graded area for aircraft which the runway is intended to serve in the event of an aeroplane running off the runway

- iv) That portion of a strip of a non-Instrument Runway within a distance of at least:

A) 75 m where the Code Number is 3 or 4;

B) 40 m where the Code Number is 2; and

C) 30 m where the Code Number is 1

from the centre line of the runway and its extended centre line shall provide a graded area for aircraft which the runway is intended to serve in the event of an aeroplane running off the runway.

- v) Within the graded area of the runway strip, constructions such as plinths, runway ends, paved taxiway edges, etc. should be delethalised, that is, so constructed as to avoid presenting a buried vertical face to aircraft wheels in soft ground conditions in any direction from which an aircraft is likely to approach. To eliminate a buried vertical surface, a slope should be provided which extends from the top of the construction to not less than 0.3 m below ground level. The slope should be no greater than 1:10.
- vi) The surface of that portion of a strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway.
- vii) That portion of a strip to at least 30 m before the start of a runway shall be prepared against blast erosion in order to protect an aeroplane from the danger of an exposed edge.
- viii) Where the areas in 8.3.8.19, e), vi) have paved surfaces, they should be able to withstand the occasional passage of the critical aeroplane for runway pavement design.

*Note: The area provided to reduce the erosive effects of jet blast and propeller wash may be referred to as a blast pad.*



**f) Slopes on Runway Strips**

**i) Longitudinal Slopes**

A longitudinal slope along that portion of a strip to be graded shall not exceed:

- A) 1.5 per cent where the Code Number is 4;
- B) 1.75 per cent where the Code Number is 3; and
- C) 2 per cent where the Code Number is 1 or 2.

**ii) Longitudinal Slope Changes**

Slope changes on that portion of a strip to be graded shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.

**iii) Transverse Slopes**

- A) Transverse slopes on that portion of a strip to be graded shall be adequate to prevent the accumulation of water on the surface but should not exceed:

- a. 2.5 per cent where the Code Number is 3 or 4; and
- b. 3 per cent where the Code Number is 1 or 2

except that to facilitate drainage the slope for the first 3 m outward from the runway, shoulder or stopway edge should be negative as measured in the direction away from the runway and may be as great as 5 per cent.

- B) The transverse slopes of any portion of a strip beyond that to be graded should not exceed an upward slope of 5 per cent as measured in the direction away from the runway.

*Note 1.— Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a runway strip and should be placed as far as practicable from the runway.*

*Note 2.— The aerodrome rescue and firefighting (RFF) procedure would need to take into account the location of open-air water conveyances within the non-graded portion of a runway strip.*





#### iv) Strength of Runway Strips

A) That portion of a strip of an Instrument Runway within a distance of at least:

- a. 75 m where the Code Number is 3 or 4; and
- b. 40 m where the Code Number is 1 or 2

from the centre line of the runway and its extended centre line shall be so prepared or constructed as to minimise hazards arising from differences in load bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

B) That portion of a strip containing a non-Instrument Runway within a distance of at least:

- a. 75 m where the Code Number is 3 or 4;
- b. 40 m where the Code Number is 2; and
- c. 30 m where the Code Number is 1

from the centre line of the runway and its extended centre line should be so prepared or constructed as to minimise hazards arising from differences in load bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

#### 8.3.9.11 *Runway End Safety Areas*

##### a) General

A Runway End Safety Area shall be provided at each end of a runway strip.

##### b) Dimensions of Runway End Safety Areas

A Runway End Safety Area shall extend from each end of a runway strip to a distance of at least:

- i) 240 m where the Code Number is 3 or 4;
- ii) 120 m where the Code Number is 1 or 2 and the runway is an instrument one; and



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- iii) 30 m where the code number is 1 or 2 and the runway is a non-instrument one.

If an Arresting System is installed, the above length may be reduced, based on the design specification of the system, subject to acceptance by the Authority.

The width of a Runway End Safety Area shall be equal to that of the graded portion of the associated runway strip.

**GM to 8.3.9.11 a) and b): Runway End Safety Areas (RESA)**

**a) General**

1. *A Runway End Safety Area should provide an area long and wide enough, and suitable to contain overruns and undershoots resulting from a reasonably probable combination of adverse operational factors. On a precision approach runway, the ILS localiser is normally the first upstanding obstacle, and the Runway End Safety Area should extend up to this facility. In other circumstances and on a non-precision approach or non-instrument runway, the first upstanding obstacle may be a road, a railroad, or other constructed or natural feature. The provision of a Runway End Safety Area should take such obstacles into consideration.*
2. *Whatever length of RESA is provided, it is important to ensure that likelihood of, and potential impacts arising from an overrun are minimised as far as reasonably practicable.*
3. *It is recognised that achieving the required distance could present challenges. Therefore, the aim of this guidance is to identify the types of aerodrome activities that can be undertaken to reduce the likelihood and consequences of an overrun occurring, and to decide on appropriate actions and it is suggested that aerodrome operators assess their RESA provisions.*
4. *The overrun is a complex risk to assess because there are a number of variables, such as prevailing weather, type of aeroplane, the landing aids available, runway characteristics and available distances, the surrounding environment, and human factors. Each of these can have a significant contribution to the overall hazard; furthermore, the nature of the hazard and level of risk should be different for each aerodrome and even for each runway direction at any one aerodrome. The aerodrome may address some, and these are included below. Additionally, aircraft operating procedures may impact but the aerodrome may have little ability to influence these. This should not prevent aerodromes from working with*



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*aircraft operators so that the operations are conducted so as to minimise the likelihood of an overrun occurring.*

5. *Noting the requirement for RESA, consideration should be given to providing an area long enough to contain overruns and undershoots resulting from a reasonably probable combination of adverse operational factors. Therefore, aerodromes should try to maximise the length of RESA available on all applicable runways. When considering the RESA distance required for individual circumstances, aerodromes operators should take into account factors, such as:*

- i) the runway length and slope, in particular the general operating lengths required for take-off and landing versus the runway distances available, including the excess of available length over that required;*
- ii) current RESA provision (length and width – how much the RESA complies with the required distance) and options to increase or improve this;*
- iii) the nature and location of any hazard beyond the runway end, including the topography and obstruction environment in and beyond the RESA and outside the runway strip;*
- iv) the type of aeroplane and level of traffic at the aerodrome, and actual or proposed changes to either;*
- v) aircraft performance limitations arising from runway and RESA length – high performance aircraft, operating at high loads and speeds have greater length requirements than smaller, low-performance aircraft, the relationship between required balanced field length and available distances;*
- vi) navigation aids available (instrument or visual - if an ILS is only available on one runway direction, a downwind approach and landing may be necessary in poor weather) and the availability of vertical guidance;*
- vii) friction and drainage characteristics of the runway, which impact on runway susceptibility to surface contamination and aeroplane braking action;*
- viii) traffic density, which may lead to increased pressure to vacate so increased speed;*



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- ix) *aerodrome weather patterns, including wind shear;*
- x) *aerodrome overrun history; and*
- xi) *overrun / undershoot causal factors.*

*b) Assessment of Runway End Safety Areas*

1. *The RESA assessment should help the aerodrome operator identify the hazards and appropriate actions to reduce the risk. A range of measures may be available, singly or in combination, to reduce the risks of an overrun occurring or becoming an accident. Measures aimed at reducing the likelihood of an overrun/undershoot include:*
  - i) *improving runway surfaces and friction measurement, particularly when the runway is contaminated — know your runways and their condition and characteristics in precipitation;*
  - ii) *ensuring that accurate and up-to-date information on weather, the runway state and characteristics, is notified and passed to flight crews in a timely way, particularly when flight crews need to make operational adjustments;*
  - iii) *improving an aerodrome management's knowledge, recording, prediction and dissemination of wind data, including wind shear, and any other relevant weather information, particularly when it is a significant feature of an aerodrome's weather pattern;*
  - iv) *upgrading visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways (including the provision of instrument landing approach systems, location of aiming point and harmonisation with PAPIs);*
  - v) *formulating, in consultation with aeroplane operators, adverse weather and any other relevant aerodrome operating procedures or restrictions, and promulgating such information appropriately; and*
  - vi) *working with aircraft operators to optimise the operation.*
2. *Combined with this, measures may be considered that would reduce the severity of the consequences should an event occur. Wherever practicable, aerodrome operators should seek to optimise the RESA. This may be achieved through a combination of:*



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- i) *relocation, shifting or realignment of the runway — it may be possible to construct additional pavement at the start of take-off end to make more pavement available to retain the declared distances. The start and end of declared distances can be moved towards the downwind (start of take-off) end, thereby retaining the declared distance and creating space for a longer RESA;*
  - ii) *in the case where undershoot RESA is limited and the runway has a displaced landing threshold, examine whether the threshold can be moved (downwind) to increase the RESA and/or runway length;*
  - iii) *reducing runway declared distances in order to provide the necessary RESA may be a viable option where the existing runway length exceeds that required for the existing or projected design aircraft. If the take-off distance required for the critical aircraft operating at the aerodrome is less than the take-off distance available, there may be an opportunity to reduce the relevant runway declared distances;*
  - iv) *increasing the length of a RESA, and/or minimising the obstruction environment in the area beyond the RESA. Means to increase the RESA provision include land acquisition, improvements to the grading, realigning fences or roads to provide additional area;*
  - v) *installing suitably positioned and designed arresting systems, to supplement or as an alternative to a RESA where an equivalent level of safety is demonstrated;*
  - vi) *improving the slopes in the RESA to minimise or remove downward slopes; and*
  - vii) *providing paved RESA with known friction characteristics.*
3. *A runway meant for take-off and landing in both directions should have two RESAs extending for the required distance beyond the end of the strip extending from the runway end. Depending of the position of the threshold on a runway, the RESA related to the reverse runway should protect aircraft undershooting the threshold. Assessments of overruns and undershoots have shown that the likelihood of an undershoot is approximately four times less than for an overrun. Additionally, the undershoot rate shows that the likelihood of an event is further reduced by the availability of precision approach aids, especially those with vertical guidance. Therefore, on a precision approach runway*



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*consideration may include whether to reduce the minimum length of RESA towards the length of the runway strip before the runway.*

4. *It is recognised that improving RESAs is often difficult. However, it is important to note that incremental gains should be obtained wherever possible, as any gain is valuable. Therefore, whenever a runway project involves construction, consideration should also be given to improving the RESA.*
5. *RESA provision should be considered by the local runway safety team.*
6. *The above lists are not in any particular order, are not exhaustive, and should complement action by aeroplane operators and designers.*

### c) Arresting systems on Runway End Safety Areas

1. *In recent years, recognising the difficulties associated with achieving a standard Runway End Safety Area (RESA) at all aerodromes, research programmes have been undertaken on the use of various materials for arresting systems. Furthermore, research programmes have been undertaken to evaluate and develop arrestor systems using engineered materials. This research was driven by the recognition that many runways where natural obstacles, local development, and/or environmental constraints inhibit the provision of RESA, lead to limited dimension RESAs. Additionally, there had been accidents at some aerodromes where the ability to stop an overrunning aeroplane within the RESA would have prevented major damage to aeroplane and/or injuries to passengers.*
2. *Research programmes, as well as evaluation of actual aircraft overruns into arresting systems, have demonstrated that the performance of some arresting systems can be predictable and effective in arresting aircraft overruns.*
3. *Arresting system designs should be supported by a validated design method that can predict the performance of the system. The design method should be derived from field or laboratory tests. Testing may be based either on passage of an actual aircraft or an equivalent single wheel load through a test bed. The design should consider multiple aircraft parameters, including but not limited to allowable aircraft gear loads, gear configuration, tire contact pressure, aircraft centre of gravity, and aircraft speed. The model should calculate imposed aircraft gear loads, g-forces on aircraft occupants, deceleration rates, and stopping distances within the arresting system. Any rebound of the crushed material that may lessen its effectiveness, should also be considered.*
4. *Demonstrated performance of an arresting system can be achieved by a validated design method which can predict the performance of the system. The design and performance should be based on the type of*



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*aircraft anticipated to use the associated runway that imposes the greatest demand upon the arresting system. The system design should be based on a critical (or design) aircraft which is defined as aircraft using the associated runway that imposes the greatest demand upon the arresting system. This is usually but not always, the heaviest/largest aircraft that regularly uses the runway. Arresting system performance is dependent not only on aircraft weight but landing gear configuration and tire pressure. All configurations should be considered in optimising the arresting system design. The aerodrome operator and arresting system manufacturer should consult regarding the selection of the design aircraft that should optimise the arresting system for a particular aerodrome.*

5. *The information relating to the provision of a Runway End Safety Area and the presence of an arresting system should be published in the AIP and information/instructions promulgated to local runway safety teams and others to promote awareness in the pilot community.*
6. *Additional information is given in the ICAO Doc 9157, aerodrome design manual, PART 1, runways.*

*d) Objects on Runway End Safety Areas*

*Note: See Appendix 13, 13.2.6 for information regarding siting of equipment and installations on Runway End Safety Areas.*

An object situated on a Runway End Safety Area which may endanger aircraft shall be regarded as an obstacle and shall be removed unless otherwise approved by the Authority.

*e) Clearing and Grading of Runway End Safety Areas*

A Runway End Safety Area shall provide a cleared and graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane undershooting or overrunning the runway.

**GM to 8.3.9.11 e): Clearing and grading Of Runway End Safety Areas**

*The surface of the ground in the Runway End Safety Area does not need to be prepared to the same quality as the runway strip. (refer to 8.3.9.11 f) for the strength of RESA).***Slopes on Runway End Safety Areas**





**i) General**

The slopes of a Runway End Safety Area shall be such that no part of the Runway End Safety Area penetrates the approach or Take-off Climb Surface.

**ii) Longitudinal Slopes**

The longitudinal slopes of a Runway End Safety Area shall not exceed a downward slope of 5 per cent. Longitudinal slope changes shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.

**iii) Transverse Slopes**

The transverse slopes of a Runway End Safety Area shall not exceed an upward or downward slope of 5 per cent. Transitions between differing slopes shall be as gradual as practicable.

**f) Strength of Runway End Safety Area**

A Runway End Safety Area shall be so prepared or constructed as to reduce the risk of damage to an aeroplane undershooting or overrunning the runway, enhance aeroplane deceleration and facilitate the movement of rescue and firefighting vehicles.

*Note: Guidance on the strength of a Runway End Safety Area is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

**8.3.9.12 Clearways**

*Note 1: The inclusion of detailed specifications for clearways is not intended to imply that a clearway has to be provided.*

*Note 2: Where clearways are provided in conjunction with precision approach runways, Aerodrome Operators should also take cognisance of the physical requirements of a radio altimeter operating area*

**a) Location of Clearways**

The origin of a clearway shall be at the end of the Take-off Run Available.

**b) Length of Clearways**

The length of a clearway shall not exceed half the length of the Take-off Run Available.





### c) Width of Clearways

A clearway shall extend laterally on each side of the extended centre line of the runway, to a distance of at least

- a) 75 m for instrument runways; and
- b) Half of the width of the runway strip for non-instrument runways..

### d) Slopes on Clearways

- i) The ground in a clearway shall not project above a plane having an upward slope of 1.25 per cent, the lower limit of this plane being a horizontal line which:
  - A) is perpendicular to the vertical plane containing the runway centre line; and
  - B) passes through a point located on the runway centre line at the end of the Take-off Run Available.

*Note: Because of transverse or longitudinal slopes on a runway, shoulder or strip, in certain cases the lower limit of the clearway plane specified above may be below the corresponding elevation of the runway, shoulder or strip. It is not intended that these surfaces be graded to conform with the lower limit of the clearway plane nor is it intended that terrain or objects which are above the clearway plane beyond the end of the strip but below the level of the strip be removed unless it is considered they may endanger aeroplanes.*

- ii) Abrupt upward changes in slope shall be avoided when the slope on the ground in a clearway is relatively small or when the mean slope is upward. In such situations, in that portion of the clearway within a distance of 22.5 m or half the runway width whichever is greater on each side of the extended centre line, the slopes, slope changes and the transition from runway to clearway shall generally conform with those of the runway with which the clearway is associated.

### e) Objects on Clearways

*Note: See Appendix 13, 13.2.6 for information regarding siting of equipment and installations on Runway End Safety Areas.*

An object situated on a clearway which may endanger aeroplanes in the air shall be regarded as an obstacle and shall be removed.

Figure App 8-3

### Normal Clearway

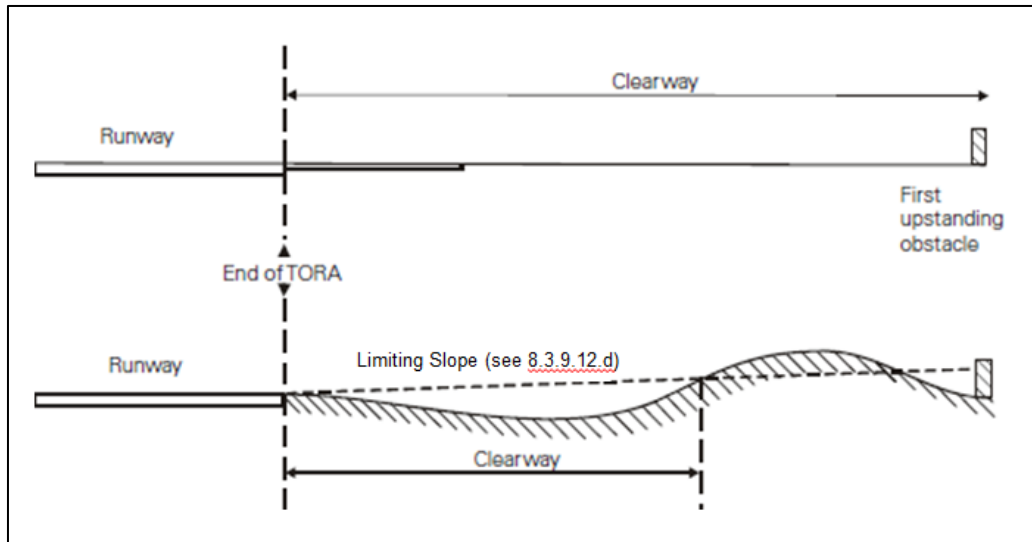


Figure App 8-4

### Horizontal Plane Clearway Not More than 9 m

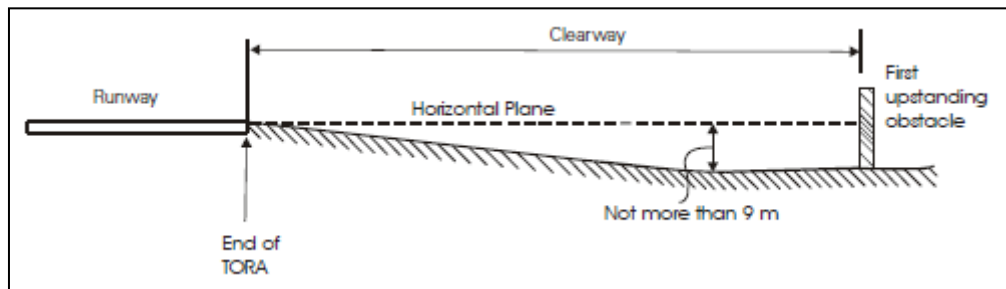


Figure App 8-5

### Horizontal Plane Clearway More than 9 m

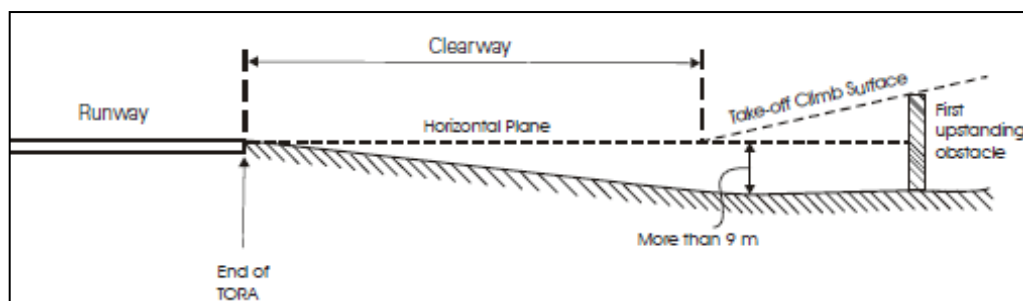
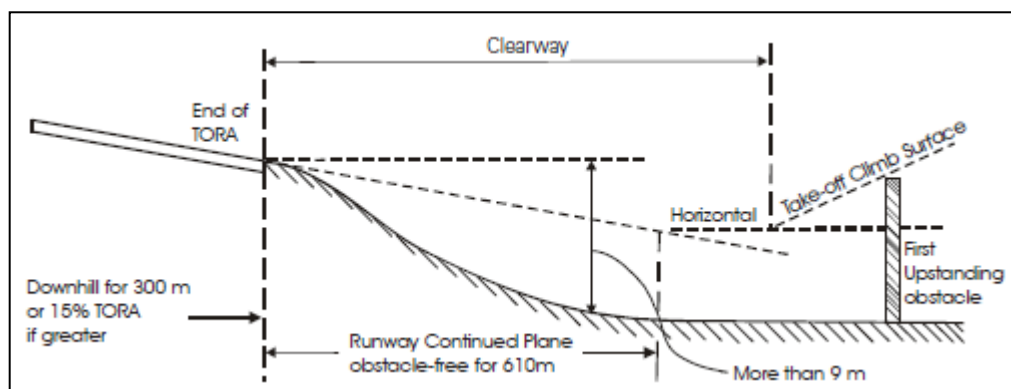


Figure App 8-6

### Runway Continued Plane Clearway



#### 8.3.9.13 Stopways

*Note 1: The inclusion of detailed specifications for stopways in this section is not intended to imply that a stopway has to be provided. ICAO Annex 14, Volume 1, Attachment A, Section 2, provides information on the use of stopways.*

*Note 2: Where stopways are provided in conjunction with precision approach runways, Aerodrome Operators should also take cognisance of the physical requirements of a radio altimeter operating area.*

##### a) Width of Stopways

A stopway shall have the same width as the runway with which it is associated.



### **b) Slopes on Stopways**

Slopes and changes in slope on a stopway, and the transition from a runway to a stopway, should comply with the specifications of Clause 8.3.9 for the runway with which the stopway is associated except that:

- i) the limitation in Clause 8.3.9.1 of a 0.8 per cent slope for the first and last quarter of the length of a runway need not be applied to the stopway; and
- ii) at the junction of the stopway and runway and along the stopway the maximum rate of slope change may be 0.3 per cent per 30 m (minimum radius of curvature of 10,000 m) for a runway where the Code Number is 3 or 4.

### **c) Strength of Stopways**

A stopway shall be prepared or constructed so as to be capable, in the event of an abandoned take-off, of supporting the aircraft which the stopway is intended to serve without inducing structural damage to the aircraft.

### **d) Surface of Stopways**

The surface of a paved stopway shall be so constructed or resurfaced as to provide surface friction characteristics at or above those of the associated runway when the stopway is wet.

## **8.3.9.14 Radio Altimeter Operating Area**

### **a) General**

A radio altimeter operating area shall be established in the pre-threshold area of a precision approach runway.

### **b) Length of the area**

A radio altimeter operating area shall extend before the threshold for a distance of at least 300 m.

### **c) Width of the area**

A radio altimeter operating area should extend laterally, on each side of the extended centre line of the runway, to a distance of 60 m.



#### d) Longitudinal slope changes

On a radio altimeter operating area, slope changes should be avoided or kept to a minimum. Where slope changes cannot be avoided, the slope changes should be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided. The rate of change between two consecutive slopes shall not exceed 2 per cent per 30 m.

*Note: Guidance on radio altimeter operating area is given in Attachment A, Section 4.3, and in the ICAO Manual of All-Weather Operations, (Doc 9365), Section 5.2. Guidance on the use of radio altimeter is given in the PANS-OPS, Volume II, Part II, Section 1.*

### 8.4 TAXIWAYS

*Note 1: Unless otherwise indicated the requirements in this section are applicable to all types of taxiways.*

*Note 2: See section 11.4.3 for a standardized scheme for the nomenclature of taxiways which may be used to improve situational awareness and as a part of an effective runway incursion prevention measure*

#### 8.4.1 General

- 8.4.1.1 Taxiways shall be provided to permit the safe and expeditious surface movement of aircraft.

Note: Guidance on layout and standardized nomenclature of taxiways is given in the Aerodrome Design Manual (9157), Part 2

- 8.4.1.2 Sufficient entrance and exit taxiways for a runway shall be provided to expedite the movement of aircraft to and from the runway and provision of rapid exit taxiways considered when traffic volumes are high.

- 8.4.1.3 The design of a taxiway shall be such that, when the cockpit of the aircraft for which the taxiway is intended remains over the taxiway centre line markings, the clearance distance between the outer main wheel of the aircraft and the edge of the taxiway shall be not less than that given by the following tabulation:

Outer main gear wheel span			
Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m



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1.5 m	2.25 m	3 m <sup>a,b</sup> 4 m <sup>c</sup>	4 m
a. On straight portions. b. On curved portions if the taxiway is intended to be used by aeroplanes with a wheel base less than 18 m. c. On curved portions if the taxiway is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.			

*Note 1: Wheel base means the distance from the nose gear to the geometric centre of the main gear.*

#### 8.4.2 Width of Taxiways

A straight portion of a taxiway should have a width of not less than that given by the following tabulation:

Outer main gear wheel span			
Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
7.5 m	10.5 m	15 m	23 m

#### 8.4.3 Taxiway Curves

Changes in direction of taxiways should be as few and small as possible. The radii of the curves shall be compatible with the manoeuvring capability and normal taxiing speeds of the aircraft for which the taxiway is intended. The design of the curve shall be such that, when the cockpit of the aircraft remains over the taxiway centre line markings, the clearance distance between the outer main wheels of the aircraft and the edge of the taxiway shall not be less than those specified in paragraph 8.4.1.3.

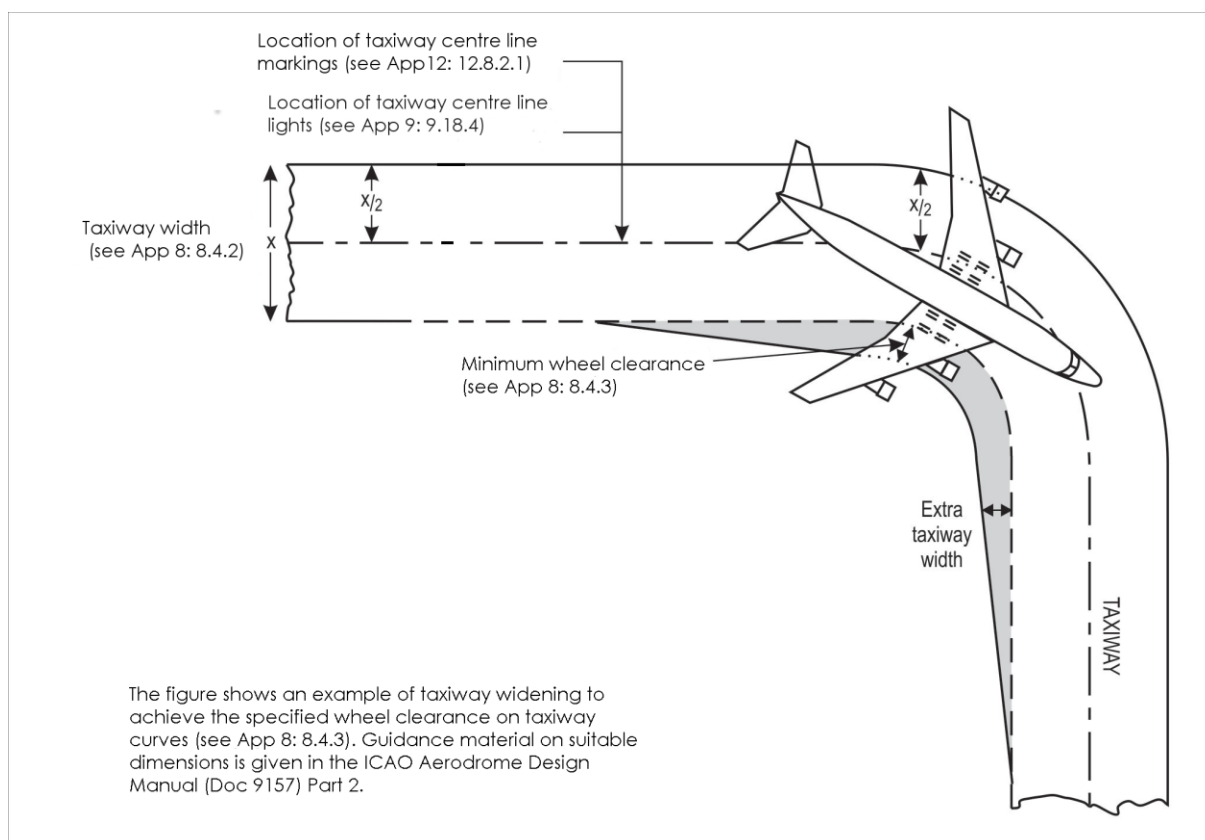
*Note 1: An example of widening taxiways to achieve the wheel clearance specified is illustrated in Figure App 8-7. Guidance on the values of suitable dimensions is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 2.*

*Note 2: The location of taxiway centre line markings and lights is specified in paragraphs Appendix 12, 12.8.2.1 and Appendix 9, 9.18.12.*

*Note 3: Compound curves may reduce or eliminate the need for extra taxiway width.*

Figure App 8-7

### Taxiway Curve



#### 8.4.4 Junctions and Intersections

To facilitate the movement of aircraft, fillets shall be provided at junctions and intersections of taxiways with runways, aprons and other taxiways. The design of the fillets shall ensure that the minimum wheel clearances specified in Clause 8.4.1.3 are maintained when aircraft are manoeuvring through the junctions or intersections.

#### 8.4.5 Taxiway Minimum Separation Distances

The separation distance between the centre line of a taxiway and the centre line of a runway, the centre line of a parallel taxiway or an object should not be less than the appropriate dimension specified in Table App 8-1.

##### **GM to 8.4.5: Taxiway Minimum Separation Distances**

*ILS and MLS installations may also influence the location of taxiways due to interferences to ILS and MLS signals by a taxiing or stopped aircraft. Information on*



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*critical and sensitive areas surrounding ILS and MLS installations is contained in ICAO Annex 10, Volume I, Attachments C and G (respectively).*

*The separation distances of Table App 8-1, column 10, do not necessarily provide the capability of making a normal turn from one taxiway to another parallel taxiway. Guidance for this condition is given in the ICAO - Aerodrome Design Manual (Doc 9157), Part 2, Taxiways, Aprons and Holding Bays.*

*The separation distance between the centre line of an aircraft stand taxilane and an object shown in Table App 8-1, column (13), may need to be increased when jet exhaust wake velocity may cause hazardous conditions for ground servicing.*

**Table App 8-1**

**Taxiway Minimum Separation Distances**

	Distance between taxiway centre line and runway centre line								Taxiway centre line to taxiway centre line (m)	Taxiway, other than aircraft stand taxilane, centre line to object (m)	Aircraft stand taxilane centre line to aircraft stand taxilane centre line (m)	Aircraft stand taxilane centre line to object (m)
	Instrument Runways Code Number				Non-Instrument Runways Code Number							
Code Letter	1	2	3	4	1	2	3	4				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	77.5	77.5	-	-	37.5	47.5	-	-	23	15.5	19.5	12
B	82	82	-	-	42	52	87	-	32	20	28.5	16.5
C	88	88	158	158	48	58	93	93	44	26	40.5	22.5
D	-	-	166	166	-	-	101	101	63	37	59.5	33.5
E	-	-	172.5	172.5	-	-	107.5	107.5	76	43.5	72.5	40
F	-	-	180	180	-	-	115	115	91	51	87.5	47.5

*Note 1 — The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways.*

*Note 2 — The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway.*

*Note 3 — The separation distances, as prescribed in Table App 8-1, may have to be increased on taxiway curves to accommodate the wing sweep of the critical aeroplane or on dual parallel taxiways when, as for example, used as bypass taxiways.*





#### 8.4.6 Slopes on Taxiways

##### 8.4.6.1 *Longitudinal Slopes*

The longitudinal slope of a taxiway should not exceed:

- a) 1.5 per cent where the Code Letter is C, D, E or F; and
- b) 3 per cent where the Code Letter is A or B.

##### 8.4.6.2 *Longitudinal Slope Changes*

Where slope changes on a taxiway cannot be avoided, the transition from one slope to another slope should be accomplished by a curved surface with a rate of change not exceeding:

- a) 1 per cent per 30 m (minimum radius of curvature of 3,000 m) where the Code Letter is C, D, E or F; and
- b) 1 per cent per 25 m (minimum radius of curvature of 2,500 m) where the Code Letter is A or B.

##### 8.4.6.3 *Sight Distance*

Where a change in slope on a taxi-way cannot be avoided, the change shall be such that, from any point:

- a) 3 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 300 m from that point, where the Code Letter is C, D, E or F;
- b) 2 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 200 m from that point, where the Code Letter is B; and
- c) 1.5 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 150 m from that point, where the Code Letter is A.

##### 8.4.6.4 *Transverse Slopes*

The transverse slopes of a taxiway shall be sufficient to prevent the accumulation of water on the surface of the taxiway but shall not exceed:

- a) 1.5 per cent where the Code Letter is C, D, E or F; and
- b) 2 per cent where the Code Letter is A or B.



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*Note: See 8.6.4 regarding transverse slopes on an aircraft stand taxilane.*

#### 8.4.7 **Strength of Taxiways**

The strength of a taxiway shall be at least equal to that of the runway it serves, due consideration being given to the fact that a taxiway will be subjected to a greater density of traffic and, as a result of slow moving and stationary aircraft, to higher stresses than the runway it serves.

*Note: Guidance on the relation of the strength of taxiways to the strength of runways is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 3.*

#### 8.4.8 **Surface of Taxiways**

8.4.8.1 The surface of a taxiway shall not have irregularities that cause damage to aircraft structures.

8.4.8.2 The surface of a paved taxiway shall be so constructed or resurfaced as to provide suitable surface friction characteristics.

#### 8.4.9 **Rapid Exit Taxiways**

*Note: The following specifications detail requirements particular to rapid exit taxiways. See ICAO Annex 14, Volume 1, Chapter 3, Figure 3-3. General requirements for taxiways also apply to this type of taxiway. Guidance on the provision, location and design of rapid exit taxiways is included in the ICAO Aerodrome Design Manual (Doc 9157), Part 2.*

8.4.9.1 A rapid exit taxiway shall be designed with a radius of turn-off curve of at least:

- a) 550 m where the Code Number is 3 or 4; and
- b) 275 m where the Code Number is 1 or 2;

to enable exit speeds under wet conditions of:

- c) 93 km/h where the Code Number is 3 or 4; and
- d) 65 km/h where the Code Number is 1 or 2.

*Note: The locations of rapid exit taxiways along a runway are based on several criteria described in the ICAO Aerodrome Design Manual (Doc 9157), Part 2, in addition to different speed criteria.*



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- 8.4.9.2 The radius of the fillet on the inside of the curve at a rapid exit taxiway shall be sufficient to provide a widened taxiway throat in order to facilitate early recognition of the entrance and turn-off onto the taxiway.
- 8.4.9.3 A rapid exit taxiway shall include a straight distance after the turn-off curve sufficient for an exiting aircraft to come to a full stop clear of any intersecting taxiway.
- 8.4.9.4 The intersection angle of a rapid exit taxiway with the runway shall not be greater than 45° nor less than 25° and preferably should be 30°.

8.4.10 **Taxiways on Bridges**

- 8.4.10.1 The width of that portion of a taxiway bridge capable of supporting aeroplanes, as measured perpendicularly to the taxiway centre line, shall not be less than the width of the graded area of the strip provided for that taxiway, unless a proven method of lateral restraint is provided which shall not be hazardous for aeroplanes for which the taxiway is intended.
- 8.4.10.2 Access shall be provided to allow rescue and firefighting vehicles to intervene in both directions within the specified response time to the largest aircraft for which the taxiway bridge is intended.

*Note: If aeroplane engines overhang the bridge structure, protection of adjacent areas below the bridge from engine blast may be required.*

- 8.4.10.3 A bridge shall be constructed on a straight section of the taxiway with a straight section on both ends of the bridge to facilitate the alignment of aircraft approaching the bridge.

8.4.11 **TAXIWAY SHOULDERS**

- 8.4.11.1 Straight portions of a taxiway where the Code Letter is C, D, E or F shall be provided with shoulders which extend symmetrically on each side of the taxiway so that the overall width of the taxiway and its shoulders on straight portions is not less than:
- a) 44 m where the Code Letter is F
  - b) 38 m where the Code Letter is E
  - c) 34 m where the Code Letter is D
  - d) 25 m where the Code Letter is C



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8.4.11.2 On taxiway curves and on junctions or intersections where increased pavement is provided, the shoulder width shall be not less than that on the adjacent straight portions of the taxiway.

8.4.11.3 When a taxiway is intended to be used by turbine-engined aeroplanes, the surface of the taxiway shoulder shall be so prepared as to resist erosion and the ingestion of the surface material by aircraft engines.

8.4.11.4 If the taxiway is intended to serve code F aircraft or an aircraft with engines that overhang the shoulders, the inner most 3 metres shall be sealed.

8.4.12 **TAXIWAY STRIPS**

8.4.12.1 **General**

A taxiway, other than an aircraft stand taxiway, shall be included in a strip.

8.4.13 **WIDTH OF TAXIWAY STRIPS**

8.4.13.1 A taxiway strip shall extend symmetrically on each side of the centre line of the taxiway throughout the length of the taxiway to at least the distance from the centre line given in Table App 8-1, column 11.

8.4.14 **OBJECTS ON TAXIWAY STRIPS**

*Note: See Appendix 13, 13.2.6 for information regarding siting of equipment and installations on taxiway strips.*

The taxiway strip shall provide an area clear of objects which may endanger taxiing aircraft.

*Note: Consideration will have to be given to the location and design of drains on a taxiway strip to prevent damage to an aeroplane accidentally running off a taxiway. Suitably designed drain covers may be required.*

8.4.15 **GRADING OF TAXIWAY STRIPS**

The centre portion of a taxiway strip shall provide a graded area to a distance from the centre line of the taxiway of at least:

- a) 22 m where the OMGWS is 9 m up to but not including 15 m where the code letter is F;
- b) 19 m where the OMGWS is 9 m up to but not including 15 m where the code letter is E;



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- c) 18.5 m where the OMGWS is 9 m up to but not including 15 m where the code letter is D;
- d) 12.5 m where the OMGWS is 6 m up to but not including 9 m
- e) 11 m where the OMGWS is 4.5 m up to but not including 6m;
- f) 10.25 m where the OMGWS is up to but not including 4.5 m.

**8.4.16 SLOPES ON TAXIWAY STRIPS**

8.4.16.1 The surface of the strip shall be flush at the edge of the taxiway or shoulder, if provided, and the graded portion shall not have an upward transverse slope exceeding:

- a) 2.5 per cent for strips where the Code Letter is C, D, E or F
- b) 3 per cent for strips of taxiways where the Code Letter is A or B

the upward slope being measured with reference to the transverse slope of the adjacent taxiway surface and not the horizontal. The downward transverse slope shall not exceed 5 per cent measured with reference to the horizontal.

8.4.16.2 The transverse slopes on any portion of a taxiway strip beyond that to be graded should not exceed an upward or downward slope of 5 per cent as measured in the direction away from the taxiway.

*Note 1.— Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a taxiway strip and would be placed as far as practicable from the taxiway.*

*Note 2.— The aerodrome RFF procedure would need to take into account the location of open-air storm water conveyances within the non-graded portion of a taxiway strip*

**8.5 HOLDING BAYS, RUNWAY-HOLDING POSITIONS, INTERMEDIATE HOLDING POSITIONS AND ROAD HOLDING POSITIONS**

**8.5.1 General**

8.5.1.1 Holding bay(s) should be provided when the traffic density is medium or heavy.

8.5.1.2 A runway-holding position or positions shall be established:

- a) on the taxiway, at the intersection of a taxiway and a runway; and



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- b) at an intersection of a runway with another runway when the former runway is part of a standard taxi-route.

- 8.5.1.3 A runway-holding position shall be established on a taxiway if the location or alignment of the taxiway is such that a taxiing aircraft or vehicle can infringe an obstacle limitation surface or interfere with the operation of radio navigation aids.
- 8.5.1.4 An Intermediate Holding Position should be established on a taxiway at any point other than a runway-holding position where it is desirable to define a specific holding limit.
- 8.5.1.5 A road-holding position shall be established at an intersection of a road with a runway.

Table App 8-2

**Minimum Distance from the Runway Centre Line to a Holding Bay, Runway-Holding Position or Road-Holding Position**

Type of Runway	Code Number			
	1	2	3	4
Non-instrument	30 m	40 m	75 m	75 m
Non-Precision approach	40 m	40 m	75 m	75 m
Precision approach Category I	60 m <sup>b</sup>	60 m <sup>b</sup>	90 m <sup>a,b</sup>	90 m <sup>a,b</sup>
Precision approach categories II & III	-	-	90 m <sup>a,b</sup>	90 m <sup>a,b</sup>
Take-off runway	30 m	40 m	75 m	75 m

- a) *If a holding bay, runway-holding position or road-holding position is at a lower elevation compared to the threshold, the distance may be decreased 5 m for every metre the bay or holding position is lower than the threshold, contingent upon not infringing the Inner Transitional Surface.*
- b) *This distance may need to be increased to avoid interference with radio navigation aids, particularly the glide path and localizer facilities. Information on critical and sensitive areas of ILS and MLS is contained in ICAO Annex 10 (Aeronautical Communications), Volume I, Attachments C and G respectively.*



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*Note 1: The distance of 90 m for Code Number 3 or 4 is based on an aircraft with a tail height of 20 m, a distance from the nose to the highest part of the tail of 52.7 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the Obstacle Free Zone and not accountable for the calculation of OCA/H.*

*Note 2: The distance of 60 m for Code Number 2 is based on an aircraft with a tail height of 8 m, a distance from the nose to the highest part of the tail of 24.6 m and a nose height of 5.2 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the Obstacle Free Zone.*

*Note 3: For code number 4 where the width of the inner edge of the inner approach surface is more than 120m, a distance greater than 90m may be necessary to ensure that a holding aircraft is clear of the obstacle free zone. For example, a distance of 100 m is based on an aircraft with a tail height of 24 m, a distance from the nose to the highest part of the tail of 62.2 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the Obstacle Free Zone.*

### 8.5.2 Location

- 8.5.2.1 The distance between a holding bay, runway-holding position established at a taxiway/runway intersection or road-holding position and the centre line of a runway shall be in accordance with Table App 8-2 and, in the case of a precision approach runway, such that a holding aircraft or vehicle will not interfere with the operation of radio navigation aids or penetrate the inner transitional surface

Note: Guidance for the positioning of runway-holding positions is given in the Aerodrome Design Manual (DOC 9157), Part 2.

- 8.5.2.2 At elevations greater than 700 m (2 300 ft) the distance of 90 m specified in Table App 8-2 for a precision approach runway code number 4 should be increased up to an elevation of 2 000 m (6 600 ft); 1 m for every 100 m (330 ft) in excess of 700 m (2 300 ft).
- 8.5.2.3 If a holding bay, runway-holding position or road-holding position for a precision approach runway code number 4 is at a greater elevation compared to the threshold, the distance specified in Table App 8-2 should be further increased 5 m for every metre the bay or position is higher than the threshold.
- 8.5.2.4 The location of a runway-holding position established in accordance with Clause 8.5.1.3 shall be such that a holding aircraft or vehicle will not infringe the Obstacle Free Zone, Approach Surface, Take-off Climb Surface or ILS/MLS critical/sensitive area or interfere with the operation of radio navigation aids.



## 8.6 APRONS

### 8.6.1 *General*

Aprons shall be provided where necessary to permit the on- and off-loading of passengers, cargo or mail as well as the servicing of aircraft without interfering with the aerodrome traffic.

### 8.6.2 *Size of Aprons*

The total apron area shall be adequate to permit expeditious handling of the aerodrome traffic at its maximum anticipated density.

### 8.6.3 *Strength of Aprons*

Each part of an apron shall be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that some portions of the apron will be subjected to a higher density of traffic and, as a result of slow moving or stationary aircraft, to higher stresses than a runway.

### 8.6.4 *Slopes on Aprons*

8.6.4.1 Slopes on an apron, including those on an aircraft stand taxilane, shall be sufficient to prevent accumulation of water on the surface of the apron and shall be kept as level as drainage requirements permit.

8.6.4.2 On an aircraft stand the maximum slope shall not exceed 1 per cent.





### 8.6.5 Clearance Distances on Aircraft Stands

*Note: The safety objective of clearance distances on aircraft stands is to provide safe separation between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects.*

- 8.6.5.1 An aircraft stand shall provide the following minimum clearances between an aircraft entering or exiting the stand and aircraft on another stand, any adjacent building, and other objects:

Code Letter	Clearance
A	3 m
B	3 m
C	4.5 m
D	7.5 m
E	7.5 m
F	7.5 m

- 8.6.5.2 Where the Code Letter is D, E or F, these clearances may be reduced at a stand provided with azimuth guidance by a visual docking guidance system provided that the aircraft stand is a power in push back configuration. The clearance distances shall not be less than:

- 2 m between any fixed passenger bridge, and the nose of an aircraft; or
- 3.75 m between any object (including other aircraft) and the aircraft over any portion of the stand, provided that all obstacles are clear of the engine ingestion danger area.

#### **GM Appendix 8, 8.6.5 Clearance Distances on Aircraft Stands**

- Reduced separation on the stand is possible where azimuth guidance by a visual docking guidance system is provided, in combination with additional mitigation measures, such as:*
- good condition of all apron marking and signage;*
- maintenance of visual docking systems.*



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- d) *Aircraft stands where reduced clearance distances apply should be identified and the information published in the AIP.*
- e) *Any aircraft passing behind an aircraft parked on an aircraft stand should keep the required clearance distances defined in Table App 8-1.*

**8.7 ISOLATED AIRCRAFT PARKING POSITIONS**

*Note: See Chapter 4, 4.12 for requirements*

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## APPENDIX 9

### AERODROME LIGHTING

#### 9.1 GENERAL

##### 9.1.1 Lights which may Endanger the Safety of Aircraft

A non-aeronautical ground light near an aerodrome which might endanger the safety of aircraft shall be extinguished, screened or otherwise modified so as to eliminate the source of danger.

##### 9.1.2 Laser Emissions which may Endanger the Safety of Aircraft

To protect the safety of aircraft against the hazardous effects of laser emitters, the following protected zones shall be established around aerodromes:

- a) a laser-beam free flight zone (LFFZ);
- b) a laser-beam critical flight zone (LCFZ); and
- c) a laser-beam sensitive flight zone (LSFZ).

##### 9.1.3 Lights which may Cause Confusion

A non-aeronautical ground light which, by reason of its intensity, configuration or colour, might prevent, or cause confusion in, the clear interpretation of aeronautical ground lights shall be extinguished, screened or otherwise modified so as to eliminate such a possibility. In particular, attention should be directed to a non-aeronautical ground light visible from the air within the areas described hereunder:

- a) Instrument Runway - Code Number 4:
  - within the areas before the threshold and beyond the end of the runway extending at least 4 500 m in length from the threshold and runway end and 750 m either side of the extended runway centre line in width.
- b) Instrument Runway - Code Number 2 or 3:
  - as in a), except that the length should be at least 3 000 m.



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c) Instrument Runway - Code Number 1; and Non-Instrument Runway:

- within the approach area.

9.1.4 **Elevated Approach Lights**

Elevated approach lights and their supporting structures shall be frangible except that, in that portion of the approach lighting system beyond 300 m from the threshold:

- a) where the height of a supporting structure exceeds 12 m, the frangibility requirement shall apply to the top 12 m only; and
- b) where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding objects shall be frangible.

9.1.5 When an approach light fixture or supporting structure is not in itself sufficiently conspicuous, it shall be suitably marked.

9.1.6 **Elevated Lights**

Elevated runway, stopway and taxiway lights shall be frangible. Their height shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

9.1.7 **Surface Lights**

Light fixtures inset in the surface of runways, stopways, taxiways and aprons shall be so designed and fitted as to withstand being run over by the wheels of an aircraft without damage either to the aircraft or to the lights themselves.

9.1.8 The temperature produced by conduction or radiation at the interface between an installed inset light and an aircraft tire should not exceed 160°C during a 10-minute period of exposure.

*Note: Guidance on measuring the temperature of inset lights is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

9.1.9 **Light Intensity and Control**

*Note: In dusk or poor visibility conditions by day, lighting can be more effective than marking. For lights to be effective in such conditions or in poor visibility by night, they must be of adequate intensity. To obtain the required intensity, it will usually be necessary to make the light directional, in which case the arcs over which the light shows will have to be adequate and so orientated as to meet the*



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*operational requirements. The runway lighting system will have to be considered as a whole, to ensure that the relative light intensities are suitably matched to the same end. (See ICAO Annex 14, Volume 1, Attachment A, Section 16, and the ICAO Aerodrome Design Manual (Doc 9157), Part 4).*

The intensity of runway lighting shall be adequate for the minimum conditions of visibility and ambient light in which use of the runway is intended, and compatible with that of the nearest section of the approach lighting system when provided.

*Note: While the lights of an approach lighting system may be of higher intensity than the runway lighting, it is good practice to avoid abrupt changes in intensity as these could give a pilot a false impression that the visibility is changing during approach.*

- 9.1.10 Where a high-intensity lighting system is provided, a suitable intensity control shall be incorporated to allow for adjustment of the light intensity to meet the prevailing conditions. Separate intensity controls or other suitable methods shall be provided to ensure that the following systems, when installed, can be operated at compatible intensities:
- a) approach lighting system;
  - b) runway edge lights;
  - c) runway threshold lights;
  - d) runway end lights;
  - e) runway centre line lights;
  - f) runway Touchdown Zone lights; and
  - g) taxiway centre line lights.
- 9.1.11 On the perimeter of and within the ellipse defining the main beam as shown in Figure App 9-18 to App 9-27, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with this Appendix, collective notes for Figure App 9-18 to App 9-28, Note 2.
- 9.1.12 On the perimeter of and within the rectangle defining the main beam as shown Figure App 9-29 to App 9-37, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with this Appendix, collective notes for Figure App 9-29 to App 9-38, Note 2.



## **9.2 EMERGENCY LIGHTING**

### **9.2.1 Application**

At an aerodrome provided with runway lighting and without a secondary power supply, sufficient emergency lights shall be conveniently available for installation on at least the primary runway in the event of failure of the normal lighting system.

*Note: Emergency lighting may also be useful to mark obstacles or delineate taxiways and apron areas.*

### **9.2.2 Location**

When installed on a runway the emergency lights shall, as a minimum, conform to the configuration required for a non-Instrument Runway.

### **9.2.3 Characteristics**

The colour of the emergency lights should conform to the colour requirements for runway lighting, except that, where the provision of coloured lights at the threshold and the runway end is not practicable, all lights may be variable white or as close to variable white as practicable.

## **9.3 AERONAUTICAL BEACONS**

### **9.3.1 Application**

Where operationally necessary as determined by the Authority an aerodrome beacon or an identification beacon shall be provided at each aerodrome intended for use at night.

9.3.2 The operational requirement shall be determined having regard to the requirements of the air traffic using the aerodrome, the conspicuity of the aerodrome features in relation to its surroundings and the installation of other visual and non-visual aids useful in locating the aerodrome

### **9.3.3 Aerodrome Beacon**

An aerodrome beacon shall be provided at an aerodrome intended for use at night if one or more of the following conditions exist:

- a) aircraft navigate predominantly by visual means;
- b) reduced visibilities are frequent; or



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- c) it is difficult to locate the aerodrome from the air due to surrounding lights or terrain.

9.3.4 **Location**

The aerodrome beacon shall be located on or adjacent to the aerodrome in an area of low ambient background lighting.

- 9.3.5 The location of the beacon shall be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.

9.3.6 **Characteristics**

The aerodrome beacon shall show either coloured flashes alternating with white flashes, or white flashes only. The frequency of total flashes shall be from 20 to 30 per minute. Where used, the coloured flashes emitted by beacons at land aerodromes shall be green and coloured flashes emitted by beacons at water aerodromes shall be yellow. In the case of a combined water and land aerodrome, coloured flashes, if used, shall have the colour characteristics of whichever section of the aerodrome is designated as the principal facility.

- 9.3.7 The light from the beacon shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the Appropriate Authority to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used and the effective intensity of the flash shall be not less than 2 000 cd.

*Note: At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.*

9.4 **IDENTIFICATION BEACON**

9.4.1 **Application**

An identification beacon shall be provided at an aerodrome which is intended for use at night and cannot be easily identified from the air by other means.

9.4.2 **Location**

The identification beacon shall be located on the aerodrome in an area of low ambient background lighting.

- 9.4.3 The location of the beacon shall be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.



#### 9.4.4 Characteristics

An identification beacon at a land aerodrome shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the Appropriate Authority to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used and the effective intensity of the flash shall be not less than 2 000 cd.

*Note: At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.*

9.4.5 An identification beacon shall show flashing-green at a land aerodrome and flashing-yellow at a water aerodrome.

9.4.6 The identification characters shall be transmitted in the International Morse Code.

9.4.7 The speed of transmission should be between six and eight words per minute, the corresponding range of duration of the Morse dots being from 0.15 to 0.2 seconds per dot.

### 9.5 APPROACH LIGHTING SYSTEMS

#### 9.5.1 Application

##### a) Non-Instrument Runway

Where physically practicable, a simple approach lighting system as specified in 9.5.2 should be provided to serve a non-Instrument Runway where the Code Number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility, and sufficient guidance is provided by other visual aids.

*Note: A simple approach lighting system can also provide visual guidance by day.*

##### b) Non-Precision Approach Runway

Where physically practicable, a simple approach lighting system as specified in 9.5.2 shall be provided to serve a non-precision approach runway, except when the runway is used only in conditions of good visibility or sufficient guidance is provided by other visual aids.

*Note: It is advisable to give consideration of a Precision Approach Category 1 lighting system or to the addition of a runway lead-in lighting system.*





Table App 9-1

Aeronautical Ground Lighting

Type of lighting	Type of Runway								CAR Part IX Ref	Notes
	Approach runway day and night					Night	Take-off runway			
	Cat III	Cat II	Cat I	Non- precision	Non- Instrume nt		<400 RVR	>400 RVR		
GENERAL										
Aerodrome Beacon						O			9.3.1	
Identification Beacon						O			9.4.1	
Windsock						R			17.1.1	
APPROACH LIGHTING										
Simple				pp <sup>1</sup>		pp <sup>1, 2</sup>			9.5.1	
CAT I			PP						9.5.1	
CAT II		R							9.5.1	
CAT III	R								9.5.1	
RUNWAY										
VASI	O	O	O	O	O				9.6.1	3
Circling Guidance	O	O	O	O	O				9.7.1	
Lead in Lighting	O	O	O	O	O				9.8.1	
Runway threshold identification lights	O	O	O	O					9.9.1	
Edge	R	R	R			R	R	R <sup>4</sup>	9.10.1	
Threshold	R	R	R			R <sup>5</sup>			9.11.1	4
Wing Bar	O	O	O	R <sup>6</sup>	R <sup>6</sup>	R <sup>6</sup>			9.11.6	
End	R	R	R			R	R	R <sup>6</sup>	9.12.1	
Centre line	R	R	R <sup>7</sup>				R	R <sup>7</sup>	9.13.1	
Touchdown zone	R	R							9.14.1	
Simple Touchdown zone			R <sup>8</sup>	R <sup>8</sup>	R <sup>9</sup>	R <sup>9</sup>			9.15.1	
Rapid exit taxiway	R	R <sup>9</sup>	R <sup>9</sup>	R <sup>9</sup>	R <sup>9</sup>	R <sup>9</sup>			9.16.1	
Stopway						R			9.17.1	
Turn pad	R					R			9.20.1	
TAXIWAY										
Centre line	R <sup>10</sup>					R <sup>11, 12, 10</sup>	R <sup>10, 12</sup>		9.18.1	13
Edge						R <sup>14, 15</sup>			9.19.1	
Stop bars	R	R							9.21.1	16
Intermediate	R <sup>17</sup>								9.22.1	18
Runway guard	R	R	R <sup>19</sup>	R <sup>19</sup>	R <sup>19</sup>		R <sup>19</sup>	R <sup>19</sup>	9.23.1	
OTHER										
Apron floodlighting						R			9.24.1	
Stand manoeuvring	R <sup>20</sup>								9.26.1	
Road holding	R	R							9.27.1	
No entry	R	R	R	R	R		R	R	9.28.1	

R = Required

PP = Where physically practicable

O = Where operationally necessary

Notes for Table 9-1. These notes should be read in conjunction with the appropriate CAR Part IX reference.

1. Except when runway used in good visibility or sufficient guidance is provided by other visual aids.	13. Required on all taxiways where component of an Advanced Surface Movement Guidance System.
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2. Code 3 and 4 only. 3. Required when used for turbojet operations or aircraft with similar approach guidance requirements. 4. Provided where RVR below 800 m by day. 5. Except where threshold is displaced. 6. Where threshold is displaced. 7. Required where landing or take-off of high speed aircraft or runway width greater than 50 m. 8. Approach angle greater than 3.5 deg or limited LDA. 9. Where traffic density is heavy. 10. Except where traffic density is light and edge lights and centre line markings provided. 11. RVR > 300 m. 12. RVR < 300 m.	14. Except where guidance can be achieved by surface illumination or other means. 15. Required on runway forming part of standard taxi route and no taxiway centre lights provided. 16. Required at intermediate hold position when part of Surface Movement Guidance System. 17. Except where stop bar installed. 18. At all intermediate hold positions where no need for stop and go signals provided by stop bar. 19. Where a stop bar is not installed and/or where runway incursion hotspots have been identified. 20. RVR < 200 m.
--	---

c) Precision Approach Runway Category I

Where physically practicable, a Precision Approach Category I lighting system as specified in 9.5.3 shall be provided to serve a Precision Approach Runway Category I.

d) Precision Approach Runway Categories II and III

A Precision Approach Category II and III lighting system as specified in 9.5.4 shall be provided to serve a Precision Approach Runway Category II or III.

9.5.2 **Simple Approach Lighting System**

9.5.2.1 **Location**

A simple approach lighting system shall consist of a row of lights on the extended centre line of the runway extending, whenever possible, over a distance of not less than 420 m from the threshold with a row of lights forming a crossbar 18 m or 30 m in length at a distance of 300 m from the threshold.

9.5.2.2 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 30 m is used, gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

*Note 1: Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches*

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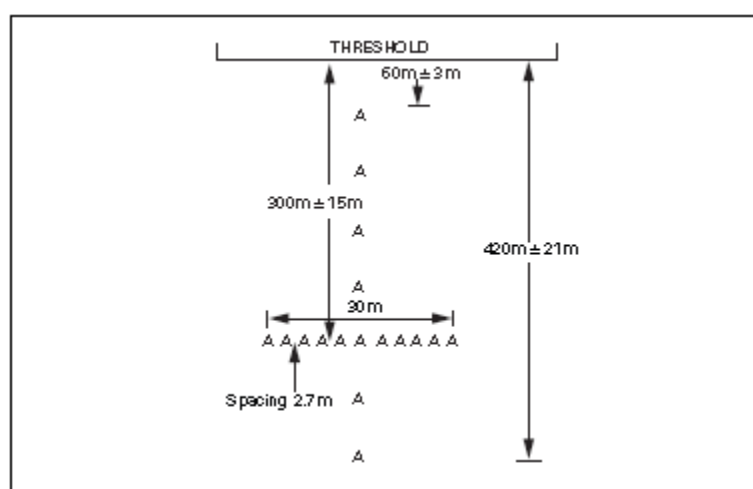
*are made with a lateral error, and facilitate the movement of rescue and firefighting vehicles.*

*Note 2: See ICAO Annex 14, Volume 1, Attachment A, Section 11, for guidance on installation tolerances*

- 9.5.2.3 The lights forming the centre line shall be placed at longitudinal intervals of 60 m, except that, when it is desired to improve the guidance, an interval of 30 m may be used. The innermost light shall be located either 60 m or 30 m from the threshold, depending on the longitudinal interval selected for the centre line lights.
- 9.5.2.4 If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it shall extend to at least 300 m so as to include the crossbar. If this is not possible, the centre line lights should be extended as far as practicable, and each centre line light should then consist of a barrette at least 3 m in length. Subject to the approach system having a crossbar at 300 m from the threshold, an additional crossbar may be provided at 150 m from the threshold.

**Figure App 9-1**

**Simple Approach Lighting System**



- 9.5.2.5 The system shall lie in the horizontal plane passing through the threshold, provided that:
- no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and



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- b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

9.5.2.6 **Characteristics**

The lights of a simple approach lighting system shall be fixed lights and the colour of the lights shall be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present. Each centre line light shall consist of either:

- a) a single source; or
- b) a barrette at least 3 m in length.

*Note 1: When the barrette as in b) is composed of lights approximating to point sources, a spacing of 1.5 m between adjacent lights in the barrette has been found satisfactory.*

*Note 2: It may be advisable to use barrettes 4 m in length if it is anticipated that the simple approach lighting system will be developed into a precision approach lighting system.*

*Note 3: At locations where identification of the simple approach lighting system is difficult at night due to surrounding lights, sequence flashing lights installed in the outer portion of the system may resolve this problem.*

- 9.5.2.7 Where provided for a non-Instrument Runway, the lights shall show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights shall be adequate for all conditions of visibility and ambient light for which the system has been provided.

- 9.5.2.8 Where provided for a non-precision approach runway, the lights shall show at all angles in azimuth necessary to the pilot of an aircraft which on final approach does not deviate by an abnormal amount from the path defined by the non-visual aid. The lights shall be designed to provide guidance during both day and night in the most adverse conditions of visibility and ambient light for which it is intended that the system remain usable.



### 9.5.3 Precision Approach Category I Lighting System

#### 9.5.3.1 Location

A Precision Approach Category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, whenever possible, over a distance of 900 m from the runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold.

*Note: The installation of an approach lighting system of less than 900 m in length may result in operational limitations on the use of the runway. See ICAO Annex 14, Volume 1, Attachment A, Section 11.*

- 9.5.3.2 The lights forming the crossbar shall be in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

*Note 1: Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and firefighting vehicles.*

*Note 2: See ICAO Annex 14, Volume 1, Attachment A, Section 11, for guidance on installation tolerances.*

- 9.5.3.3 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold.

- 9.5.3.4 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

- a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
- b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

- 9.5.3.5 Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.



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9.5.3.6 **Characteristics**

The extended centre line and crossbar lights of a Precision Approach Category I lighting system shall be fixed lights showing variable white. Each centre line light position shall consist of either:

- a) a single light source in the innermost 300 m of the centre line, two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line to provide distance information; or
- b) a barrette.

9.5.3.7 Where the serviceability level of the approach lights specified as a maintenance objective in Chapter 4, 4.16.16.4 can be demonstrated, each centre line light position may consist of either:

- a) a single light source; or
- b) a barrette.

9.5.3.8 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

9.5.3.9 If the centre line consists of barrettes as described in 9.5.3.6 b) or 9.5.3.7 b), each barrette should be supplemented by a flashing light, except where such lighting is considered unnecessary by the Authority taking into account the characteristics of the system and the nature of the meteorological conditions.

9.5.3.10 Each flashing light described in 9.5.3.9 shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

9.5.3.11 If the centre line consists of a single light source as described in as described in 9.5.3.6 a) or 9.5.3.7 a), additional crossbars of lights to the crossbar provided at 300 m from the threshold shall be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar be shall as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.



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*Note: See ICAO Annex 14, Volume 1, Attachment A, Section 11, for detailed configuration.*

9.5.3.12 Where the additional crossbars described in 9.5.3.11 are incorporated in the system, the outer ends of the crossbars shall lie on two straight lines that either are parallel to the line of the centre line lights or converge to meet the runway centre line 300 m from threshold.

9.5.3.13 The lights shall be in accordance with the specifications of, Figure App 9-18.

*Note: The flight path envelopes used in the design of these lights are given in ICAO Annex 14 Volume 1, Attachment A, Figure A-4.*

#### 9.5.4 Precision Approach Category II and III Lighting System

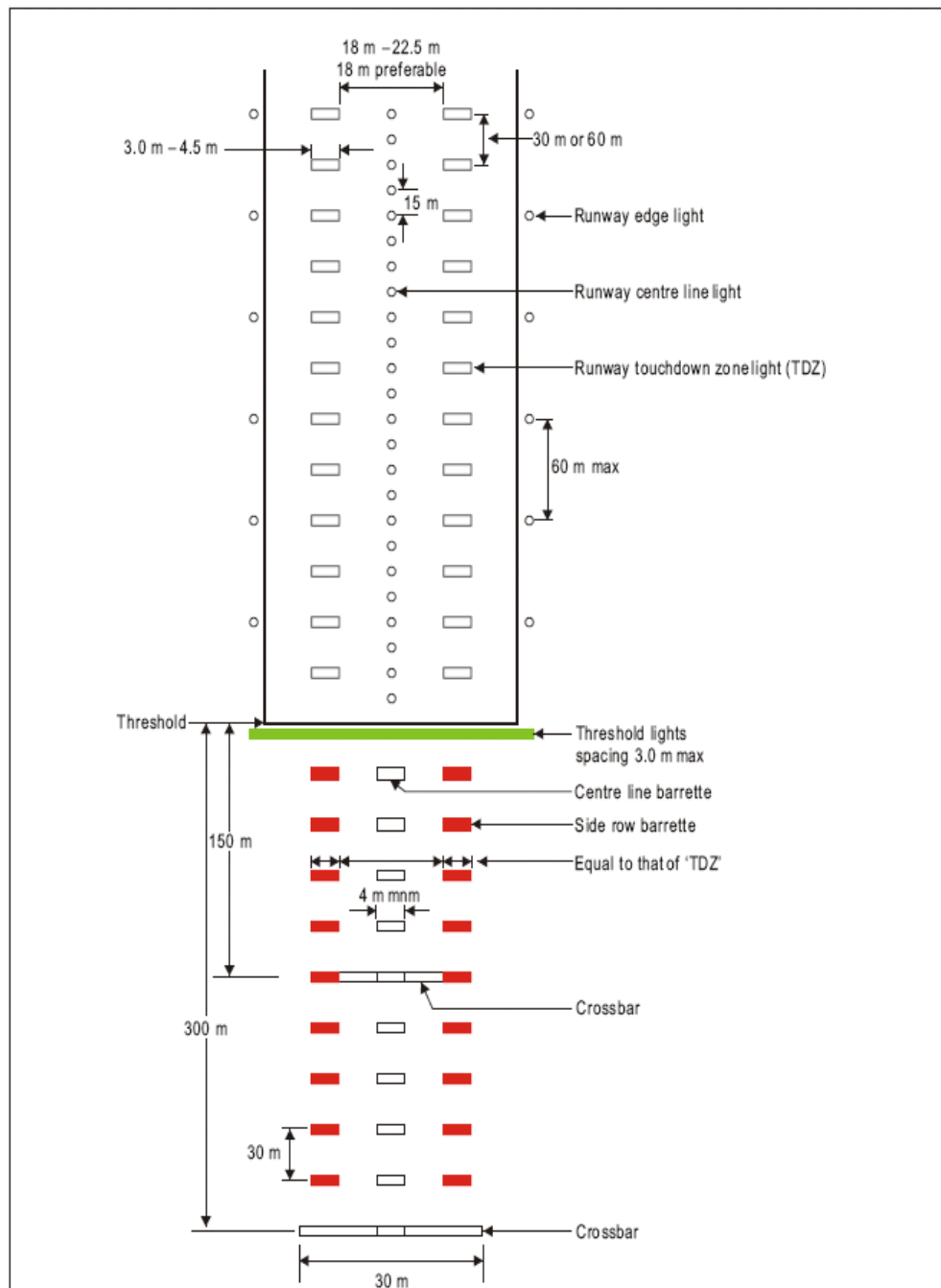
##### 9.5.4.1 Location

The approach lighting system shall consist of a row of lights on the extended centre line of the runway, extending, over a distance of 900 m from the runway threshold. In addition, the system shall have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure App 9-2. Where the serviceability level of the approach lights specified as maintenance objectives in Chapter 4, 4.16 can be demonstrated, the system may have two side rows of lights, extending 240 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure App 9-3.

*Note: The length of 900 m is based on providing guidance for operations under category I, II and III conditions. Reduced lengths may support Category II and III operations but may impose limitations on Category I operations. See ICAO Annex 14, Volume 1, Attachment A, Section 11.*

Figure App 9-2

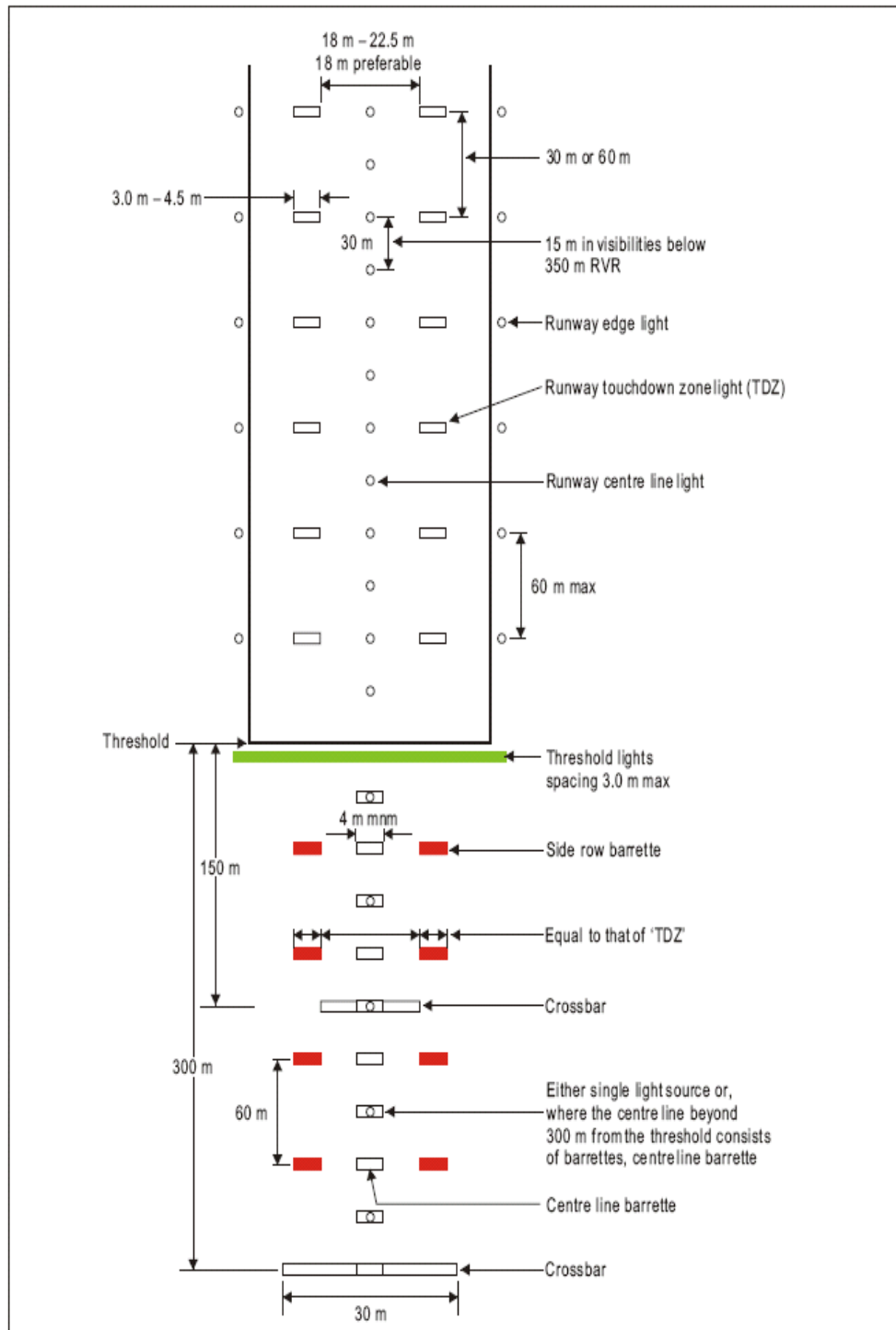
**Inner 300 m Approach and Runway Lighting for Precision Approach Runways Categories II and III**





**Figure App 9-3**

Inner 300 m Approach and Runway Lighting for Precision Approach Runways Categories II and III where the Serviceability Levels of the Lights Specified as Maintenance Objectives in Chapter 4 of these Regulations can be Demonstrated





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- 9.5.4.2 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold.
- 9.5.4.3 The lights forming the side rows shall be placed on each side of the centre line, at a longitudinal spacing equal to that of the centre line lights and with the first light located 30 m from the threshold. Where the serviceability level of the approach lights specified as maintenance objectives in Chapter 4, Clause 4.16 can be demonstrated, lights forming the side rows may be placed on each side of the centre line, at a longitudinal spacing of 60 m with the first light located 60 m from the threshold. The lateral spacing (or gauge) between the innermost lights of the side rows shall be not less than 18 m nor more than 22.5 m, and preferably 18 m, but in any event shall be equal to that of the Touchdown Zone lights.
- 9.5.4.4 The crossbar provided at 150 m from the threshold shall fill in the gaps between the centre line and side row lights.
- 9.5.4.5 The crossbar provided at 300 m from the threshold shall extend on both sides of the centre line lights to a distance of 15 m from the centre line.
- 9.5.4.6 If the centre line beyond a distance of 300 m from the threshold consists of lights as described in 9.5.4.11 b) or 9.5.4.12 b), additional crossbars of lights shall be provided at 450 m, 600 m and 750 m from the threshold.
- 9.5.4.7 Where the additional crossbars described in 9.5.4.6 are incorporated in the system, the outer ends of these crossbars shall lie on two straight lines that either are parallel to the centre line or converge to meet the runway centre line 300 m from the threshold.
- 9.5.4.8 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
- a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
  - b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.
- 9.5.4.9 Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.



#### 9.5.4.10 **Characteristics**

The centre line of a Precision Approach Category II and III lighting system for the first 300 m from the threshold shall consist of barrettes showing variable white, except that, where the threshold is displaced 300 m or more, the centre line may consist of single light sources showing variable white. Where the serviceability level of the approach lights specified as maintenance objectives in Chapter 4, paragraph 4.16 can be demonstrated, the centre line of a Precision Approach Category II and III lighting system for the first 300 m from the threshold may consist of either:

- a) barrettes, where the centre line beyond 300 m from the threshold consists of barrettes as described in 9.5.4.12 a); or
- b) alternate single light sources and barrettes, where the centre line beyond 300 m from the threshold consists of single light sources as described in 9.5.4.12 b), with the innermost single light source located 30 m and the innermost barrette located 60 m from the threshold; or
- c) single light sources where the threshold is displaced 300 m or more

all of which shall show variable white.

#### 9.5.4.11 Beyond 300 m from the threshold each centre line light position shall consist of either:

- a) a barrette as used on the inner 300 m; or
- b) two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line

all of which shall show variable white.

#### 9.5.4.12 Where the serviceability level of the approach lights specified as maintenance objectives in Chapter 4, 4.16 can be demonstrated, beyond 300 m from the threshold each centre line light position may consist of either:

- a) a barrette; or
- b) a single light source

all of which shall show variable white.

#### 9.5.4.13 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.



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- 9.5.4.14 If the centre line beyond 300 m from the threshold consists of barrettes as described in 9.5.4.11 a) or 9.5.4.12 a), each barrette beyond 300 m should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.
- 9.5.4.15 Each flashing light shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. (See Figure App 9-4) The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.
- 9.5.4.16 Reserved.
- 9.5.4.17 Reserved.
- 9.5.4.18 The side row shall consist of barrettes showing red. The length of a side row barrette and the spacing of its lights shall be equal to those of the Touchdown Zone light barrettes.
- 9.5.4.19 The lights forming the crossbars shall be fixed lights showing variable white. The lights shall be uniformly spaced at intervals of not more than 2.7 m.
- 9.5.4.20 The intensity of the red lights shall be compatible with the intensity of the white lights.
- 9.5.4.21 The lights shall be in accordance with the specifications of Figures App 9-18 and 9-19.

*Note: The flight path envelopes used in the design of these lights are given in ICAO Annex 14, Volume 1, Attachment A, Figure A-6.*

## 9.6 VISUAL APPROACH SLOPE INDICATOR SYSTEMS

### 9.6.1 Application

- 9.6.1.1 A visual approach slope indicator system shall be provided to serve the approach to a runway whether or not the runway is served by other visual approach aids or by non-visual aids, where one or more of the following conditions exist:

- a) the runway is used by turbojet or other aircraft with similar approach guidance requirements;
- b) the pilot of any type of aircraft may have difficulty in judging the approach due to:



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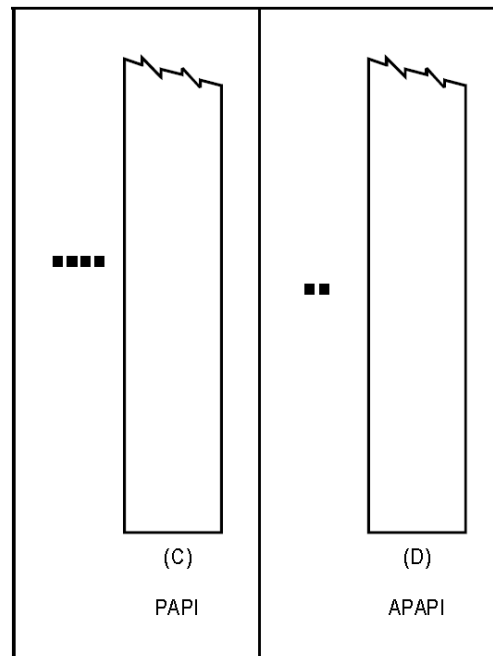
- i) inadequate visual guidance such as is experienced during an approach over water or featureless terrain by day or in the absence of sufficient extraneous lights in the approach area by night, or
- ii) misleading information such as is produced by deceptive surrounding terrain or runway slopes;
- c) the presence of objects in the approach area may involve serious hazard if an aircraft descends below the normal approach path, particularly if there are no non-visual or other visual aids to give warning of such objects;
- d) physical conditions at either end of the runway present a serious hazard in the event of an aircraft undershooting or overrunning the runway; and
- e) terrain or prevalent meteorological conditions are such that the aircraft may be subjected to unusual turbulence during approach.

*Note: Guidance on the priority of installation of visual approach slope indicator systems is contained in ICAO Annex 14, Volume 1, Attachment A, Section 13.*

- 9.6.1.2 The standard visual approach slope indicator systems shall consist of PAPI and APAPI systems conforming to the specifications contained in this Appendix as shown in Figure App 9-5.
- 9.6.1.3 PAPI shall be provided where code number is 3 or 4 when one or more of the conditions specified in 9.6.1.1 exist.
- 9.6.1.4 PAPI or APAPI shall be provided where the code number is 1 or 2 when one or more of the conditions specified in 9.6.1.1 exist.
- 9.6.1.5 Where a runway threshold is temporarily displaced from the normal position and one or more of the conditions specified in 9.6.1.1 exist, a PAPI should be provided except that where the Code Number is 1 or 2 an APAPI may be provided.

Figure App 9-5

### Visual Approach Slope Indicator Systems



Due to the lack of usage both globally and within the UAE, detail of these systems has been withdrawn. Should an Aerodrome Operator wish to utilise this system they should contact the Authority for guidance.

#### 9.6.2 **PAPI and APAPI**

##### 9.6.2.1 **Description**

The PAPI system shall consist of a wing bar of 4 sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically impracticable to do so.

9.6.2.2 The APAPI system shall consist of a wing bar of 2 sharp transition multi-lamp (or paired single lamp) units. The system shall be located on the left side of the runway unless it is physically impracticable to do so.

*Note: Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.*

9.6.2.3 The wing bar of a PAPI shall be constructed and arranged in such a manner that a pilot making an approach will:



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- a) when on or close to the approach slope, see the two units nearest the runway as red and the two units farthest from the runway as white;
- b) when above the approach slope, see the one unit nearest the runway as red and the three units farthest from the runway as white; and when further above the approach slope, see all the units as white; and
- c) when below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red.

9.6.2.4 The wing bar of an APAPI shall be constructed and arranged in such a manner that a pilot making an approach will:

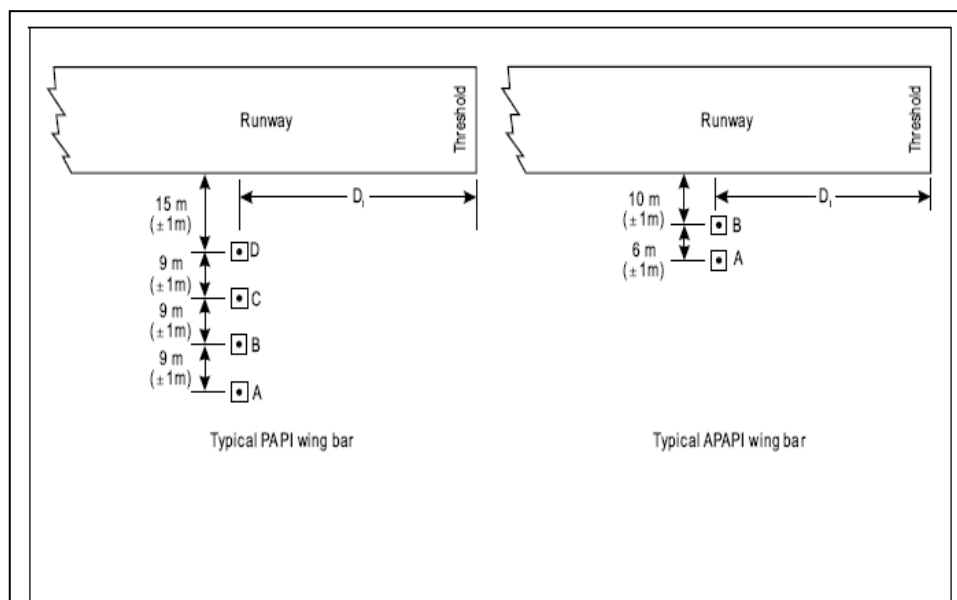
- a) when on or close to the approach slope, see the unit nearer the runway as red and the unit farther from the runway as white;
- b) when above the approach slope, see both the units as white; and
- c) when below the approach slope, see both the units as red.

9.6.2.5 ***Siting***

The light units shall be located as in the basic configuration illustrated in Figure App 9-6, subject to the installation tolerances given therein. The units forming a wing bar shall be mounted so as to appear to the pilot of an approaching aircraft to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.

Figure App 9-6

### Siting of PAPI and APAPI



#### 9.6.2.6 Installation Tolerances

Where a PAPI or APAPI is installed on a runway not equipped with an ILS or MLS, the distance  $D_1$  shall be calculated to ensure that the lowest height at which a pilot will see a correct approach path indication (Figure App 9-7, angle B for a PAPI and angle A for an APAPI) provides the wheel clearance over the threshold specified in Table App 9-2 for the most demanding amongst aircraft regularly using the runway.

- 9.6.2.7 Where a PAPI or APAPI is installed on a runway equipped with an ILS and/or MLS, the distance  $D_1$  shall be calculated to provide the optimum compatibility between the visual and non-visual aids for the range of eye-to-antenna heights of the aircraft regularly using the runway. The distance shall be equal to that between the threshold and the effective origin of the ILS glide path or MLS minimum glide path, as appropriate, plus a correction factor for the variation of eye-to-antenna heights of the aircraft concerned. The correction factor is obtained by multiplying the average eye-to-antenna height of those aircraft by the cotangent of the approach angle. However, the distance shall be such that in no case will the wheel clearance over the threshold be lower than that specified in column (3) of Table App 9-2.

*Note: See Appendix 12, 12.5 for specifications on aiming point marking. Guidance on the harmonization of PAPI, ILS and/or MLS signals is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*





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- 9.6.2.8 If a wheel clearance, greater than that specified in a) above is required for specific aircraft, this can be achieved by increasing D1.
- 9.6.2.9 Distance D1 shall be adjusted to compensate for differences in elevation between the lens centres of the light units and the threshold.
- 9.6.2.10 To ensure that units are mounted as low as possible and to allow for any transverse slope, small height adjustments of up to 5 cm between units are acceptable. A lateral gradient not greater than 1.25 per cent can be accepted provided it is uniformly applied across the units.
- 9.6.2.11 A spacing of 6 m ( $\pm 1$  m) between PAPI units should be used on Code Numbers 1 and 2. In such an event, the inner PAPI unit shall be located not less than 10 m ( $\pm 1$  m) from the runway edge.
- Note: Reducing the spacing between light units' results in a reduction in usable range of the system.*
- 9.6.2.12 The lateral spacing between APAPI units may be increased to 9 m ( $\pm 1$  m) if greater range is required or later conversion to a full PAPI is anticipated. In the latter case, the inner APAPI unit shall be located 15 m ( $\pm 1$  m) from the runway edge.
- 9.6.2.13 **Characteristics of the Light Units**
- The system shall be suitable for both day and night operations.
- 9.6.2.14 The colour transition from red to white in the vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3'.
- 9.6.2.15 At full intensity the red light shall have a Y coordinate not exceeding 0.320.
- 9.6.2.16 The light intensity distribution of the light units shall be as shown in Figure App 9-40.
- Note: See the ICAO Aerodrome Design Manual (Doc 9157), Part 4, for additional guidance on the characteristics of light units.*
- 9.6.2.17 Suitable intensity control shall be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.
- 9.6.2.18 Each light unit shall be capable of adjustment in elevation so that the lower limit of the white part of the beam may be fixed at any desired angle of elevation between 1°30' and at least 4°30' above the horizontal.



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9.6.2.19 The light units shall be so designed that deposits of condensation, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall not affect the contrast between the red and white signals and the elevation of the transition sector.

9.6.2.20 ***Approach Slope and Elevation Setting of Light Units***

The approach slope as defined in Figure App 9-7 shall be appropriate for use by the aircraft using the approach.

9.6.2.21 When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

9.6.2.22 The angle of elevation settings of the light units in a PAPI wing bar shall be such that, during an approach, the pilot of an aircraft observing a signal of one white and three reds will clear all objects in the approach area by a safe margin (see Table App 9-2).

9.6.2.23 The angle of elevation settings of the light units in an APAPI wing bar shall be such that, during an approach, the pilot of an aircraft observing the lowest onslope signal, i.e. one white and one red, will clear all objects in the approach area by a safe margin (see Table App 9-2).

9.6.2.24 The azimuth spread of the light beam shall be suitably restricted where an object located outside the obstacle protection surface of the PAPI or APAPI system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an Aeronautical Study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

*Note: See 9.6.3.26 to 9.6.3.30 concerning the related obstacle protection surface.*

9.6.2.25 Where wing bars are installed on each side of the runway to provide roll guidance, corresponding units shall be set at the same angle so that the signals of each wing bar change symmetrically at the same time.

9.6.2.26 ***Obstacle Protection Surface***

*Note: The following specifications apply to PAPI and APAPI.*

An obstacle protection surface shall be established when it is intended to provide a visual approach slope indicator system.



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9.6.2.27 The characteristics of the obstacle protection surface, i.e. origin, divergence, length and slope shall correspond to those specified in the relevant column of Table App 9-3 and Figure App 9-8.

9.6.2.28 New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when, in the opinion of the Authority, the new object or extension would be shielded by an existing immovable object.

*Note: Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137), Part 6.*

9.6.2.29 Existing objects above an obstacle protection surface shall be removed except when, in the opinion of the Appropriate Authority, the object is shielded by an existing immovable object, or after an Aeronautical Study it is determined that the object would not adversely affect the safety of operations of aeroplanes.

9.6.2.30 Where an Aeronautical Study indicates that an existing object extending above an obstacle protection surface could adversely affect the safety of operations of aircraft one or more of the following measures shall be taken:

- a) remove the object;
- b) suitably raise the approach slope of the system;
- c) reduce the azimuth spread of the system so that the object is outside the confines of the beam;
- d) displace the axis of the system and its associated obstacle protection surface by no more than 5°;
- e) suitably displace the system upwind of the threshold such that the object no longer penetrates the OPS

*Note 1: Guidance on this issue is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

*Note 2: The displacement of the system upwind of the threshold reduces the operational landing distances*

9.6.2.31 **Initial Flight Inspection**

A flight inspection of a new installation shall be undertaken by a qualified service provider authorised by the aerodrome operator to confirm the correct operation of the system. The inspection shall include checks of range, setting angles, brilliancy control and compatibility with the precision instrument glide path, if provided.



**9.6.2.32 Routine Maintenance**

PAPI maintenance shall include checking and, if necessary, taking the indicated corrective action, as follows:

Twice monthly:

1. Elevation setting of the vertical angle of the light units; adjusting
2. Spreader glasses, filters and lamps for cleanness; cleaning

Annually (within 360 calendar days +/- 20 days):

1. System from the air, and recording results; adjusting and replacing lamps
2. Supporting structure and the foundation of each unit; repairing.

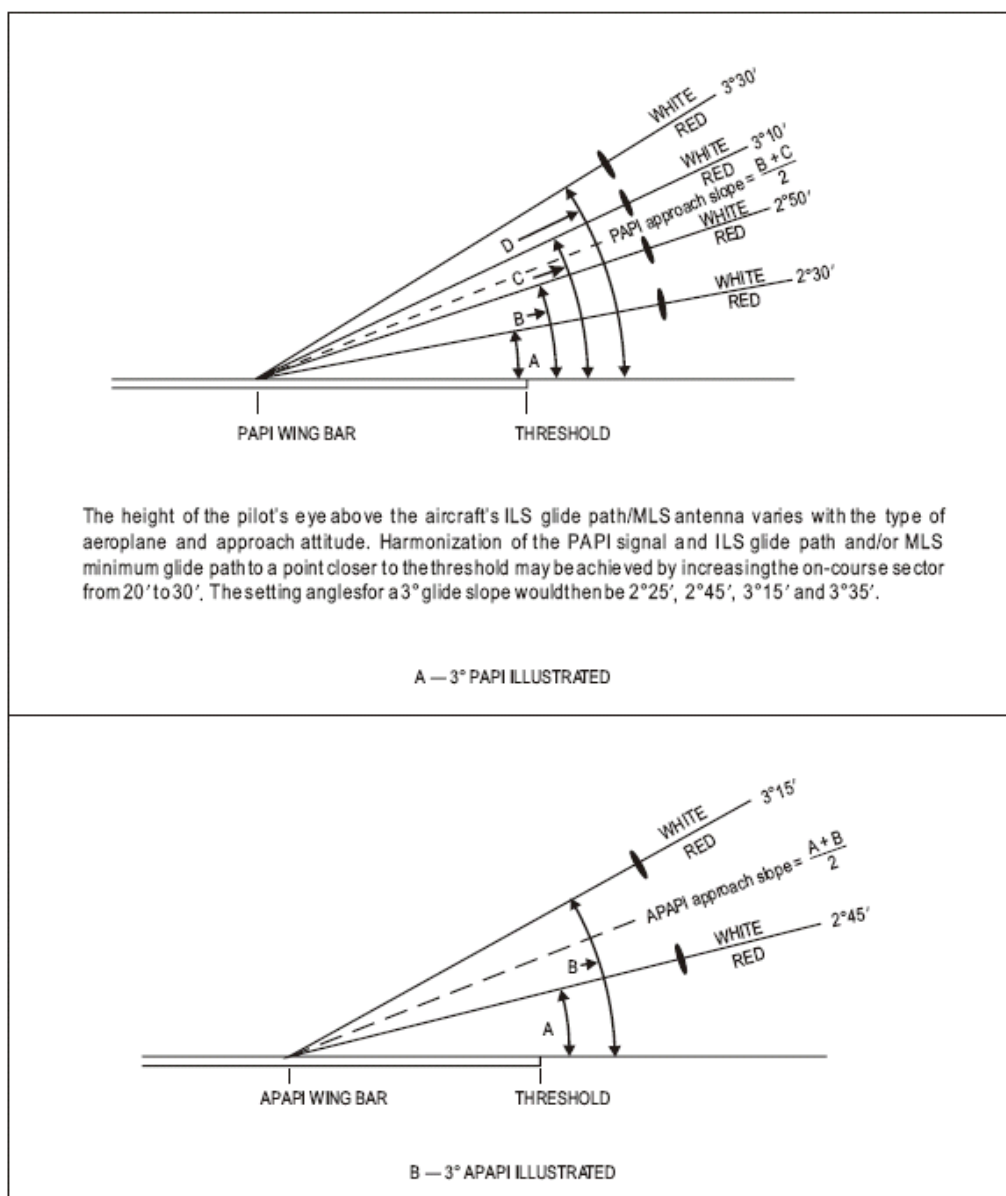
**9.6.2.33 General condition**

A daily check should be made of each unit to ensure that:

1. All lamps are lighted and illuminated evenly;
2. No evidence of damage is apparent;
3. The change from red to white is coincident for all elements in a unit; and
4. The lenses are not contaminated.

Figure App 9-7

### Light Beams and Angle of Elevation Setting of PAPI and APAPI





**Table App 9-2**

**Wheel Clearance over Threshold for PAPI and APAPI**

Eye-to-wheel height of aeroplane in the approach configuration <sup>a</sup>	Desired wheel clearance (metres) <sup>b,c</sup>	Minimum wheel clearance (metres) <sup>d</sup>
(1)	(2)	(3)
up to but not including 3 m	6	3 <sup>e</sup>
3 m up to but not including 5 m	9	4
5 m up to but not including 8 m	9	5
8 m up to but not including 14 m	9	6

- In selecting the eye-to-wheel height group, only aeroplane meant to use the system on a regular basis shall be considered. The most demanding amongst such aeroplane shall determine the eye-to-wheel height group.*
- Where practicable the desired wheel clearances shown in column (2) shall be provided.*
- The wheel clearances in column (2) may be reduced to no less than those in column (3) where an aeronautical study indicates that such reduced wheel clearances are acceptable.*
- When a reduced wheel clearance is provided at a displaced threshold it shall be ensured that the corresponding desired wheel clearance specified in column (2) will be available when an aeroplane at the top end of the eye-to-wheel height group chosen overflies the extremity of the runway.*
- This wheel clearance may be reduced to 1.5 m on runways used mainly by light-weight non-turbo-jet aeroplanes.*



Table App 9-3

**Dimensions and Slopes of the Obstacle Protection Surface**

Surface Dimensions	Runway Type/Code Number							
	Non-Instrument Code Number				Instrument Code Number			
	1	2	3	4	1	2	3	4
Length of inner edge	60 m	80 m	150 m	150 m	150 m	150 m	300 m	300 m
Distance from the visual approach slope indicator system (b)	D <sub>1</sub> + 30 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m	D <sub>1</sub> + 60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15 %
Total Length	7 500 m	7 500 m <sup>b</sup>	15 000 m	15 000 m	7 500 m	7 500 m	15 000 m	15 000 m
<b>Slope</b>								
PAPI <sup>a</sup>	-	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°
APAPI <sup>a</sup>	A-0.9°	A-0.9°	-	-	A-0.9°	A-0.9°	-	-

a) Angles as indicated in Figure App 9-7

b) D<sub>1</sub> is the distance of the visual approach slope indicator system from threshold prior to any displacement to remedy object penetration of the OPS (refer Figure App 9-6). The start of the OPS is fixed to the visual approach slope indicator system location, such that displacement of the PAPI results in an equal displacement of the start of the OPS. See 9.6.3.30(e)

## 9.7 CIRCLING GUIDANCE LIGHTS

### 9.7.1 Application

Circling guidance lights should be provided when existing approach and runway lighting systems do not satisfactorily permit identification of the runway and/or approach area to a circling aircraft in the conditions for which it is intended the runway be used for circling approaches.

### 9.7.2 Location

The location and number of circling guidance lights when provided shall be adequate to enable a pilot, as appropriate, to:

- join the downwind leg or align and adjust the aircraft's track to the runway at a required distance from it and to distinguish the threshold in passing; and
- keep in sight the runway threshold and/or other features which will make it possible to judge the turn on to base leg and final approach, taking into account the guidance provided by other visual aids.

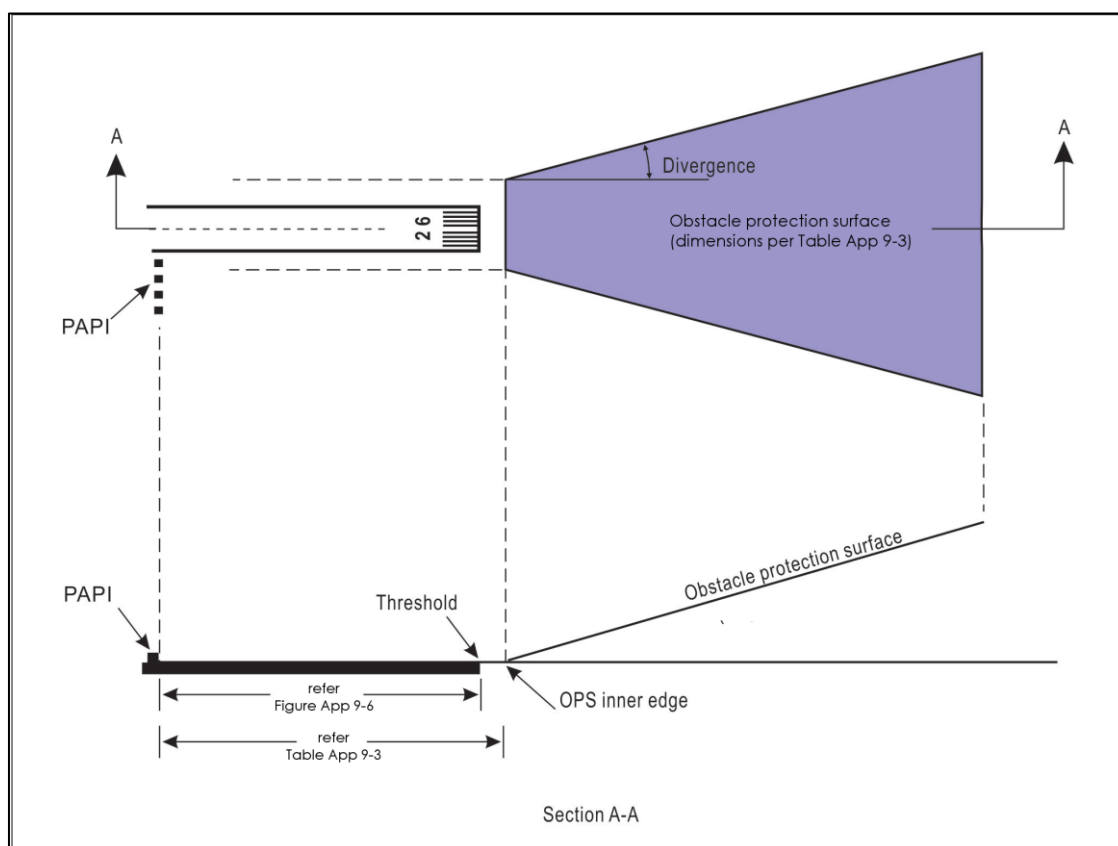
### 9.7.3 Circling guidance lights when provided shall consist of

- a) lights indicating the extended centre line of the runway and/or parts of any approach lighting system; or
- b) lights indicating the position of the runway threshold; or
- c) lights indicating the direction or location of the runway;

or a combination of such lights as is appropriate to the runway under consideration.

**Figure App 9-8**

#### **Obstacle Protection Surface for Visual Approach Slope Indicator Systems**



*Note: Guidance on installation of circling guidance lights is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

### 9.7.4 Characteristic

Circling guidance lights shall be fixed or flashing lights of an intensity and beam spread adequate for the conditions of visibility and ambient light in which it is





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intended to make visual circling approaches. The flashing lights shall be white, and the steady lights either white or gaseous discharge lights.

- 9.7.5 The lights shall be designed and be installed in such a manner that they will not dazzle or confuse a pilot when approaching to land, taking off or taxiing.

**9.8 RUNWAY LEAD-IN LIGHTING SYSTEMS**

**9.8.1 Application**

A runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path, for reasons such as avoiding hazardous terrain or for purposes of noise abatement.

*Note: Guidance on providing lead-in lighting systems is given in the Aerodrome Design Manual (Doc 9157), Part 4.*

**9.8.2 Location**

A runway lead-in lighting system when provided shall consist of groups of lights positioned so as to define the desired approach path and so that one group may be sighted from the preceding group. The interval between adjacent groups should not exceed approximately 1 600 m.

*Note: Runway lead-in lighting systems may be curved, straight or a combination thereof.*

- 9.8.3 A runway lead-in lighting system shall when provided extend from a point as determined by the Authority, up to a point where the approach lighting system, if provided, or the runway or the runway lighting system is in view.

**9.8.4 Characteristics**

Each group of lights of a runway lead-in lighting system shall consist of at least three flashing lights in a linear or cluster configuration. The system may be augmented by steady burning lights where such lights would assist in identifying the system.

- 9.8.5 The flashing lights and the steady burning lights shall be white.

- 9.8.6 The flashing lights in each group shall flash in sequence towards the runway.



## **9.9 RUNWAY THRESHOLD IDENTIFICATION LIGHTS**

### **9.9.1 Application**

Runway threshold identification lights shall be installed:

- a) at the threshold of a non-precision approach runway when additional threshold conspicuity is necessary or where it is not practicable to provide other approach lighting aids; and
- b) where a runway threshold is permanently displaced from the runway extremity or temporarily displaced from the normal position and additional threshold conspicuity is necessary.

### **9.9.2 Location**

Runway threshold identification lights shall be located symmetrically about the runway centre line, in line with the threshold and approximately 10 m outside each line of runway edge lights.

### **9.9.3 Characteristics**

9.9.4 Runway threshold identification lights shall be flashing white lights with a flash frequency between 60 and 120 per minute.

9.9.5 The lights shall be visible only in the direction of approach to the runway.

## **9.10 RUNWAY EDGE LIGHTS**

### **9.10.1 Application**

Runway edge lights shall be provided for a runway intended for use at night or for a precision approach runway intended for use by day or night.

9.10.2 Runway edge lights should be provided on a runway intended for take-off with an operating minimum below an RVR of 800 m by day.

### **9.10.3 Location**

Runway edge lights shall be placed along the full length of the runway and shall be in two parallel rows equidistant from the centre line.

9.10.4 Runway edge lights shall be placed along the edges of the area declared for use as the runway or outside the edges of the area at a distance of not more than 3 m.



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- 9.10.5 Where the width of the area which could be declared as runway exceeds 60 m, the distance between the rows of lights shall be determined by the Authority taking into account the nature of the operations, the light distribution characteristics of the runway edge lights, and other visual aids serving the runway.
- 9.10.6 The lights shall be uniformly spaced in rows at intervals of not more than 60 m for an Instrument Runway, and at intervals of not more than 100 m for a non-Instrument Runway. The lights on opposite sides of the runway axis shall be on lines at right angles to that axis. At intersections of runways, lights may be spaced irregularly or omitted, provided that adequate guidance remains available to the pilot.
- 9.10.7 **Characteristics**
- Runway edge lights shall be fixed lights showing variable white, except that:
- a) in the case of a displaced threshold, the lights between the beginning of the runway and the displaced threshold shall show red in the approach direction;
  - b) a section of the lights 600 m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-off run is started, may show yellow; and
  - c) in the case of a runway starter extension the lights between the beginning of the runway starter extension and the threshold shall show red in the approach direction and blue in the opposite direction.
- 9.10.8 The runway edge lights shall show at all angles in azimuth necessary to provide guidance to a pilot landing or taking off in either direction. When the runway edge lights are intended to provide circling guidance, they shall show at all angles in azimuth (see 9.7.1).
- 9.10.9 In all angles of azimuth required in 9.10.8, runway edge lights shall show at angles up to 15° above the horizontal with an intensity adequate for the conditions of visibility and ambient light in which use of the runway for take-off or landing is intended. In any case, the intensity shall be at least 50 cd except that at an aerodrome without extraneous lighting the intensity of the lights may be reduced to not less than 25 cd to avoid dazzling the pilot.
- 9.10.10 Runway edge lights on a precision approach runway shall be in accordance with the specifications of Figure App 9-26 or App 9-27.



## **9.11 RUNWAY THRESHOLD AND WING BAR LIGHTS**

*(see Figure App 9-9)*

### **9.11.1 Application of Runway Threshold Lights**

Runway threshold lights shall be provided for a runway equipped with runway edge lights except on a non-instrument or non-precision approach runway where the threshold is displaced and wing bar lights are provided.

### **9.11.2 Location of Runway Threshold Lights**

When a threshold is at the extremity of a runway, the threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.

9.11.3 When a threshold is displaced from the extremity of a runway, threshold lights shall be placed in a row at right angles to the runway axis at the displaced threshold.

9.11.4 Threshold lighting shall consist of:

- a) on a non-instrument or non-precision approach runway, at least six lights;
- b) on a Precision Approach Runway Category I, at least the number of lights that would be required if the lights were uniformly spaced at intervals of 3 m between the rows of runway edge lights; and
- c) on a Precision Approach Runway Category II or III, lights uniformly spaced between the rows of runway edge lights at intervals of not more than 3 m.

9.11.5 The lights prescribed in 9.11.4 a) and b) should be either:

- a) equally spaced between the rows of runway edge lights, or
- b) symmetrically disposed about the runway centre line in two groups, with the lights uniformly spaced in each group and with a gap between the groups equal to the gauge of the Touchdown Zone marking or lighting, where such is provided, or otherwise not more than half the distance between the rows of runway edge lights.

### **9.11.6 Application of Wing Bar Lights**

Wing bar lights should be provided on a precision approach runway when additional conspicuity is considered desirable.



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9.11.7 Wing bar lights shall be provided on a non-instrument or non-precision approach runway where the threshold is displaced and runway threshold lights are required, but are not provided.

9.11.8 **Location of Wing Bar Lights**

Wing bar lights shall be symmetrically disposed about the runway centre line at the threshold in two groups, i.e. wing bars. Each wing bar shall be formed by at least five lights extending at least 10 m outward from, and at right angles to, the line of the runway edge lights, with the innermost light of each wing bar in the line of the runway edge lights.

9.11.9 **Characteristics of Runway Threshold and Wing Bar Lights**

Runway threshold and wing bar lights shall be fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

9.11.10 Runway threshold lights on a precision approach runway shall be in accordance with the specifications of, Figure App 9-20.

9.11.11 Threshold wing bar lights on a precision approach runway shall be in accordance with the specifications of, Figure App 9-21.

9.12 **RUNWAY END LIGHTS**

*(see Figure App 9-9)*

9.12.1 **Application**

Runway end lights shall be provided for a runway equipped with runway edge lights.

*Note: When the threshold is at the runway extremity, fittings serving as threshold lights may be used as runway end lights.*

9.12.2 **Location**

- a) Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end.
- b) Where a runway starter extension is provided, the runway end lights shall be placed at the limit of the runway available for roll-out.

9.12.3 Runway end lighting shall consist of at least six lights. The lights should be either:

- a) equally spaced between the rows of runway edge lights;



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- b) symmetrically disposed about the runway centre line in two groups with the lights uniformly spaced in each group and with a gap between the groups of not more than half the distance between the rows of runway edge lights; or
- c) disposed as stated in 9.12.3 b), where a runway starter extension is provided.

For a Precision Approach Runway Category III, the spacing between runway end lights, except between the two innermost lights if a gap is used, shall not exceed 6 m.

*Note: Lighting circuitry shall be such that the failure of one lighting circuit will not result in the number of working runway end lights being less than six.*

9.12.4 **Characteristics**

Runway end lights shall be fixed unidirectional lights showing red in the direction of the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

- 9.12.5 Runway end lights on a precision approach runway shall be in accordance with the specifications of Figure App 9-25.

Figure App 9-9

Arrangement of Runway Threshold and Runway End Lights

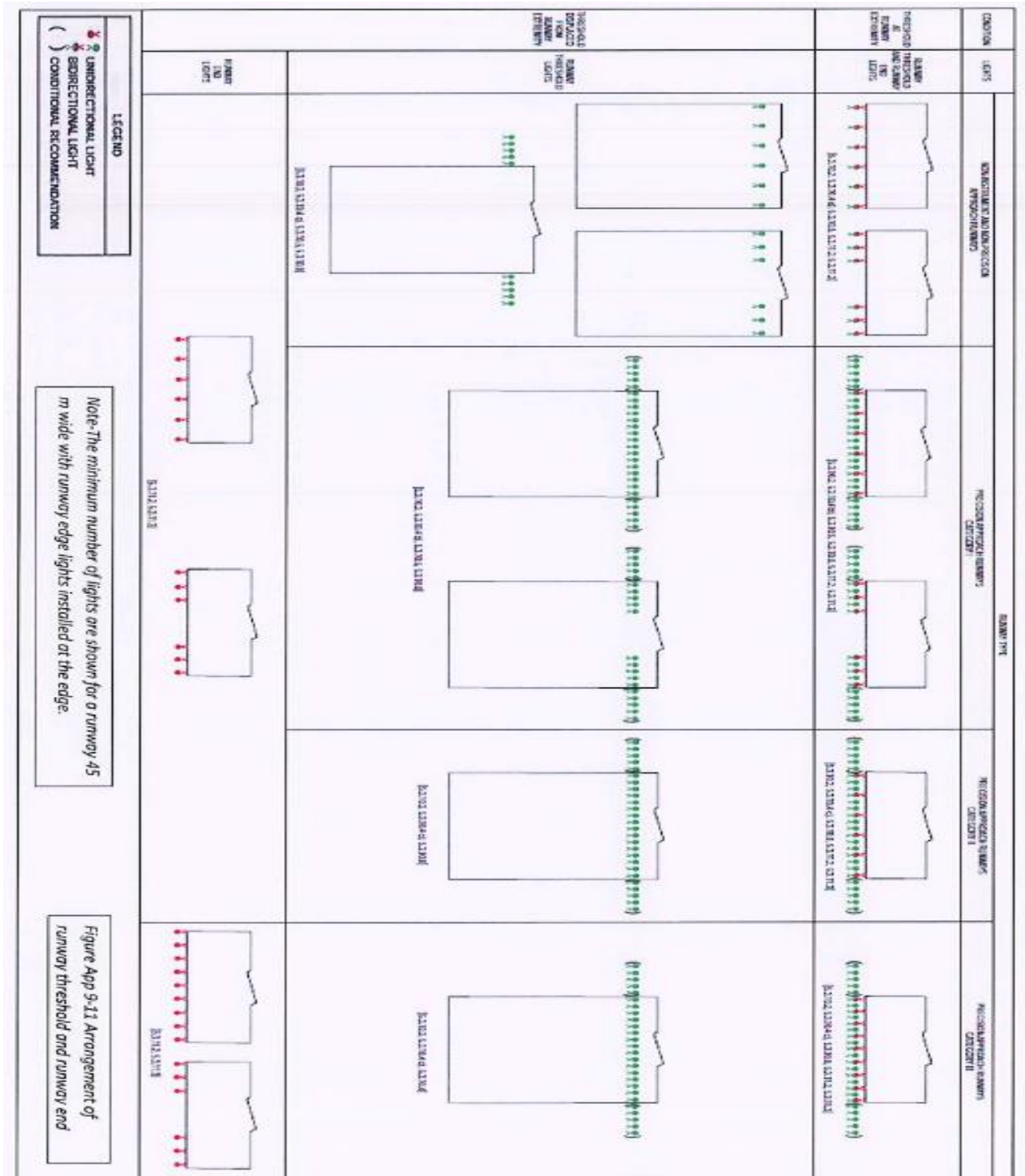
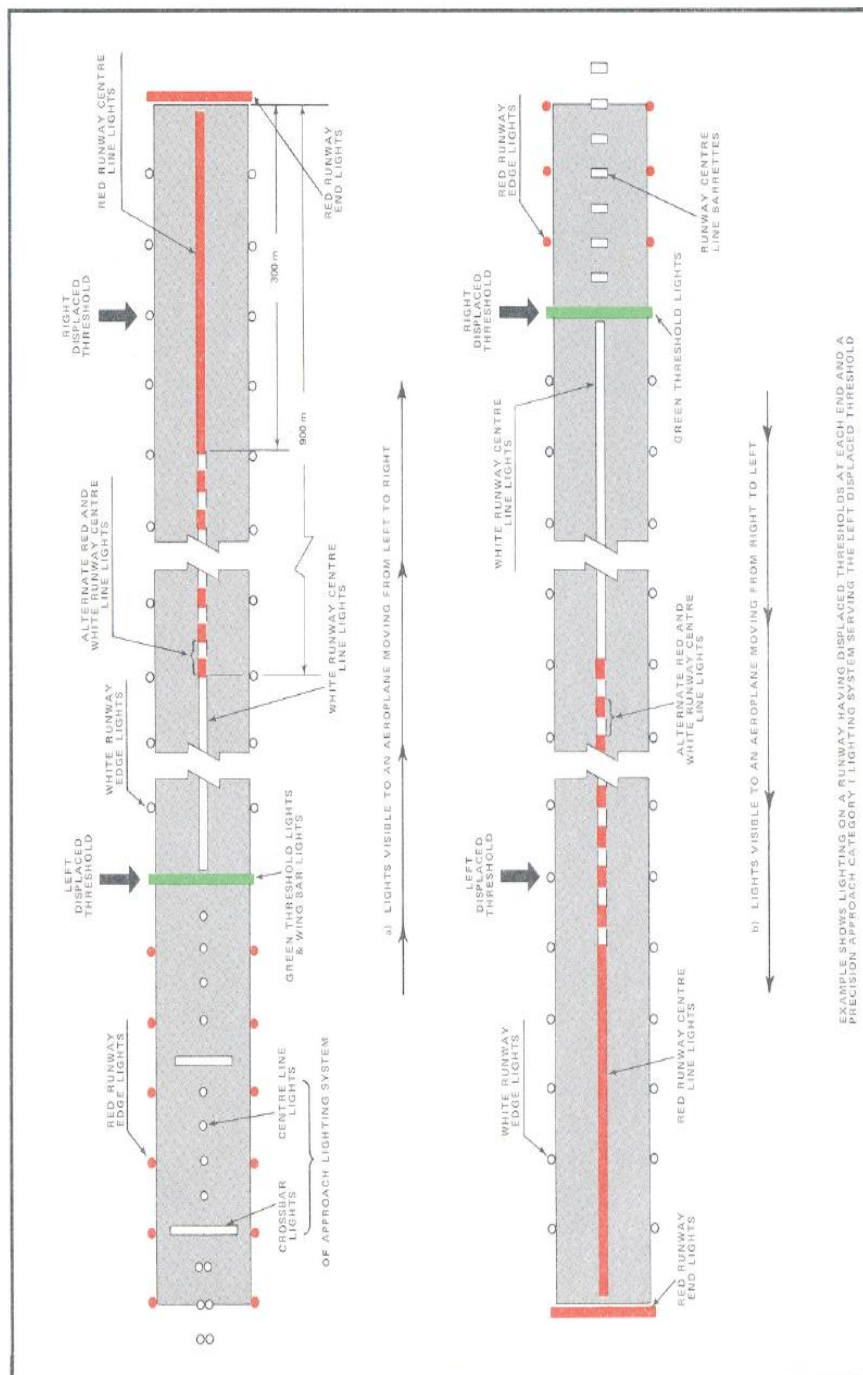




Figure App 9-10

Example of Approach and Runway Lighting for Runway with Displaced Thresholds







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**9.13 RUNWAY CENTRE LINE LIGHTS**

**9.13.1 Application**

Runway centre line lights shall be provided on a Precision Approach Runway Category II or III.

9.13.2 Runway centre line lights shall be provided on a Precision Approach Runway Category I when the runway is used by aircraft with high landing speeds or where the width, as measured perpendicular to the runway centre line, between the runway edge lights is greater than 50 m.

9.13.3 Runway centre line lights shall be provided on a runway intended to be used for take-off with an operating minimum below an RVR of 400 m.

9.13.4 Runway centre line lights shall be provided on a runway intended to be used for take-off with an operating minimum of an RVR of 400 m or higher when used by aeroplanes with a very high take-off speed, or where the width, as measured perpendicular to the runway centre line, between the runway edge lights is greater than 50 m.

**9.13.5 Location**

Runway centre line lights shall be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights shall be located from the threshold to the end at longitudinal spacing of approximately 15 m. Where the serviceability level of the runway centre line lights specified as maintenance objectives in Chapter 4, 4.16 can be demonstrated and the runway is intended for use in Runway Visual Range conditions of 300 m or greater, the longitudinal spacing may be approximately 30 m.

*Note: Existing centre line lighting where lights are spaced at 7.5 m need not be replaced.*

9.13.6 Centre line guidance for take-off from the beginning of a runway to a displaced threshold should be provided by:

- a) an approach lighting system if its characteristics and intensity settings afford the guidance required during take-off and it does not dazzle the pilot of an aircraft taking off; or
- b) runway centre line lights; or



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- c) barrettes of at least 3 m length and spaced at uniform intervals of 30 m, as shown in Figure App 9-10, designed so that their photometric characteristics and intensity setting afford the guidance required during take-off without dazzling the pilot of an aircraft taking off.

Where necessary, provision should be made to extinguish those centre line lights specified in b) or reset the intensity of the approach lighting system or barrettes when the runway is being used for landing. In no case should only the single source runway centre line lights show from the beginning of the runway to a displaced threshold when the runway is being used for landing.

### 9.13.7 Characteristics

Runway centre line lights shall be fixed lights showing variable white from the threshold to the point 900 m from the runway end; alternate red and variable white from 900 m to 300 m from the runway end; and red from 300 m to the runway end, except that for runways less than 1 800 m in length, the alternate red and variable white lights shall extend from the mid-point of the runway usable for landing to 300 m from the runway end.

*Note: Care is required in the design of the electrical system to ensure that failure of part of the electrical system will not result in a false indication of the runway distance remaining.*

- 9.13.8 Runway centre line lights shall be in accordance with the specifications of Figure App 9-23 or App 9-24.

## 9.14 RUNWAY TOUCHDOWN ZONE LIGHTS

### 9.14.1 Application

Touchdown Zone (TDZ) lights shall be provided in the Touchdown Zone of a Precision Approach Runway Category II or III.

*Note: Further guidance is given within Figure App 9-2 and Figure App 9-3.*

### 9.14.2 Location

Touchdown Zone lights shall extend from the threshold for a longitudinal distance of 900 m, except that, on runways less than 1 800 m in length, the system shall be shortened so that it does not extend beyond the midpoint of the runway. The pattern shall be formed by pairs of barrettes symmetrically located about the runway centre line. The lateral spacing between the innermost lights of a pair of barrettes shall be equal to the lateral spacing selected for the Touchdown Zone



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marking. The longitudinal spacing between pairs of barrettes shall be either 30 m or 60 m.

*Note: To allow for operations at lower visibility minima, it may be advisable to use a 30 m longitudinal spacing between barrettes.*

**9.14.3 Characteristics**

A barrette shall be composed of at least three lights with a spacing between the lights of not more than 1.5 m.

9.14.4 A barrette shall be not less than 3 m or more than 4.5 m in length.

9.14.5 Touchdown Zone lights shall be fixed unidirectional lights showing variable white.

9.14.6 Touchdown Zone lights shall be in accordance with the specifications of Figure App 9-22.

**9.15 SIMPLE TOUCHDOWN ZONE LIGHTS**

*Note: The purpose of simple touchdown zone lights is to provide pilots with enhanced situational awareness in all visibility conditions and to help enable pilots to decide whether to commence a go-around if the aircraft has not landed by a certain point on the runway. It is essential that pilots operating at aerodromes with simple touchdown zone lights be familiar with the purpose of these lights.*

**9.15.1 Application**

Except where TDZ lights are provided in accordance with paragraph 9.14, at an aerodrome where the approach angle is greater than 3.5 degrees and/or the Landing Distance Available combined with other factors increases the risk of an overrun, simple touchdown zone lights should be provided.

**Location**

9.15.2 Simple touchdown zone lights shall be a pair of lights located on each side of the runway centreline 0.3 m beyond the upwind edge of the final touchdown zone marking. The lateral spacing between the inner lights of the two pairs of lights shall be equal to the lateral spacing selected for the touchdown zone marking. The spacing between the lights of the same pair shall not be more than 1.5 m or half the width of the touchdown zone marking, whichever is greater. (See Figure App 9-11.)

9.15.3 Where provided on a runway without TDZ markings, simple touchdown zone lights should be installed in such a position that provides the equivalent TDZ information.

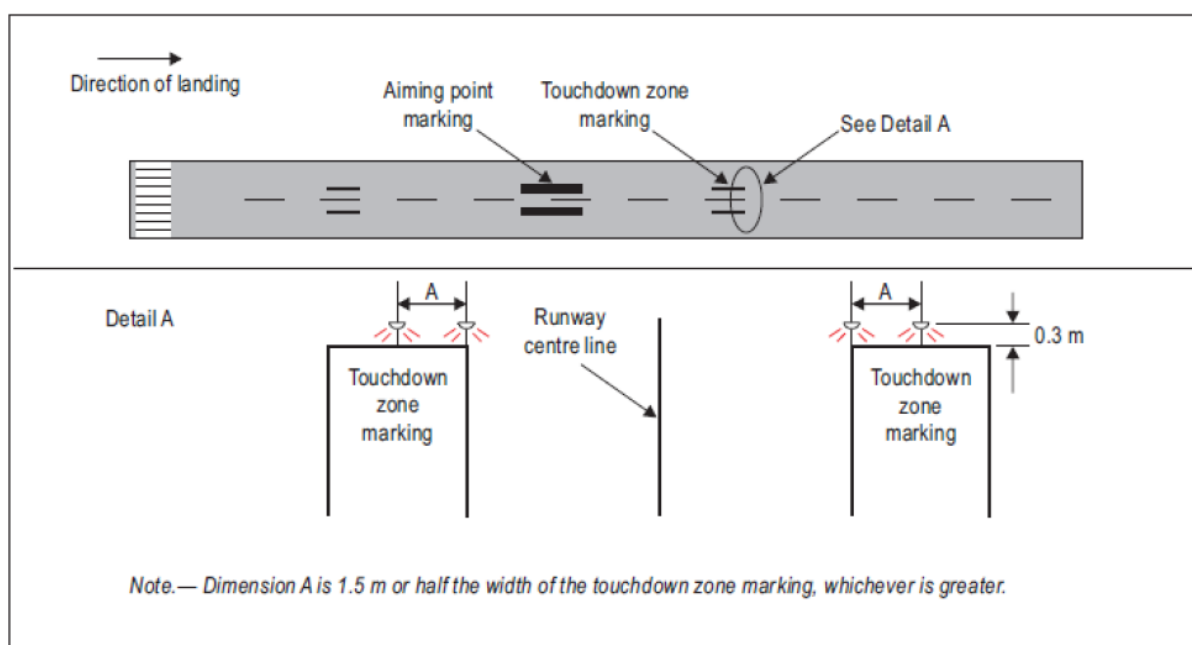
## Characteristics

- 9.15.4 Simple touchdown zone lights shall be fixed unidirectional lights showing variable white, aligned so as to be visible to the pilot of a landing aeroplane in the direction of approach to the runway.
- 9.15.5 Simple touchdown zone lights shall be in accordance with the specifications in Figure App 9-22.

*Note: As a good operating practice, simple touchdown zone lights are supplied with power on a separate circuit to other runway lighting so that they may be used when other lighting is switched off.*

Figure App 9-11

### Simple Touchdown Zone Lighting



## 9.16 RAPID EXIT TAXIWAY INDICATOR LIGHTS

*Note: The purpose of rapid exit taxiway indicator lights (RETILs) is to provide pilots with distance-to-go information to the nearest rapid exit taxiway on the runway, to enhance situational awareness in low visibility conditions and enable pilots to apply braking action for more efficient roll-out and runway exit speeds. It is essential that pilots operating at aerodromes with runway(s) displaying rapid exit taxiway indicator lights be familiar with the purpose of these lights.*



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9.16.1 **Application**

Rapid exit taxiway indicator lights should be provided on a runway intended for use in Runway Visual Range conditions less than a value of 300 m and/or where the traffic density is Heavy.

*Note: See ICAO Annex 14, Volume 1, Attachment A, Section 15.*

9.16.2 Rapid exit taxiway indicator lights shall not be displayed in the event of any lamp failure or other failure that prevents the display of the light pattern depicted in Figure App 9-12, in full.

9.16.3 A set of rapid exit taxiway indicator lights shall be located on the runway on the same side of the runway centre line as the associated rapid exit taxiway, in the configuration shown in Figure App 9-12. In each set, the lights shall be located 2 m apart and the light nearest to the runway centre line shall be displaced 2 m from the runway centre line.

9.16.4 Where more than one rapid exit taxiway exists on a runway, the set of rapid exit taxiway indicator lights for each exit shall not overlap when displayed.

9.16.5 **Characteristic**

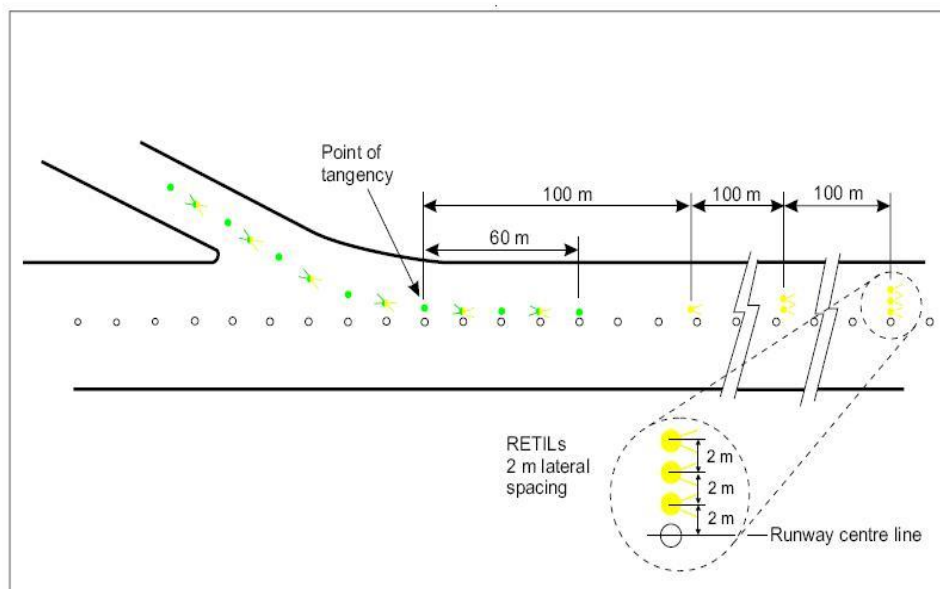
Rapid exit taxiway indicator lights shall be fixed unidirectional yellow lights, aligned so as to be visible to the pilot of a landing aircraft in the direction of approach to the runway.

9.16.6 Rapid exit taxiway indicator lights shall be in accordance with the specifications in Figure App 9-23 or Figure App 9-24, as appropriate.

9.16.7 Rapid exit taxiway indicator lights shall be supplied with power on a separate circuit to other runway lighting so that they may be used when other lighting is switched off.

Figure App 9-12

### Rapid Exit Taxiway Indicator Lights (RETILs)



## 9.17 STOPWAY LIGHTS

### 9.17.1 Application

Stopway lights shall be provided for a stopway intended for use at night.

### 9.17.2 Location

Stopway lights shall be placed along the full length of the stopway and shall be in two parallel rows that are equidistant from the centre line and coincident with the rows of the runway edge lights. Stopway lights shall also be provided across the end of a stopway on a line at right angles to the stopway axis as near to the end of the stopway as possible and, in any case, not more than 3 m outside the end.

### 9.17.3 Characteristics

Stopway lights shall be fixed unidirectional lights showing red in the direction of the runway.

## 9.18 TAXIWAY CENTRE LINE LIGHTS

### 9.18.1 Application

Taxiway centre line lights shall be provided on an exit taxiway, taxiway, and apron intended for use in Runway Visual Range conditions less than a value of 300 m in



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such a manner as to provide continuous guidance between the runway centre line and aircraft stands, except that these lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance.

- 9.18.2 Taxiway centre line lights should be provided on a taxiway intended for use at night in Runway Visual Range conditions of 300 m or greater, and particularly on complex taxiway intersections and exit taxiways, except that these lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance.

*Note: Where there may be a need to delineate the edges of a taxiway, e.g. on a rapid exit taxiway or narrow taxiway, this may be done with taxiway edge lights or markers.*

- 9.18.3 Taxiway centre line lights shall be provided on an exit taxiway, taxiway, and apron in all visibility conditions where specified as components of an Advanced Surface Movement Guidance and Control System in such a manner as to provide continuous guidance between the runway centre line and aircraft stands.

- 9.18.4 Taxiway centre line lights shall be provided on a runway forming part of a standard taxi-route and intended for taxiing in Runway Visual Range conditions less than a value of 300 m, except that these lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance.

*Note: See Chapter 4, 4.16.15.3 for provisions concerning the interlocking of runway and taxiway lighting systems*

- 9.18.5 Taxiway centre line lights shall be provided in all visibility conditions on a runway forming part of a standard taxi-route where specified as components of an Advanced Surface Movement Guidance and Control System.

### 9.18.6 Characteristics

Except as provided for in 9.18.8, taxiway centre line lights on a taxiway other than an exit taxiway and on a runway forming part of a standard taxi-route shall be fixed lights showing green with beam dimensions such that the light is visible only from aircraft on or in the vicinity of the taxiway.

- 9.18.7 Taxiway centre line lights on an exit taxiway shall be fixed lights. Alternate taxiway centre line lights shall show green and yellow from their beginning near the runway centre line to the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the Inner Transitional Surface, whichever is farthest from the runway; and thereafter all lights shall show green (Figure App 9-13). The first light



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in the exit centre line shall always show green and the light nearest to the perimeter shall always show yellow.

*Note 1: Care is necessary to limit the light distribution of green lights on or near a runway so as to avoid possible confusion with threshold lights.*

*Note 2: For yellow filter characteristics see ICAO Annex 14, Volume 1, Appendix 1, 2.2.*

*Note 3: The size of the ILS/MLS critical/sensitive area depends on the characteristics of the associated ILS/MLS and other factors. Guidance is provided in ICAO Annex 10, Volume I, Attachments C and G.*

*Note 4: See Appendix 11, 11.4 for specifications on runway vacated signs*

9.18.8 Where it is necessary to denote the proximity to a runway, taxiway centre line lights should be fixed lights showing alternating green and yellow from the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farthest from the runway, to the runway and continue alternating green and yellow until:

- a) their end point near the runway centre line; or
- b) in the case of the taxiway centre line lights crossing the runway, to the opposite perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farthest from the runway.

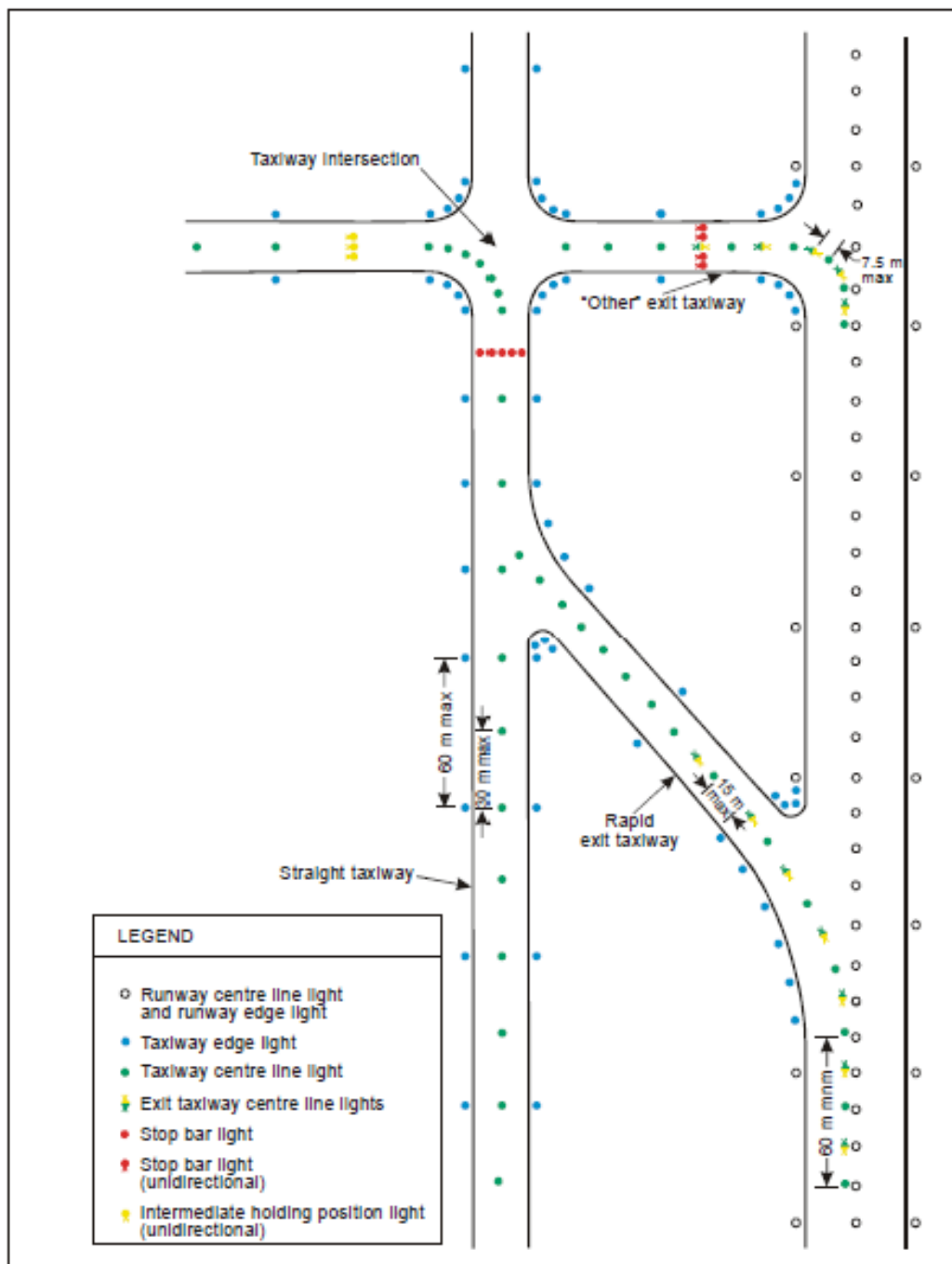
*Note 1: Care is necessary to limit the light distribution of green lights on or near a runway so as to avoid possible confusion with threshold lights.*

*Note 2: The provisions of 9.18.8 can form part of effective runway incursion prevention measures.*



Figure App 9-13

### Taxiway Lighting





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- 9.18.9 Taxiway centre line lights shall be in accordance with the specifications of:
- Figure App 9-29, App 9-30 or App 9-31 for taxiways intended for use in Runway Visual Range conditions of less than a value of 300 m; and
  - Figure App 9-32 or App 9-33 for other taxiways.
- 9.18.10 Where higher intensities are required, from an operational point of view, taxiway centre line lights on rapid exit taxiways intended for use in Runway Visual Range conditions less than a value of 300 m shall be in accordance with the specifications of Figure App 9-29. The number of levels of brilliancy settings for these lights shall be the same as that for the runway centre line lights.
- 9.18.11 Where taxiway centre line lights are specified as components of an Advanced Surface Movement Guidance and Control System and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, taxiway centre line lights shall be in accordance with the specifications of Figure App 9-34, App 9-35 or App 9-36.
- 9.18.12 **Location**
- Taxiway centre line lights shall be located on the taxiway centre line marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.
- 9.18.13 **Taxiway Centre Line Lights on Taxiways**
- 9.18.14 **Location**
- Taxiway centre line lights on a straight section of a taxiway shall be spaced at longitudinal intervals of not more than 30 m, except that:
- larger intervals not exceeding 60 m may be used where, because of the prevailing meteorological conditions, adequate guidance is provided by such spacing and it is approved by the Authority;
  - intervals less than 30 m shall be provided on short straight sections; and
  - on a taxiway intended for use in RVR conditions of less than a value of 300 m, the longitudinal spacing shall not exceed 15 m.
- 9.18.15 Taxiway centre line lights on a taxiway curve shall continue from the straight portion of the taxiway at a constant distance from the outside edge of the taxiway curve. The lights shall be spaced at intervals such that a clear indication of the curve is provided.



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9.18.16 On a taxiway intended for use in RVR conditions of less than a value of 300 m, the lights on a curve shall not exceed a spacing of 15 m and on a curve of less than 400 m radius the lights shall be spaced at intervals of not greater than 7.5 m. This spacing shall extend for 60 m before and after the curve.

9.18.17 **Taxiway Centre Line Lights on Rapid Exit Taxiways**

9.18.18 **Location**

Taxiway centre line lights on a rapid exit taxiway shall commence at a point at least 60 m before the beginning of the taxiway centre line curve and continue beyond the end of the curve to a point on the centre line of the taxiway where an aircraft can be expected to reach normal taxiing speed. The lights on that portion parallel to the runway centre line shall always be at least 60 cm from any row of runway centre line lights, as shown in Figure App 9.15.

9.18.19 The lights should be spaced at longitudinal intervals of not more than 15 m, except that, where runway centre line lights are not provided, a greater interval not exceeding 30 m may be used.

9.18.20 **Taxiway Centre Line Lights on other Exit Taxiways**

9.18.21 **Location**

9.18.22 Taxiway centre line lights on exit taxiways other than rapid exit taxiways shall commence at the point where the taxiway centre line marking begins to curve from the runway centre line, and follow the curved taxiway centre line marking at least to the point where the marking leaves the runway. The first light shall be at least 60 cm from any row of runway centre line lights, as shown in Figure App 9-14.

9.18.23 The lights shall be spaced at longitudinal intervals of not more than 7.5 m.

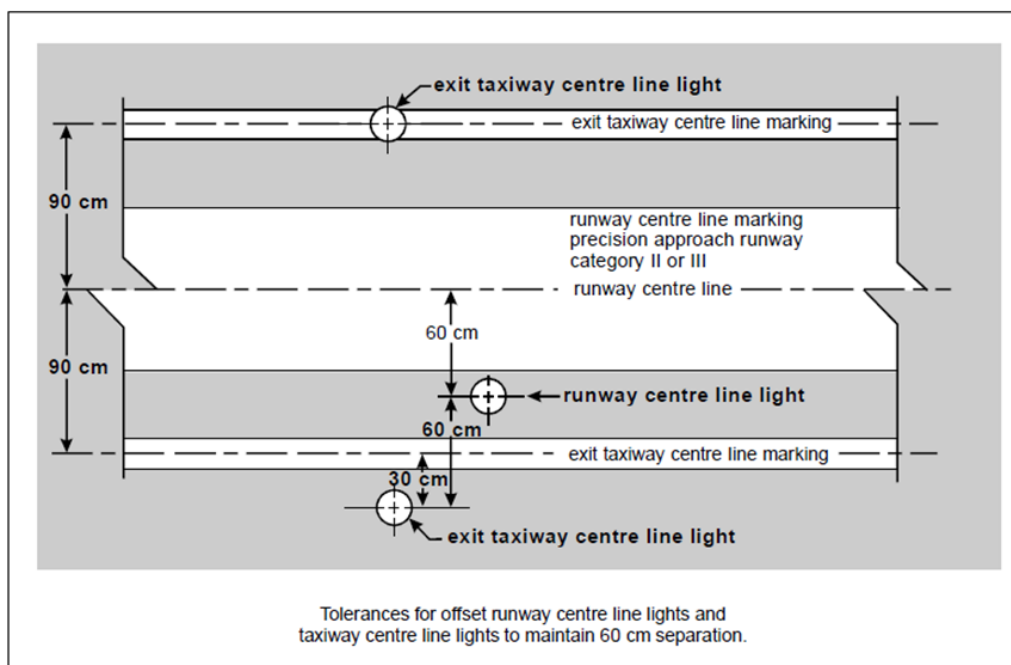
9.18.24 **Taxiway Centre Line Lights on Runways**

9.18.25 **Location**

Taxiway centre line lights on a runway forming part of a standard taxi-route and intended for taxiing in Runway Visual Range conditions less than a value of 300 m shall be spaced at longitudinal intervals not exceeding 15 m.

Figure App 9-14

### Offset Runway and Taxiway Centre Line Lights



*Note: See Chapter 4, 4.16.15.3 for details on applicable electrical system design.*

## 9.19 TAXIWAY EDGE LIGHTS

### 9.19.1 Application

Taxiway edge lights shall be provided at the edges of a runway turn pad, holding bay, apron, etc. intended for use at night and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations, adequate guidance can be achieved by surface illumination or other means.

9.19.2 Taxiway edge lights shall be provided on a runway forming part of a standard taxi-route and intended for taxiing at night where the runway is not provided with taxiway centre line lights.

### 9.19.3 Location

Taxiway edge lights on a straight section of a taxiway and on a runway forming part of a standard taxi-route shall be spaced at uniform longitudinal intervals of not more than 60 m. The lights on a curve shall be spaced at intervals less than 60 m so that a clear indication of the curve is provided.



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- 9.19.4 Taxiway edge lights on a holding bay, apron, etc. should be spaced at uniform longitudinal intervals of not more than 60 m.
- 9.19.5 Taxiway edge lights on a runway turn pad shall be spaced at uniform longitudinal intervals of not more than 30 m.
- 9.19.6 The lights shall be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, apron or runway, etc. or outside the edges at a distance of not more than 3 m.
- 9.19.7 **Characteristics**
- Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 30° above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxiing in either direction. At an inter-section, exit or curve the lights shall be shielded as far as practicable so that they cannot be seen in angles of azimuth in which they may be confused with other lights.
- 9.20 **RUNWAY TURN PAD LIGHTS**
- 9.20.1 **Application**
- Runway turn pad lights shall be provided for continuous guidance on a runway turn pad intended for use in Runway Visual Range conditions less than a value of 300 m, to enable an aircraft to complete a 180 degree turn and align with the runway centre line.
- 9.20.2 Runway turn pad lights should be provided on a runway turn pad intended for use at night.
- 9.20.3 **Location**
- Runway turn pad lights should normally be located on the runway turn pad marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.
- 9.20.4 Runway turn pad lights on a straight section of the runway turn pad marking shall be spaced at longitudinal intervals of not more than 15 m.
- 9.20.5 Runway turn pad lights on a curved section of the runway turn pad marking shall not exceed a spacing of 7.5 m.



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9.20.6 **Characteristics**

Runway turn pad lights shall be unidirectional fixed lights showing green with beam dimensions such that the light is visible only from aircraft on or approaching the runway turn pad.

9.20.7 Runway turn pad lights shall be in accordance with the specifications of Figure App 9-30, App 9-31 or App 9-32, as appropriate.

9.21 **STOP BARS**

*Note 1: A stop bar is intended to be controlled either manually or automatically by Air Traffic Services.*

*Note 2: Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway-holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures.*

9.21.1 **Application**

A stop bar shall be provided at every runway-holding position serving a runway when it is intended that the runway will be used in Runway Visual Range conditions less than a value of 550 m, except where:

- a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of traffic onto the runway; or:
- b) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:
  - i) aircraft on the Manoeuvring Area to one at a time; and
  - ii) vehicles on the Manoeuvring Area to the essential minimum.

*Note: It is permissible to co-locate Runway Holding Positions Category I and Category II/III providing that the greater distance from the runway centre line is applied.*

9.21.2 Where there is more than one stop bar associated with a taxiway/runway intersection, only one shall be illuminated at any given time.

9.21.3 A stop bar shall be provided at an Intermediate Holding Position when it is part of a surface movement guidance and control system used to provide traffic control by visual means.



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9.21.4 **Location**

Stop bars shall be located across the taxiway at the point where it is desired that traffic stop. Where the additional lights specified in 9.21.6 are provided, these lights shall be located not less than 3 m from the taxiway edge.

9.21.5 **Characteristics**

Stop bars shall consist of lights spaced at intervals of 3 m across the taxiway, showing red in the intended direction(s) of approach to the intersection or runway-holding position.

*Note: Where necessary to enhance conspicuity of an existing stop bar, extra lights are installed uniformly.*

9.21.6 A pair of elevated lights should be added to each end of the stop bar where the in-pavement stop bar lights might be obscured from a pilot's view, for example, by rain, or where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft.

9.21.7 Stop bars installed at a runway-holding position shall be unidirectional and shall show red in the direction of approach to the runway.

9.21.8 Where the additional lights specified in 9.21.6 are provided, these lights shall have the same characteristics as the lights in the stop bar, but shall be visible to approaching aircraft up to the stop bar position.

9.21.9 The intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications in Figures App 9-29 through App 9-33, as appropriate.

9.21.10 Where stop bars are specified as components of an Advanced Surface Movement Guidance and Control System and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications of, Figure App 9-34, App 9-35 or App 9-36.

*Note: High-intensity stop bars should only be used in case of an absolute necessity and following a specific study.*

9.21.11 Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications of, Figure App 9-34 or App 9-36.

9.21.12 The lighting circuit shall be designed so that:



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- a) stop bars located across entrance taxiways are selectively switchable;
- b) stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups;
- c) when a stop bar is illuminated, any taxiway centre line lights installed beyond the stop bar shall be extinguished for a distance of at least 90 m; and
- d) stop bars are interlocked with the taxiway centre line lights so that when the centre line lights beyond the stop bar are illuminated the stop bar is extinguished and vice versa.

*Note: Care is required in the design of the electrical system to ensure that all of the lights of a stop bar will not fail at the same time. Guidance on this issue is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

## 9.22 INTERMEDIATE HOLDING POSITION LIGHTS

*Note: See Appendix 12, 12.11 for specifications on intermediate holding position marking.*

### 9.22.1 Application

Except where a stop bar has been installed, Intermediate Holding Position lights shall be provided at an Intermediate Holding Position intended for use in Runway Visual Range conditions less than a value of 300 m.

- 9.22.2 Intermediate Holding Position lights shall be provided at an Intermediate Holding Position where there is no need for stop-and-go signals as provided by a stop bar.

### 9.22.3 Location

Intermediate Holding Position lights shall be located along the Intermediate Holding Position marking at a distance of 0.3 m prior to the marking.

### 9.22.4 Characteristics

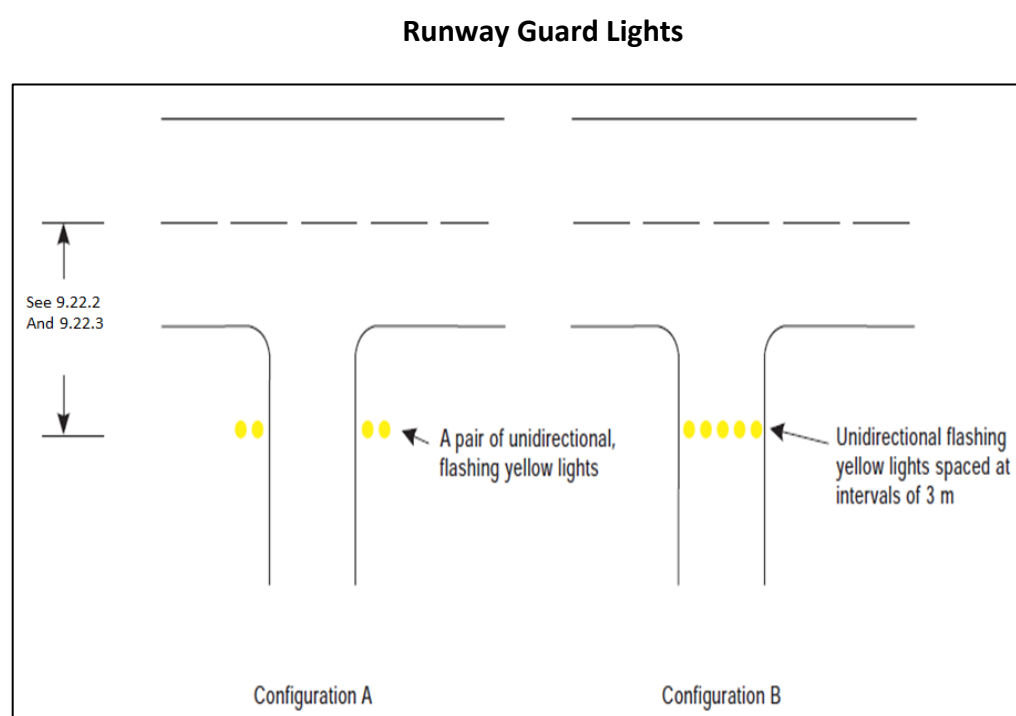
Intermediate Holding Position lights shall consist of three fixed unidirectional lights showing yellow in the direction of approach to the Intermediate Holding Position with a light distribution similar to taxiway centre line lights if provided. The lights shall be disposed symmetrically about and at right angle to the taxiway centre line, with individual lights spaced 1.5 m apart.



## 9.23 RUNWAY GUARD LIGHTS

*Note: Runway incursions may take place in all visibility or weather conditions. The use of runway guard lights at runway-holding positions can form part of effective runway incursion prevention measures. – Runway guard lights warn pilots, and drivers of vehicles when operating on taxiways, that they are about to enter a runway. There are two standard configurations of runway guard lights as illustrated in Figure App 9-15.*

**Figure App 9-15**



### 9.23.1 Application

Runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

- a) Runway Visual Range conditions less than a value of 550 m where a stop bar is not installed; and
- b) Runway Visual Range conditions of values between 550 m and 1200 m where the traffic density is heavy

Note 1: Runway guard lights, Configuration B may supplement Configuration A when deemed necessary.



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Note 2: Guidance on design, operation and location of runway guard lights Configuration B is given in the Aerodrome Design Manual (Doc 9157), Part 4.

9.23.2 As part of runway incursion prevention measures, runway guard lights, Configuration A or Configuration B, shall be provided at each taxiway/runway intersection where runway incursion hot spots have been identified, and used under all weather conditions during day and night.

9.23.3 Configuration B runway guard lights should not be collocated with a stop bar.

9.23.4 Where more than one runway holding positions exist at a runway/taxiway intersection, only the set of runway guard lights associated with the operational runway holding position shall be illuminated.

9.23.5 **Location**

Runway guard lights, Configuration A, shall be located at each side of the taxiway on the side of the runway-holding position marking.

9.23.6 Runway guard lights, Configuration B, shall be located across the taxiway on the holding side of the runway-holding position marking.

9.23.7 **Characteristics**

Runway guard lights, Configuration A, shall consist of two pairs of yellow lights.

9.23.8 Where there is a need to enhance the contrast between the on and off state of runway guard lights, Configuration A, intended for use during the day, a visor of sufficient size to prevent sunlight from entering the lens without interfering with the function of the fixture shall be located above each lamp.

*Note: Some other device or design, e.g. specially designed optics, may be used in lieu of the visor.*

9.23.9 Runway guard lights, Configuration B, shall consist of yellow lights spaced at intervals of 3 m across the taxiway.

9.23.10 The light beam shall be unidirectional and shall show yellow in the direction of approach to the runway-holding position.

9.23.11 The intensity in yellow light and beam spreads of lights of Configuration A shall be in accordance with the specifications in Figure App 9-41.



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9.23.12 Where runway guard lights are intended for use during the day, the intensity in yellow light and beam spreads of lights of Configuration A shall be in accordance with the specifications in Figure App 9-41.

9.23.13 Where runway guard lights are specified as components of an Advanced Surface Movement Guidance and Control System where higher light intensities are required, the intensity in yellow light and beam spreads of lights of Configuration A shall be in accordance with the specifications in Figure App 9-42.

*Note: Higher light intensities may be required to maintain ground movement at a certain speed in low visibilities.*

9.23.14 The intensity in yellow light and beam spreads of lights of Configuration B shall be in accordance with the specifications in Figure App 9-29.

9.23.15 Where runway guard lights are intended for use during the day, the intensity in yellow light and beam spreads of lights of Configuration B shall be in accordance with the specifications in Figure App 9-37.

9.23.16 Where runway guard lights are specified as components of an Advanced Surface Movement Guidance and Control System where higher light intensities are required, the intensity in yellow light and beam spreads of lights of Configuration B shall be in accordance with the specifications in Figure App 9-37.

9.23.17 The lights in each unit of Configuration A shall be illuminated alternately.

9.23.18 For Configuration B, adjacent lights shall be alternately illuminated and alternative lights shall be illuminated in unison.

9.23.19 The lights shall be illuminated between 30 and 60 cycles per minute and the light suppression and illumination periods shall be equal and opposite in each light.

*Note: The optimum flash rate is dependent on the rise and fall times of the lamps used. Runway guard lights, Configuration A, installed on 6.6 ampere series circuits have been found to look best when operated at 45 to 50 flashes per minute per lamp. Runway guard lights, Configuration B, installed on 6.6 ampere series circuits have been found to look best when operated at 30 to 32 flashes per minute per lamp.*

**9.24 APRON FLOODLIGHTING**

*(see also Appendix 9, 9.18.1 and 9.19.1)*



#### 9.24.1 Application

Apron floodlighting shall be provided on an apron and on a designated isolated aircraft parking position intended to be used at night.

*Note 1: The designation of an isolated aircraft parking position is specified in Chapter 4, 4.12.*

*Note 2: Guidance on apron floodlighting is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

#### 9.24.2 Location

Apron floodlights shall be located so as to provide adequate illumination on all apron service areas, with a minimum of glare to pilots of aircraft in flight and on the ground, aerodrome and apron controllers, and personnel on the apron. The arrangement and aiming of floodlights shall be such that an aircraft stand receives light from two or more directions to minimise shadows.

#### 9.24.3 Characteristics

The spectral distribution of apron floodlights shall be such that the colours used for aircraft marking connected with routine servicing, and for surface and obstacle marking, can be correctly identified. Monochromatic lights must not be used.

#### 9.24.4 The average illuminance shall be at least the following:

##### a) Aircraft stand:

- i) horizontal illuminance - 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and
- ii) vertical illuminance - 20 lux at a height of 2 m above the apron in relevant directions.

##### b) Other apron areas:

horizontal illuminance - 50 per cent of the average illuminance on the aircraft stands with a uniformity ratio (average to minimum) of not more than 4 to 1.



## **9.25 VISUAL DOCKING GUIDANCE SYSTEM**

### **9.25.1 Application**

A visual docking guidance system shall be provided when it is intended to indicate, by a visual aid, the precise positioning of an aircraft on an aircraft stand and other alternative means, such as marshallers, are not practicable.

### **9.25.2 Characteristics**

The system shall provide both azimuth and stopping guidance.

9.25.3 The azimuth guidance unit and the stopping position indicator shall be adequate for use in all weather, visibility, background lighting and pavement conditions for which the system is intended both by day and night, but shall not dazzle the pilot.

9.25.4 The azimuth guidance unit and the stopping position indicator shall be of a design such that:

- a) a clear indication of malfunction of either or both is available to the pilot; and
- b) they can be turned off.

9.25.5 The azimuth guidance unit and the stopping position indicator shall be located in such a way that there is continuity of guidance between the aircraft stand markings, the aircraft stand manoeuvring guidance lights, if present, and the visual docking guidance system.

9.25.6 The accuracy of the system shall be adequate for the type of loading bridge and fixed aircraft servicing installations with which it is to be used.

9.25.7 The system should be usable by all types of aircraft for which the aircraft stand is intended, preferably without selective operation.

9.25.8 If selective operation is required to prepare the system for use by a particular type of aircraft, then the system shall provide an identification of the selected aircraft type to both the pilot and the system operator as a means of ensuring that the system has been set properly.

### **9.25.9 Azimuth Guidance Unit**

#### **9.25.9.1 Location**

The azimuth guidance unit shall be located on or close to the extension of the stand centre line ahead of the aircraft so that its signals are visible from the cockpit of an



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aircraft throughout the docking manoeuvre and aligned for use by the pilot occupying both the left and right seats.

**9.25.9.2 Characteristics**

The azimuth guidance unit shall provide unambiguous left/right guidance which enables the pilot to acquire and maintain the lead-in line without overcontrolling.

9.25.9.3 When azimuth guidance is indicated by colour change, green shall be used to identify the centre line and red for deviations from the centre line.

**9.25.10 Stopping Position Indicator**

**9.25.10.1 Location**

The stopping position indicator shall be located in conjunction with, or sufficiently close to, the azimuth guidance unit so that pilots occupying both left and right seats, can observe both the azimuth and stop signals without turning their head.

**9.25.10.2 Characteristics**

The stopping position information provided by the indicator for a particular aircraft type shall account for the anticipated range of variations in pilot eye height and/or viewing angle.

9.25.10.3 The stopping position indicator shall show the stopping position for the aircraft for which guidance is being provided, and shall provide closing rate information to enable the pilot to gradually decelerate the aircraft to a full stop at the intended stopping position.

9.25.10.4 The stopping position indicator shall provide closing rate information over a distance of at least 10 m.

9.25.10.5 When stopping guidance is indicated by colour change, green shall be used to show that the aircraft can proceed and red to show that the stop point has been reached except that for a short distance prior to the stop point a third colour may be used to warn that the stopping point is close.

**9.26 AIRCRAFT STAND MANOEUVRING GUIDANCE LIGHTS**

**9.26.1 Application**

Aircraft stand manoeuvring guidance lights shall be provided to facilitate the positioning of an aircraft on an aircraft stand on a paved apron intended for use in RVR conditions less than a value of 200 m (i.e. Category IIIB).



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9.26.2 Aircraft stand manoeuvring guidance lights should be provided to facilitate the positioning of an aircraft on an aircraft stand or on a paved apron intended for use in poor visibility conditions, unless adequate guidance is provided by other means.

9.26.3 **Location**

Aircraft stand manoeuvring guidance lights shall be collocated with the aircraft stand markings.

9.26.4 **Characteristics**

Aircraft stand manoeuvring guidance lights, other than those indicating a stop position, shall be fixed yellow lights, visible throughout the segments within which they are intended to provide guidance.

9.26.5 The lights used to delineate lead-in, turning and lead-out lines should be spaced at intervals of not more than 7.5 m on curves and 15 m on straight sections.

9.26.6 The lights indicating a stop position shall be fixed, unidirectional lights, showing red.

9.26.7 The intensity of the lights shall be adequate for the condition of visibility and ambient light in which the use of the aircraft stand is intended.

9.26.8 The lighting circuit should be designed so that the lights may be switched on to indicate that an aircraft stand is to be used and switched off to indicate that it is not to be used.

**9.27 ROAD-HOLDING POSITION LIGHT**

9.27.1 **Application**

A road-holding position light shall be provided at each road-holding position serving a runway when it is intended that the runway will be used in Runway Visual Range conditions less than a value of 550 m.

9.27.2 **Location**

A road-holding position light shall be located adjacent to the holding position marking 1.5 m ( $\pm 0.5$  m) from one edge of the road, i.e. left or right as appropriate to the local traffic regulations.

9.27.3 **Characteristics**

The road-holding position light shall comprise:



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a) a controllable red (stop)/green (go) traffic light; or

b) a flashing-red light

9.27.4 The road-holding position light beam shall be unidirectional and aligned so as to be visible to the driver of a vehicle approaching the holding position

9.27.5 The intensity of the light beam shall be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended, but shall not dazzle the driver

9.27.6 The flash frequency of the flashing-red light shall be between 30 and 60 per minute.

**9.28 NO-ENTRY BAR**

*Note : Runway incursions may take place in all visibility or weather conditions. The use can form part of effective runway incursion prevention measures.*

**9.28.1 Application**

A no-entry bar should be provided across a taxiway which is intended to be used as an exit only taxiway to assist in preventing inadvertent access of traffic to that taxiway.

**9.28.2 Location**

A no-entry bar should be located across the taxiway at the end of an exit only taxiway where it is desired to prevent traffic from entering the taxiway in the wrong direction.

A no-entry bar should be co-located with a no-entry sign and/or a no-entry marking.

**9.28.3 Characteristics**

9.28.4 A no-entry bar should consist of unidirectional lights spaced at uniform intervals of no more than 3 m showing red in the intended direction(s) of approach to the runway.

*Note: Where necessary to enhance conspicuity, extra lights are installed uniformly.*

9.28.5 A pair of elevated lights should be added to each end of the no-entry bar where the in-pavement no entry bar lights might be obscured from a pilot's view, for example, by sand or rain, or where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft.





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9.28.6 The intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications in Figure App 9-29 through Figure App 9-33.

9.28.7 Where no-entry bars are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of no-entry bar lights should be in accordance with the specifications of Figure App 9-34 or Figure App 9-36.

*Note: High-intensity no-entry bars are typically only used in case of an absolute necessity and following a specific study.*

9.28.8 Where a wide beam fixture is required, the intensity in red light and beam spreads of no-entry bar lights should be in accordance with the specifications of Figure App 9-34 or Figure App 9-36.

9.28.9 Taxiway centre line lights installed beyond the no-entry bar, looking in the direction of the runway shall not be visible when viewed from the taxiway.

## 9.29 LIGHTS IN UNSERVICEABLE OR CLOSED AREAS

### 9.29.1 Application

Unserviceability lights shall be displayed to delineate an area unsafe for aircraft operation, i.e. closed areas, areas temporarily unserviceable.

### 9.29.2 Location

Unserviceability lights shall be positioned at the outer perimeter of an Unserviceable Area, or at the entry to the taxiway/ aircraft stand as appropriate.

*Note: Unserviceability lights are normally used in conjunction with the extinguishment of other airfield lighting. Runway centre line and edge lighting, and taxiway lighting shall be turned off in areas that are closed to aircraft traffic. This includes taxiway centre line lights that form a guidance path immediately leading to the closed area.*

9.29.3 A minimum of four lights shall be used except whether the area is triangular in shape where a minimum of three lights may be employed. The number of lights must be increased where the area is large or of unusual configuration. With the exception of 9.26.4, at least one light shall be installed for each 7.5 m of peripheral distance of the area. If the lights are directional, they shall be orientated so that as far as possible their beams are aligned from the direction which aircraft or vehicles are approaching.



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9.29.4 In addition to closed markings, when a runway or taxiway, or portion thereof closed is intercepted by a usable runway or taxiway which is used at night, unserviceability lights shall be placed across the entrance to the closed area at intervals not exceeding 3 m.

### 9.29.5 Characteristics of Unserviceability Lights

An unserviceability light shall consist of a red fixed light. The light shall have an intensity sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general level of illumination against which it would normally be viewed. In no case shall the intensity be less than 10 cd of red light.

9.29.6 Unserviceable area lights shall be mounted so as to be frangible. Their height shall be sufficiently low to preserve clearance for propellers and for engine pods of jet aircraft.

9.29.7 If the lights are directional, they shall be orientated so that as far as possible their beams are aligned in the direction from which aircraft or vehicles will approach.

### 9.30 LIGHTS FOR TEMPORARY CLOSURE OF RUNWAY

9.30.1 A lighted visual aid may be utilized to indicate the temporary closure of a runway instead of closure markings. Where installed the lighted visual aid unit should comply with the following:

- a) Be a portable, towable unit that can be quickly removed from the runway.
- b) Consist of clear incandescent lamps or transmit a white colour, arranged in the shape of a letter "x" with arms crossed at an appropriate angle to make the "x" discernible. The arms shall be painted white or yellow on all sides so that the unit will be clearly visible when in its position. The arms must be at least 4.5 m in length with a minimum of 9 x equally spaced 150 W spot lights.
- c) It should be energized by a portable power supply
- d) It shall be controlled so that the lighted signal will flash at an approximate rate of 2.5-3 seconds "on" and 1-2.5 seconds "off".
- e) It shall provide the following daytime visual reference during VFR conditions when placed on the centre line at the threshold markings.
- f) Visible to the pilot at a range of at least 5 nm
- g) Recognisable as a letter "x" from a range of at least 1- 2 nm



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- h) It shall provide lamp dimming capability for night time operations
- i) It shall produce a signal that provides a horizontal coverage to at least 15 degrees on each side of the runway centre line, and a vertical coverage from 0 degrees to 10 degrees above horizontal, both day and night, at a range of 0.5 nm
- j) It shall have adjustable aiming and levelling to allow tilting to an optimum angle of 3 degrees from vertical
- k) It shall be able to withstand wind speeds of 40 kts without affecting aiming or operation
- l) It shall include an illuminated failure indicator that is visible from back (runway side) of the unit, that can be seen from the aerodrome control tower

9.30.2 Where a visual aid as described in 9.28.1 is used to denote a temporary closed runway, a minimum of two units shall be located on the runway. One shall be located on the centre line at the threshold of the runway in use, and another located at the aiming point 350-400 m from the threshold. All other airfield lighting associated with the runway shall be extinguished in association with the use of these units.

### 9.31 RUNWAY STATUS LIGHTS

*Introductory Note.— Runway status lights (RWSL) is a type of autonomous runway incursion warning system (ARIWS). The two basic visual components of RWSL are runway entrance lights (RELs) and take-off hold lights (THLs). Either component may be installed by itself, but the two components are designed to be complementary to each other.*

#### 9.31.1 Location

- a) Where provided, RELs shall be offset 0.6 m from the taxiway centre line on the opposite side to the taxiway centre line lights and begin 0.6 m before the runway holding position extending to the edge of the runway. An additional single light shall be placed on the runway 0.6 m from the runway centre line and aligned with the last two taxiway RELs.

*Note.— Where two or more runway holding positions are provided, the runway holding position referred is that closest to the runway.*

- b) RELs shall consist of at least five light units and shall be spaced at a minimum of 3.8 m and a maximum of 15.2 m longitudinally, depending



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upon the taxiway length involved, except for a single light installed near the runway centre line.

- c) reserved.
- d) reserved.
- e) Where provided, THLs shall be offset 1.8 m on each side of the runway centre line lights and extend, in pairs, starting at a point 115 m from the beginning of the runway and, thereafter, every 30 m for at least 450 m.

*Note. — Additional THLs may be similarly provided at the starting point of the take-off roll.*

9.31.2 Characteristics

- a) Where provided, RELs shall consist of a single line of fixed in pavement lights showing red in the direction of aircraft approaching the runway.
- b) RELs shall illuminate as an array at each taxiway/runway intersection where they are installed less than two seconds after the system determines a warning is needed.
- c) Intensity and beam spread of RELs shall be in accordance with the specifications of Appendix 2, Figures App 9-29 and App 9-31.

*Note. — Consideration for reduced beam width may be required for some REL lights at acute angled runway/taxiway intersections to ensure the RELs are not visible to aircraft on the runway.*

- d) Where provided, THLs shall consist of two rows of fixed in pavement lights showing red facing the aircraft taking off.
- e) THLs shall illuminate as an array on the runway less than two seconds after the system determines a warning is needed.
- f) Intensity and beam spread of THLs shall be in accordance with the specifications of Figure App 9-43.
- g) RELs and THLs should be automated to the extent that the only control over each system will be to disable one or both systems.



## 9.32 COLOUR SPECIFICATIONS

### 9.32.1 General

*Introductory Note: The following specifications define the chromaticity limits of colours to be used for aeronautical ground lights, markings, signs and panels. The specifications are in accord with the 1983 specifications of the International Commission on Illumination (CIE), except for the colour orange in Fig App 11-3.*

*It is not possible to establish specifications for colours such that there is no possibility of confusion. For reasonably certain recognition, it is important that the eye illumination be well above the threshold of perception, that the colour not be greatly modified by selective atmospheric attenuations and that the observer's colour vision be adequate. There is also a risk of confusion of colour at an extremely high level of eye illumination such as may be obtained from a high-intensity source at very close range. Experience indicates that satisfactory recognition can be achieved if due attention is given to these factors.*

*The chromaticities are expressed in terms of the standard observer and coordinate system adopted by the International Commission on Illumination (CIE) at its Eighth Session at Cambridge, England, in 1931.\* See CIE Publication No. 15, Colorimetry (1971)*

### 9.32.2 Colours for Aeronautical Ground Lights

#### 9.32.2.1 Chromaticities for lights having filament type light sources

The chromaticities of aeronautical ground lights filament type light sources shall be within the following boundaries

CIE Equations (see Figure App 9-17a):

- a) Red
  - Purple boundary  $y = 0.980 - x$
  - Yellow boundary  $y = 0.335$  except for visual approach slope indicator systems
  - Yellow boundary  $y = 0.320$  for visual approach slope indicator systems

*Note. See 9.6.3.15*

- b) Yellow
  - Red boundary  $y = 0.382$
  - White boundary  $y = 0.790 - 0.667x$
  - Green boundary  $y = x - 0.120$
- c) Green
  - Yellow boundary  $x = 0.360 - 0.080y$



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White boundary  $x = 0.650y$   
Blue boundary  $y = 0.390 - 0.171x$

d) Blue

Green boundary  $y = 0.805x + 0.065$   
White boundary  $y = 0.400 - x$   
Purple boundary  $x = 0.600y + 0.133$

e) White

Yellow boundary  $x = 0.500$   
Blue boundary  $x = 0.285$   
Green boundary  $y = 0.440$  and  $y = 0.150 + 0.640x$   
Purple boundary  $y = 0.050 + 0.750x$  and  $y = 0.382$

f) Variable White

Yellow boundary  $x = 0.255 + 0.750y$  and  $y = 0.790 - 0.667x$   
Blue boundary  $x = 0.285$   
Green boundary  $y = 0.440$  and  $y = 0.150 + 0.640x$   
Purple boundary  $y = 0.050 + 0.750x$  and  $y = 0.382$

*Note: Guidance on chromaticity changes resulting from the effect of temperature on filtering elements is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4*

- 9.32.2.2 Where dimming is not required, or where observers with defective colour vision must be able to determine the colour of the light, green signals should be within the following boundaries:

Yellow boundary  $y = 0.726 - 0.726x$   
White boundary  $x = 0.650y$   
Blue boundary  $y = 0.390 - 0.171x$

*Note. Where the colour signal is to be seen from long range, it has been the practice to use colours within the boundaries of 9.32.2.2.*

- 9.32.2.3 Where increased certainty of recognition from white is more important than maximum visual range, green signals should be within the following boundaries:



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Yellow boundary	$y = 0.726 - 0.726x$
White boundary	$x = 0.625y - 0.041$
Blue boundary	$y = 0.390 - 0.171x$

**9.32.3 Discrimination between Lights having filament type sources**

9.32.3.1 If there is a requirement to discriminate yellow and white from each other, they should be displayed in close proximity of time or space as, for example, by being flashed successively from the same beacon.

9.32.3.2 If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centre line lights, the y coordinates of the yellow light should not exceed a value of 0.40.

*Note: The limits of white have been based on the assumption that they will be used in situations in which the characteristics (colour temperature) of the light source will be substantially constant*

9.32.3.3 The colour variable white is intended to be used only for lights that are to be varied in intensity, e.g. to avoid dazzling. If this colour is to be discriminated from yellow, the lights should be so designed and operated that:

- a) the x coordinate of the yellow is at least 0.050 greater than the x coordinate of the white; and
- b) the disposition of the lights will be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

**9.32.4 Chromaticities for lights having a solid state light source**

9.32.4.1 The chromaticities of aeronautical ground lights with solid state light sources, e.g. LEDs, shall be within the following boundaries:

CIE Equations (see Figure App 9-17b):

- a) Red
 

Purple boundary	$y = 0.980 - x$
Yellow boundary	$y = 0.335$ , except for visual approach slope indicator systems;
Yellow boundary	$y = 0.320$ , for visual approach slope indicator systems.

*Note. — See 9.6.3.14*

- b) Yellow
 

Red boundary	$y = 0.387$
--------------	-------------



APPENDIX 9

White boundary  $y = 0.980 - x$   
Green boundary  $y = 0.727x + 0.054$

- c) Green (also refer 9.32.8.2 and 9.32.8.3)  
Yellow boundary  $x = 0.310$   
White boundary  $x = 0.625y - 0.041$   
Blue boundary  $y = 0.400$

- d) Blue  
Green boundary  $y = 1.141x - 0.037$   
White boundary  $x = 0.400 - y$   
Purple boundary  $x = 0.134 + 0.590y$

- e) White  
Yellow boundary  $x = 0.440$   
Blue boundary  $x = 0.320$   
Green boundary  $y = 0.150 + 0.643x$   
Purple boundary  $y = 0.050 + 0.757x$

- f) Variable white  
The boundaries of variable white for solid state light sources are those of e) White above.

9.32.4.2 Where observers with defective colour vision must be able to determine the colour of the light, green signals should be within the following boundaries:

Yellow boundary  $y = 0.726 - 0.726x$   
White boundary  $x = 0.625y - 0.041$   
Blue boundary  $y = 0.400$

9.32.4.3 In order to avoid a large variation of shades of green, if colours within the boundaries below are selected, colours within the boundaries of 9.32.8.2 should not be used.

Yellow boundary  $x = 0.310$   
White boundary  $x = 0.625y - 0.041$   
Blue boundary  $y = 0.726 - 0.726x$

9.32.5 ***Colour measurement for filament-type and solid state-type light sources***





APPENDIX 9

- 9.32.5.1 The colour of aeronautical ground lights shall be verified as being within the boundaries specified in Figure App 9-1717a or 9-17b as appropriate, by measurement at five points within the area limited by the innermost isocandela curve (isocandela diagrams Fig 9-18 to Fig 9-43 refer), with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the colour measurements shall be taken at the centre and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the colour measurements shall be taken at the centre and the limits of the diagonals (corners). In addition, the colour of the light shall be checked at the outermost isocandela curve to ensure that there is no colour shift that might cause signal confusion to the pilot.

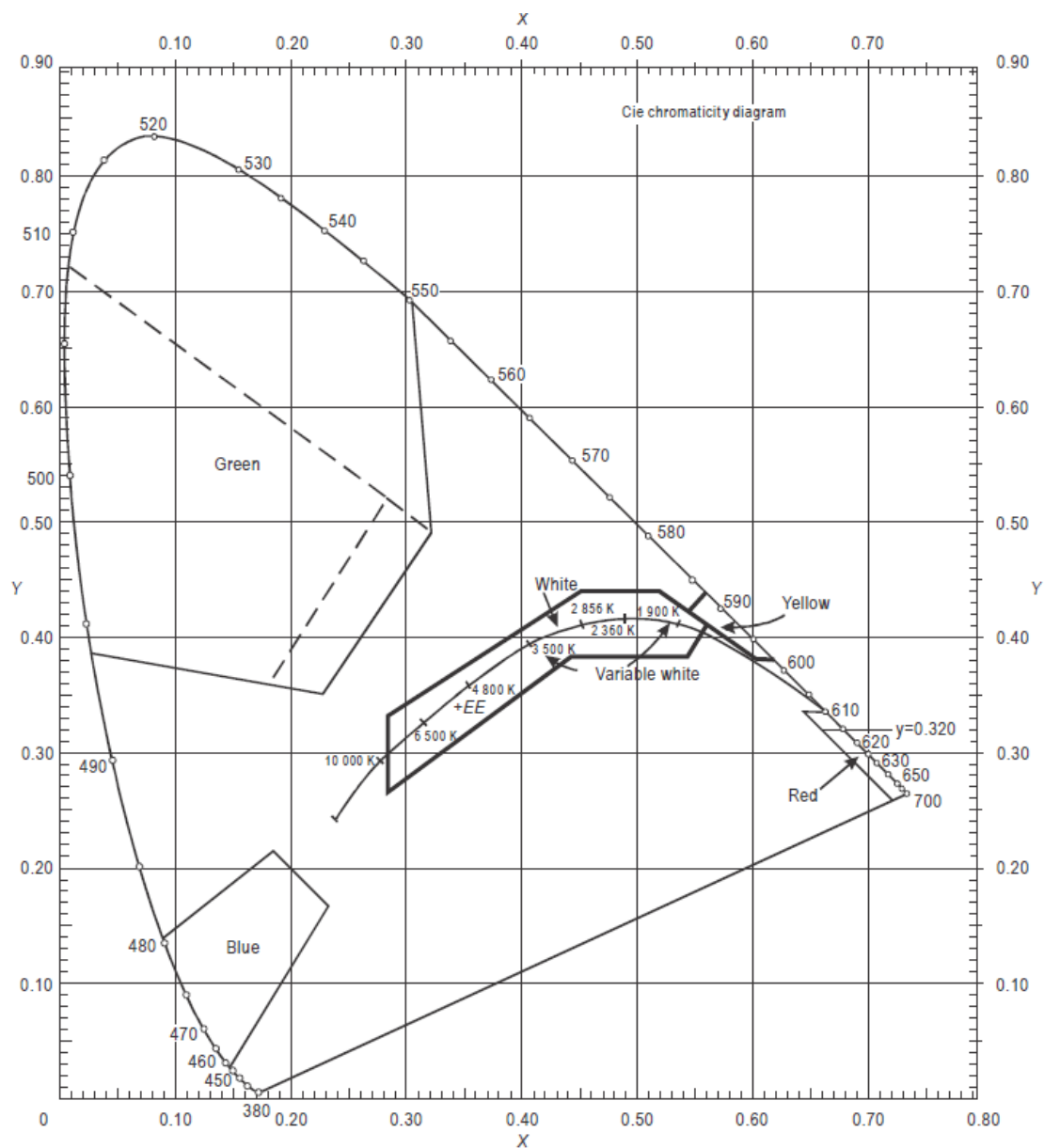
*Note 1: For the outermost isocandela curve, a measurement of colour coordinates should be made and recorded for review and judgement of acceptability by the appropriate authority.*

*Note 2: Certain light units may have application so that they may be viewed and used by pilots from directions beyond that of the outermost isocandela curve (e.g. stop bar lights at significantly wide runway-holding positions). In such instances, the appropriate authority should assess the actual application and if necessary require a check of colour shift at angular ranges beyond the outermost curve.*

- 9.32.5.2 In the case of visual approach slope indicators and other light units having a colour transition sector, the colour shall be measured at points in accordance with 9.32.5.1, except that the colour areas shall be treated separately and no point shall be within 0.5 degrees of the transition sector.

**Figure App 9-17a**

### Colours for Aeronautical Ground Lights (filament type lamps)



**Figure App 9-17b**

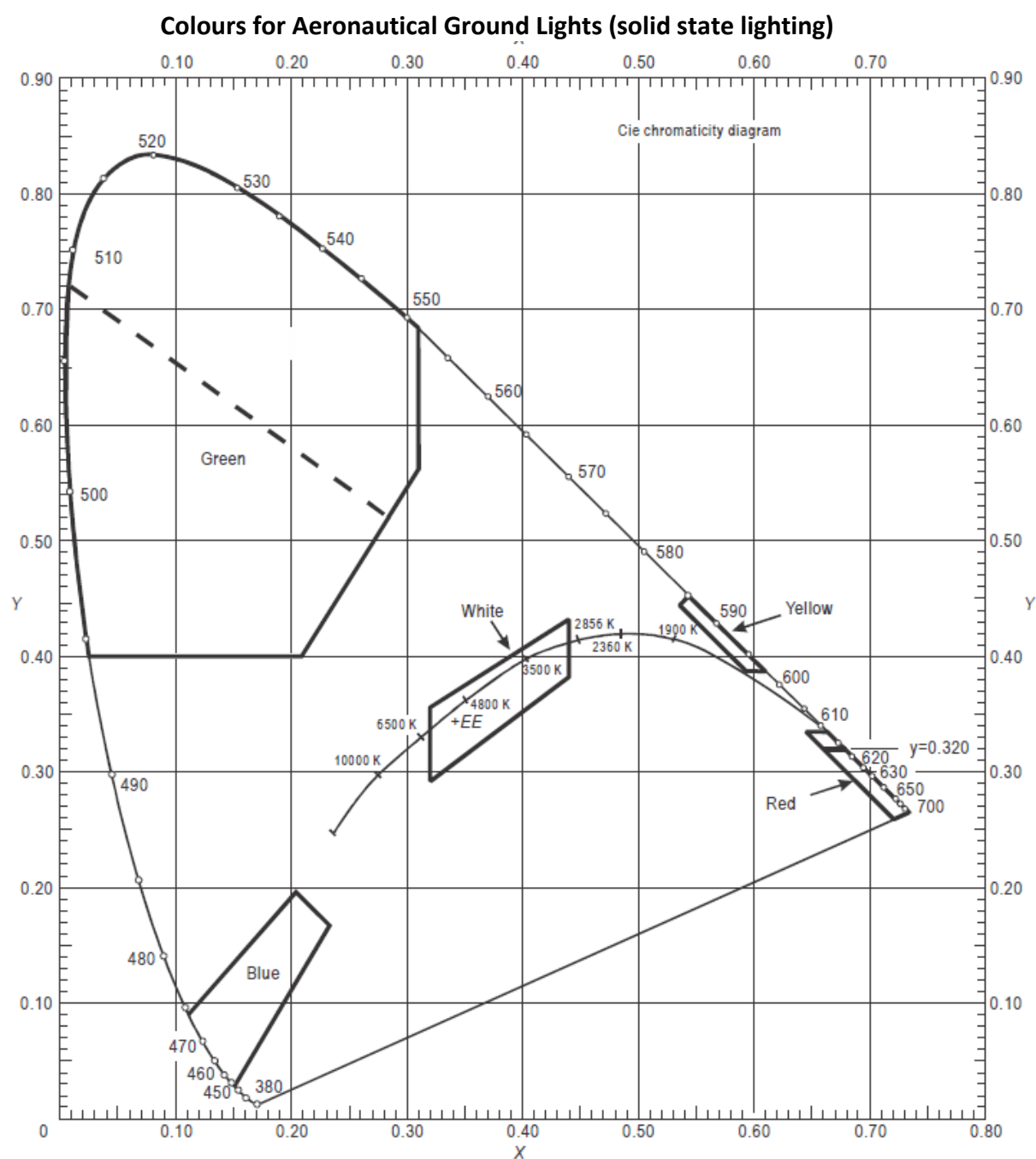
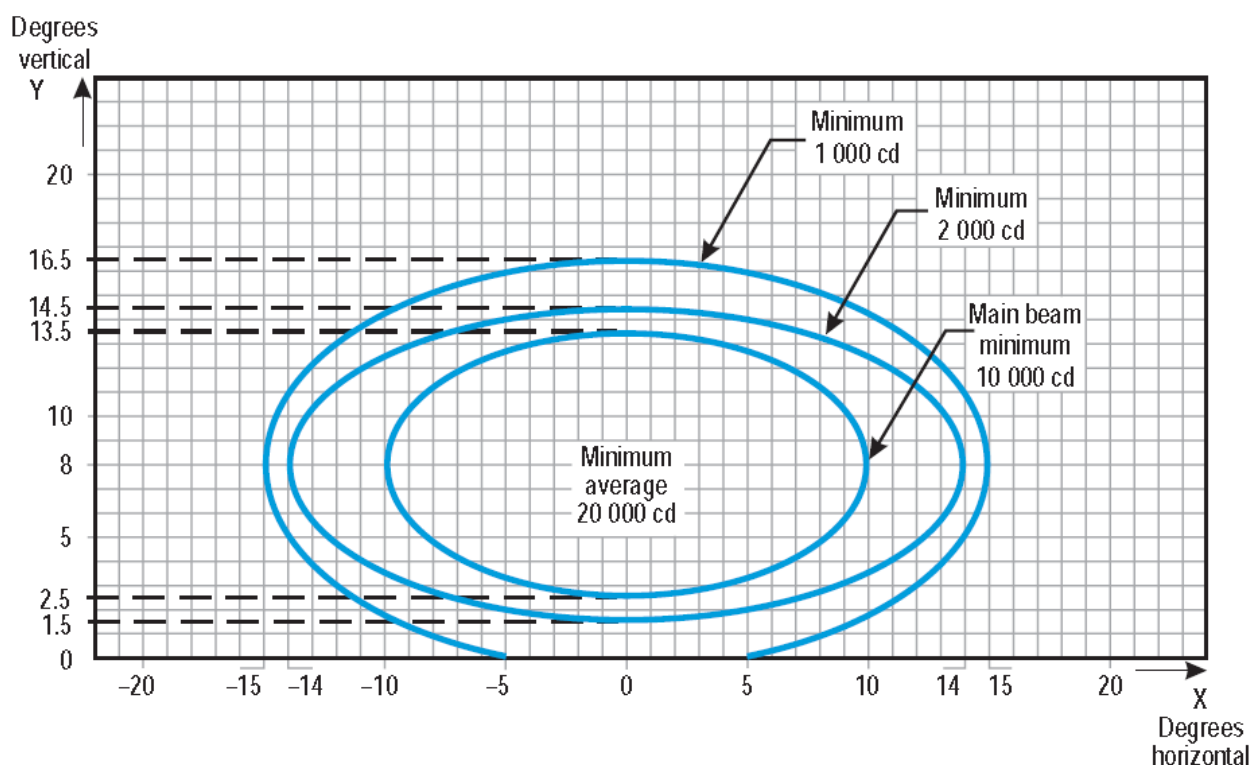


Figure App 9-18

**Isocandela Diagram for Approach Centre Line Light and Crossbars  
(White Light)**



**Notes:**

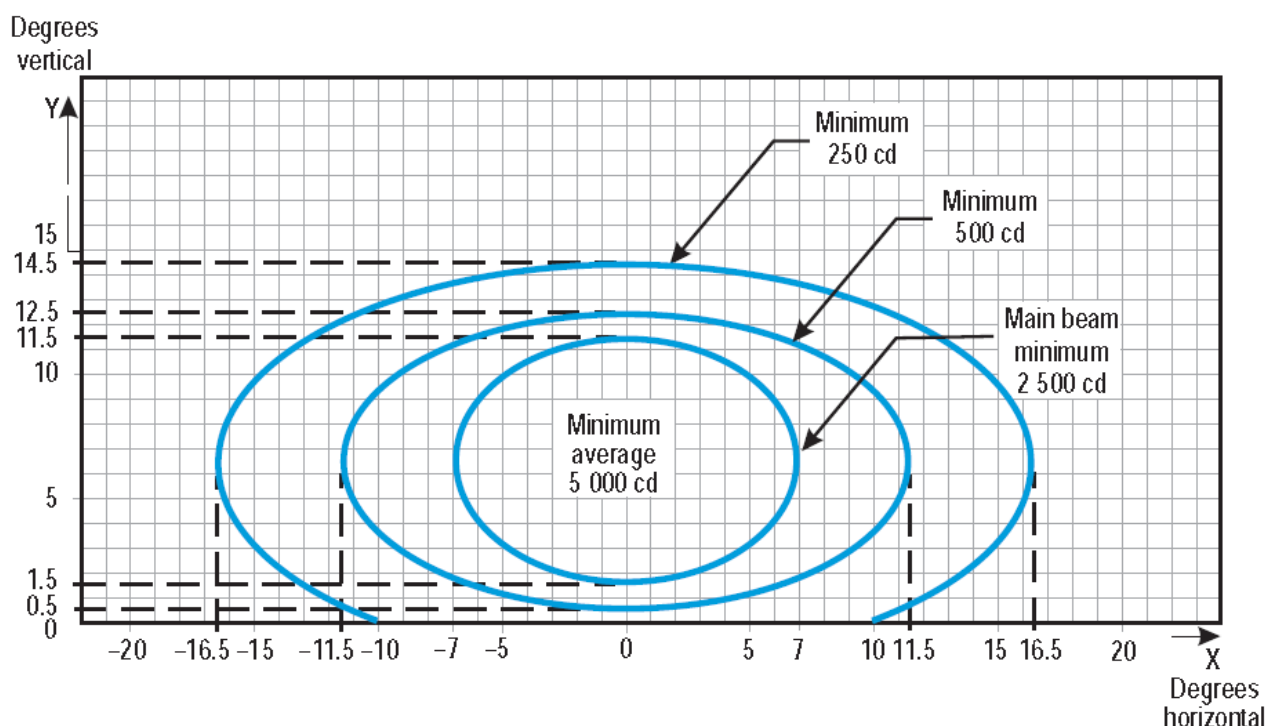
- 1 Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ 

<i>a</i>	10	14	15
<i>b</i>	5.5	6.5	8.5
- 2 Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

<i>distance from threshold</i>	<i>vertical main beam coverage</i>
threshold to 315 m	0.0° — 11°
316 m to 475 m	0.5° — 11.5°
476 m to 640 m	1.5° — 12.5°
641 m and beyond	2.5° — 13.5° (as illustrated above)
- 3 Lights in crossbars beyond 22.5 m from the centre line shall be toed-in 2 degrees. All other lights shall be aligned parallel to the centre line of the runway.
- 4 See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-19

Isocandela Diagram for Approach Side Row Light  
(Red Light)



Notes:

- Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

a	7.0	11.5	16.5
b	5.0	6.0	8.0

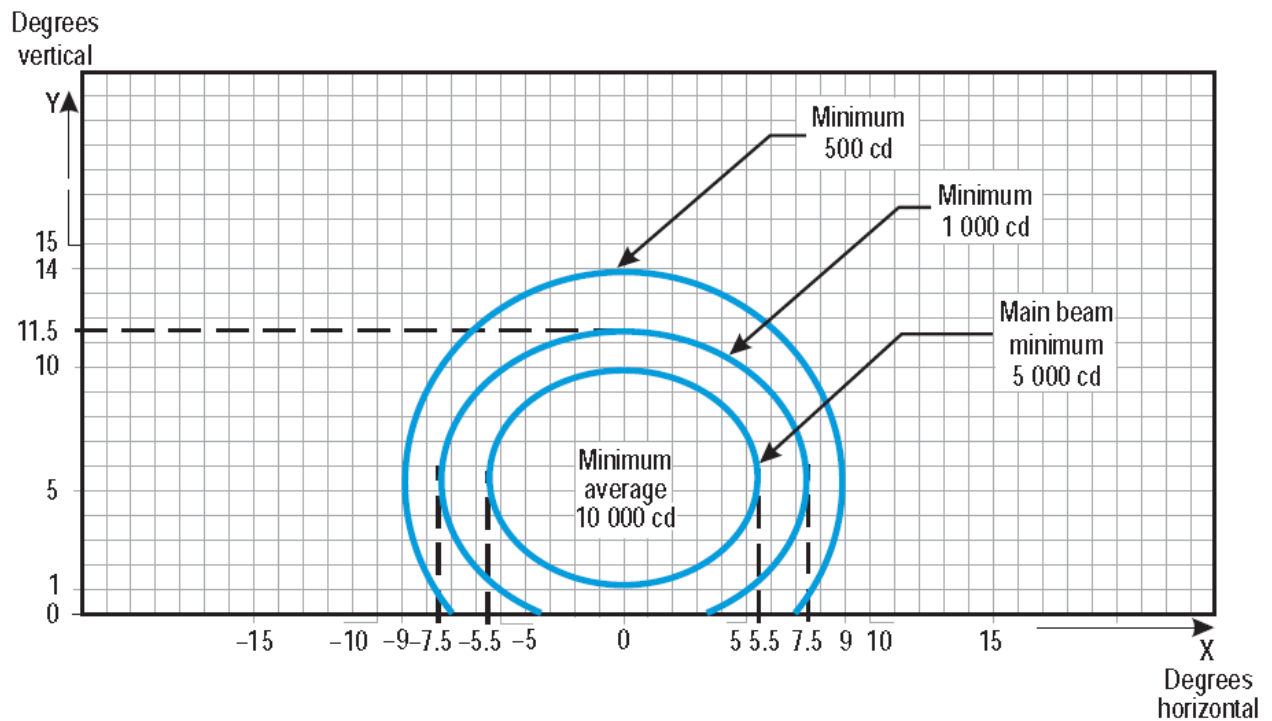
- Toe-in 2 degrees
- Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

distance from threshold	vertical main beam coverage
threshold to 115 m	0.5° — 10.5°
116 m to 215 m	0 1° — 11°
216 m and beyond	1.5° — 11.5° (as illustrated above)

- See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-20

Isocandela Diagram for Threshold Light  
(Green Light)



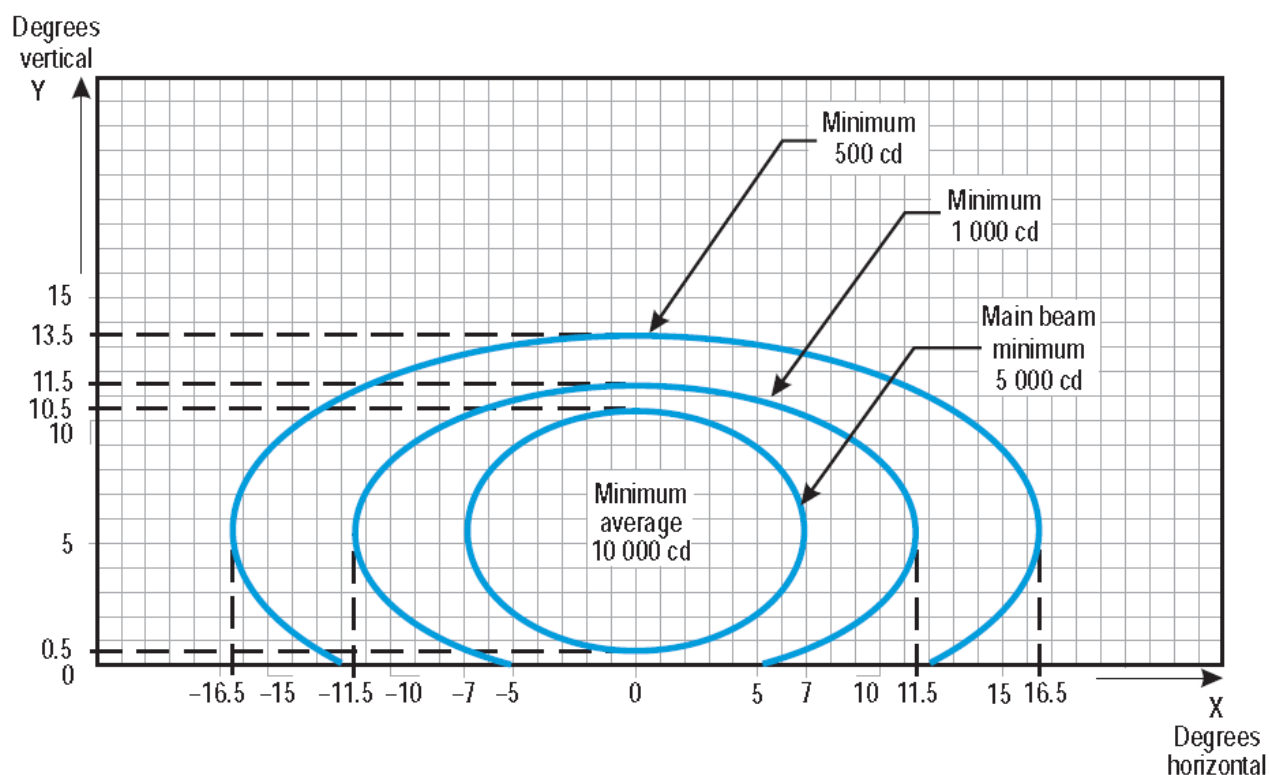
Notes:

- Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- Toe-in 3.5 degrees
- See collective notes for Figures App 9-18 to App 9-28.

a	5.5	7.5	9.0
b	4.5	6.0	8.5

Figure App 9-21

Isocandela Diagram for Threshold Wing Bar Light  
(Green Light)



Notes:

1. Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

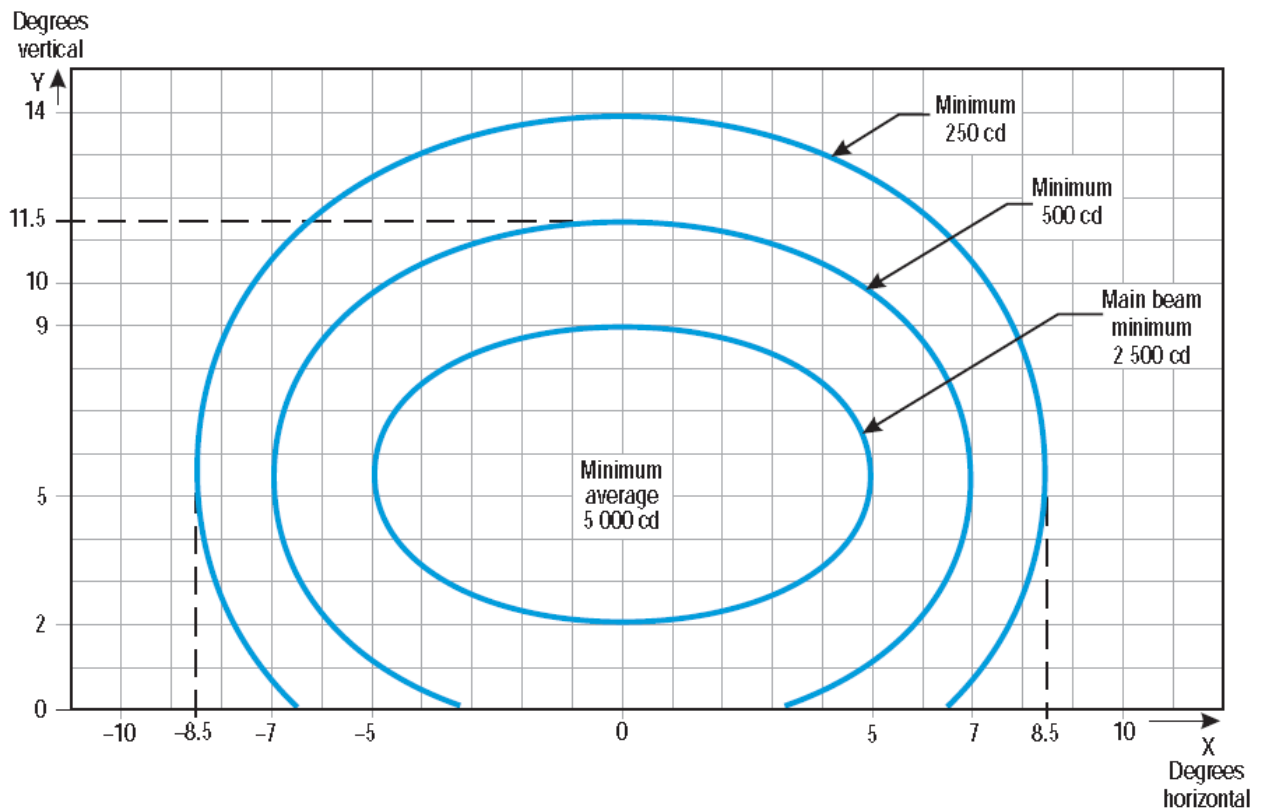
<i>a</i>	7.0	11.5	16.5
<i>b</i>	5.0	6.0	8.0

2. Toe-in 2 degrees

3. See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-22

Isocandela Diagram for Touchdown Zone Light  
(White Light)



Notes:

1. Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

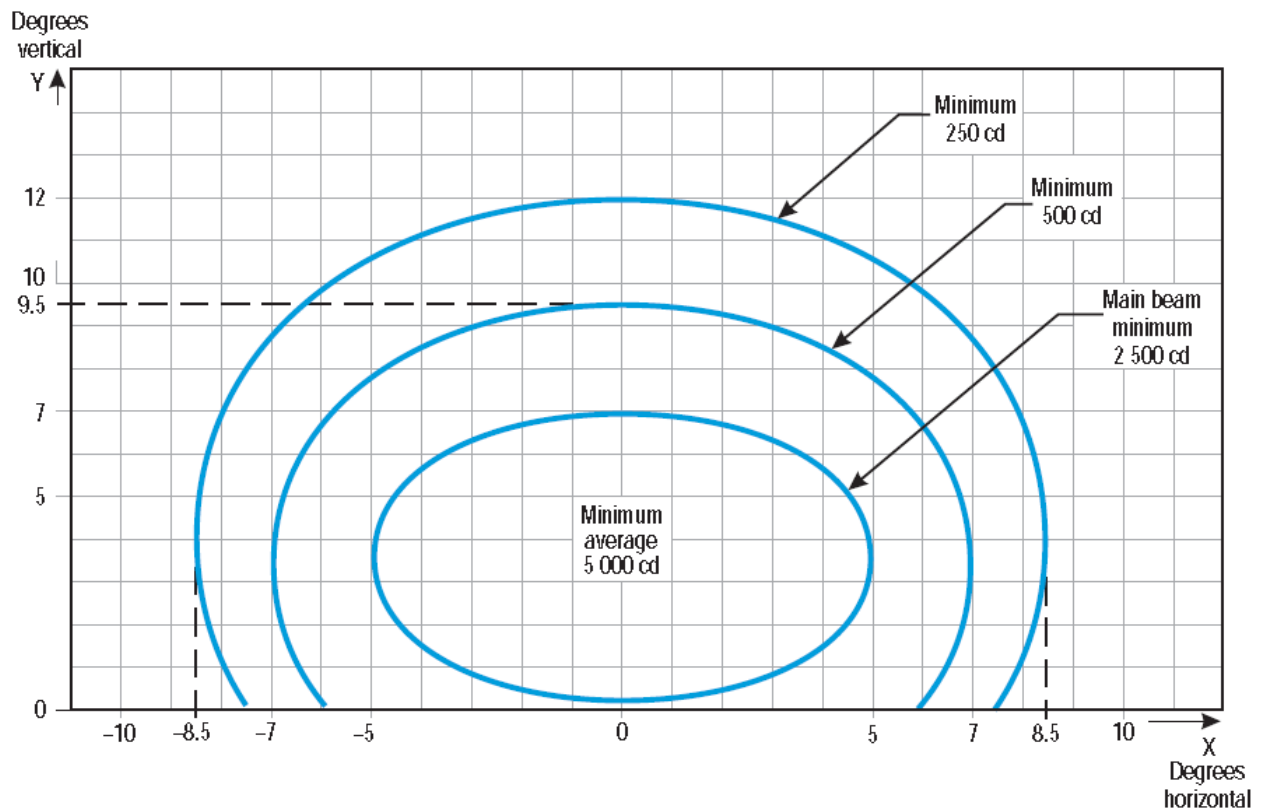
a	5.0	7.0	8.5
b	3.5	6.0	8.5

2. Toe-in 4 degrees
3. See collective notes for Figures App 9-18 to App 9-28.



Figure App 9-23

**Isocandela Diagram for Runway Centre Line Light with 30 m Longitudinal Spacing (White Light) and Rapid Exit Taxiway Indicator Light (Yellow Light)**



Notes:

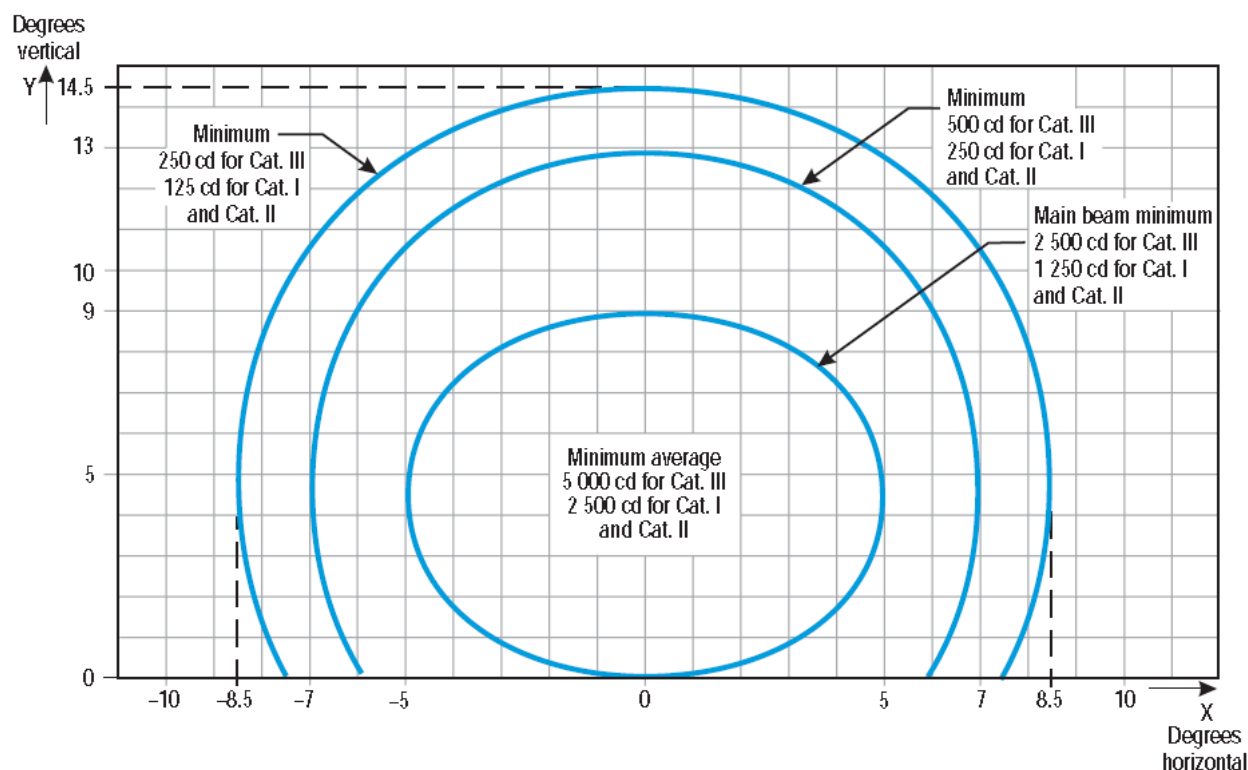
1. Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

- For red light, multiply values by 0.15.
- For yellow light, multiply values by 0.40.
- See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-24

**Isocandela Diagram for Runway Centre Line Light with 15 m Longitudinal Spacing (White Light) and Rapid Exit Taxiway Indicator Light (Yellow Light)**



**Notes:**

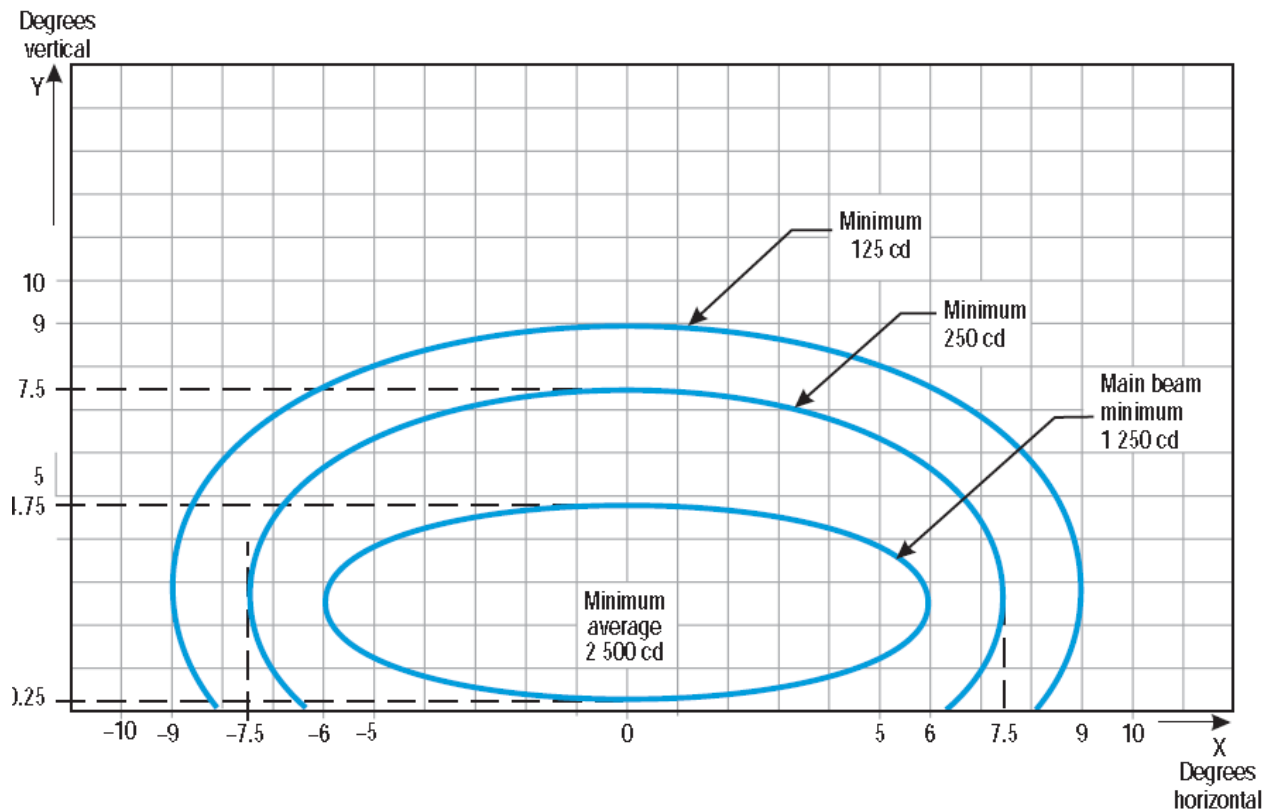
1. Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

a	5.0	7.0	8.5
b	4.5	8.5	10

- For red light, multiply values by 0.15.
- For yellow light, multiply values by 0.40.
- See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-25

Isocandela Diagram for Runway End Light  
(Red Light)



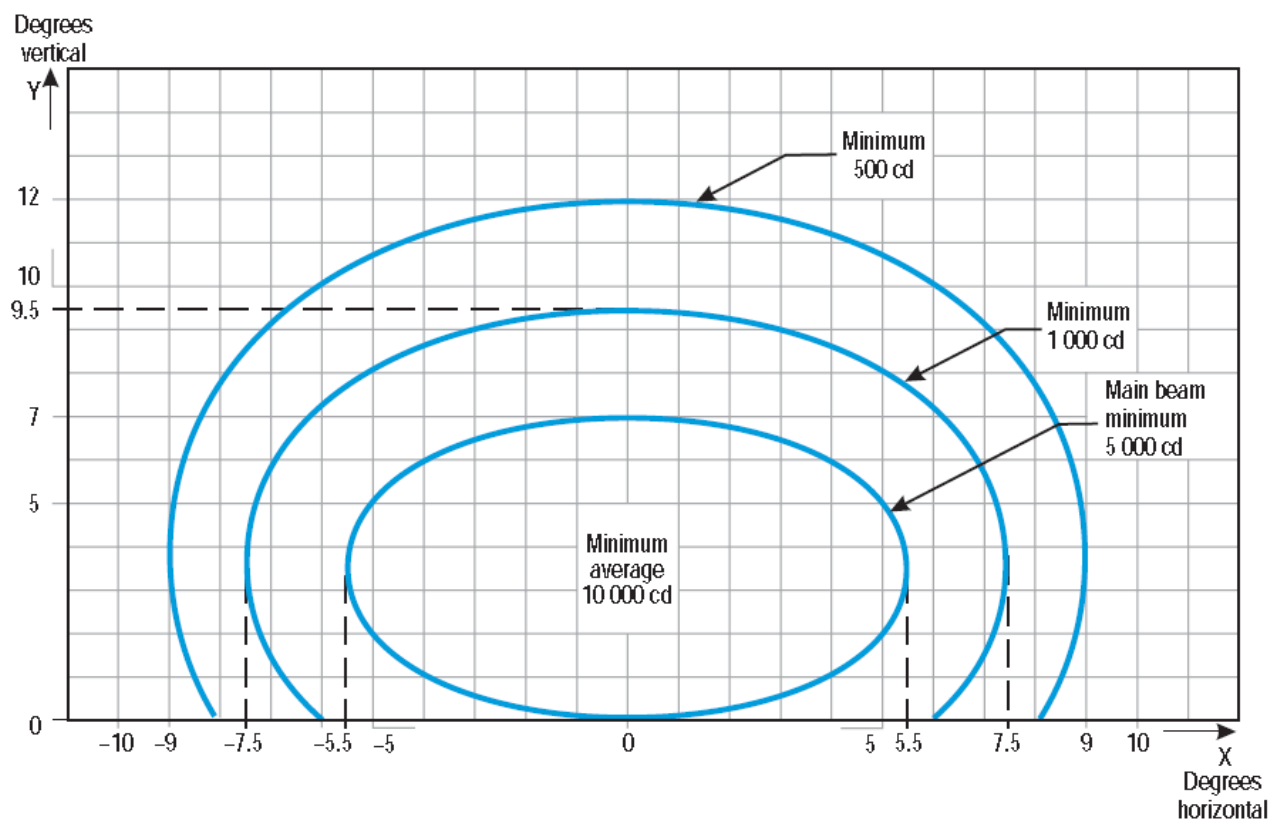
Notes:

- Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- See collective notes for Figures App 9-18 to App 9-28.

<i>a</i>	6.0	7.5	9.0
<i>b</i>	2.25	5.0	6.5

Figure App 9-26

**Isocandela Diagram for Runway Edge Light where Width of Runway is 45 m  
(White Light)**



Notes:

1. Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

a	5.5	7.5	9.0
b	3.5	6.0	8.5

2. Toe-in 3.5 degrees

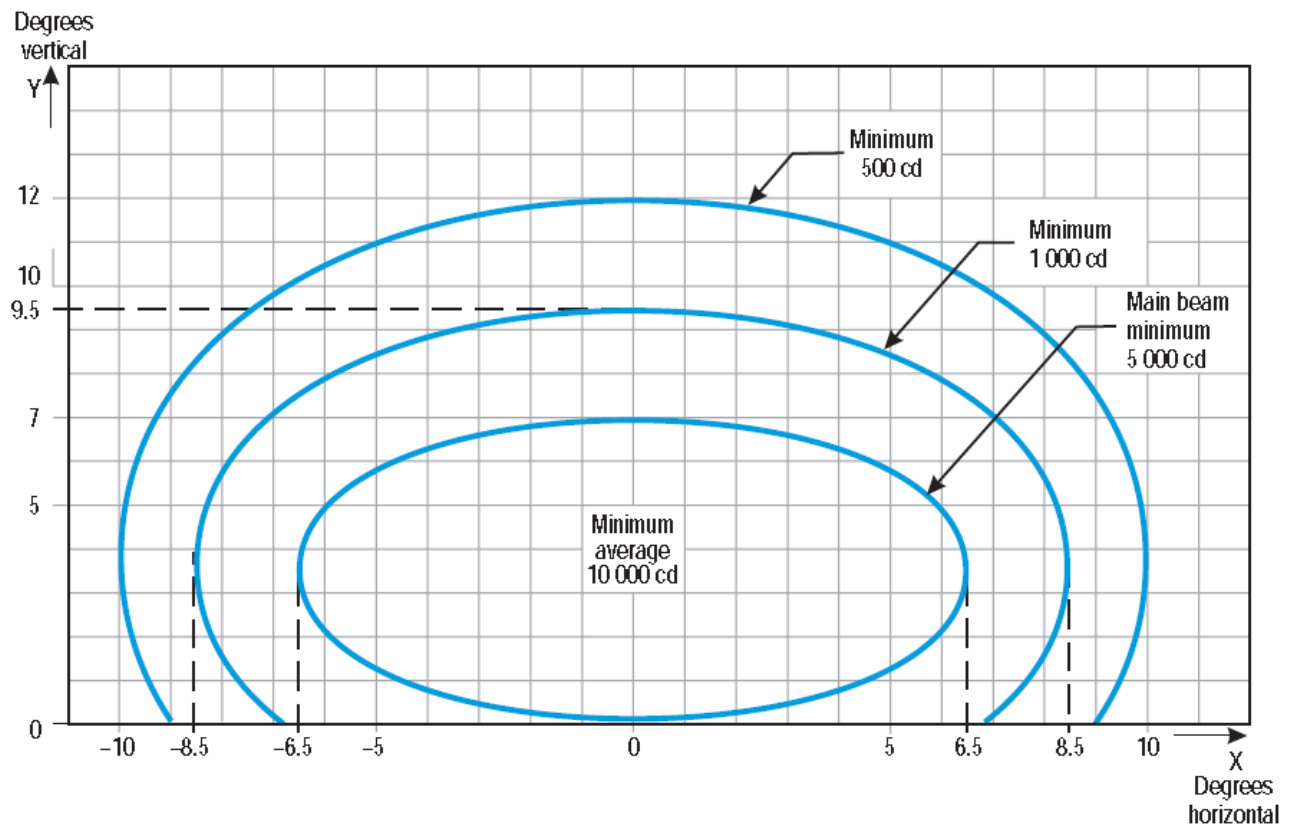
3. For red light, multiply values by 0.15.

4. For yellow light, multiply values by 0.40.

5. See collective notes for Figures App 9-18 to App 9-28.

Figure App 9-27

**Isocandela Diagram for Runway Edge Light where Width of Runway is 60 m  
(White Light)**



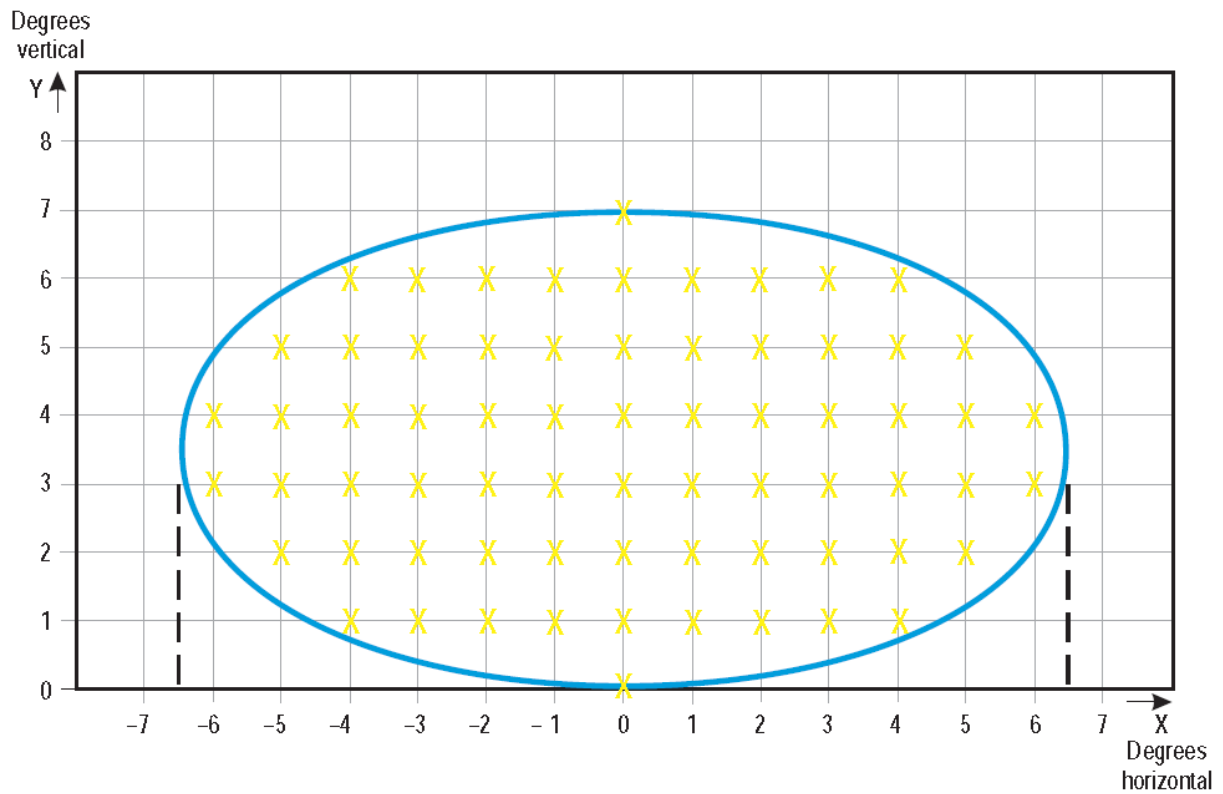
Notes:

- Curves calculated on formula  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ 

<i>a</i>	6.5	8.5	10.0
<i>b</i>	3.5	6.0	8.5
- Toe-in 4.5 degrees
- For red light, multiply values by 0.15.
- For yellow light, multiply values by 0.40.
- See collective notes for Figures App 9-18 to App 9-28.

**Figure App 9-28**

**Grid Points to be used for the Calculation of Average Intensity of Approach and Runway Lights**





APPENDIX 9

**Collective notes to Figures App 9-18 to App 9-28**

1. The ellipses in each figure are symmetrical about the common vertical and horizontal axes.
2. Figures App 9-18 to App 9-28 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure App 9-28 and using the intensity values measures at all grid points located within and on the perimeter of the ellipse representing the main beam. The average value is the arithmetic average of light intensities measured at all considered grid points.
3. No deviations are acceptable in the main beam pattern when the lighting fixture is properly aimed.
4. Average intensity ratio. The ratio between the average intensity within the ellipse defining the main beam of a typical new light and the average light intensity of the main beam of a new runway edge light shall be as follows:

Figure App 9-18	Approach centre line and crossbars	1.5 to 2.0 (white light)
Figure App 9-19	Approach side row	0.5 to 1.0 (red light)
Figure App 9-20	Threshold	1.0 to 1.5 (green light)
Figure App 9-21	Threshold wing bar	1.0 to 1.5 (green light)
Figure App 9-22	Touchdown Zone	0.5 to 1.0 (white light)
Figure App 9-23	Runway centre line (longitudinal spacing 30 m)	0.5 to 1.0 (white light)
Figure App 9-24	Runway centre line(longitudinal spacing 15 m)	0.5 to 1.0 for CAT III (white light)  0.5 to 0.25 for CAT I, II (white light)
Figure App 9-25	Runway end	0.25 to 0.5 (red light)
Figure App 9-26	Runway edge (45 m runway width)	1.0 (white light)
Figure App 9-27	Runway edge (60 m runway width)	1.0 (white light)

5. The beam coverages in the figures provide the necessary guidance for approaches down to an RVR of the order of 150 m and take-offs down to an RVR of the order of 100 m.
6. Horizontal angles are measured with respect to the vertical plane through the runway centre line. For lights other than centre line lights, the direction towards the runway centre



APPENDIX 9

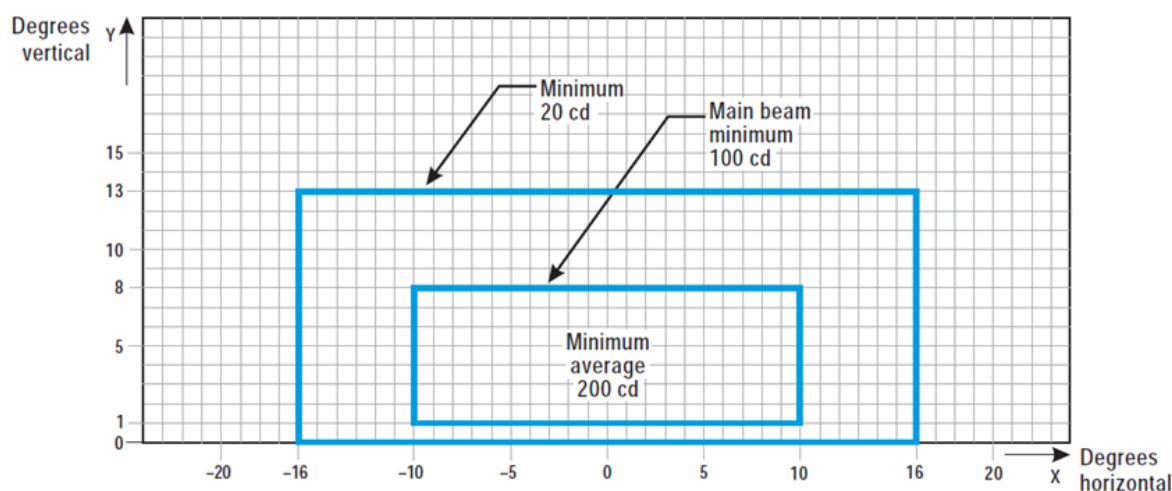
*line is considered positive. Vertical angles are measured with respect to the horizontal plane.*

- 7. Where, for approach centre line lights and crossbars and for approach side row lights, inset lights are used in lieu of elevated lights, e.g. on a runway with a displaced threshold, the intensity requirements can be met by installing two or three fittings (lower intensity) at each position.*
- 8. The importance of adequate maintenance cannot be over-emphasized. The average intensity should never fall to a value less than 50 per cent of the value shown in the figures and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.*
- 9. The light unit shall be installed so that the main beam is aligned within one-half degree of the specified requirement.*



Figure App 9-29

**Isocandela Diagram for Taxiway Centre Line (15 m spacing), RELs, No-Entry Bar and Stop Bar Lights in Straight Sections intended for use in Runway Visual Range Conditions of less than a value of 300 m where Large Offsets can Occur and for Low-Intensity Runway Guard Lights, Configuration B**

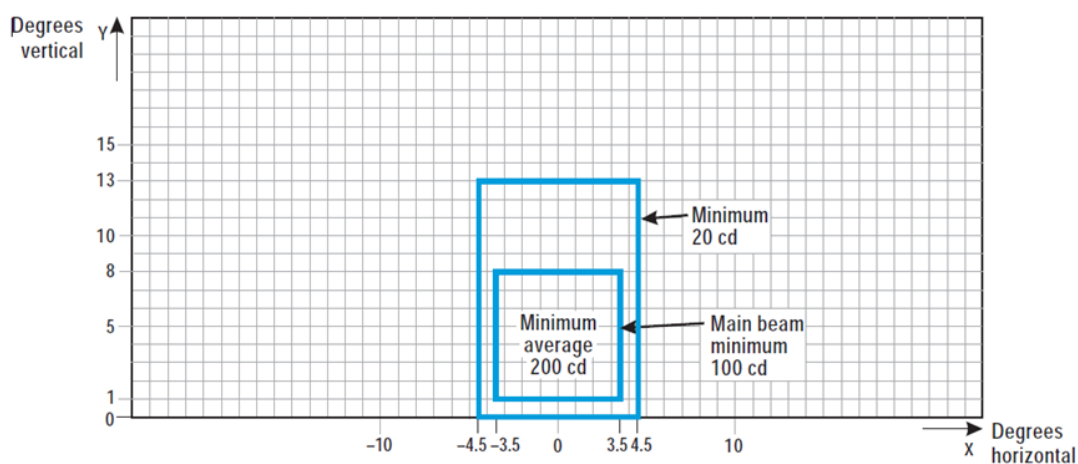


**Notes:**

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.
2. Increased intensities for enhanced rapid exit taxiway centre line lights as recommended in 9.16.9 are four times the respective intensities in the figure (i.e. 800 cd for minimum average main beam).
3. See collective notes for Figures App 9-29 to App 9-38.

**Figure App 9-30**

**Isocandela Diagram for Taxiway Centre Line (15 m spacing), No-Entry Bar and Stop Bar Lights in Straight Sections intended for use in Runway Visual Range Conditions of Less than a value of 300 m**

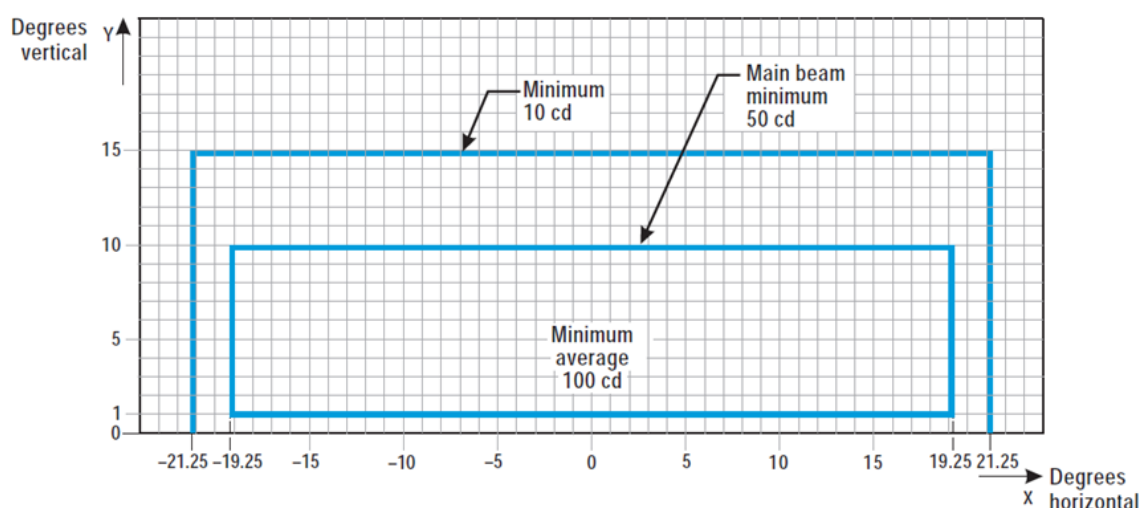


**Notes:**

1. These beam coverage are generally satisfactory and cater for a normal displacement of the cockpit from the centre line of approximately 3 m.
2. See collective notes for Figures App 9-29 to App 9-38.

**Figure App 9-31**

**Isocandela Diagram for Taxiway Centre Line (7.5 m spacing), RELs, No-Entry Bar and stop bar lights in curved sections intended for use in Runway Visual Range conditions of less than a value of 300 m**

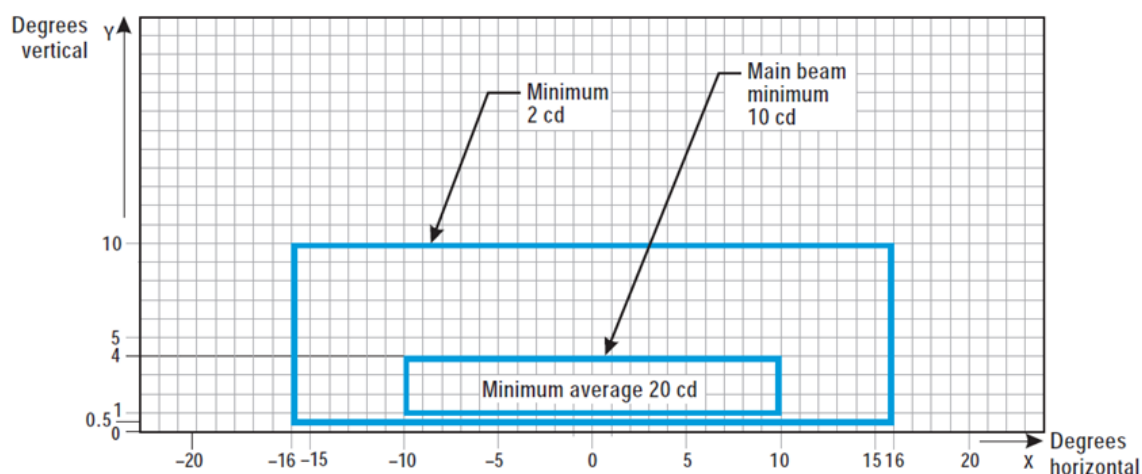


**Notes:**

1. *Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve. This does not apply to runway entrance lights (RELs).*
2. *Increased intensities for RELs shall be twice the specified intensities, i.e. minimum 20 cd, main beam minimum intensity 100 cd and minimum average 200 cd*
3. *See collective notes for Figures App 9-29 to App 9-43.*

Figure App 9-32

**Isocandela Diagram for Taxiway Centre Line (30 m, 60 m spacing), No-Entry Bar and Stop Bar Lights in Straight Sections intended for use in Runway  
Visual Range Conditions of 300 m or greater**

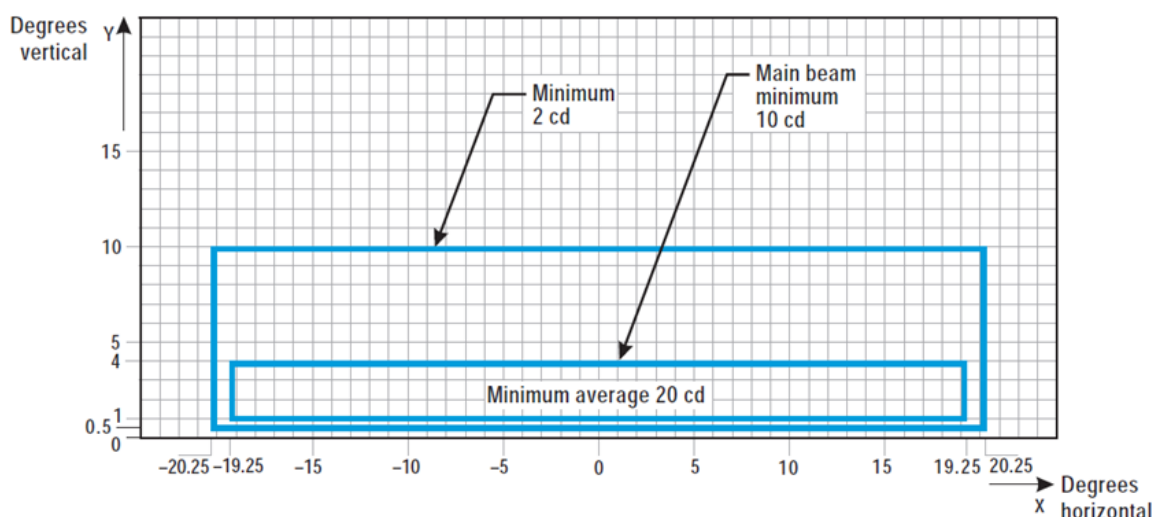


**Notes:**

1. At locations where high background luminance is usual and where deterioration of light output resulting from dust, sand and local contamination is a significant factor, the cd-values should be multiplied by 2.5.
2. Where omnidirectional lights are used they shall comply with the vertical beam requirements in this figure.
3. See collective notes for Figures App 9-29 to App 9-38.

Figure App 9-33

**Isocandela Diagram for Taxiway Centre Line (7.5 m, 15 m, 30 m spacing), No-Entry Bar and Stop Bar Lights in Curved Sections intended for use in Runway Visual Range Conditions of 300 m or greater**

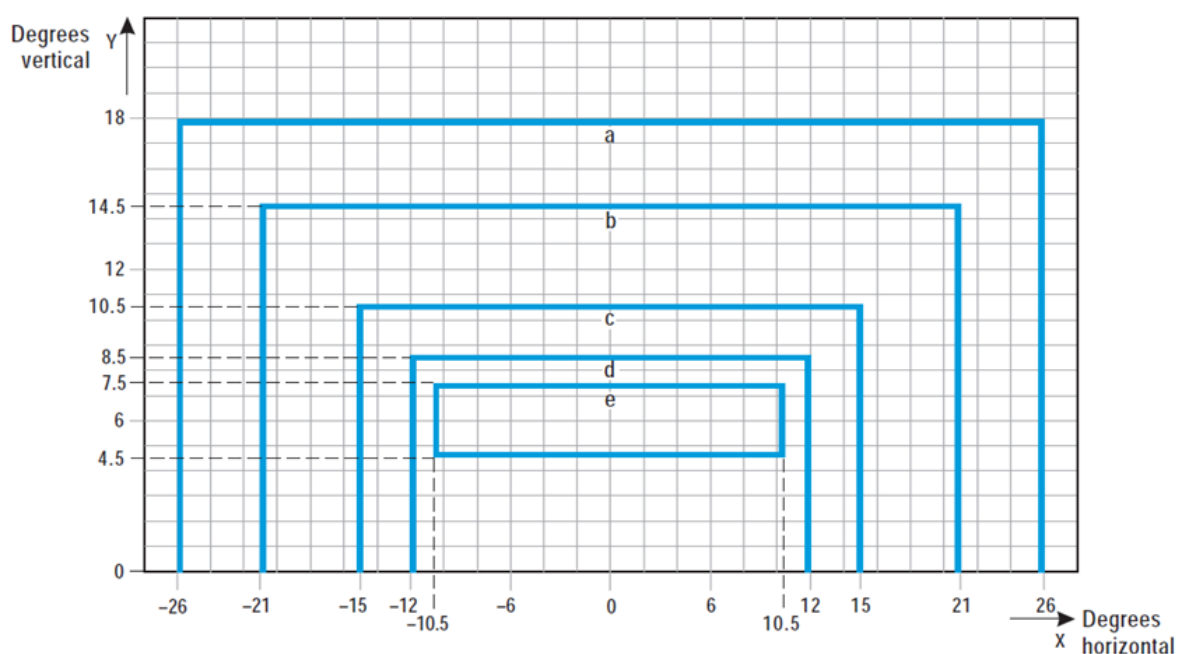


Notes:

1. *Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.*
2. *At locations where high background luminance is usual and where deterioration of light output resulting from dust, sand and local contamination is a significant factor, the cd-values should be multiplied by 2.5.*
3. *These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m as could occur at the end of curves.*
4. *See collective notes for Figures App 9-29 to App 9-38.*

**Figure App 9-34**

**Isocandela Diagram for High-intensity Taxiway Centre Line (15 m spacing), No-Entry Bar and Stop Bar Lights in Straight Sections intended for use in an Advanced Surface Movement Guidance and Control System where Higher Light Intensities are Required and where Large Offsets can Occur**



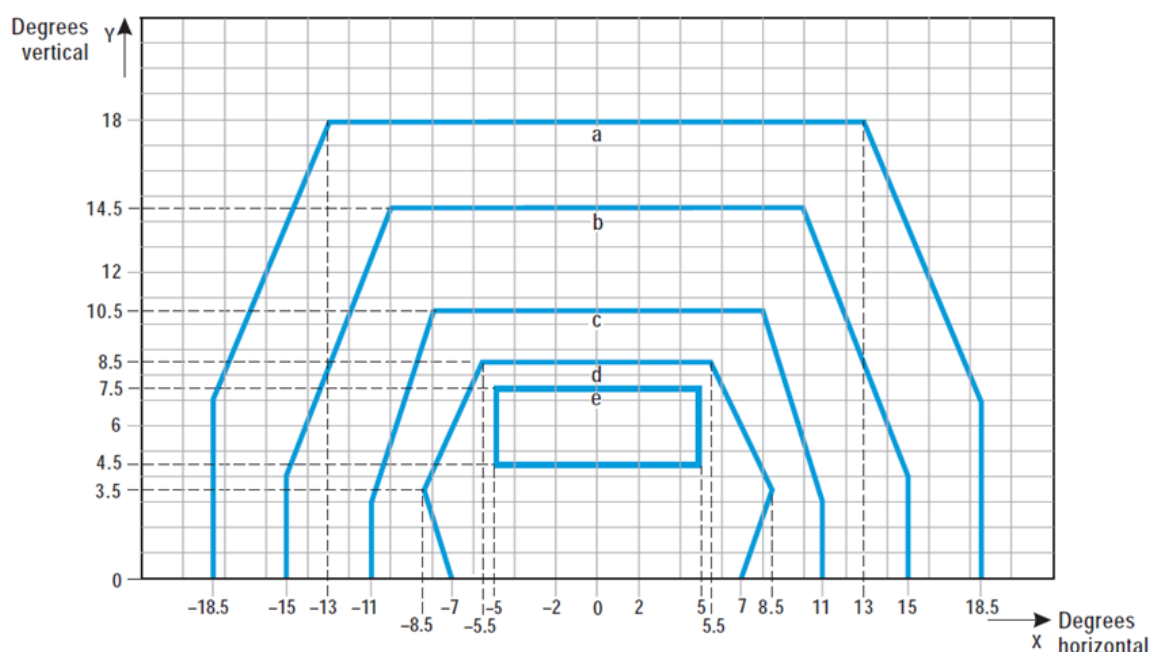
Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1 800

**Notes:**

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.
2. See collective notes for Figures App 9-29 to App 9-38.

Figure App 9-35

**Isocandela Diagram for High-intensity Taxiway Centre Line (15 m spacing), No-Entry Bar and Stop Bar Lights in Straight Sections intended for use in an Advanced Surface Movement Guidance and Control System where Higher Light Intensities are Required**



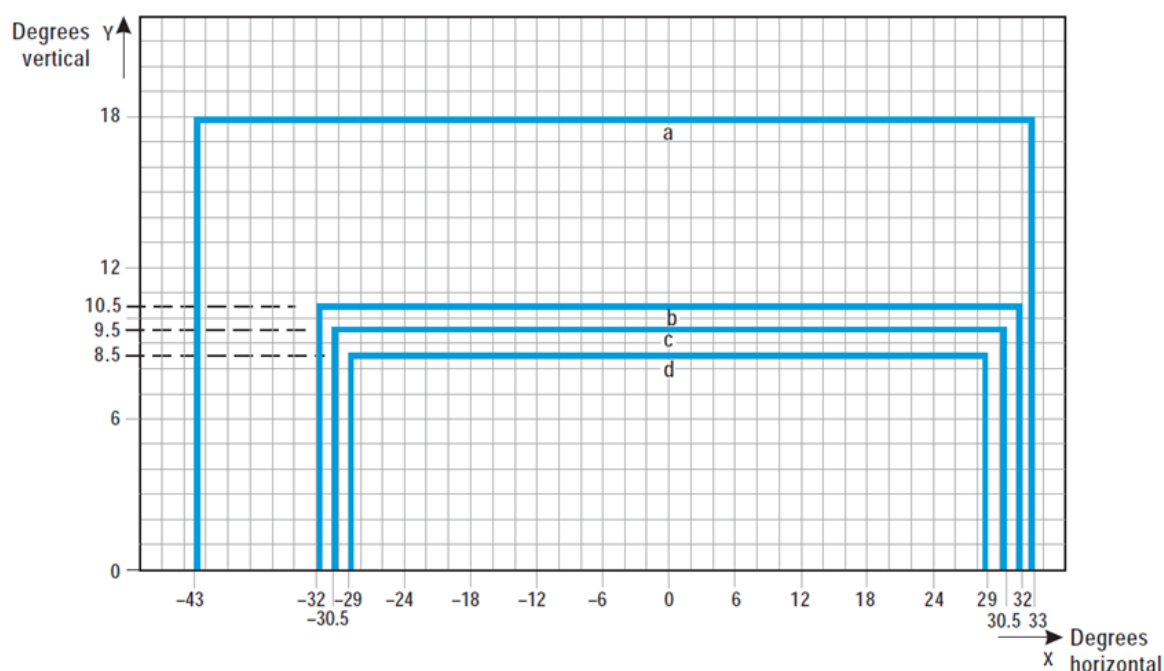
Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1 800

Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.
2. See collective notes for Figures App 9-29 to App 9-38.

Figure App 9-36

**Isocandela Diagram for High-intensity Taxiway Centre Line (7.5 m spacing), No-Entry Bar and Stop Bar Lights in Curved Sections intended for use in an Advanced Surface Movement Guidance and Control System where Higher Light Intensities are Required**



Curve	a	b	c	d
Intensity (cd)	8	100	200	400

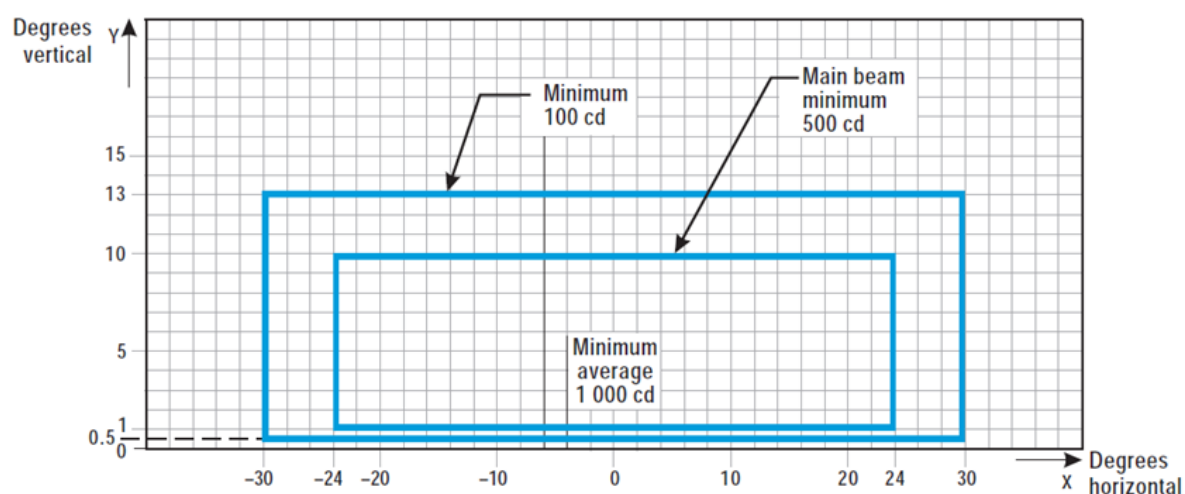
Notes:

1. Lights on curves to be toed-in 17 degrees with respect to the tangent of the curve.
2. See collective notes for Figures App 9-29 to App 9-38.



**Figure App 9-37**

**Isocandela Diagram for High-intensity Runway Guard Lights, Configuration B**

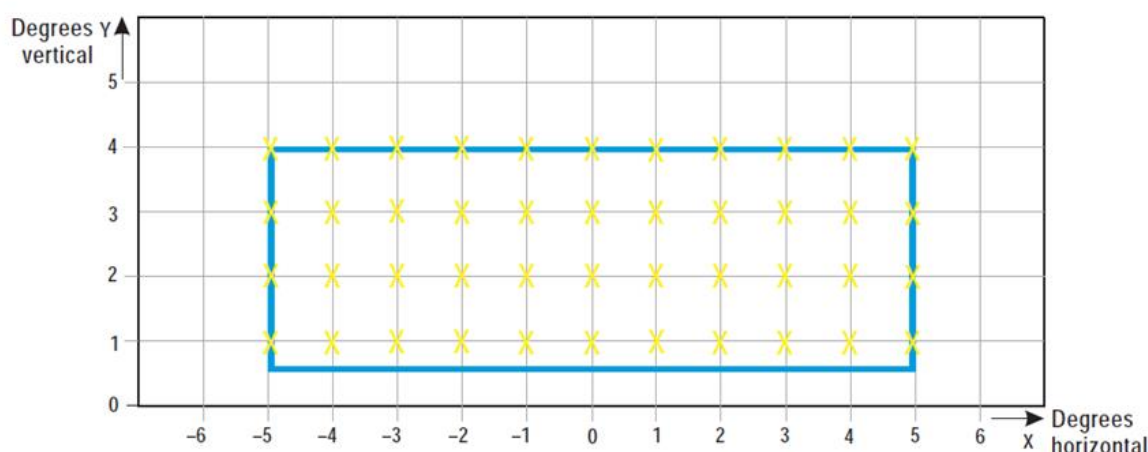


**Notes:**

1. *Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.*
2. *See collective notes for Figures App 9-29 to App 9-38..*

Figure App 9-38

### Grid Points to be used for Calculation of Average Intensity of Taxiway Centre Line and Stop Bar Lights

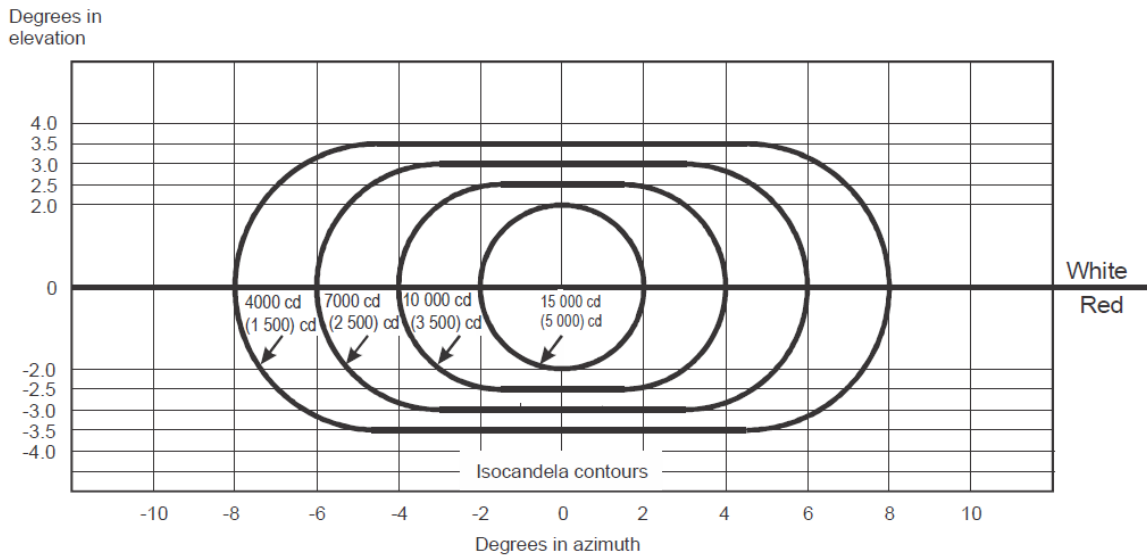


#### Collective notes to Figures App 9-28 to App 9-38

1. The intensities specified in Figures App 9-29 to App 9-37 are in green and yellow light for taxiway centre line lights, yellow light for runway guard lights and red light for stop bar lights.
2. Figures App 9-29 to App 9-37 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure App 9-38 and using the intensity values measured at all grid points located within and on the perimeter of the rectangle representing the main beam. The average value is the arithmetic average of the light intensities measured at all considered grid points.
3. No deviations are acceptable in the main beam or in the innermost beam, as applicable, when the lighting fixture is properly aimed.
4. Horizontal angles are measured with respect to the vertical plane through the taxiway centre line except on curves where they are measured with respect to the tangent to the curve.
5. Vertical angles are measured from the longitudinal slope of the taxiway surface.
6. The importance of adequate maintenance cannot be over-emphasized. The intensity, either average where applicable or as specified on the corresponding isocandela curves, should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.
7. The light unit shall be installed so that the main beam or the innermost beam, as applicable, is aligned within one-half degree of the specified requirement.

Figure App 9-40

### Light Intensity Distribution of PAPI and APAPI

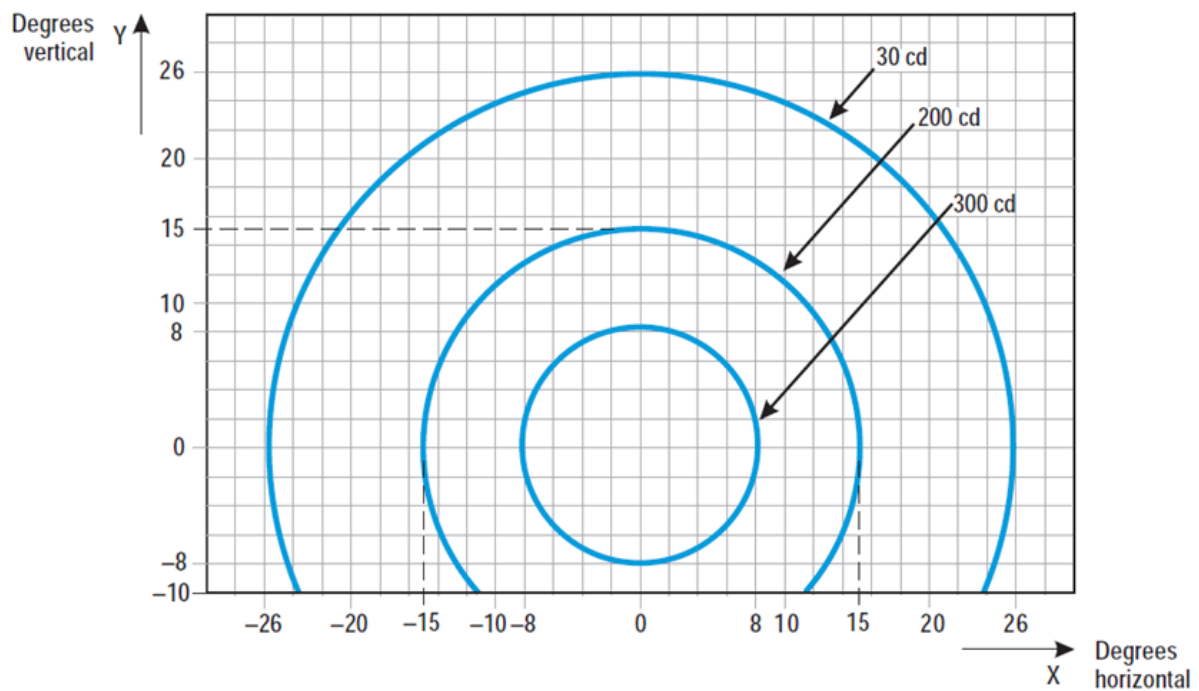


**Notes:**

1. These curves are for minimum intensities in red light.
2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.
3. The intensity values shown in brackets are for APAPI.

Figure App 9-41

**Isocandela Diagram for Each Light in Low-intensity Runway Guard Lights Configuration A**

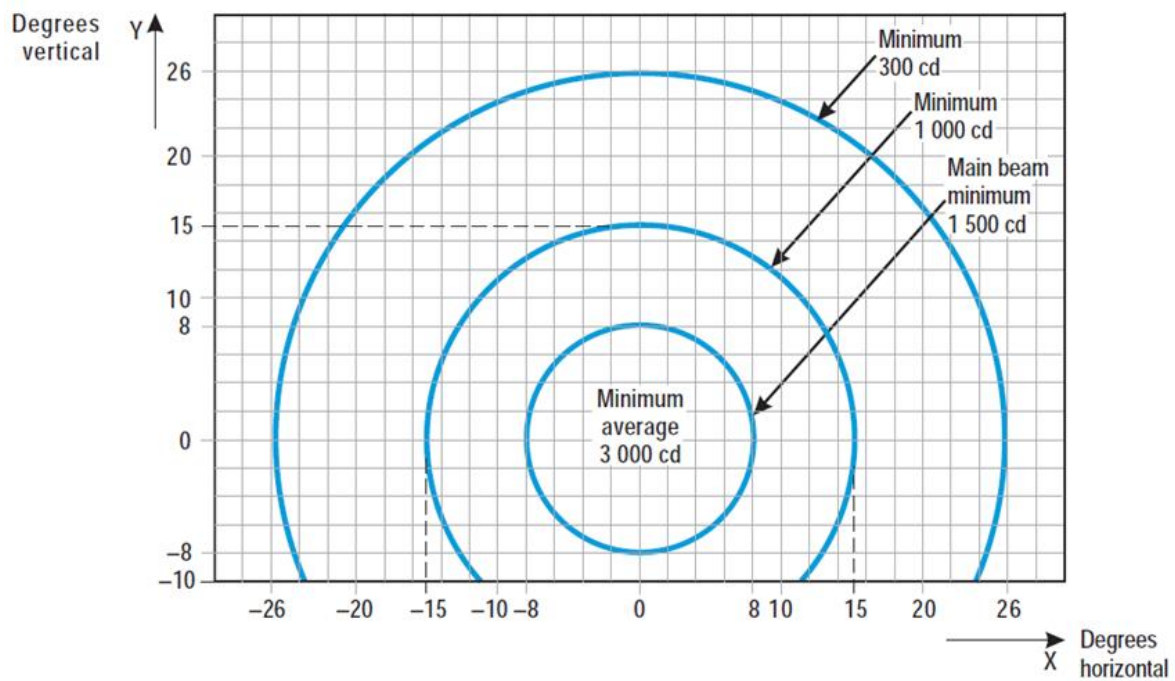


**Notes:**

1. *Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.*
2. *The intensities specified are in yellow light.*

Figure App 9-42

**Isocandela Diagram for Each Light in High-intensity Runway Guard Lights Configuration A**

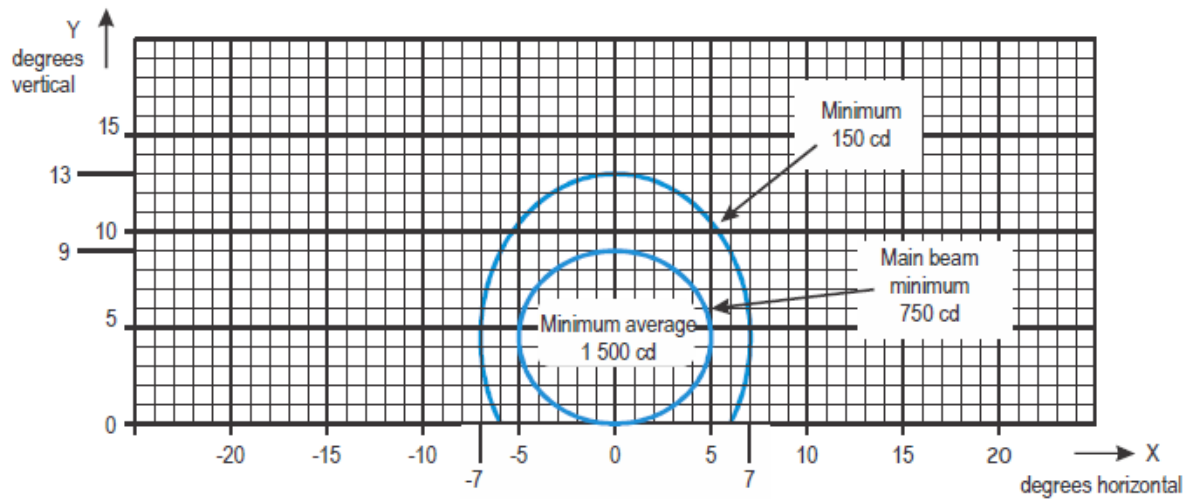


**Notes:**

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.
2. The intensities specified are in yellow light.

**Figure App 9-43**

**Isocandela Diagram for Each Take-off and Hold Lights (THL) (red light)**



**Notes:**

1. Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.0	7.0
b	4.5	8.5

2. See collective notes for Figures App 9-29 to App 9-38 and App 9-43



**APPENDIX 10**

**SECONDARY POWER SUPPLY MAXIMUM SWITCH-OVER TIMES**

Runway	Navigation Aids Requiring Power	Max Switch-Over Time
Non - Instrument	Visual approach slope indicators <sup>a</sup>	15 seconds
	Runway edge <sup>b</sup>	
	Runway threshold <sup>b</sup>	
	Runway end <sup>b</sup>	
	Obstacle <sup>a</sup>	15 seconds
Instrument	SRE	15 seconds
	VOR	15 seconds
	DME	15 seconds
	D/F facility	15 seconds
Non – Precision Approach	Approach lighting system	15 seconds
	Visual Approach Slope Indicators <sup>a, d</sup>	15 seconds
	Runway edge <sup>d</sup>	15 seconds
	Runway threshold <sup>d</sup>	15 seconds
	Runway end	15 seconds
Precision Approach Category I	Obstacle <sup>a</sup>	15 seconds
	ILS localizer	10 seconds
	ILS glidepath	10 seconds
	ILS middle marker	10 seconds
	ILS outer marker	10 seconds



APPENDIX 10

Runway	Navigation Aids Requiring Power	Max Switch-Over Time
	Approach lighting system	15 seconds
	Visual Approach Slope Indicators <sup>a, d</sup>	
	Runway edge <sup>d</sup>	15 seconds
	Runway threshold <sup>d</sup>	15 seconds
	Runway end	15 seconds
	All stop bars where installed	15 seconds
	Essential taxiway <sup>a</sup>	15 seconds
Precision Approach Category II /III	Obstacle <sup>a</sup>	15 seconds
	ILS localizer	0 seconds
	ILS glidepath	0 seconds
	ILS inner marker	1 second
	ILS middle marker	1 second
	ILS outer marker	10 seconds
	Inner 300 m of the approach lighting system	1 second
	Other parts of the approach lighting system	15 seconds
	Runway edge	15 seconds
	Runway threshold	1 second
	Runway end	1 second
	Runway centre line	1 second
	Runway Touchdown Zone	1 second





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Runway	Navigation Aids Requiring Power	Max Switch-Over Time
	All stop bars	1 second
	Essential taxiway	15 seconds
	Obstacle <sup>a</sup>	15 seconds
Runway meant for take-off in RVR < 800 m	Runway edge <sup>c</sup>	15 seconds
	Runway end	1 second
	Runway centre line	1 second
	All stop bars	1 second
	Essential taxiway <sup>a</sup>	15 seconds
	Obstacle <sup>a</sup>	15 seconds

- a. Supplied with secondary power when their operation is essential to the safety of flight operations*
- b. Secondary power should be provided where primary runway is non-Instrument Runway, except where emergency lighting can be activated within 15 minutes*
- c. One second where no runway centre line lights are provided*
- d. One second where approaches are over hazardous or precipitous terrain*



## APPENDIX 11

### SIGNS

#### 11.1 GENERAL

##### 11.1.1 Application

11.1.1.1 Signs shall be provided to convey a mandatory instruction, information on a specific location or destination on a Movement Area or to provide other information to meet the requirements of SMGCS.

11.1.1.2 A variable message sign should be provided where:

- the instruction or information displayed on the sign is relevant only during a certain period of time; and/or
- there is a need for variable pre-determined information to be displayed on the sign to meet the requirements of SMGCS

##### 11.1.2 Characteristics

11.1.2.1 Signs shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and the engine pods of jet aircraft. The installed height of the sign shall not exceed the dimension shown in the appropriate column of Table App 11-1.

**Table App 11-1**

**Location Distances for Taxiing Guidance Signs including Runway Exit Signs**

Code Number	Legend	Sign Height (mm)		Perpendicular distance from defined taxiway pavement edge to near side of sign	Perpendicular distance from defined runway pavement edge to near side of sign
		Face (min)	Installed (max)		
1 or 2	200	300	700	5-11 m	3-10 m
1 or 2	300	450	900	5-11 m	3-10 m
3 or 4	300	450	900	11-21 m	8-15 m
3 or 4	400	600	1 100	11-21 m	8-15 m



*Note: defined taxiway or runway pavement edge means: the edge of the defined taxiway or runway as marked i.e. this does not include the shoulders.*

11.1.2.2 Signs shall be rectangular, as shown in Figures App 11-8 and App 11-9 with the longer side horizontal.

11.1.2.3 The face height of signs shall be as follows:

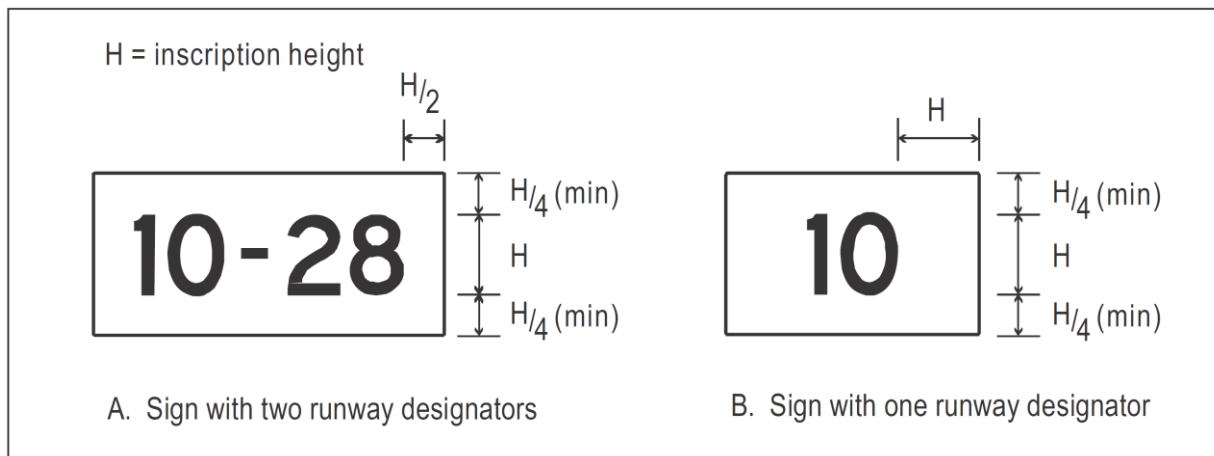
<b>Legend Height</b>	<b>Face Height (Min)</b>
200 mm	300 mm
300 mm	450 mm
400 mm	600 mm

11.1.2.4 The face width of signs shall be determined using Figure App 11-1 except that, where a mandatory instruction sign is provided on one side of a taxiway only due to physical impracticability, the face width shall not be less than:

- a) 1.94 m where the Code Number is 3 or 4; and
- b) 1.46 m where the Code Number is 1 or 2.

*Note: Additional guidance on determining the face width of a sign is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

Figure App 11-1



Explanatory note to Figure App 11-1: “H” stands for the inscription height.

11.1.2.5 Inscription heights shall conform to the following tabulation.

Table App 11-2

Runway Code Number	Minimum Character Height		
	Mandatory Instruction Sign	Information Sign	
		Runway Exit and Runway Vacated Signs	Other Signs
1 or 2	300 mm	300 mm	200 mm
3 or 4	400 mm	400 mm	300 mm

*Note: Where a taxiway location sign is installed in conjunction with a runway designation sign, the character size shall be that specified for mandatory instruction signs.*

11.1.2.6 Arrow dimensions shall be as follows:

**Legend Height**

200 mm

300 mm

400 mm

**Stroke**

32 mm

48 mm

64 mm



11.1.2.7 Stroke width for single letter shall be as follows:

<b><i>Legend Height</i></b>	<b><i>Stroke</i></b>
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

11.1.2.8 The forms of characters, i.e. letters, numbers, arrows and symbols, shall conform to those shown in Figures App 11-2. The width of characters and the space between individual characters shall be determined as indicated in Table App 11-3.

11.1.2.9 Borders

- a) The black vertical delineator between adjacent direction signs should have a width of approximately 0.7 of the stroke width.
- b) The yellow border on a stand-alone location sign should be approximately 0.5 stroke width.

**Figure App 11-2**

### **Forms of Characters**

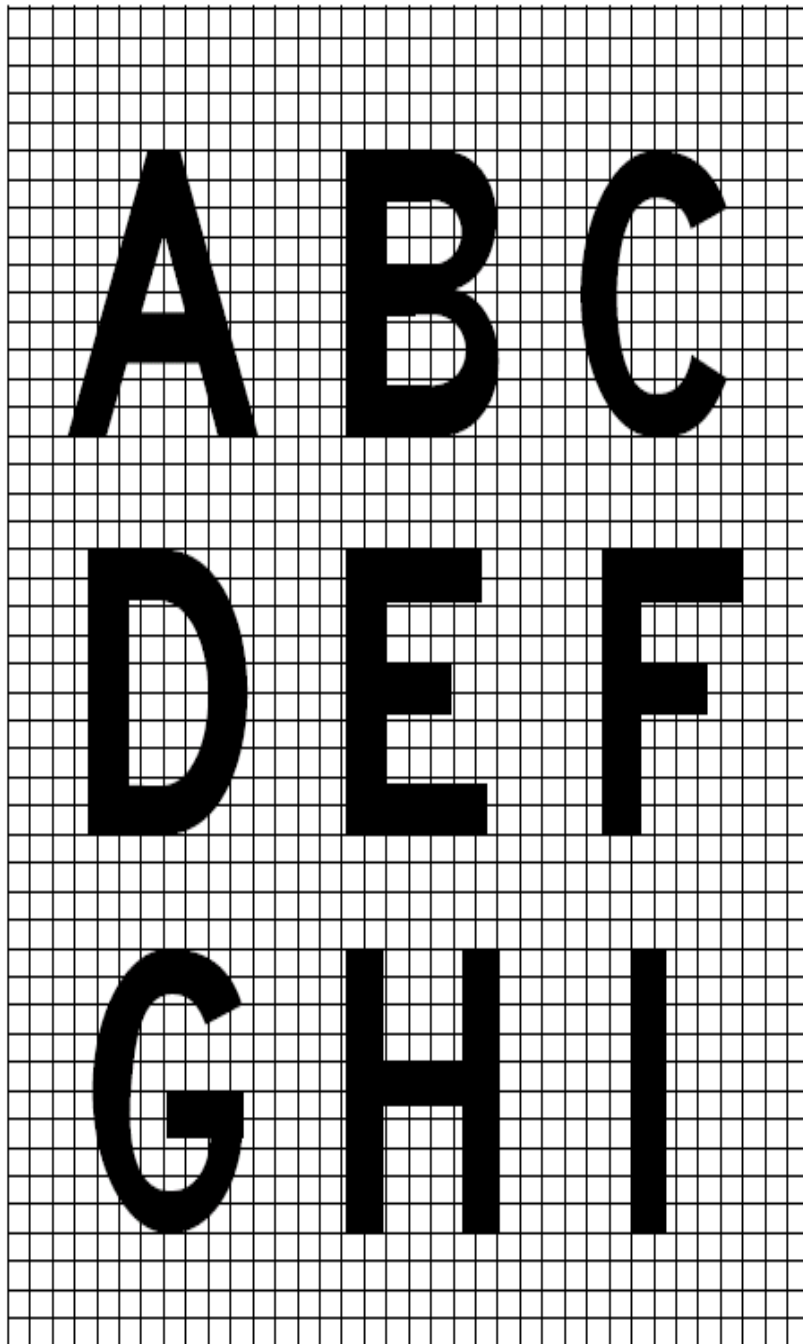


Figure App 11-2 (cont.)

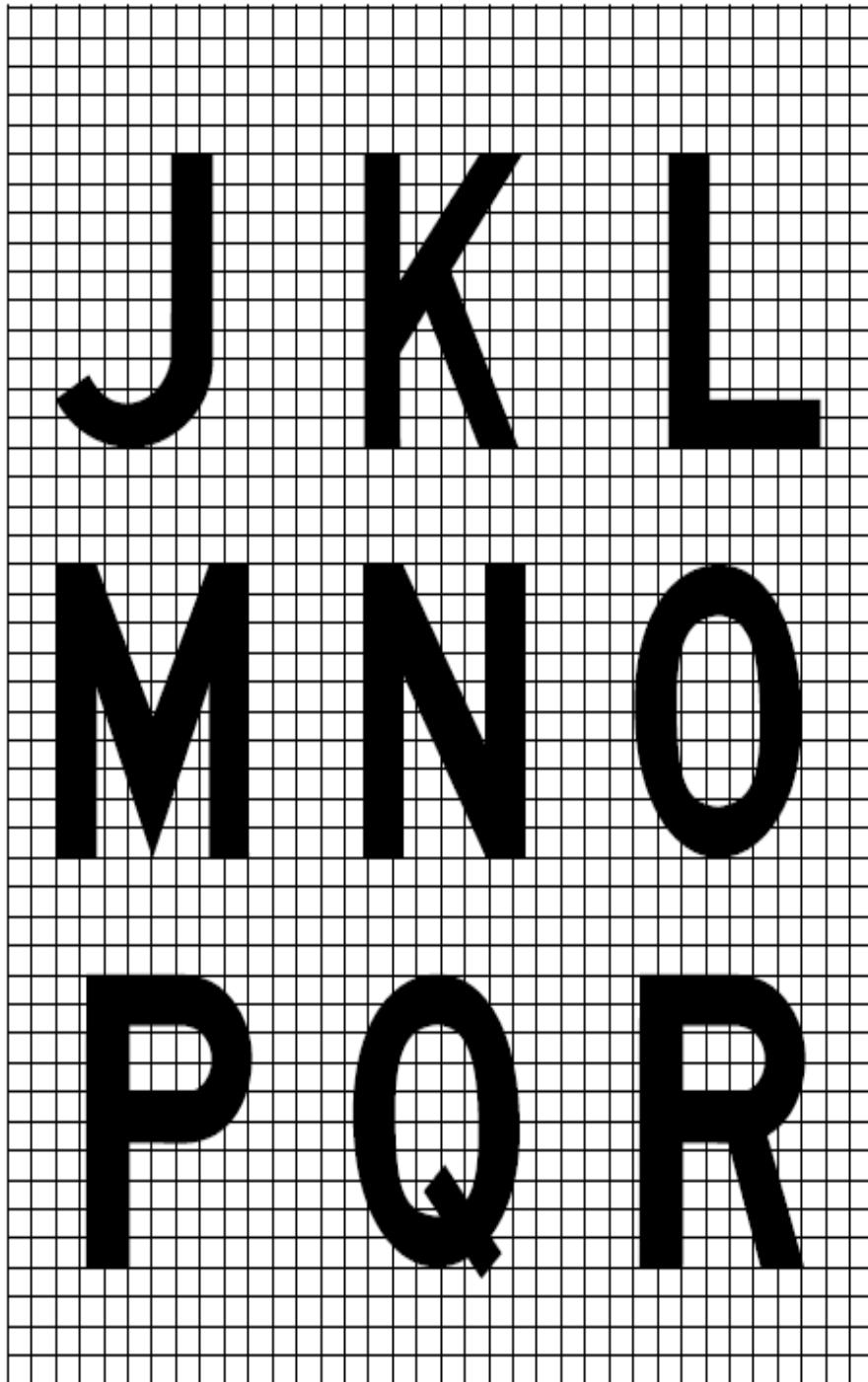




Figure App 11-2 (cont.)

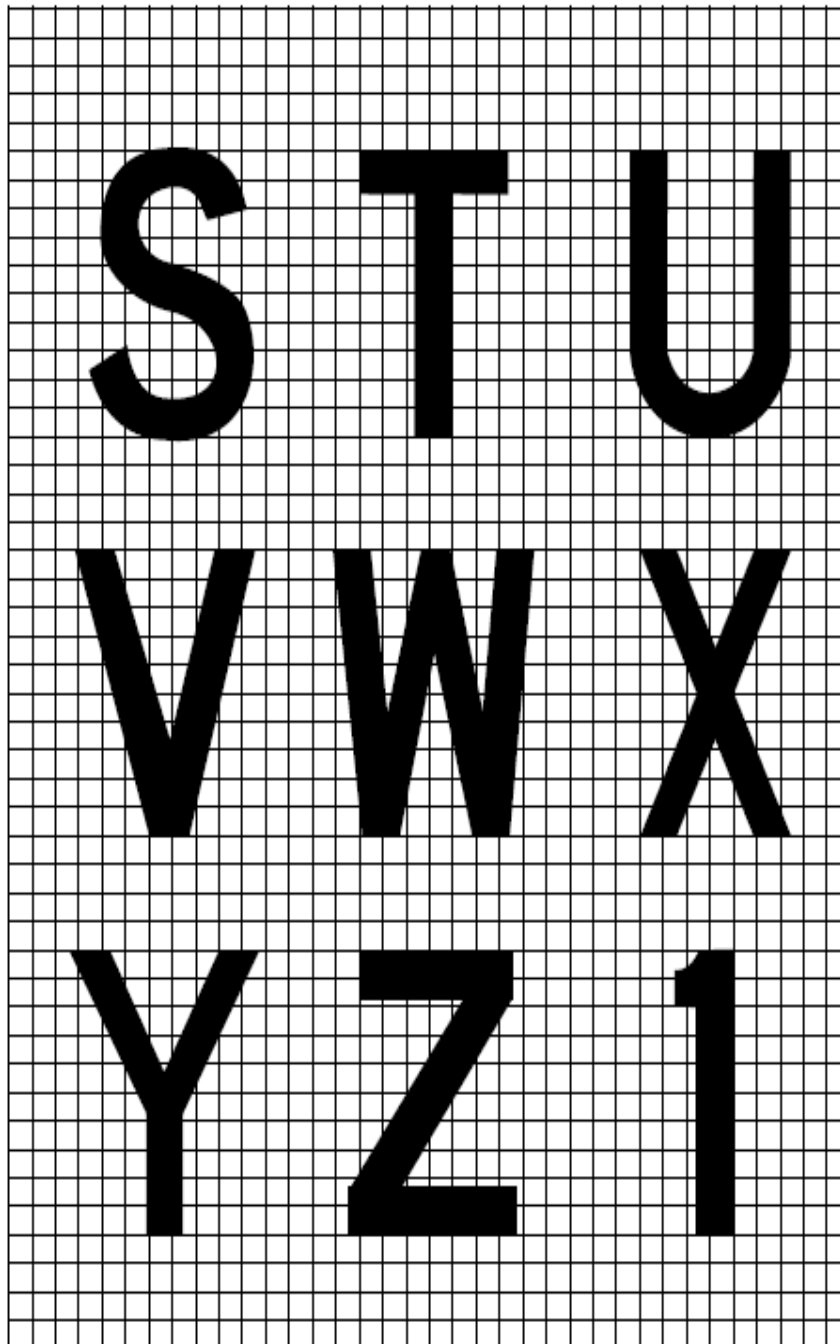




Figure App 11-2 (cont.)

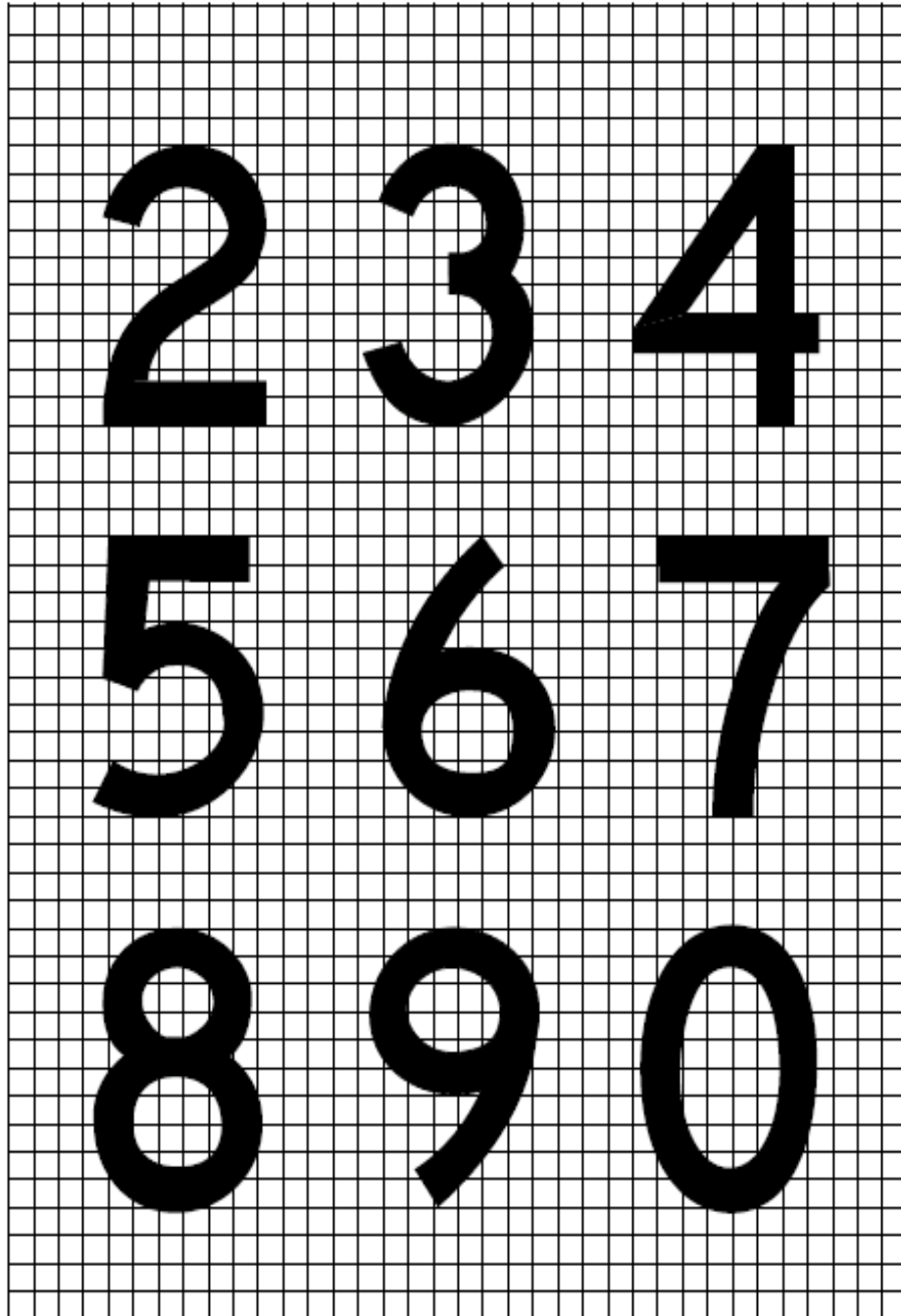




Figure App 11-2 (cont.)

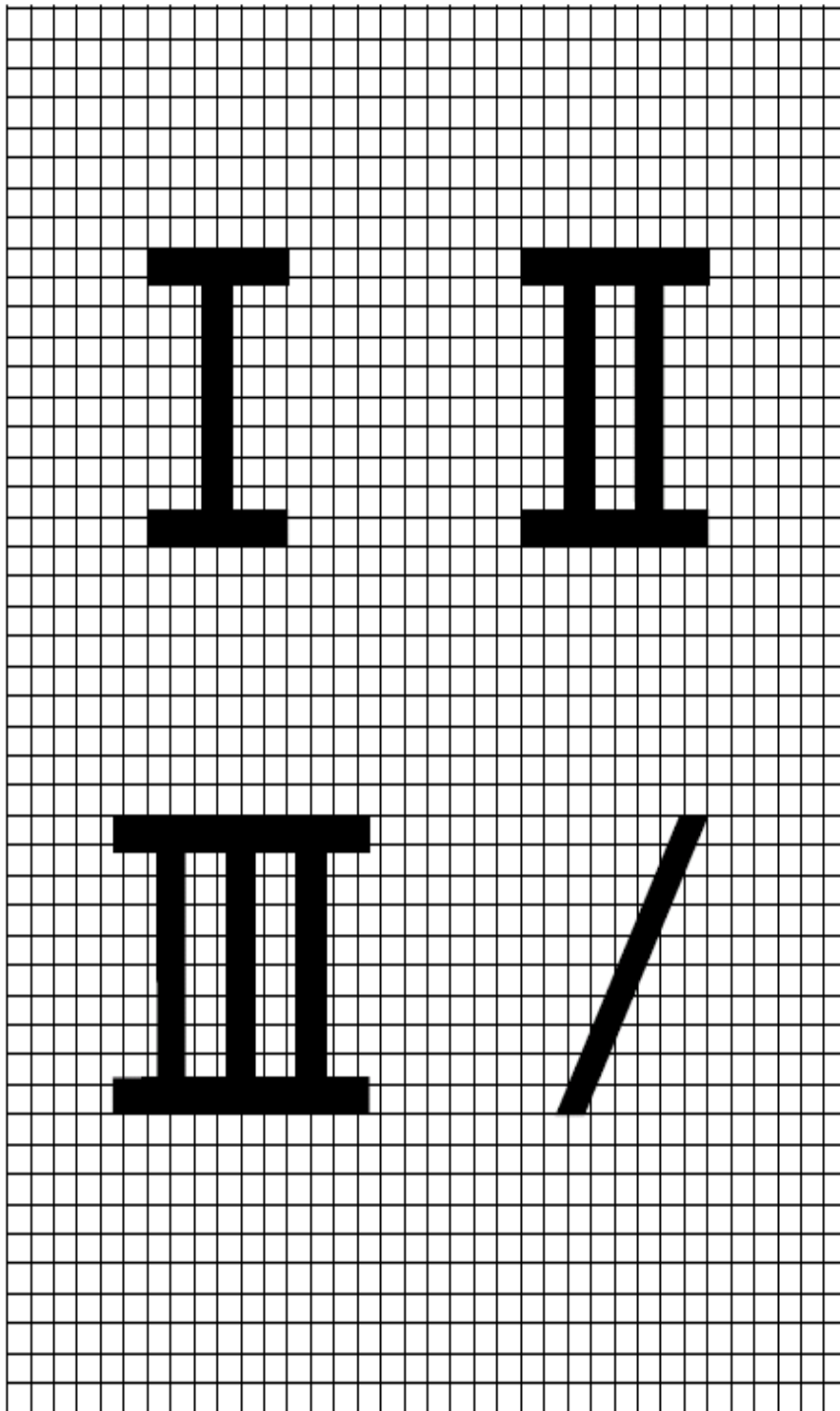
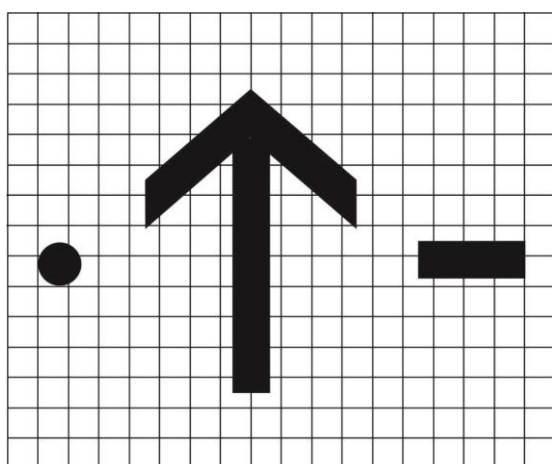
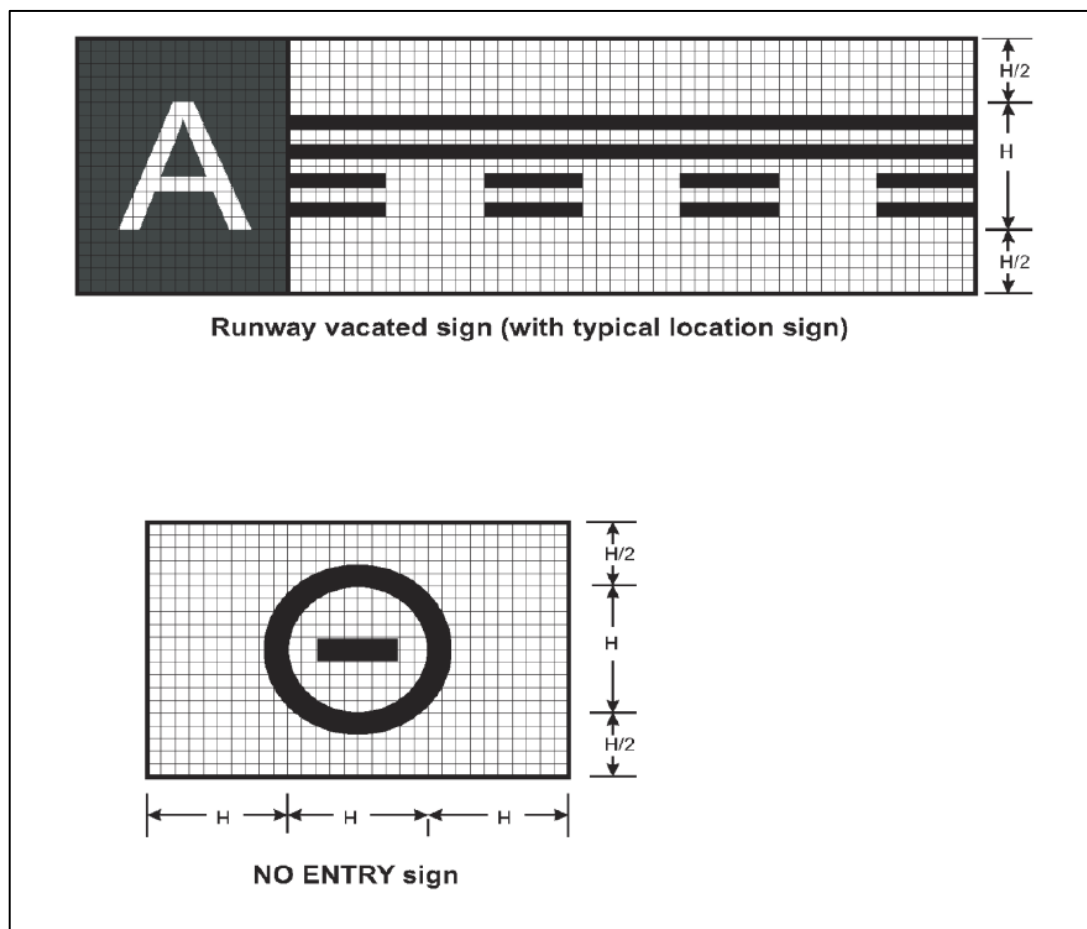


Figure App 11-2 (cont.)



Arrow, dot and dash

Note 1. – The arrow stroke width of the dot, and both width and length of the dash shall be proportional to the character stroke widths.

Note 2. – The dimensions of the arrow shall remain constant for a particular sign size, regardless of orientation.

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Table App 11-3

Letter and Numeral Widths and Space between Letters or Numerals

a) Letter to letter code number			
Preceding letter	Following letter		
	B, D, E, F, H, I, K, L, M, N, P, R, U	C, G, O, Q, S, X, Z	A, J, T, V, W, Y
	Code number		
A	2	2	4
B	1	2	2
C	2	2	3
D	1	2	2
E	2	2	3
F	2	2	3
G	1	2	2
H	1	1	2
I	1	1	2
J	1	1	2
K	2	2	3
L	2	2	4
M	1	1	2
N	1	1	2
O	1	2	2
P	1	2	2
Q	1	2	2
R	1	2	2
S	1	2	2
T	2	2	4
U	1	1	2
V	2	2	4
W	2	2	4
X	2	2	3
Y	2	2	4
Z	2	2	3

b) Numeral to numeral code letter			
Preceding Numeral	Following letter		
	1, 5	2, 3, 6, 8, 9, 0	4, 7
	Code number		
1	1	1	2
2	1	2	2
3	1	2	2
4	2	2	4
5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

c) Space between characters			
Code No	Character height (mm)		
	200	300	400
	Space		
1	48	71	96
2	38	57	76
3	25	38	50
4	13	19	26

d) Width of letter			
Letter	Letter height (mm)		
	200	300	400
	Width (mm)		
A	170	255	340
B	137	205	274
C	137	205	274
D	137	205	274
E	124	186	248
F	124	186	248
G	137	205	274
H	137	205	274
I	32	48	64
J	127	190	254
K	140	210	280
L	124	186	248
M	157	236	314
N	137	205	274
O	143	214	286
P	137	205	274
Q	143	214	286
R	137	205	274
S	137	205	274
T	124	186	248
U	137	205	274
V	152	229	304
W	178	267	356
X	137	205	274
Y	171	257	342
Z	137	205	274

e) Width of numeral			
Numeral	Numeral height (mm)		
	200	300	400
	Width (mm)		
1	50	74	98
2	137	205	274
3	137	205	274
4	149	224	298
5	137	205	274
6	137	205	274
7	137	205	274
8	137	205	274
9	137	205	274
0	143	214	286

f) Spacing between characters for markings			
Code No	Character length		
	2 m	4 m	
	Space (mm)		
1	200	400	
2	150	300	
3	100	200	
4	50	100	

Instructions

- To determine the proper SPACE between letters or numerals, obtain the code number from table a) or b) and enter table c) for that code number to the desired letter or numeral height.
- The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.7 of the height of the characters used except that where an arrow is located with a single character such as 'A →' the space may be reduced to not less than one quarter of the height of the character in order to provide a good visual balance.
- Where the numeral follows a letter or vice versa, use code 1.
- Where a hyphen, dot or diagonal stroke follows a character or vice versa use code 1.
- For the intersection take-off sign, the height of the lower case "m" is 0.75 of the height of the preceding "0" (zero) and spaced from the preceding "0" at code 1 for the character height of the numerals.



#### 11.1.2.10 Colours for Signs and Panels

11.1.2.11 The colours of signs shall be in accordance with the specifications of this Appendix.

11.1.2.12 The only signs on the Movement Area utilizing red shall be mandatory instruction signs.

*Note 1: The specifications of surface colours given below apply only to freshly coloured surfaces. Colours used for, signs and panels usually change with time and therefore require renewal.*

*Note 2: Guidance on surface colours is contained in the CIE document entitled Recommendations for Surface Colours for Visual Signalling — Publication No. 39-2 (TC-106) 1983.*

*Note 3: The specifications recommended in Clause 11.1.3.4 below for transilluminated panels are interim in nature and are based on the CIE specifications for transilluminated signs. It is intended that these specifications will be reviewed and updated as and when CIE develops specifications for transilluminated panels*

11.1.2.13 The chromaticities and luminance factors of ordinary colours, colours of retro-reflective materials and colours of transilluminated (internally illuminated) signs and panels shall be determined under the following standard conditions:

- a) Angle of illumination: 45°;
- b) Direction of view: perpendicular to surface; and
- c) Illuminant: CIE standard illuminant D65.

The chromaticity and luminance factors of ordinary colours for markings and externally illuminated signs and panels should be within the following boundaries when determined under standard conditions.

*CIE Equations (see Figure App 11-3):*

- a) Red
  - Purple boundary  $y = 0.345 - 0.051x$
  - White boundary  $y = 0.910 - x$
  - Orange boundary  $y = 0.314 + 0.047x$
  - Luminance factor  $\beta = 0.07 \text{ (mnm)}$
- b) Orange
  - Red boundary  $y = 0.285 + 0.100x$
  - White boundary  $y = 0.940 - x$



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	Yellow boundary	$y = 0.250 + 0.220x$
	Luminance factor	$\beta = 0.20 \text{ (mnm)}$
c)	Yellow	
	Orange boundary	$y = 0.108 + 0.707x$
	White boundary	$y = 0.910 - x$
	Green boundary	$y = 1.35x - 0.093$
	Luminance factor	$\beta = 0.45 \text{ (mnm)}$
d)	White	
	Purple boundary	$y = 0.010 + x$
	Blue boundary	$y = 0.610 - x$
	Green boundary	$y = 0.030 + x$
	Yellow boundary	$y = 0.710 - x$
	Luminance factor	$\beta = 0.75 \text{ (mnm)}$
e)	Black	
	Purple boundary	$y = x - 0.030$
	Blue boundary	$y = 0.570 - x$
	Green boundary	$y = 0.050 + x$
	Yellow boundary	$y = 0.740 - x$
	Luminance factor	$\beta = 0.03 \text{ (max)}$
f)	Yellowish green	
	Green boundary	$y = 1.317x + 0.4$
	White boundary	$y = 0.910 - x$
	Yellow boundary	$y = 0.867x + 0.4$
g)	Green	
	Yellow boundary	$x = 0.313$
	White boundary	$y = 0.243 + 0.670x$
	Blue boundary	$y = 0.493 - 0.524x$
	Luminance factor	$\beta = 0.10 \text{ (mnm)}$

*Note: The small separation between surface red and surface orange is not sufficient to ensure the distinction of these colours when seen separately.*

11.1.2.14 The chromaticity and luminance factors of colours of retro-reflective materials for markings, signs and panels should be within the following boundaries when determined under standard conditions.

CIE Equations (see Figure App 11-4):

a)	Red	
	Purple boundary	$y = 0.345 - 0.051x$
	White boundary	$y = 0.910 - x$



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<i>Orange boundary</i>	$y = 0.314 + 0.047x$
<i>Luminance factor</i>	$\beta = 0.03 \text{ (mnm)}$
b) <i>Orange</i>	
<i>Red boundary</i>	$y = 0.265 + 0.205x$
<i>White boundary</i>	$y = 0.910 - x$
<i>Yellow boundary</i>	$y = 0.207 + 0.390x$
<i>Luminance factor</i>	$\beta = 0.14 \text{ (mnm)}$
c) <i>Yellow</i>	
<i>Orange boundary</i>	$y = 0.160 + 0.540x$
<i>White boundary</i>	$y = 0.910 - x$
<i>Green boundary</i>	$y = 1.35x - 0.093$
<i>Luminance factor</i>	$\beta = 0.16 \text{ (mnm)}$
d) <i>White</i>	
<i>Purple boundary</i>	$y = x$
<i>Blue boundary</i>	$y = 0.610 - x$
<i>Green boundary</i>	$y = 0.040 + x$
<i>Yellow boundary</i>	$y = 0.710 - x$
<i>Luminance factor</i>	$\beta = 0.27 \text{ (mnm)}$
e) <i>Blue</i>	
<i>Green boundary</i>	$y = 0.118 + 0.675x$
<i>White boundary</i>	$y = 0.370 - x$
<i>Purple boundary</i>	$y = 1.65x - 0.187$
<i>Luminance factor</i>	$\beta = 0.01 \text{ (mnm)}$
f) <i>Green</i>	
<i>Yellow boundary</i>	$y = 0.711 - 1.22x$
<i>White boundary</i>	$y = 0.243 + 0.670x$
<i>Blue boundary</i>	$y = 0.405 - 0.243x$
<i>Luminance factor</i>	$\beta = 0.03 \text{ (mnm)}$

11.1.2.15 The chromaticity and luminance factors of colours for luminescent or transilluminated (internally illuminated) signs and panels shall be within the following boundaries when determined under standard conditions.

CIE Equations (see Figure App 11-5):

a) <i>Red</i>	
<i>Purple boundary</i>	$y = 0.345 - 0.051x$
<i>White boundary</i>	$y = 0.910 - x$
<i>Orange boundary</i>	$y = 0.314 + 0.047x$
<i>Luminance factor</i>	$\beta = 0.07 \text{ (mnm)}$
<i>(day condition)</i>	
<i>Relative luminance</i>	5% (mnm)



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<i>to white (night condition)</i>	<i>20% (max)</i>
b) <i>Yellow</i>	
<i>Orange boundary</i>	$y = 0.108 + 0.707x$
<i>White boundary</i>	$y = 0.910 - x$
<i>Green boundary</i>	$y = 1.35x - 0.093$
<i>Luminance factor (day condition)</i>	$\beta = 0.45 \text{ (mnm)}$
<i>Relative luminance to white (night condition)</i>	<i>30% (mnm)</i> <i>80% (max)</i>
c) <i>White</i>	
<i>Purple boundary</i>	$y = 0.010 + x$
<i>Blue boundary</i>	$y = 0.610 - x$
<i>Green boundary</i>	$y = 0.030 + x$
<i>Yellow boundary</i>	$y = 0.710 - x$
<i>Luminance factor (day condition)</i>	$\beta = 0.75 \text{ (mnm)}$
<i>Relative luminance to white (night condition)</i>	<i>100%</i>
d) <i>Black</i>	
<i>Purple boundary</i>	$y = x - 0.030$
<i>Blue boundary</i>	$y = 0.570 - x$
<i>Green boundary</i>	$y = 0.050 + x$
<i>Yellow boundary</i>	$y = 0.740 - x$
<i>Luminance factor (day condition)</i>	$\beta = 0.03 \text{ (max)}$
<i>Relative luminance to white (night condition)</i>	<i>0% (mnm)</i> <i>2% (max)</i>
e) <i>Green</i>	
<i>Yellow boundary</i>	$x = 0.313$
<i>White boundary</i>	$y = 0.243 - 0.670x$
<i>Blue boundary</i>	$y = 0.493 - 0.524x$
<i>Luminance factor (day condition)</i>	$\beta = 0.10 \text{ (mnm)}$
<i>Relative luminance to white (night condition)</i>	<i>5% (mnm)</i> <i>30% (max)</i>



Figure App 11-3

Ordinary Colours for Markings and Externally Illuminated Signs and Panels

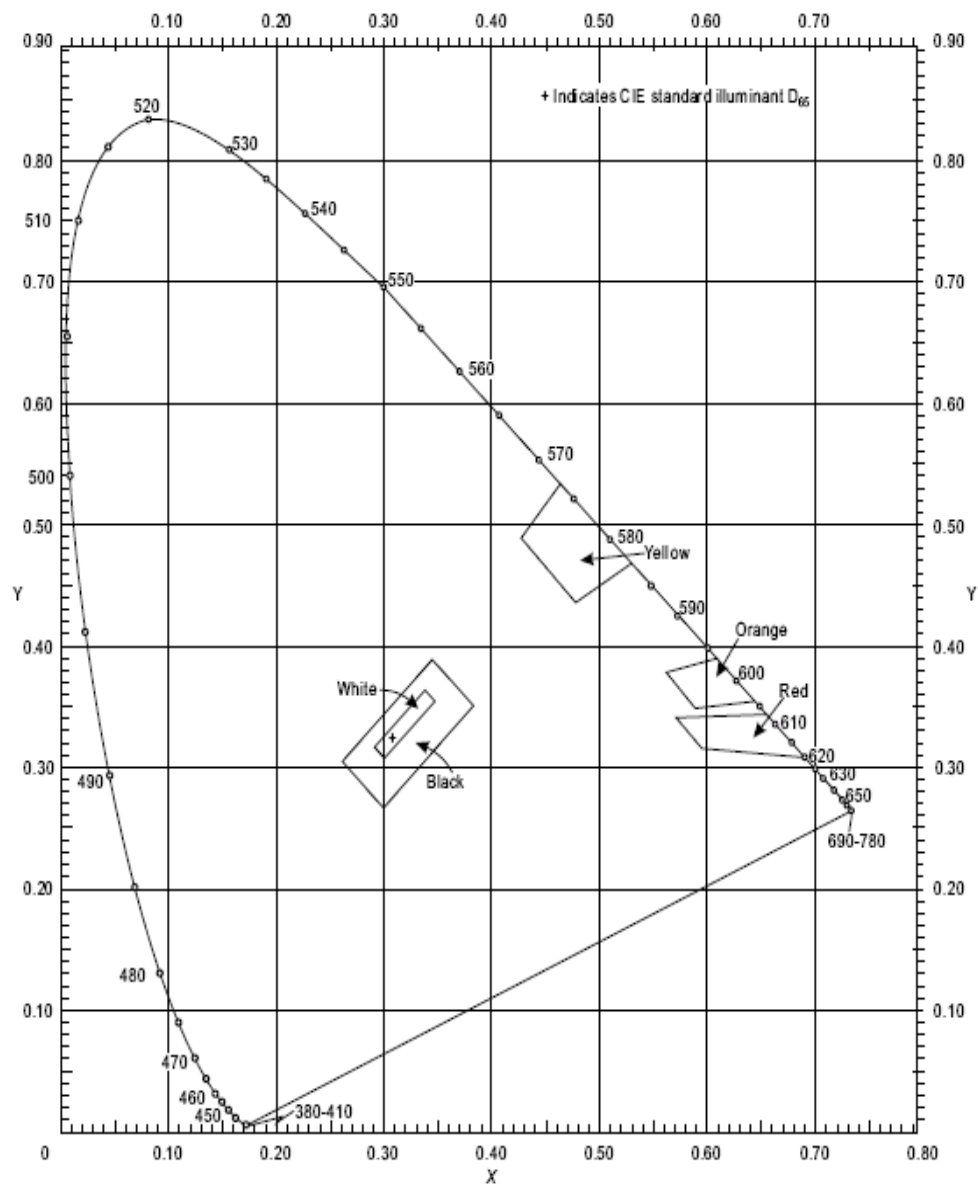


Figure App 11-4

Colours of Retro-Reflective Materials for Markings, Signs and Panels

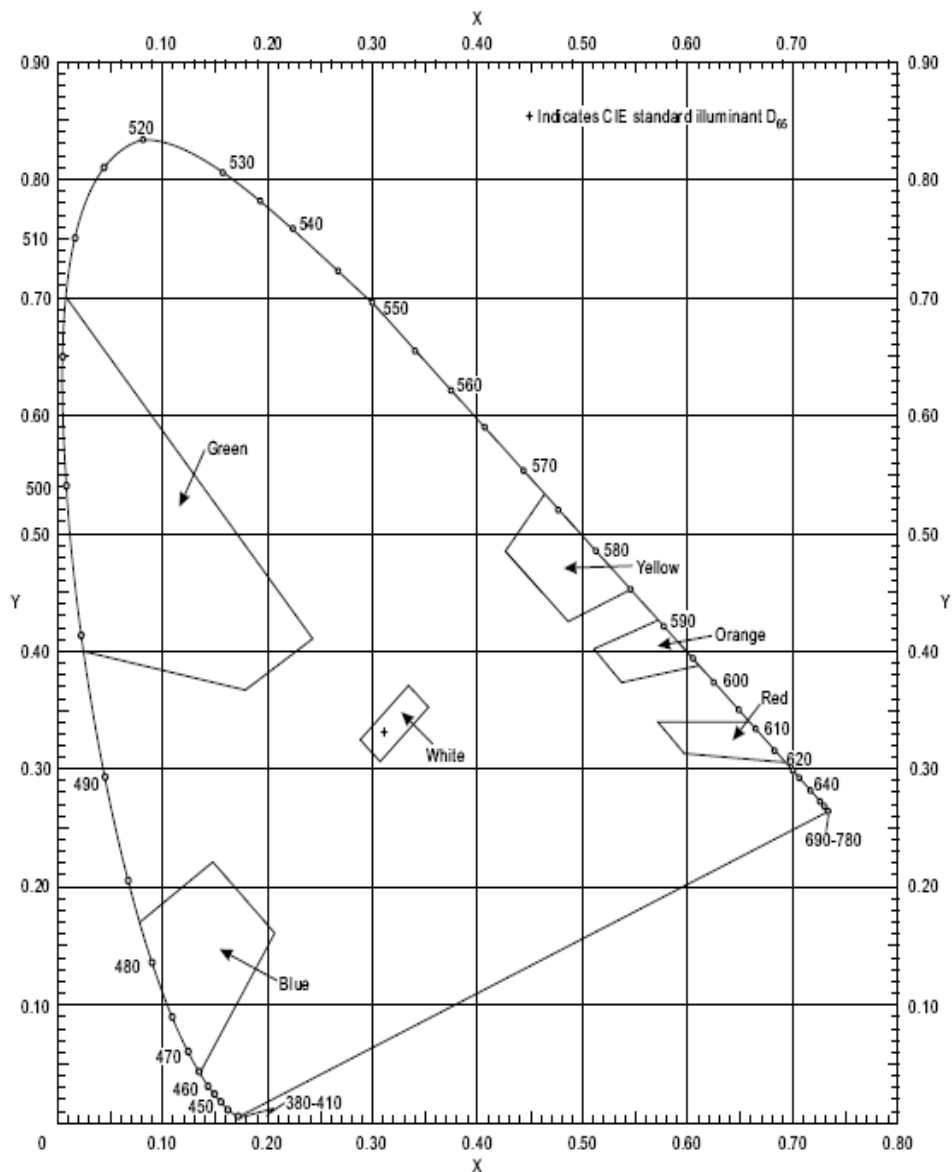
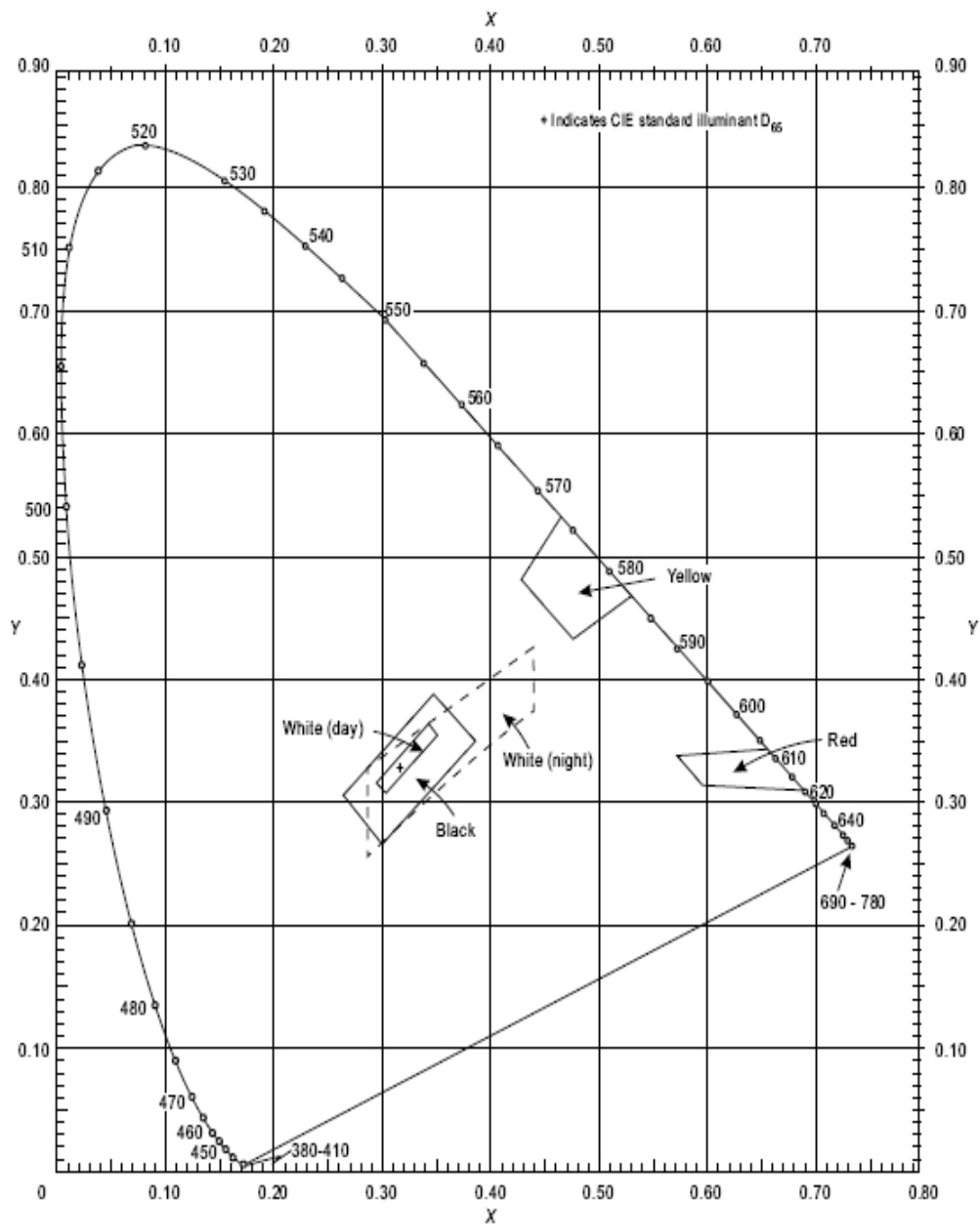


Figure App 11-5

Colours of Luminescent or Transilluminated (internally illuminated) Signs and Panels





### 11.1.3 Illumination

#### 11.1.3.1 Signs shall be illuminated when intended for use:

- a) in Runway Visual Range conditions less than a value of 800 m;
- b) at night in association with Instrument Runways;
- c) at night in association with Non-Instrument Runways where the Code Number is 3 or 4.

#### 11.1.3.2 Signs shall be retroreflective and/or illuminated in accordance with the provisions of this Appendix when intended for use at night in association with Non-Instrument Runways where the Code Number is 1 or 2.

#### 11.1.3.3 Sign luminance shall be as follows:

- a) Where operations are conducted in Runway Visual Range conditions less than a value of 800 m, average sign luminance shall be at least:

Red	30 cd/m <sup>2</sup>
Yellow	150 cd/m <sup>2</sup>
White	300 cd/m <sup>2</sup>

- b) Where operations are conducted with Instrument Runways at night or with non Instrument Runways at night, average sign luminance shall be at least:

Red	10 cd/m <sup>2</sup>
Yellow	50 cd/m <sup>2</sup>
White	100 cd/m <sup>2</sup>

*Note: In Runway Visual Range conditions less than a value of 400 m, there will be some degradation in the performance of signs.*

#### 11.1.3.4 The luminance ratio between red and white elements of a mandatory sign shall be between 1:5 and 1:10.

#### 11.1.3.5 The average luminance of the sign is calculated by establishing grid points as shown in Figure App 11-6 and using the luminance values measured at all grid points located within the rectangle representing the sign.

#### 11.1.3.6 The average value is the arithmetic average of the luminance values measured at all considered grid points.



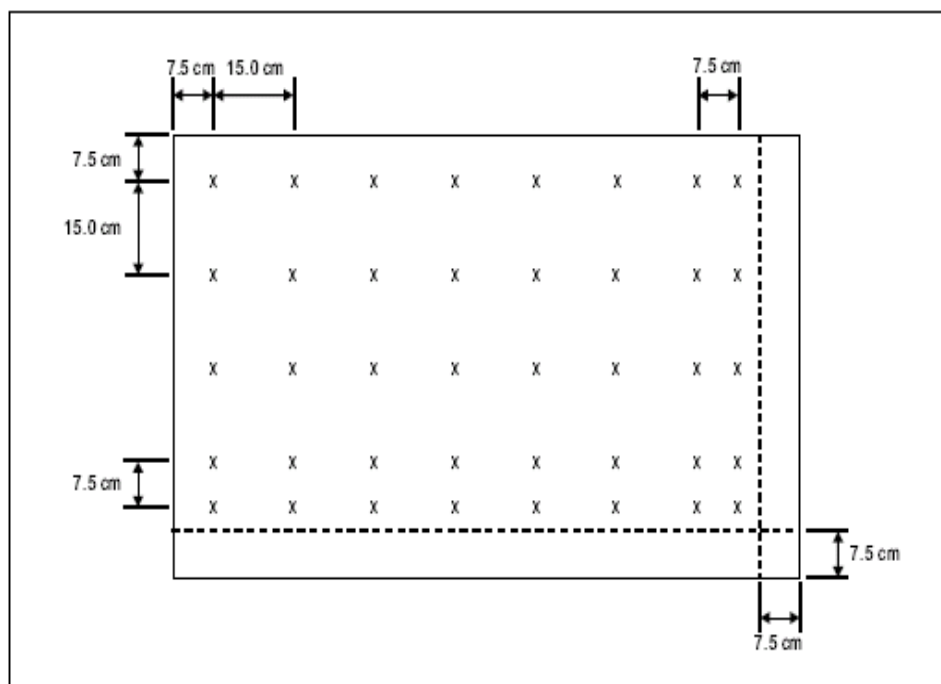
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*Note: Guidance on measuring the average luminance of a sign is contained in the Aerodrome Design Manual, Part 4 (ICAO Doc 9157).*

- 11.1.3.7 The ratio between luminance values of adjacent grid points shall not exceed 1.5:1. For areas on the sign face where the grid spacing is 7.5 cm, the ratio between luminance values of adjacent grid points shall not exceed 1.25:1. The ratio between the maximum and minimum luminance value over the whole sign face shall not exceed 5:1.

**Figure App 11-6**

## Grid Points for Calculating Average Luminance of a Sign



*Note 1.— The average luminance of a sign is calculated by establishing grid points on a sign face showing typical inscriptions and a background of the appropriate colour (red for mandatory instruction signs and yellow for direction and destination signs) as follows:*

- Starting at the top left corner of the sign face, establish a reference grid point at 7.5 cm from the left edge and the top of the sign face.*
- Create a grid of 15 cm spacing horizontally and vertically from the reference grid point. Grid points within 7.5 cm of the edge of the sign face shall be excluded.*
- Where the last point in a row/column of grid points is located between 22.5 cm and 15 cm from the edge of the sign face (but not inclusive), an additional point shall be added 7.5 cm from this point.*
- Where a grid point falls on the boundary of a character and the background, the grid point shall be slightly shifted to be completely outside the character.*

*Note 2.— Additional grid points may be required to ensure that each character includes at least five evenly spaced grid points.*

*Note 3.— Where one unit includes two types of signs, a separate grid shall be established for each type.*

## 11.2 VARIABLE SIGNS

- 11.2.1 A variable message sign shall show a blank face when not in use.
- 11.2.2 In case of failure, a variable message sign shall not provide information that could lead to unsafe action from a pilot or a vehicle driver.
- 11.2.3 The time interval to change from one message to another on a variable message sign shall not exceed 5 seconds.



### 11.3 MANDATORY INSTRUCTION SIGNS

#### 11.3.1 Application

- 11.3.1.1 A mandatory instruction sign shall be provided to identify a location beyond which an aircraft taxiing or vehicle shall not proceed unless authorised by the Air Traffic Services Unit.
- 11.3.1.2 Mandatory instruction signs shall include runway designation signs, Category I, II or III holding position signs, runway-holding position signs, road-holding position signs and NO ENTRY signs. Mandatory Instruction Signs shall include Intermediate Holding Positions when it is part of a surface movement and guidance control system used to provide traffic control by visual means.
- 11.3.1.3 A Pattern "A" runway-holding position marking shall be supplemented at a taxiway/runway intersection or a runway/ runway intersection with a runway designation sign. If the runway holding position is designated as a Category I, II or III holding position, the marking shall be supplemented with a Category I, II or III holding position sign.
- 11.3.1.4 A Pattern "B" runway-holding position marking shall be supplemented with a Category I, II or III holding position sign.
- 11.3.1.5 A Pattern "A" runway-holding position marking at a runway-holding position established in accordance with Appendix 8, 8.5.1.3 shall be supplemented with a runway-holding position sign.
- 11.3.1.6 A runway designation sign at a taxiway/runway intersection shall be supplemented with a location sign in the outboard (farthest from the taxiway) position, as appropriate.
- 11.3.1.7 A NO ENTRY sign shall be provided when entry into an area is prohibited.
- 11.3.1.8 Where a stop bar is provided as per 9.21.3, mandatory instruction signs shall be provided at an Intermediate Holding Position.

#### 11.3.2 Location

- 11.3.2.1 A runway designation sign at a taxiway/runway intersection or a runway/runway intersection shall be located on each side of the runway-holding position marking facing the direction of approach to the runway.
- 11.3.2.2 A Category I, II or III holding position sign shall be located on each side of the runway-holding position marking facing the direction of the approach to the critical area.



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- 11.3.2.3 A NO ENTRY sign shall be located at the beginning of the area to which entrance is prohibited on each side of the taxiway as viewed by the pilot.
- 11.3.2.4 A runway-holding position sign shall be located on each side of the runway-holding position established in accordance with Appendix 8, 8.5.1.3, facing the approach to the obstacle limitation surface or ILS/MLS critical/sensitive area, as appropriate.
- 11.3.2.5 A mandatory instruction sign, where provided, at an intermediate holding position shall be located on each side of the taxiway holding position.
- 11.3.3 **Characteristics**
- 11.3.3.1 A mandatory instruction sign shall consist of an inscription in white on a red background.
- 11.3.3.2 The inscription on a runway designation sign shall consist of the runway designations of the intersecting runway properly oriented with respect to the viewing position of the sign, except that a runway designation sign installed in the vicinity of a runway extremity may show the runway designation of the concerned runway extremity only.
- 11.3.3.3 The inscription on a Category I, II, III, joint I/II/III or joint II/III holding position sign shall consist of the runway designator followed by CAT I, CAT II, CAT III or CAT I/II/III or CAT II/III, as appropriate.
- 11.3.3.4 The inscription on a NO ENTRY sign shall be in accordance with Figure App 11-7.
- 11.3.3.5 The inscription on a runway-holding position sign at a runway-holding position established in accordance with Appendix 8, 8.5.1.3 shall consist of the taxiway designation and a number.
- 11.3.3.6 Where installed, the following inscriptions/ symbol shall be used:





Figure App 11-7

### Mandatory Instruction Signs

Runway designation of a runway extremity (Example)	<b>25</b>	Indicates a runway-holding position at a runway extremity
Runway designation of both extremities of a runway (Example)	<b>25-07</b>	Indicates a runway-holding position located at taxiway/runway intersection other than runway extremity
Category I hold position (Example)	<b>25 CAT I</b>	Indicates a category I runway-holding position at the threshold of runway 25
Category II hold position (Example)	<b>25 CAT II</b>	Indicates a category II runway-holding position at the threshold of runway 25
Category III hold position (Example)	<b>25 CAT III</b>	Indicates a category III runway-holding position at the threshold of runway 25
Category II and III hold position (Example)	<b>25 CAT II/III</b>	Indicates a joint category II and III runway-holding position at the threshold of runway 25
Category I, II and III hold position (Example)	<b>25 CAT I/II/III</b>	Indicates a joint category I, II and III runway-holding position at the threshold of runway 25
NO ENTRY		Indicates that entry to an area is prohibited
Holding position (Example)	<b>B2</b>	Indicates a holding position established in accordance with Appendix 8, 8.5.1.3 or Appendix 11, 11.3.1.

Figure App 11-8

Information Signs

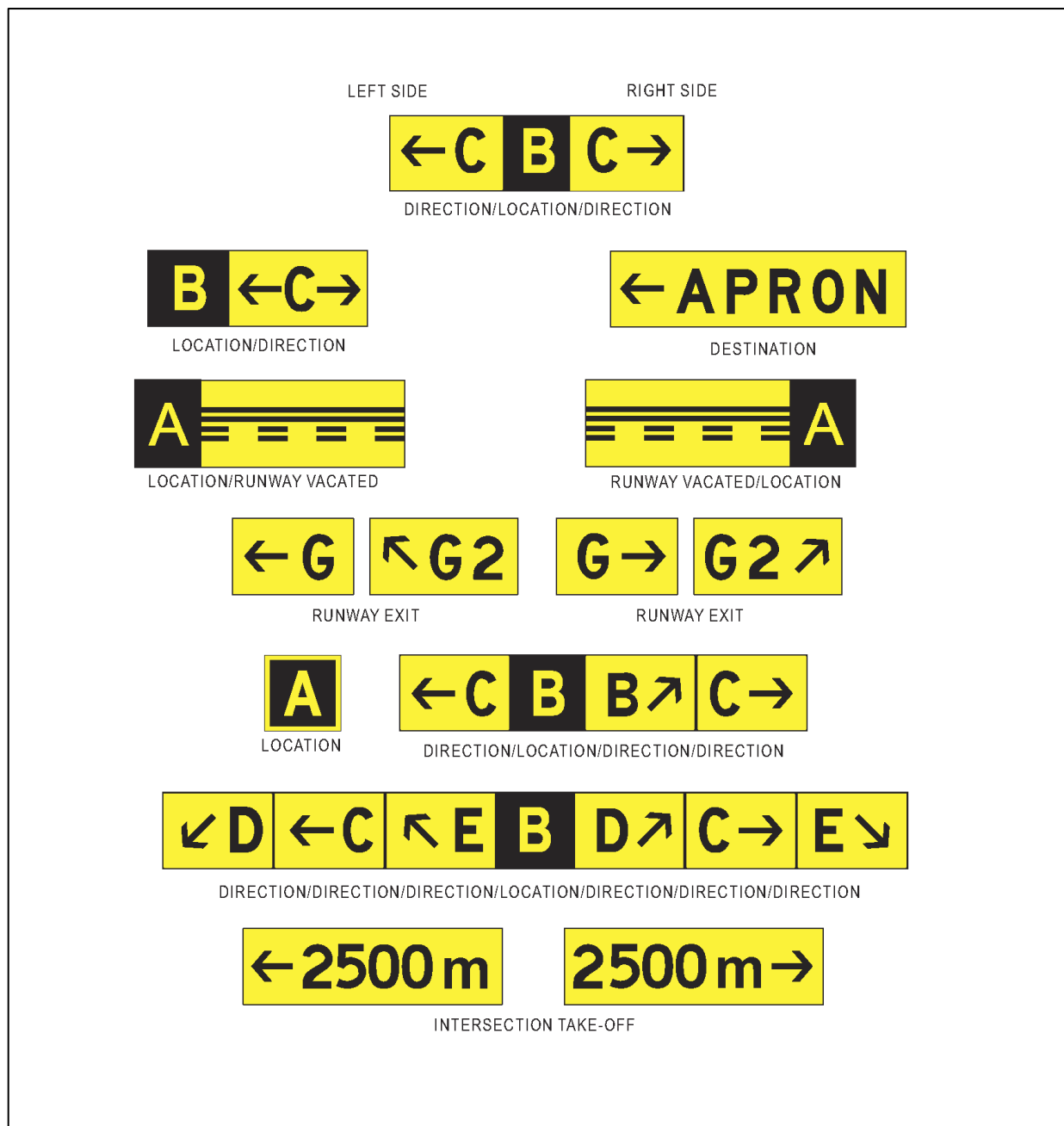


Figure App 11-9

Examples of Sign Positions at Taxiway/Runway Intersections

NON-INSTRUMENT, NON-PRECISION, TAKE-OFF RUNWAYS	
PRECISION APPROACH RUNWAYS	
CATEGORY I	
CATEGORY I CATEGORY II/III	
CATEGORY I/II/III	

*Note 1: Distance X is established in accordance with Table App 8-2. Distance Y is established in accordance with Table App 8-2 for a precision approach runway or at the edge of the ILS critical area, whichever is further.*

*Note 2: For guidance on critical/sensitive areas see ICAO Annex 10 (Aeronautical Communications) Vol. 1.*



## **11.4 INFORMATION SIGNS**

### **11.4.1 Application**

- 11.4.1.1 An information sign shall be provided where there is an operational need to identify by a sign, a specific location or routing (direction or destination) information.
- 11.4.1.2 Information signs shall include: direction signs, location signs including aircraft stand identification sign, INS sign and VOR checkpoint sign, destination signs, runway exit signs, runway vacated signs and intersection take-off signs.
- 11.4.1.3 A runway exit sign shall be provided where there is an operational need to identify a runway exit.
- 11.4.1.4 A runway vacated sign shall be provided where the exit taxiway is not provided with taxiway centre line lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the Inner Transitional Surface whichever is farther from the runway centre line.
- 11.4.1.5 An intersection take-off sign shall be provided when there is an operational need to indicate the remaining Take-off Run Available (TORA) for intersection take-offs.
- 11.4.1.6 Where multiple aprons are provided, or elsewhere considered to be operationally necessary a destination sign shall be provided to indicate the direction to a specific destination on the aerodrome, such as cargo area, general aviation, etc.
- 11.4.1.7 A combined location and direction sign shall be provided when it is intended to indicate routing information prior to a taxiway intersection.
- 11.4.1.8 A direction sign shall be provided when there is an operational need to identify the designation and direction of taxiways at an intersection.
- 11.4.1.9 A location sign shall be provided at an Intermediate Holding Position. Where a stop bar is provided at an Intermediate Holding Position as per 9.21.3, mandatory instruction signs shall be provided at an Intermediate Holding Position.
- 11.4.1.10 A location sign shall be provided in conjunction with a runway designation sign except at a runway/runway intersection.
- 11.4.1.11 A location sign shall be provided in conjunction with a direction sign, except that it may be omitted where an Aeronautical Study indicates that it is not needed and it is approved by the Authority.
- 11.4.1.12 Where necessary, a location sign shall be provided to identify taxiways exiting an apron or taxiways beyond an intersection.



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- 11.4.1.13 Where a taxiway ends at an intersection such as a "T" and it is necessary to identify this, a barricade, direction sign and/or other appropriate visual aid shall be used.
- 11.4.2 **Location**
- 11.4.2.1 Except as specified in Clauses 11.4.2.3 and 11.4.2.11 information signs shall, wherever practicable, be located on the left-hand side of the taxiway in accordance with Table App 11-1.
- 11.4.2.2 At a taxiway intersection, information signs shall be located prior to the intersection and in line with the intermediate holding position marking. Where there is no intermediate holding position marking, the signs shall be installed at least 60 m from the centre line of the intersecting taxiway where the Code Number is 3 or 4 and at least 40 m where the Code Number is 1 or 2.
- 11.4.2.3 A runway exit sign shall be located on the same side of the runway as the exit is located (i.e. left or right) and positioned in accordance with Table App 11-1.
- 11.4.2.4 A runway exit sign shall be located prior to the runway exit point in line with a position at least 60 m prior to the point of tangency where the Code Number is 3 or 4, and at least 30 m where the Code Number is 1 or 2.
- 11.4.2.5 A runway vacated sign shall be located at least on one side of the taxiway. The distance between the sign and the centre line of a runway shall be not less than the greater of the following:
- a) the distance between the centre line of the runway and the perimeter of the ILS/MLS critical/sensitive area; or
  - b) the distance between the centre line of the runway and the lower edge of the Inner Transitional Surface.
- 11.4.2.6 Where provided in conjunction with a runway vacated sign, the taxiway location sign shall be positioned outboard of the runway vacated sign.
- 11.4.2.7 An intersection take-off sign shall be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway shall be not less than 60 m where the Code Number is 3 or 4 and not less than 45 m where the Code Number is 1 or 2.
- 11.4.2.8 A taxiway location sign installed in conjunction with a runway designation sign shall be positioned outboard of the runway designation sign.
- 11.4.2.9 A destination sign should not normally be co-located with a location or direction sign.



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- 11.4.2.10 An information sign other than a location sign shall not be collocated with a mandatory instruction sign.
- 11.4.2.11 A direction sign, barricade and/or other appropriate visual aid used to identify a “T” intersection shall be located on the opposite side of the intersection facing the taxiway.
- 11.4.3 **Characteristics**
- 11.4.3.1 An information sign other than a location sign shall consist of an inscription in black on a yellow background.
- 11.4.3.2 A location sign shall consist of an inscription in yellow on a black background and where it is a stand-alone sign shall have a yellow border.
- 11.4.3.3 The inscription on a runway exit sign shall consist of the designator of the exit taxiway and an arrow indicating the direction to follow.
- 11.4.3.4 The inscription on a runway vacated sign shall depict the Pattern A runway-holding position marking as shown in Figure App 11-8.
- 11.4.3.5 The inscription on an intersection take-off sign shall consist of a numerical message indicating the remaining Take-off Run Available in metres plus an arrow, appropriately located and oriented, indicating the direction of the take-off as shown in Figure App 11 – 8.
- 11.4.3.6 The inscription on a destination sign shall comprise an alpha, alphanumerical or numerical message identifying the destination plus an arrow indicating the direction to proceed as shown in Figure App 11-8.
- 11.4.3.7 The inscription on a direction sign shall comprise an alpha or alphanumerical message identifying the taxiway(s) plus an arrow or arrows appropriately oriented as shown in Figure App 11-8.
- 11.4.3.8 The inscription on a location sign shall comprise the designation of the location taxiway, runway or other pavement the aircraft is on or is entering and shall not contain arrows.
- 11.4.3.9 Where it is necessary to identify each of a series of Intermediate Holding Positions on the same taxiway, the location sign shall consist of the taxiway designation and a number.
- 11.4.3.10 Where a location sign and direction signs are used in combination:
- a) all direction signs related to left turns shall be placed on the left side of the location sign and all direction signs related to right turns shall be



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placed on the right side of the location sign, except that where the junction consists of one intersecting taxiway, the location sign may alternatively be placed on the left hand side;

- b) the direction signs shall be placed such that the direction of the arrows departs increasingly from the vertical with increasing deviation of the corresponding taxiway;
- c) an appropriate direction sign shall be placed next to the location sign where the direction of the location taxiway changes significantly beyond the intersection; and
- d) adjacent direction signs shall be delineated by a vertical black line as shown in Figure App 11-8.

11.4.3.11 A taxiway shall be identified by a designator that is used only once on an aerodrome comprising a letter, letters or a combination of a letter or letters followed by a number.

11.4.3.12 When designating taxiways, words such as inner and outer shall not be used.

11.4.3.13 When designating taxiways, the letters I, O, X shall not be used to avoid confusion with the numerals 1, 0 and closed marking.

11.4.3.14 Apron stand designators should not be the same as taxiway designators.

11.4.3.15 The use of numbers alone on the Manoeuvring Area shall be reserved for the designation of runways.

### 11.5 VOR AERODROME CHECKPOINT SIGN

#### 11.5.1 Application

When a VOR aerodrome checkpoint is established, it shall be indicated by a VOR aerodrome checkpoint marking and sign.

#### 11.5.2 Location

A VOR aerodrome checkpoint sign shall be located as near as possible to the checkpoint and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome checkpoint marking.

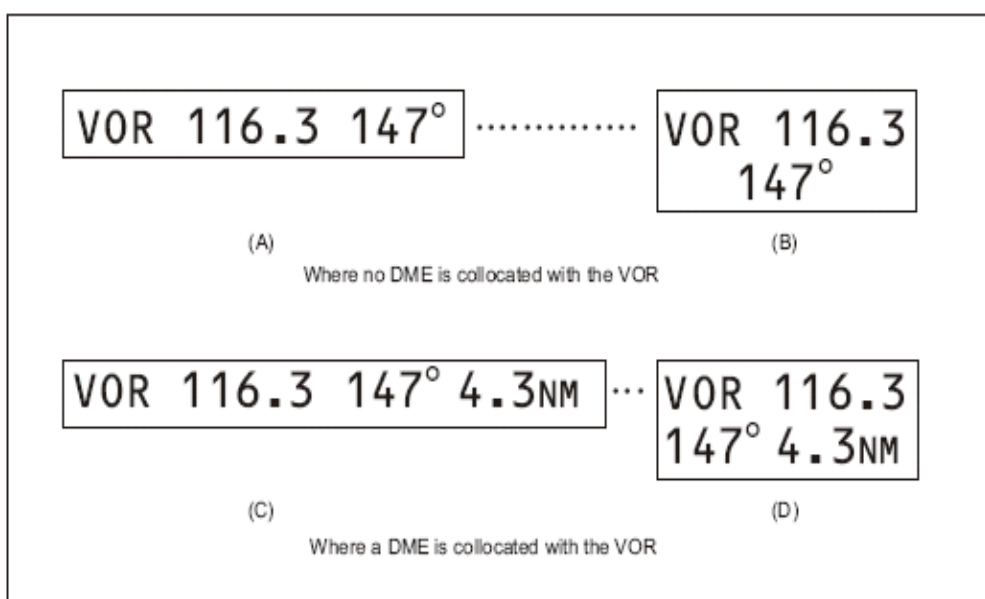
### 11.5.3 Characteristics

- 11.5.3.1 A VOR aerodrome checkpoint sign shall consist of an inscription in black on a yellow background.
- 11.5.3.2 The inscriptions on a VOR checkpoint sign shall be in accordance with one of the alternatives shown in Figure App 11-10 in which:

VOR	is an abbreviation identifying this as a VOR checkpoint;
116.3	is an example of the radio frequency of the VOR concerned;
147°	is an example of the VOR bearing, to the nearest degree, which should be indicated at the VOR checkpoint; and
4.3 NM	is an example of the distance in nautical miles to a DME collocated with the VOR concerned.

Figure App 11-10

#### VOR Aerodrome Checkpoint Sign







## **11.6 AERODROME IDENTIFICATION SIGN**

### **11.6.1 Application**

An aerodrome identification sign shall be provided at an aerodrome where there is insufficient alternative means of visual identification.

### **11.6.2 Location**

The aerodrome identification sign should be placed on the aerodrome so as to be legible, in so far as is practicable, at all angles above the horizontal.

### **11.6.3 Characteristics**

11.6.3.1 The aerodrome identification sign shall consist of the name of the aerodrome.

11.6.3.2 The colour selected for the sign should give adequate conspicuity when viewed against its background.

11.6.3.3 The characters shall have a height of not less than 3 m.

## **11.7 AIRCRAFT STAND IDENTIFICATION SIGNS**

### **11.7.1 Application**

11.7.1.1 An aircraft stand identification marking should be supplemented with an aircraft stand identification sign where a nose in guidance system is provided.

11.7.1.2 An aircraft stand identification marking should be supplemented with an aircraft stand identification sign where feasible.

### **11.7.2 Location**

Where installed, an aircraft stand identification sign shall be located so as to be clearly visible from the cockpit of an aircraft on a taxilane prior to entering the aircraft stand.

### **11.7.3 Characteristics**

11.7.3.1 An aircraft stand identification sign shall consist of an inscription in black on a yellow background.

11.7.3.2 The size of the inscription shall be such that the letters are easily distinguishable from the taxilane where the aircraft stand commences, and shall be illuminated, where the aircraft stand is utilised at night.



## **11.8 INS SIGNS**

### **11.8.1 Application**

An aircraft stand coordinate sign (INS sign) shall be provided whenever an aircraft stand identification sign is provided.

### **11.8.2 Location**

An INS sign shall be located in a position that is readably visible to the pilots occupying either the left or the right seat, and preferable at the nose of the aircraft.

### **11.8.3 Characteristics**

11.8.3.1 An INS sign shall consist of an inscription in black on a yellow background.

11.8.3.2 An INS sign inscription shall consist of the aircraft stand number and the coordinates of the aircraft stand in WGS84 format. Coordinates shall be displayed to two decimal places.

11.8.3.3 The coordinates shall be displayed on two lines with the Latitude coordinate displaying above the Longitudinal coordinate.

*Note: The aircraft stand number does not have to be included where the sign is collocated with the aircraft stand identification sign, or where no confusion can exist as to the which aircraft stand the coordinates apply.*

11.8.3.4 The coordinates displayed shall be the same as those published in the AIP Aerodrome Ground Chart. The location, for which the coordinates apply, shall be the central point where the taxiway centre line and stop block intersect, for the forward most stopping position on the aircraft stand.

## **11.9 ROAD-HOLDING POSITION SIGN**

### **11.9.1 Application**

A road-holding position sign shall be provided at all road entrances to a runway.

### **11.9.2 Location**

The road-holding position sign shall be located 1.5 m from one edge of the road (left or right as appropriate to the local traffic regulations) at the holding position.

### **11.9.3 Characteristics**

11.9.3.1 A road-holding position sign shall consist of an inscription in white on a red background.



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11.9.3.2 The inscription on a road-holding position sign shall be in English and Arabic, and include the following:

- a) a requirement to stop; and
- b) where appropriate:
  - i) a requirement to obtain ATC clearance; and
  - ii) location designator.

11.9.3.3 A road-holding position sign intended for night use shall be retroreflective or illuminated.



## APPENDIX 12

### MARKINGS AND MARKERS

#### 12.1 GENERAL

##### 12.1.1 Interruption of Runway Markings

12.1.1.1 At an intersection of two (or more) runways the markings of the more important runway, except for the runway side stripe marking, shall be displayed and the markings of the other runway(s) shall be interrupted. The runway side stripe marking of the more important runway may be either continued across the intersection or interrupted.

12.1.1.2 The order of importance of runways for the display of runway markings should be as follows:

- 1st - precision approach runway;
- 2nd - non-precision approach runway; and
- 3rd - non-Instrument Runway.

12.1.1.3 At an intersection of a runway and taxiway the markings of the runway shall be displayed and the markings of the taxiway interrupted, except that runway side stripe markings may be interrupted.

##### 12.1.2 Colour and Conspicuity

12.1.2.1 Runway markings shall be white.

12.1.2.2 Taxiway markings, runway turn pad markings and aircraft stand markings shall be yellow.

12.1.2.3 Apron safety lines shall be of a conspicuous colour which shall contrast with that used for aircraft stand markings.

12.1.2.4 At aerodromes where operations take place at night, pavement markings shall be made with reflective materials designed to enhance the visibility of the markings, except where the line is co-located with airfield ground lighting.

*Note: Guidance on reflective materials is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

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### 12.1.3 Unpaved Taxiways

- 12.1.3.1 An unpaved taxiway should be provided, so far as practicable, with the markings prescribed for paved taxiways.

## 12.2 RUNWAY DESIGNATION MARKING

### 12.2.1 Application

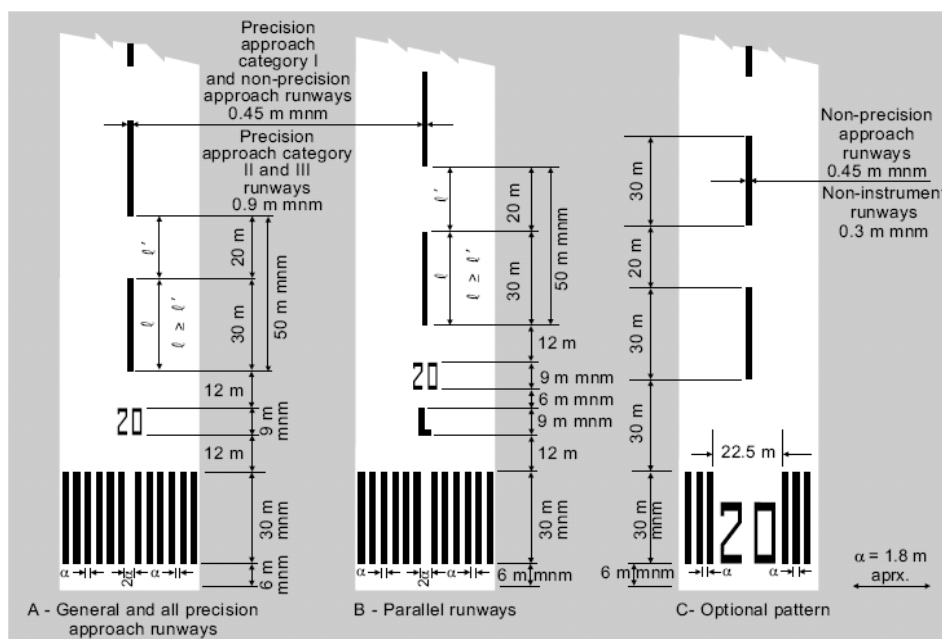
- 12.2.1.1 A runway designation marking shall be provided at the thresholds of a paved runway.
- 12.2.1.2 A runway designation marking should be provided, so far as practicable, at the thresholds of an unpaved runway.

### 12.2.2 Location

A runway designation marking shall be located at a threshold as shown in Figure App 12-1.

Figure App 12-1

Runway designation, Centre Line and Threshold Markings



### 12.2.3 Characteristics

- 12.2.3.1 A runway designation marking shall consist of a two-digit number and on parallel runways shall be supplemented with a letter. On a single runway, dual parallel



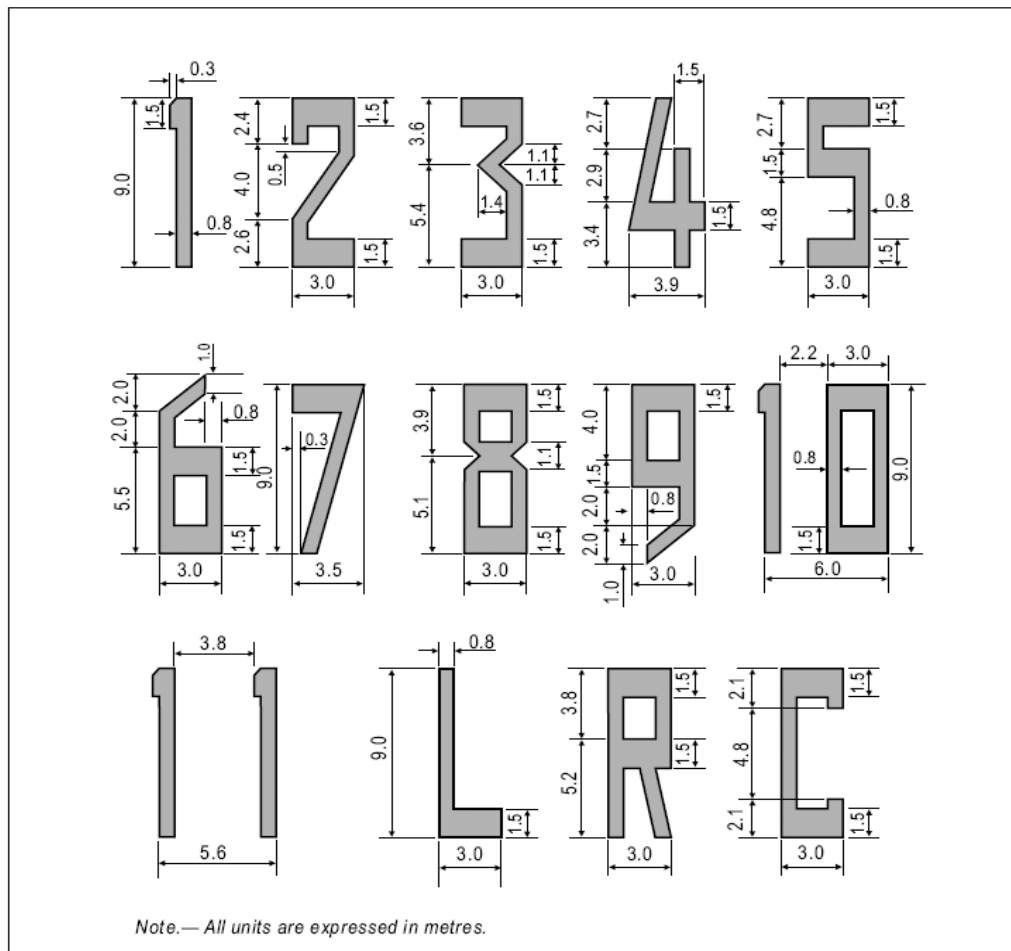
APPENDIX 12

runways and triple parallel runways the two-digit number shall be the whole number nearest the one-tenth of the magnetic North when viewed from the direction of approach. On four or more parallel runways, one set of adjacent runways shall be numbered to the nearest one-tenth magnetic azimuth and the other set of adjacent runways numbered to the next nearest one-tenth of the magnetic azimuth. When the above rule would give a single digit number, it shall be preceded by a zero.

- 12.2.3.2 In the case of parallel runways, each runway designation number shall be supplemented by a letter as follows, in the order shown from left to right when viewed from the direction of approach:
- a) for two parallel runways: "L" "R";
  - b) for three parallel runways: "L" "C" "R";
  - c) for four parallel runways: "L" "R" "L" "R";
  - d) for five parallel runways: "L" "C" "R" "L" "R" or "L" "R" "L" "C" "R"; and
  - e) for six parallel runways: "L" "C" "R" "L" "C" "R".
- 12.2.3.3 The numbers and letters shall be in the form and proportion shown in Figure App 12-2. The dimensions shall be not less than those shown in Figure App 12-2, but where the numbers are incorporated in the threshold marking, larger dimensions shall be used in order to fill adequately the gap between the stripes of the threshold marking.

Figure App 12-2

### Form and Proportions of Numbers and Letters for Runway Designation Markings



## 12.3 RUNWAY CENTRE LINE MARKING

### 12.3.1 Application

A runway centre line marking shall be provided on a paved runway.

### 12.3.2 Location

A runway centre line marking shall be located along the centre line of the runway between the runway designation markings as shown in Figure App 12-1, except when interrupted in compliance with Clause 12.1.1.



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**12.3.3 Characteristics**

12.3.3.1 A runway centre line marking shall consist of a line of uniformly spaced stripes and gaps. The length of a stripe plus a gap shall be not less than 50 m or more than 75 m. The length of each stripe shall be at least equal to the length of the gap or 30 m, whichever is greater.

12.3.3.2 The width of the stripes shall be not less than:

- a) 0.90 m on Precision Approach Category II and III runways;
- b) 0.45 m on non-precision approach runways where the Code Number is 3 or 4, and Precision Approach Category I runways; and
- c) 0.30 m on non-precision approach runways where the Code Number is 1 or 2, and on Non-Instrument Runways.

**12.4 THRESHOLD MARKING**

**12.4.1 Application**

12.4.1.1 A threshold marking shall be provided at the threshold of a paved Instrument Runway, and of a paved non- Instrument Runway where the Code Number is 3 or 4 and the runway is intended for use by international commercial air transport.

12.4.1.2 A threshold marking should be provided at the threshold of a paved non-Instrument Runway where the Code Number is 3 or 4 and the runway is intended for use by other than international commercial air transport.

12.4.1.3 A threshold marking should be provided, so far as practicable, at the thresholds of an unpaved runway.

**12.4.2 Location**

The stripes of the threshold marking shall commence 6 m from the threshold.

**12.4.3 Characteristics**

12.4.3.1 A runway threshold marking shall consist of a pattern of longitudinal stripes of uniform dimensions disposed symmetrically about the centre line of a runway as shown in Figure App 12-1 (A) and (B). The number of stripes shall be in accordance with the runway width as follows:





<i>Runway Width</i>	<i>Number of Stripes</i>
18 m	4
23 m	6
30 m	8
45 m	12
60 m	16

except that on non-precision approach and Non-Instrument Runways 45 m or greater in width, they may be as shown in Figure App 12-1 (C).

- 12.4.3.2 The stripes shall extend laterally to within 3 m of the edge of a runway or to a distance of 27 m on either side of a runway centre line, whichever results in the smaller lateral distance. Where a runway designation marking is placed above a threshold marking, the stripes shall be continued across the runway. The stripes shall be at least 30 m long and approximately 1.80 m wide with spacings of approximately 1.80 m between them except that, where the stripes are continued across a runway, a double spacing shall be used to separate the two stripes nearest the centre line of the runway, and in the case where the designation marking is included within the threshold marking this spacing shall be 22.5 m.

#### 12.4.4 **Transverse Stripe**

- 12.4.4.1 Where a threshold is displaced from the extremity of a runway or where the extremity of a runway is not square with the runway centre line, a transverse stripe as shown in Figure App 12-3 (B) should be added to the threshold marking.

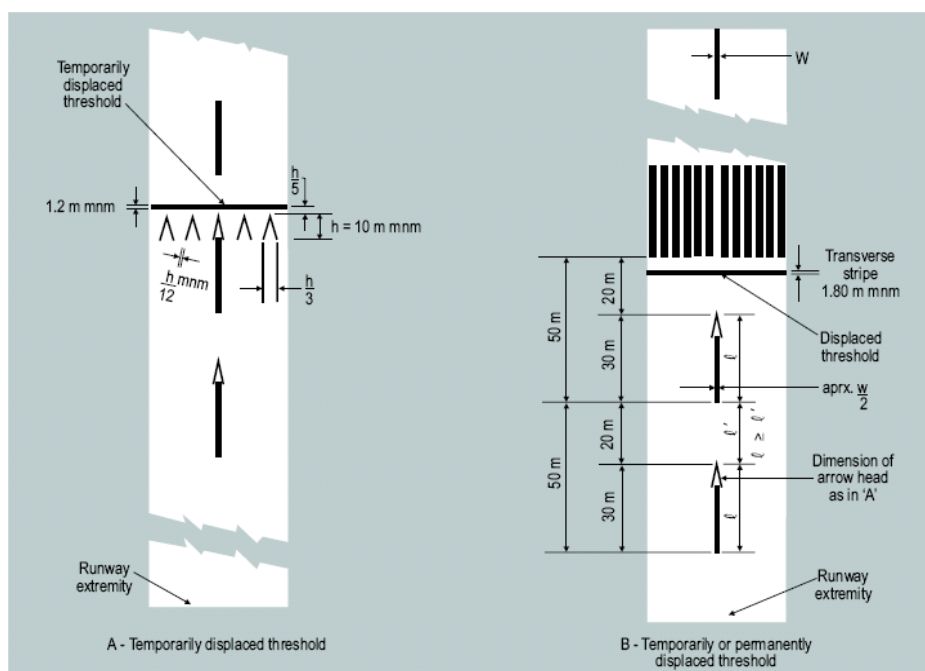
- 12.4.4.2 A transverse stripe shall be not less than 1.80 m wide.

#### 12.4.5 **Arrows**

- 12.4.5.1 Where a runway threshold is permanently displaced, arrows conforming to Figure App 12-3 (B) shall be provided on the portion of the runway before the displaced threshold.

Figure App 12-3

### Displaced Threshold Markings



- 12.4.5.2 When a runway threshold is temporarily displaced from the normal position, it shall be marked as shown in Figure App 12-3 (A) or 12-3 (B) and all markings prior to the displaced threshold shall be obscured except the runway centre line marking, which shall be converted to arrows.

## 12.5 AIMING POINT MARKING

### 12.5.1 Application

- 12.5.1.1 An aiming point marking shall be provided at each approach end of a paved Instrument Runway where the Code Number is 2, 3 or 4.

- 12.5.1.2 An aiming point marking shall be provided at each approach end of:

- a) a paved non-Instrument Runway where the Code Number is 3 or 4,
- b) a paved Instrument Runway where the Code Number is 1,

when additional conspicuity of the aiming point is desirable.



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12.5.2 **Location**

- 12.5.2.1 The aiming point marking shall commence no closer to the threshold than the distance indicated in the appropriate column of Table App 12-1, except that, on a runway equipped with a visual approach slope indicator system, the beginning of the marking shall be coincident with the visual approach slope origin.

**Table App 12-1**

**Location and Dimensions of Aiming Point Marking**

Location and dimensions	Landing Distance Available			
	Less than 800 m	800 m up to but not including 1 200 m	1 200 m up to but not including 2 400 m	2 400 m and above
(1)	(2)	(3)	(4)	(5)
Distance from threshold to beginning of marking	150 m	250 m	300 m	400 m
Length of stripe <sup>a</sup>	30–45 m	30–45 m	45–60 m	45–60 m
Width of stripe	4 m	6 m	6–10 m <sup>b</sup>	6–10 m <sup>b</sup>
Lateral spacing between inner sides of stripes	6 m <sup>c</sup>	9 m <sup>c</sup>	18–22.5 m	18–22.5 m

- a. The greater dimensions of the specified ranges are intended to be used where increased conspicuity is required.*
- b. The lateral spacing may be varied within these limits to minimize the contamination of the marking by rubber deposits.*
- c. These figures were deduced by reference to the outer main gear wheel span which is the letter component (second element) of the Aerodrome Reference Code in Appendix 7.*

- 12.5.2.2 An aiming point marking shall consist of two conspicuous stripes. The dimensions of the stripes and the lateral spacing between their inner sides shall be in accordance with the provisions of the appropriate column of Table App 12-1. Where a Touchdown Zone marking is provided, the lateral spacing between the markings shall be the same as that of the touch-down zone marking.

**12.6 TOUCHDOWN ZONE MARKING**

**12.6.1 Application**

- 12.6.1.1 A Touchdown Zone marking shall be provided in the Touchdown Zone of a paved precision approach runway where the Code Number is 2, 3 or 4.



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- 12.6.1.2 A Touchdown Zone marking should be provided in the Touchdown Zone of a paved non-precision approach or non-Instrument Runway where the Code Number is 3 or 4 and additional conspicuity of the Touchdown Zone is desirable.

12.6.2 **Location and Characteristics**

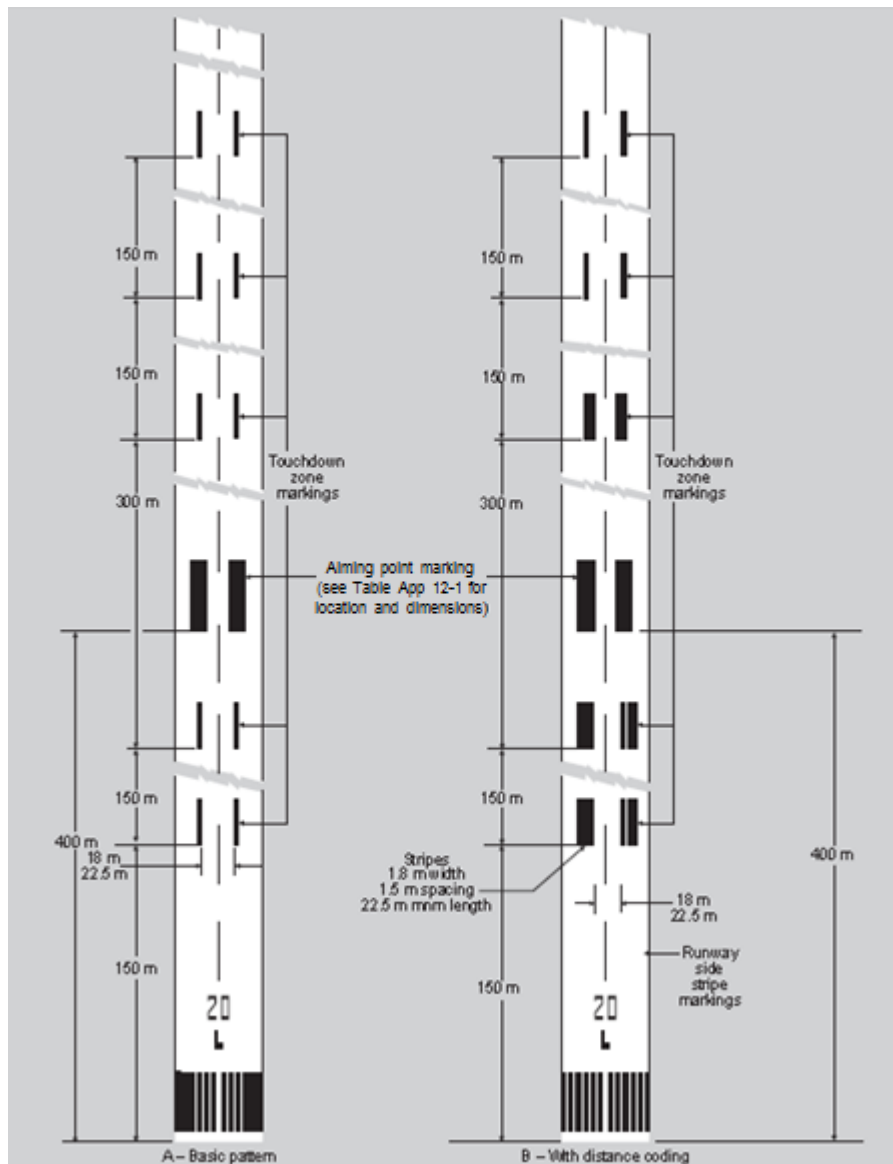
- 12.6.2.1 A Touchdown Zone marking shall consist of pairs of rectangular markings symmetrically disposed about the runway centre line with the number of such pairs related to the Landing Distance Available and, where the marking is to be displayed at both the approach directions of a runway, the distance between the thresholds, as follows:

<i>Landing Distance Available or the Distance between Thresholds</i>	<i>Pair(s) of Markings</i>
less than 900 m	1
900 m up to but not including 1 200 m	2
1 200 m up to but not including 1 500 m	3
1 500 m up to but not including 2 400 m	4
2 400 m or more	6

- 12.6.2.2 A Touchdown Zone marking shall conform to either of the two patterns shown in Figure App 12-4. For the pattern shown in Figure App 12-4 (A), the markings shall be not less than 22.5 m long and 3 m wide. For the pattern shown in Figure App 12-4 (B), each stripe of each marking shall be not less than 22.5 m long and 1.8 m wide with a spacing of 1.5 m between adjacent stripes. The lateral spacing between the inner sides of the rectangles shall be equal to that of the aiming point marking where provided. Where an aiming point marking is not provided, the lateral spacing between the inner sides of the rectangles shall correspond to the lateral spacing specified for the aiming point marking in Table App 12-1 (columns 2, 3, 4 or 5, as appropriate). The pairs of markings shall be provided at longitudinal spacings of 150 m beginning from the threshold except that pairs of Touchdown Zone markings coincident with or located within 50 m of an aiming point marking shall be deleted from the pattern.

Figure App 12-4

**Aiming Point and Touchdown Zone Markings  
(Illustrated for a Runway with a Length of 2,400 m or more)**



- 12.6.2.3 On a non-precision approach runway where the Code Number is 2, an additional pair of Touchdown Zone marking stripes should be provided 150 m beyond the beginning of the aiming point marking.



## **12.7 RUNWAY SIDE STRIPE MARKING**

### **12.7.1 Application**

- 12.7.1.1 A runway side stripe marking shall be provided on a paved runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain. For unpaved runways, frangible or flush markings may be used.
- 12.7.1.2 A runway side stripe marking shall be provided on a precision approach runway irrespective of the contrast between the runway edges and the shoulders or the surrounding terrain.

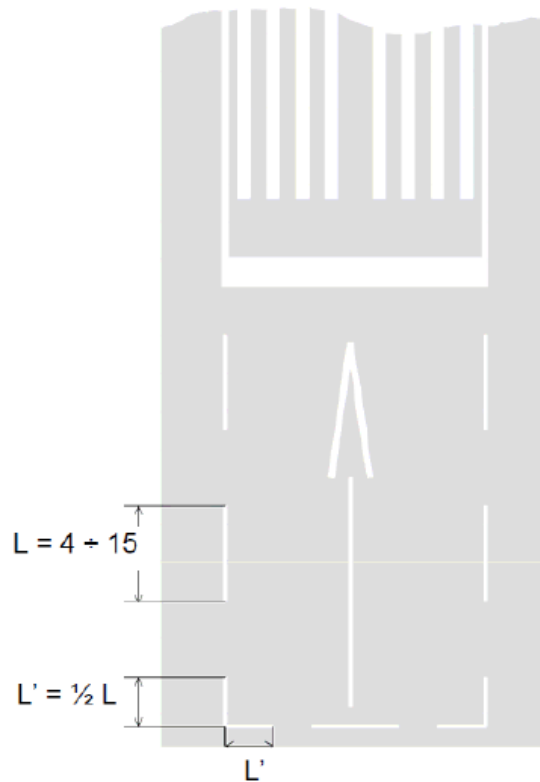
### **12.7.2 Location**

- 12.7.2.1 A runway side stripe marking shall consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway, except that, where the runway is greater than 60 m in width, the stripes should be located 30 m from the runway centre line.
- 12.7.2.2 Where a runway turn pad is provided, the runway side stripe marking shall be continued between the runway and the runway turn pad.
- 12.7.2.3 Where a runway starter extension is provided, the runway side stripe shall continue along the edge of the runway starter extension as a dashed line.

### **12.7.3 Characteristics**

- 12.7.3.1 Except on a runway starter extension, a runway side stripe shall have an overall width of at least 0.9 m on runways 30 m or more in width and at least 0.45 m on narrower runways.
- 12.7.3.2 On a runway starter extension, the runway side strip shall be a dashed line conforming to the dimensions shown in Figure App 12-4A and with dimensions described in Table 12 App 12-1A.

**Figure App 12-4A - Dashed Runway Side Stripe Marking**



**Table 12 App 12-1A Runway Dashed Markings**

Runway width (m)	Single dash dimensions	
	Length (minimum m)	Width (m)
60	15	0.45
45	15	0.45
30	10	0.45
23	6	0.25
18	4	0.25



## 12.8 TAXIWAY CENTRE LINE MARKING

### 12.8.1 Application

12.8.1.1 Taxiway centre line marking shall be provided on a paved taxiway and apron in such a way as to provide continuous guidance between the runway centre line and aircraft stands.

12.8.1.2 Taxiway centre line marking shall be provided on a paved runway when the runway is part of a standard taxi-route and:

- a) there is no runway centre line marking; or
- b) where the taxiway centre line is not coincident with the runway centre line.

12.8.1.3 Where it is necessary to denote the proximity of a runway-holding position, enhanced taxiway centre line marking should be provided.

*Note: The provision of enhanced taxiway centre line marking may form part of runway incursion prevention measures.*

12.8.1.4 Where provided, enhanced taxiway centre line marking shall be installed at each taxiway/runway intersection.

### 12.8.2 Location

12.8.2.1 On a straight section of a taxiway the taxiway centre line marking shall be located along the taxiway centre line. On a taxiway curve the marking shall continue from the straight portion of the taxiway at a constant distance from the outside edge of the curve.

*Note: See Appendix 8, 8.4.3 and Figure App 8-7.*

12.8.2.2 At an intersection of a taxiway with a runway where the taxiway serves as an exit from the runway, the taxiway centre line marking shall be curved into the runway centre line marking as shown in Figures App 12-5 and App 9-14 of Appendix 9. The taxiway centre line marking shall be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the Code Number is 3 or 4, and for a distance of at least 30 m where the Code Number is 1 or 2.

12.8.2.3 Where taxiway centre line marking is provided on a runway in accordance with paragraph 12.8.1.2, the marking shall be located on the centre line of the designated taxiway.

12.8.2.4 Where provided





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- a) An enhanced taxiway centre line marking shall extend from the runway-holding position pattern A (as defined in Figure App 12-5, Taxiway Markings) to a distance of up to 47 m in the direction of travel away from the runway. See Figure App 12-6 (a).
- b) If the enhanced taxiway centre line marking intersects another runway-holding position marking, such as for a precision approach category II or III runway, that is located within 47 m of the first runway-holding position marking, the enhanced taxiway centre line marking shall be interrupted 0.9 m prior to and after the intersected runway-holding position marking. The enhanced taxiway centre line marking shall continue beyond the intersected runway-holding position marking for at least three dashed line segments or 47 m from start to finish, whichever is greater. See Figure App 12-6 (b).
- c) If the enhanced taxiway centre line marking continues through a taxiway/taxiway intersection that is located within 47 m of the runway-holding position marking, the enhanced taxiway centre line marking shall be interrupted 1.5 m prior to and after the point where the intersected taxiway centre line crosses the enhanced taxiway centre line. The enhanced taxiway centre line marking shall continue beyond the taxiway/taxiway intersection for at least three dashed line segments or 47 m from start to finish, whichever is greater. See Figure App 12-6 (c).
- d) Where two taxiway centre lines converge at or before the runway-holding position marking, the inner dashed line shall not be less than 3 m in length. See Figure App 12-6 (d).
- e) Where there are two opposing runway-holding position markings and the distance between the markings is less than 94 m, the enhanced taxiway centre line markings shall extend over this entire distance. The enhanced taxiway centre line markings shall not extend beyond either runway-holding position marking. See Figure App 12-6 (e).

**12.8.3 Characteristics**

- 12.8.3.1 A taxiway centre line marking shall be at least 15 cm in width and continuous in length except where it intersects with a runway-holding position marking or an Intermediate Holding Position marking as shown in Figure App 12-5.
- 12.8.3.2 Enhanced taxiway centre line marking shall be as shown in Figure App-12-6.

**Figure App 12-5**

**Taxiway Markings  
(shown with basic runway markings)**

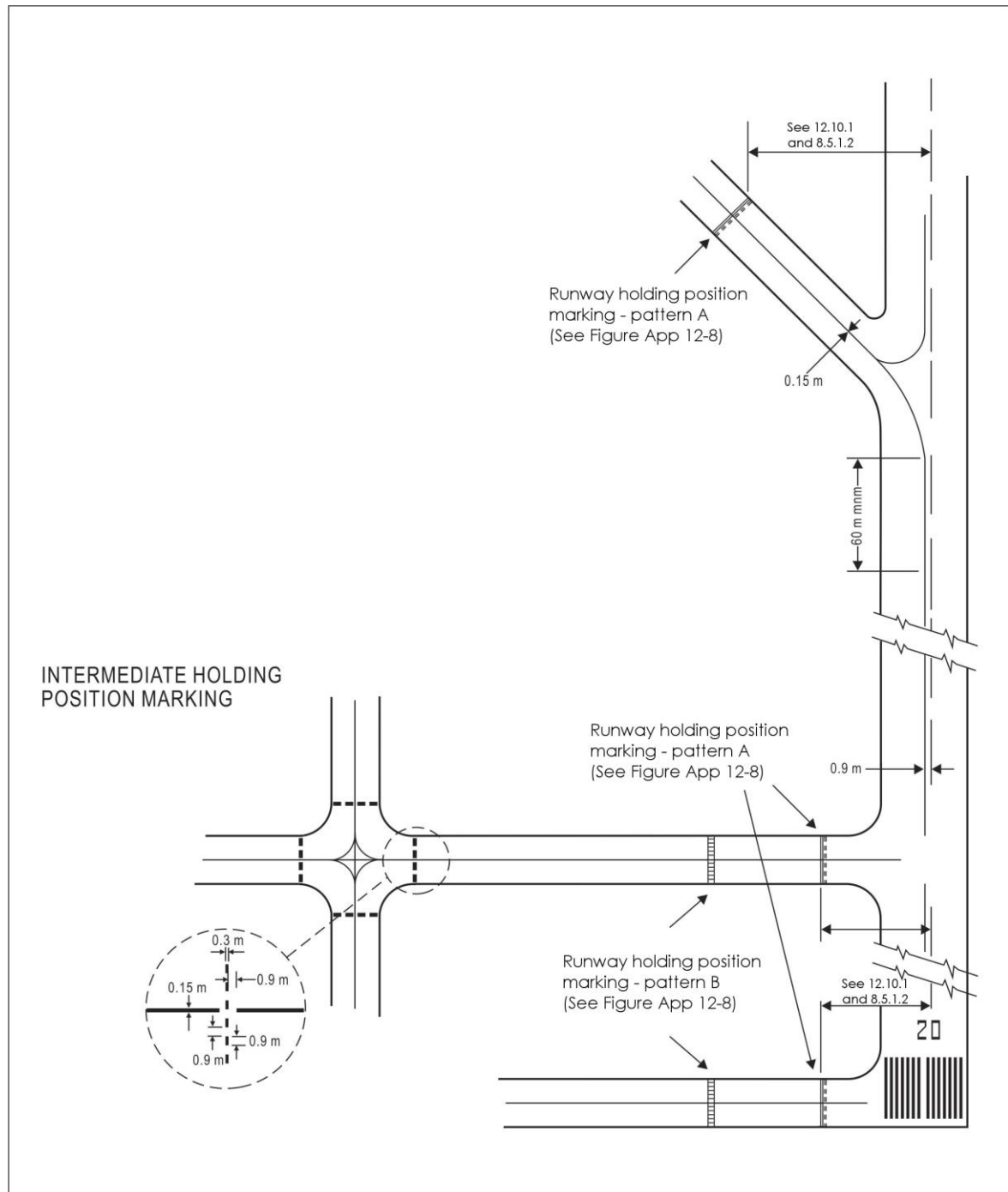
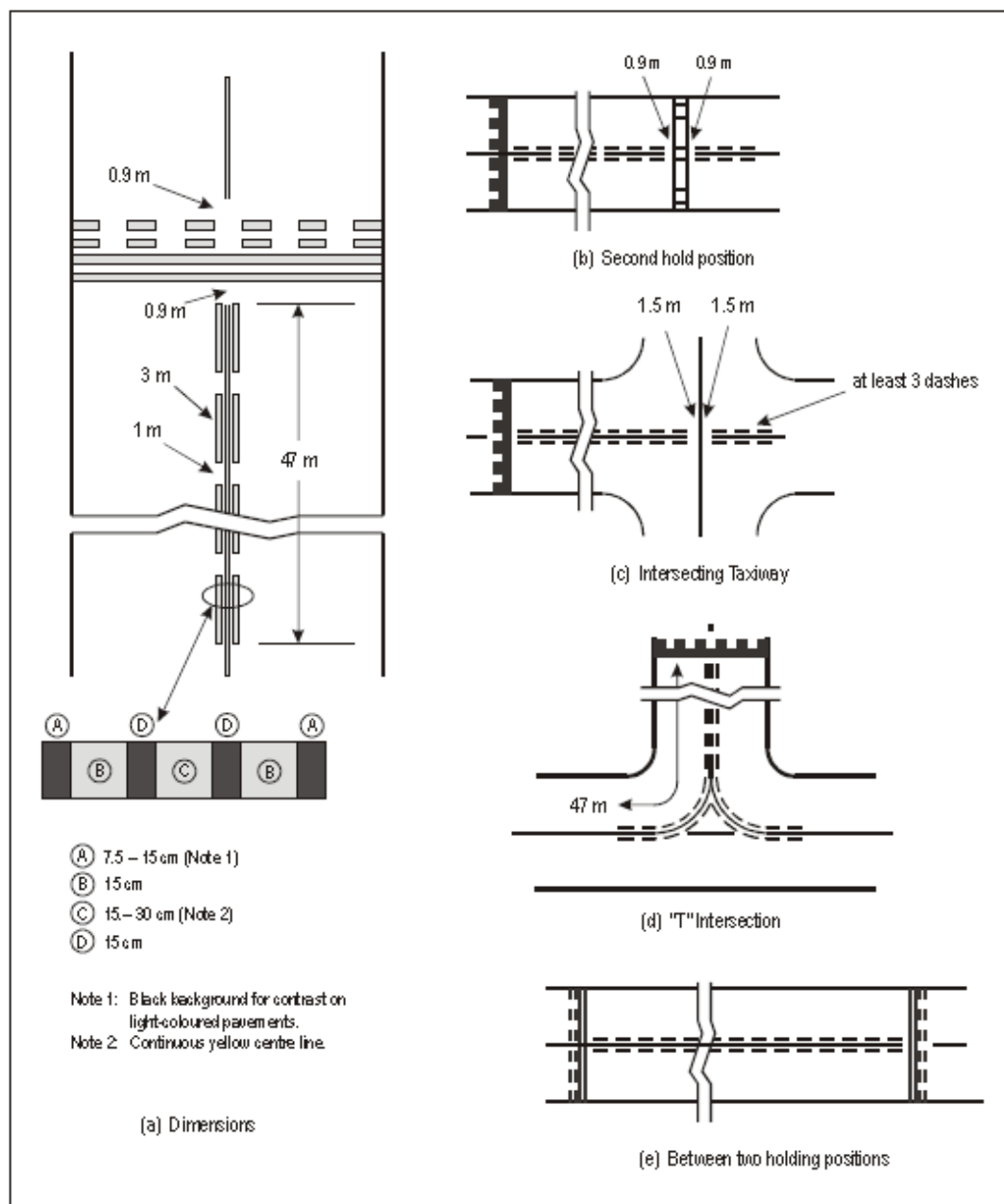


Figure App 12-6

### Enhanced Taxiway Centre Line Marking



## 12.9 RUNWAY TURN PAD MARKING

### 12.9.1 Application

- 12.9.1.1 Where a runway turn pad is provided, a runway turn pad marking shall be provided for continuous guidance to enable an aircraft to complete a 180-degree turn and align with the runway centre line.



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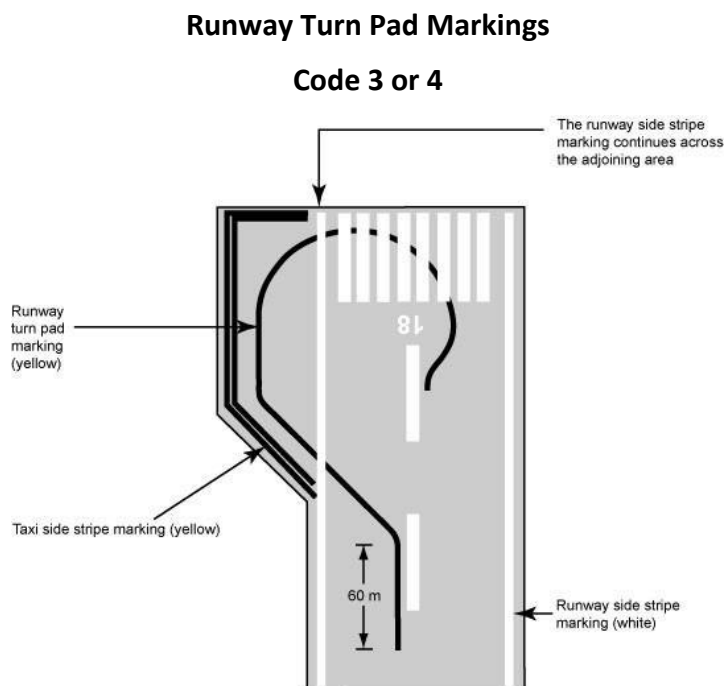
- 12.9.1.2 The runway turn pad marking shall be curved from the runway centre line into the turn pad. The radius of the curve shall be compatible with the manoeuvring capability and normal taxiing speeds of the aeroplane for which the runway turn pad is intended. The intersection angle of the runway turn pad marking with the runway centre line shall not be greater than 30 degrees.
- 12.9.1.3 The runway turn pad marking shall be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the Code Number is 3 or 4, and for a distance of at least 30 m where the Code Number is 1 or 2.
- 12.9.1.4 A runway turn pad marking shall guide the aeroplane in such a way as to allow a straight portion of taxiing before the point where a 180-degree turn is to be made. The straight portion of the runway turn pad marking shall be parallel to the outer edge of the runway turn pad.
- 12.9.1.5 The design of the curve allowing the aeroplane to negotiate a 180-degree turn shall be based on a nose wheel steering angle not exceeding 45 degrees.
- 12.9.1.6 The design of the turn pad marking shall be such that, when the cockpit of the aircraft remains over the runway turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the runway turn pad shall be not less than those specified in Appendix 8, 8.3.9.9 a) vi).

*Note: For ease of manoeuvring, consideration should be given to providing a larger wheel-to-edge clearance for aircraft code E and greater*

12.9.2 **Characteristics**

A runway turn pad marking shall be at least 15 cm in width and continuous in length.

### Figure App 12-7



**Runway turn pad markings (not to scale)**

## 12.10 RUNWAY-HOLDING POSITION MARKING

### 12.10.1 Application and Location

A runway-holding position marking shall be displayed along a runway-holding position.

### 12.10.2 Characteristics

*Note 1: -- Until 25 November 2022, the dimensions of runway holding position markings may be as shown in Figure App 12-8, pattern A1 or A2 or pattern B1 or B2 as appropriate.*

*Note 2: -- As of 25 November 2022, the dimensions of runway holding position markings shall be as shown in Figure App 12-8, pattern A2 or pattern B2 as appropriate.*

- 12.10.2.1 At an intersection of a taxiway and a non-instrument, non-precision approach or take-off runway, the runway-holding position marking shall be as shown in Figure App 12-8, Pattern A1 or A2.
- 12.10.2.2 Where a single runway-holding position is provided at an intersection of a taxiway and a Precision Approach Category I, II or III runway, the runway-holding position



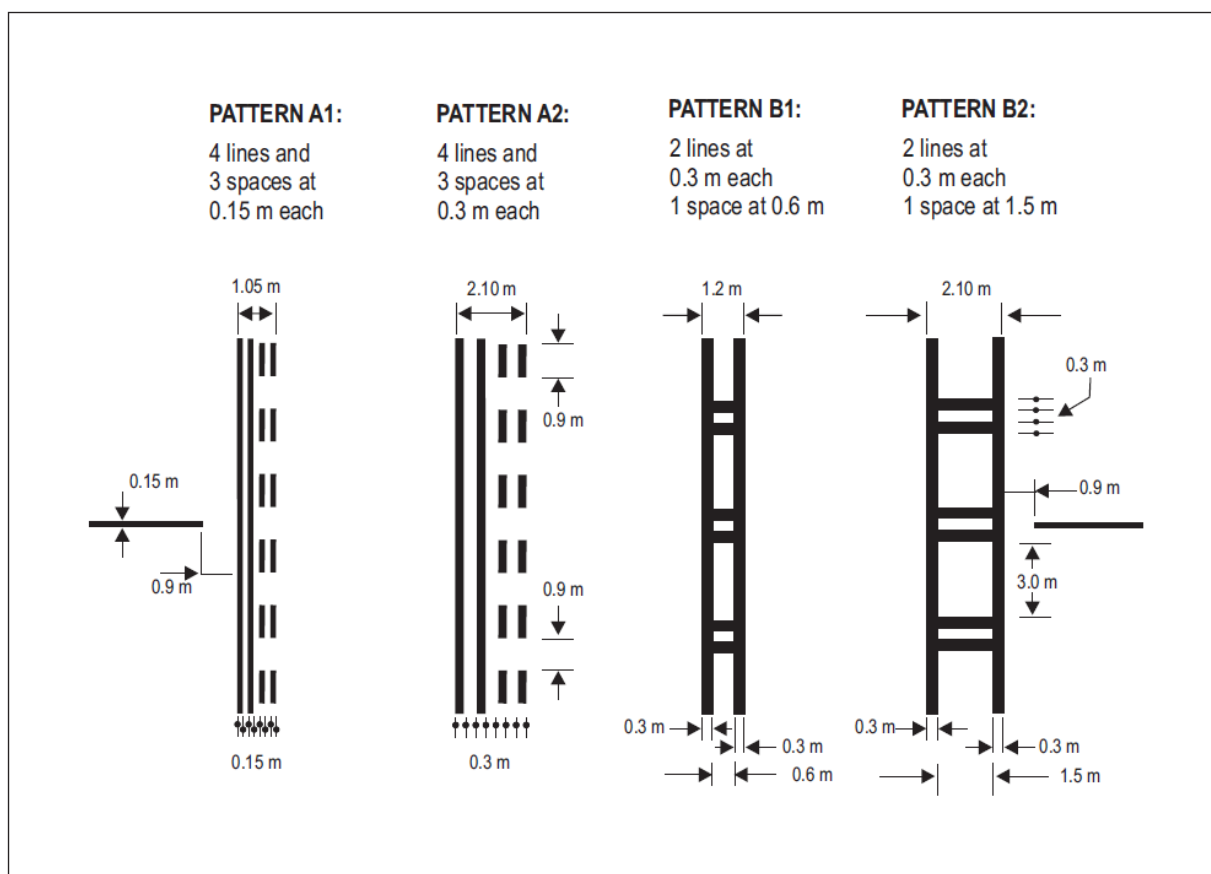
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marking shall be as shown in Figure App 12-8, Pattern A1 or A2. Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closer (closest) to the runway shall be as shown in Figure App 12-8, Pattern A1 or A2 and the markings farther from the runway shall be as shown in Figure App 12-8, Pattern B1 or B2.

- 12.10.2.3 The runway-holding position marking displayed at a runway-holding position established in accordance with Appendix 8, 8.5.1.3 shall be as shown in Figure App 12-8, Pattern A1 or A2.
- 12.10.2.4 Where increased conspicuity of the runway-holding position is required, the runway-holding position marking shall be as shown in Figure App 12-8 Pattern A2 or Pattern B2, as appropriate.
- 12.10.2.5 Where a pattern B1 or B2 runway-holding position marking is located on an area where it would exceed 60 m in length, the term "CAT II" or "CAT III" as appropriate should be marked on the surface at the ends of the runway-holding position marking and at equal intervals of 45 m maximum between successive marks. The letters should be not less than 1.8 m high and shall be placed not more than 0.9 m beyond the holding position marking.
- 12.10.2.6 The runway-holding position marking displayed at a runway/runway intersection shall be perpendicular to the centre line of the runway forming part of the standard taxi-route. The pattern of the marking shall be as shown in Figure App 12-8 Pattern A1 or A2.

Figure App 12-8

### Runway-Holding Position Markings



## 12.11 INTERMEDIATE HOLDING POSITION MARKING

### 12.11.1 Application and Location

- 12.11.1.1 An Intermediate Holding Position marking shall be displayed along an Intermediate Holding Position.
- 12.11.1.2 An Intermediate Holding Position marking shall be displayed at the exit boundary of a remote holding facility adjoining a taxiway.
- 12.11.1.3 Where an Intermediate Holding Position marking is displayed at an intersection of two paved taxiways, it shall be located across the taxiway at sufficient distance from the near edge of the intersecting taxiway to ensure safe clearance between taxiing aircraft. It shall be coincident with a stop bar or Intermediate Holding Position lights, where provided.



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- 12.11.1.4 The distance between an Intermediate Holding Position marking at the exit boundary of a remote holding facility and the centre line of the adjoining taxiway shall not be less than the dimension specified in Table App 8-1, Column 11.

12.11.2 **Characteristics**

An Intermediate Holding Position marking shall consist of a single broken line as shown in Figure App 12-5.

**12.12 VOR AERODROME CHECKPOINT MARKING**

12.12.1 **Application**

When a VOR aerodrome checkpoint is established, it shall be indicated by a VOR aerodrome checkpoint marking and sign.

*Note: See Appendix 11, 11.5 for VOR aerodrome checkpoint sign.*

12.12.2 **Site Selection**

*Note: Guidance on the selection of sites for VOR aerodrome checkpoints is given in ICAO Annex 10, Volume I, Attachment E.*

12.12.3 **Location**

A VOR aerodrome checkpoint marking shall be centred on the spot at which an aircraft is to be parked to receive the correct VOR signal.

12.12.4 **Characteristics**

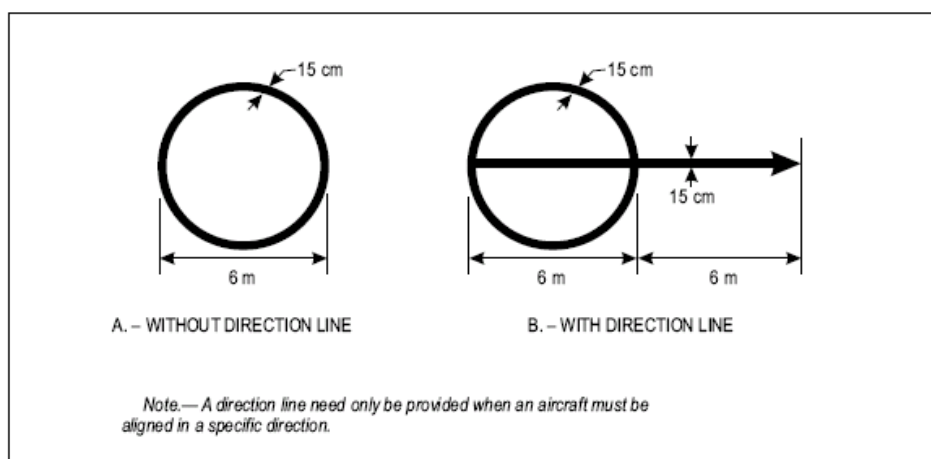
- 12.12.4.1 A VOR aerodrome checkpoint marking shall consist of a circle 6 m in diameter and have a line width of 15 cm (see Figure App 12-9 (A)).

- 12.12.4.2 When it is preferable for an aircraft to be aligned in a specific direction, a line should be provided that passes through the centre of the circle on the desired azimuth. The line should extend 6 m outside the circle in the desired direction of heading and terminate in an arrowhead. The width of the line should be 15 cm (see Figure App 12-9 (B)).



Figure App 12-9

### VOR Aerodrome Checkpoint Marking



12.12.4.3 A VOR aerodrome checkpoint marking shall be white in colour.

## 12.13 AIRCRAFT STAND MARKINGS

### 12.13.1 Application

Aircraft stand markings shall be provided for designated parking positions on a paved apron for Code 2, 3 and 4 aircraft.

### 12.13.2 Location

Aircraft stand markings on a paved apron shall be located so as to provide the clearances specified in Appendix 8, 8.6.5 when the nose wheel follows the stand marking.

### 12.13.3 Characteristics

12.13.3.1 Aircraft stand markings shall include as a minimum such elements as stand identification, lead-in line, stop block and lead-out line, as are required by the parking configuration and to complement other parking aids.

12.13.3.2 Aircraft stand markings may also include such elements as a turn bar, turning line, alignment bar and stop line, as required by the parking configuration and to complement other parking aids.

12.13.3.3 An aircraft stand identification (letter and/or number) shall be included in the lead-in line a short distance after the beginning of the lead-in line. The height of the identification shall be adequate to be readable from the cockpit of aircraft using the stand.



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*Note: Example: 2A-B747, 2B-F28.*

- 12.13.3.4 Where two sets of aircraft stand markings are superimposed on each other in order to permit more flexible use of the apron and it is difficult to identify which stand marking should be followed, or safety would be impaired if the wrong marking was followed, then identification of the aircraft for which each set of markings is intended shall be added to the stand identification.
- 12.13.3.5 Lead-in, turning and lead-out lines shall be continuous in length and have a width of not less than 15 cm. Where one or more sets of stand markings are superimposed on a stand marking, the lines shall be continuous for the most demanding aircraft and broken for other aircraft.
- 12.13.3.6 The curved portions of lead-in, turning and lead-out lines shall have radii appropriate to the most demanding aircraft type for which the markings are intended.
- 12.13.3.7 Where it is intended that an aircraft proceed in one direction only, arrows pointing in the direction to be followed shall be added as part of the lead-in and lead-out lines.
- 12.13.3.8 A turn bar where provided, shall be located at right angles to the lead-in line, abeam the left pilot position at the point of initiation of any intended turn. It shall have a length and width of not less than 6 m and 15 cm, respectively, and include an arrowhead to indicate the direction of turn.
- Note: The distances to be maintained between the turn bar and the lead-in line may vary according to different aircraft types, taking into account the pilot's field of view.*
- 12.13.3.9 If more than one turn bar and/or stop line is required, they shall be coded with aircraft type.
- 12.13.3.10 An alignment bar, where provided shall be placed so as to be coincident with the extended centre line of the aircraft in the specified parking position and visible to the pilot during the final part of the parking manoeuvre. It shall have a width of not less than 15 cm.
- 12.13.3.11 A stop line shall be located at right angles to the alignment bar, abeam the left pilot position at the intended point of stop. It should have a length and width of not less than 6 m and 15 cm, respectively.

*Note: The distances to be maintained between the stop line and the lead-in line may vary according to different aircraft types, taking into account the pilot's field of view.*



## **12.14 APRON SAFETY LINES**

*Note: Guidance on apron safety lines is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

### **12.14.1 Application**

Apron safety lines should be provided on a paved apron as required by the parking configurations and ground facilities.

### **12.14.2 Location**

Apron safety lines shall be located so as to define the areas intended for use by ground vehicles and other aircraft servicing equipment, etc., to provide safe separation from aircraft.

### **12.14.3 Characteristics**

12.14.3.1 Apron safety lines should include such elements as wing tip clearance lines and service road boundary lines as required by the parking configurations and ground facilities.

12.14.3.2 An apron safety line should be continuous in length and at least 10 cm in width.

12.14.3.3 Apron safety Line markings should conform to the colour guidelines published by Airport Council International. Stand safety lines shall be provided and shall be red outlined in white. Service roads shall be marked in white. Double white lines shall delineate the vehicle limit line on the apron – beyond which clearance from the Air Traffic Services Unit is required.

## **12.15 ROAD-HOLDING POSITION MARKING**

### **12.15.1 Application**

A road-holding position marking shall be provided at all road entrances to a runway or taxiway.

### **12.15.2 Location**

The road-holding position marking shall be located across the road at the holding position to provide clearance from aircraft or protection to navigation aids.

### **12.15.3 Characteristics**

The road-holding position marking should be displayed as double white lines or be in accordance with the local road traffic regulations.



## **12.16 MANDATORY INSTRUCTION MARKING**

*Note: Guidance on mandatory instruction marking is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

### **12.16.1 Application**

12.16.1.1 Where it is impracticable to install a mandatory instruction sign in accordance with Appendix 11, 11.3.1.1, a mandatory instruction marking shall be provided on the surface of the pavement.

12.16.1.2 Where operationally required, such as on taxiways exceeding 60 m in width, a mandatory instruction sign shall be supplemented by a mandatory instruction marking.

### **12.16.2 Location**

12.16.2.1 The mandatory instruction marking on taxiways where the code letter is A, B, C or D shall be located across the taxiway equally placed about the taxiway centre line and on the holding side of the runway-holding position marking as shown in Figure App 12-10 (A). The distance between the nearest edge of the marking and the runway-holding position marking or the taxiway centre line marking shall be not less than 1 m.

12.16.2.2 The mandatory instruction marking on taxiways where the code letter is E or F shall be located on both sides of the taxiway centre line marking and on the holding side of the runway-holding position marking as shown in Figure App 12-10 (B). The distance between the nearest edge of the marking and the runway-holding position marking or the taxiway centre line marking shall be not less than 1 m.

12.16.2.3 Except where operationally required and approved by the Authority, a mandatory instruction marking shall not be located on a runway.

### **12.16.3 Characteristics**

12.16.3.1 A mandatory instruction marking shall consist of an inscription in white on a red background. Except for a NO ENTRY marking, the inscription shall provide information identical to that of the associated mandatory instruction sign.

12.16.3.2 A NO ENTRY marking shall consist of an inscription in white reading NO ENTRY on a red background.

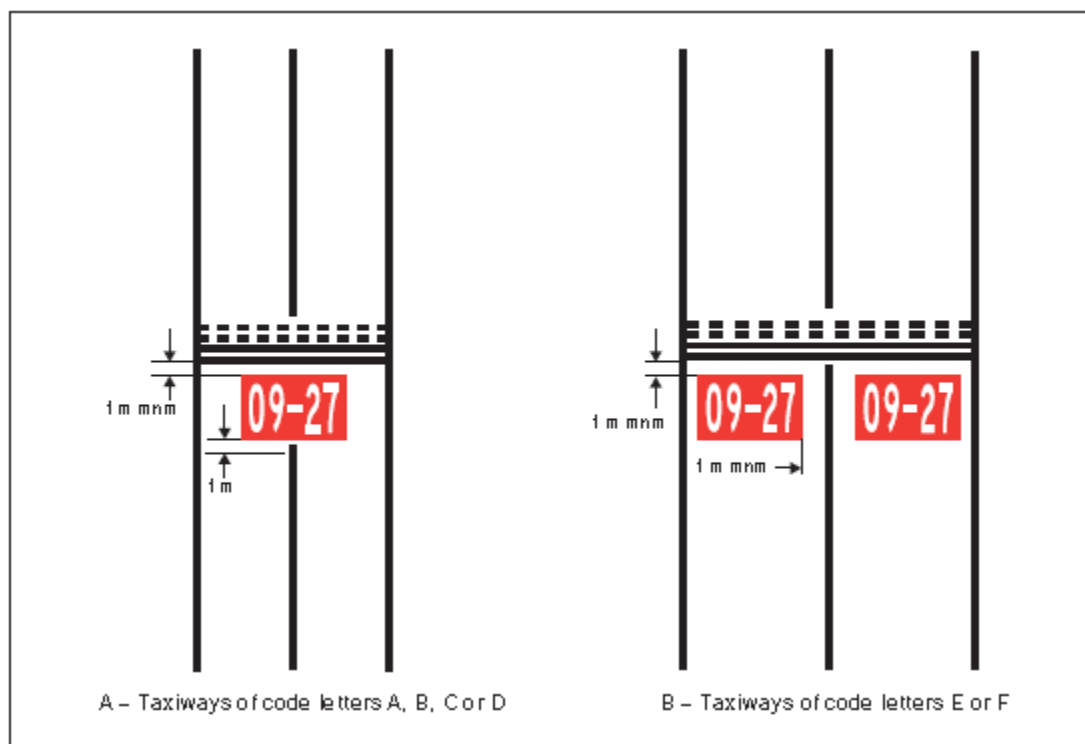
12.16.3.3 Where there is insufficient contrast between the marking and the pavement surface, the mandatory instruction marking shall include an appropriate border, preferably white or black.

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- 12.16.3.4 The character height shall be 4 m for inscriptions where the code letter is C, D, E or F, and 2 m where the code letter is A or B. The inscriptions should be in the form and proportions shown in Figure App 12-14.
- 12.16.3.5 The background shall be rectangular and extend a minimum of 0.5 m laterally and vertically beyond the extremities of the inscription.

Figure App 12-10

Mandatory Instruction Marking



12.17 INFORMATION MARKING

*Note: Guidance on information marking is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

12.17.1 Application

- 12.17.1.1 Where an information sign would normally be installed and it is impractical to install, as confirmed by the Authority, an information marking shall be displayed on the surface of the pavement.
- 12.17.1.2 Where operationally required an information sign should be supplemented by an information marking.



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12.17.1.3 An information (location/direction) marking should preferably be displayed prior to and following complex taxiway intersections and where operational experience has indicated the addition of a taxiway location marking could assist flight crew ground navigation.

12.17.1.4 An information (location) marking shall be displayed on the pavement surface at regular intervals along taxiways of great length when required by the Authority.

**12.17.2 Location**

The information marking shall be displayed across the surface of the taxiway or apron where necessary and positioned so as to be legible from the cockpit of an approaching aircraft.

**12.17.3 Characteristics**

12.17.3.1 An information marking shall consist of:

- a) an inscription in yellow upon a black background, when it replaces or supplements a location sign; and
- b) an inscription in black upon a yellow background, when it replaces or supplements a direction or destination sign.

12.17.3.2 Where there is insufficient contrast between the marking background and the pavement surface, the marking shall include:

- a) a black border where the inscriptions are in black; and
- b) a yellow border where the inscriptions are in yellow.

12.17.3.3 The character height shall be as for a mandatory instruction marking. The inscriptions shall be in the form and proportions shown in Figure App 12-14.

**12.18 MARKERS**

**12.18.1 General**

Markers shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

*Note 1: Anchors or chains, to prevent markers which have broken from their mounting from blowing away, are sometimes used.*

*Note 2: Guidance on frangibility of markers is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 6.*



## **12.19 UNPAVED RUNWAY EDGE MARKERS**

### **12.19.1 Application**

Markers shall be provided when the extent of an unpaved runway is not clearly indicated by the appearance of its surface compared with that of the surrounding ground.

### **12.19.2 Location**

Where runway lights are provided, the markers shall be incorporated in the light fixtures. Where there are no lights, markers of flat rectangular or conical shape should be placed so as to delimit the runway clearly.

### **12.19.3 Characteristics**

The flat rectangular markers shall have a minimum size of 1 m by 3 m and shall be placed with their long dimension parallel to the runway centre line. The conical markers shall have a height not exceeding 50 cm.

## **12.20 STOPWAY EDGE MARKERS**

### **12.20.1 Application**

Stopway edge markers shall be provided when the extent of a stopway is not clearly indicated by its appearance compared with that of the surrounding ground.

### **12.20.2 Characteristics**

The stopway edge markers shall be sufficiently different from any runway edge markers used to ensure that the two types of markers cannot be confused.

## **12.21 TAXIWAY EDGE MARKERS**

### **12.21.1 Application**

Taxiway edge markers shall be provided on a taxiway where the Code Number is 1 or 2 and taxiway centre line or edge lights or taxiway centre line markers are not provided.

### **12.21.2 Location**

Taxiway edge markers should be installed at least at the same locations as would the taxiway edge lights had they been used.



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**12.21.3 Characteristics**

- 12.21.3.1 A taxiway edge marker shall be retroreflective blue.
- 12.21.3.2 The marked surface as viewed by the pilot should be a rectangle and shall have a minimum viewing area of 150 cm<sup>2</sup>.
- 12.21.3.3 Taxiway edge markers shall be frangible. Their height shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

**12.22 TAXIWAY CENTRE LINE MARKERS**

**12.22.1 Application**

- 12.22.1.1 Taxiway centre line markers should be provided on a taxiway where the Code Number is 1 or 2 and taxiway centre line or edge lights or taxiway edge markers are not provided.
- 12.22.1.2 Taxiway centre line markers shall be provided on a taxiway where the Code Number is 3 or 4 and taxiway centre line lights are not provided if there is a need to improve the guidance provided by the taxiway centre line marking.

**12.22.2 Location**

- 12.22.2.1 Taxiway centre line markers shall be installed at least at the same location as would taxiway centre line lights had they been used.

*Note: See Appendix 9, 9.18.12 for the spacing of taxiway centre line lights.*

- 12.22.2.2 Taxiway centre line markers should normally be located on the taxiway centre line marking except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.

**12.22.3 Characteristics**

- 12.22.3.1 A taxiway centre line marker shall be retroreflective green.
- 12.22.3.2 The marked surface as viewed by the pilot should be a rectangle and should have a minimum viewing area of 20 cm<sup>2</sup>.
- 12.22.3.3 Taxiway centre line markers shall be so designed and fitted as to withstand being run over by the wheels of an aircraft without damage either to the aircraft or to the markers themselves.





## **12.23 UNPAVED TAXIWAY EDGE MARKERS**

### **12.23.1 Application**

Where the extent of an unpaved taxiway is not clearly indicated by its appearance compared with that of the surrounding ground, markers shall be provided.

### **12.23.2 Location**

Where taxiway lights are provided, the markers shall be incorporated in the light fixtures. Where there are no lights, markers shall be placed so as to delimit the taxiway clearly.

## **12.24 BOUNDARY MARKERS**

### **12.24.1 Application**

Boundary markers shall be provided at an aerodrome where the Landing Area has no runway.

### **12.24.2 Location**

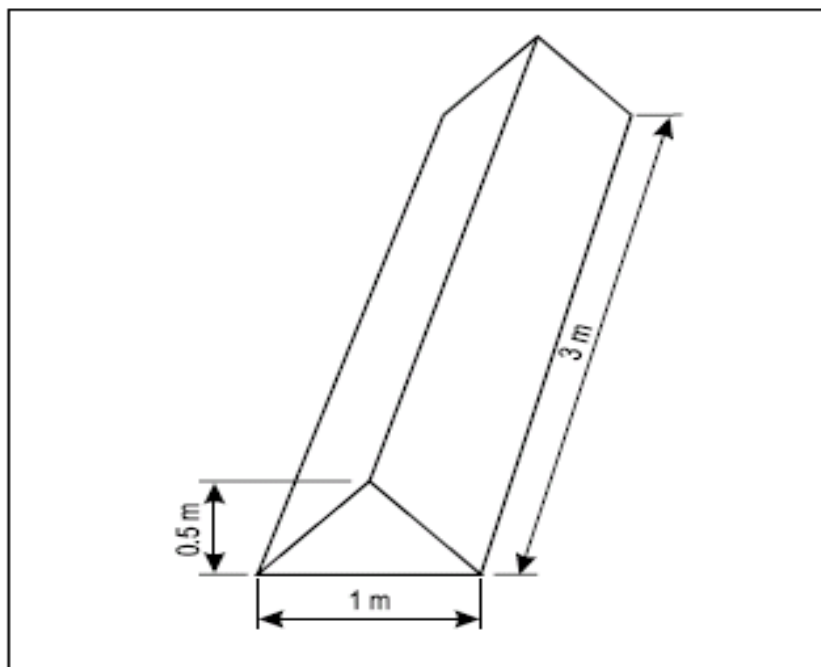
Boundary markers shall be spaced along the boundary of the Landing Area at intervals of not more than 200 m, if the type shown in Figure App 12-11 is used, or approximately 100 m, if the conical type is used with a marker at any corner.

### **12.24.3 Characteristics**

Boundary markers should be of a form similar to that shown in Figure App 12-11, or in the form of a cone not less than 50 cm high and not less than 75 cm in diameter at the base. The markers should be coloured to contrast with the background against which they will be seen. A single colour, orange or red, or two contrasting colours, orange and white or alternatively red and white, should be used, except where such colours merge with the background.

**Figure App 12-11**

**Boundary Markers**



**12.25 VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS**

**12.25.1 Closed Runways and Taxiways or Parts Thereof**

**12.25.2 Application**

- a) A closed marking shall be displayed on a runway or taxiway, or portion thereof, which is permanently closed to the use of all aircraft.
- b) A closed marking should be displayed on a temporarily closed runway or taxiway or portion thereof, except that such marking may be omitted when the closing is of short duration (<6 hrs) and adequate warning by air traffic services is provided. (see also Appendix 9, 9.28)

**12.25.3 Location**

On a runway a closed marking shall be placed at each end of the runway, or portion thereof, declared closed, and additional markings shall be so placed that the maximum interval between markings does not exceed 300 m. On a taxiway a closed marking shall be placed at least at each end of the taxiway or portion thereof closed.



#### 12.25.4 Characteristics

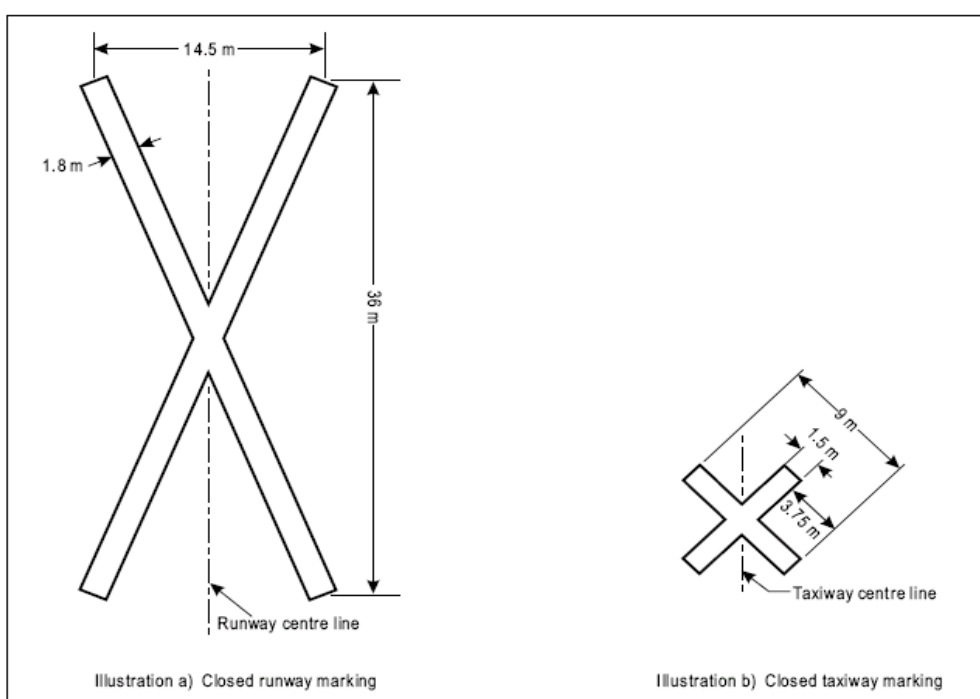
- a) The closed marking shall follow the form and proportions as detailed in Figure App 12-12, Illustration a), when displayed on a runway, and shall be of the form and proportions as detailed in Figure App 12-12, Illustration b), when displayed on a taxiway. The marking shall be white when displayed on a runway and shall be yellow when displayed on a taxiway.

Note: When an area is temporarily closed, frangible barriers or markings utilizing materials other than paint or other suitable means may be used to identify the closed area.

- b) When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.
- c) Airfield lighting on a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes.
- d) In addition to closed markings, when the runway or taxiway or portion thereof closed is intercepted by a usable runway or taxiway which is used at night, unserviceability lights shall be placed across the entrance to the closed area at intervals not exceeding 3 m (see Appendix 9, 9.27.3).

**Figure App 12-12**

### Closed Runway and Taxiway Markings



Note 1: Procedures pertaining to the planning, coordination, monitoring and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).

#### 12.25.5 Non-Load-Bearing Surfaces

#### 12.25.6 Application

Shoulders for taxiways, runway turn pads, holding bays and aprons and other non-load bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aircraft, might result in damage to the aircraft shall have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.

#### 12.25.7 Location

A taxi side stripe marking shall be placed along the edge of the load-bearing pavement, with the outer edge of the marking approximately on the edge of the load-bearing pavement.

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12.25.8 **Characteristics**

A taxi side stripe marking shall consist of a pair of solid lines, each 15 cm wide and spaced 15 cm apart and the same colour as the taxiway centre line marking.

*Note: Guidance on providing additional transverse stripes at an intersection or a small area on the apron is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

12.25.9 **Pre-Threshold Area**

12.25.10 **Application**

When the surface before a threshold is paved and exceeds 60 m in length and is not suitable for normal use by aircraft, the entire length before the threshold shall be marked with a chevron marking.

12.25.11 **Location**

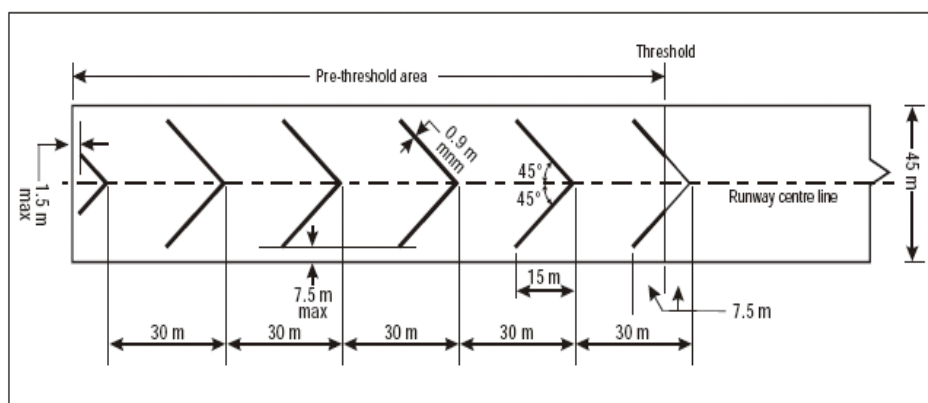
A chevron marking shall point in the direction of the runway and be placed as shown in Figure App 12-13.

12.25.12 **Characteristics**

A chevron marking shall be yellow to contrast with the colour used for the runway markings. It shall have an over-all width of at least 0.9 m.

**Figure App 12-13**

**Pre-Threshold Marking**



12.25.13 **Unserviceable Areas**

12.25.14 Unserviceability markers shall be displayed wherever any portion of a taxiway, apron or holding bay is unfit for the movement of aircraft but it is still possible to bypass



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the area safely. On a movement area used at night, unserviceability lights shall be used. (refer to 9, 9.29)

Note 1: Unserviceability markers and lights are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of a pavement, such as on an apron, that is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, not on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is closed.

Note 2: Procedures pertaining to the planning, coordination, monitoring and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (9981)

**12.25.15 Location**

Unserviceability markers and lights shall be placed at intervals sufficiently close so as to delineate the Unserviceable Area. (refer also Appendix 9, 9.27)

**12.25.16 Characteristics of Unserviceability Markers**

Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones or marker boards.

**12.25.17 Characteristics of Unserviceability Cones**

An unserviceability cone should be at least 0.5 m in height and red, orange or yellow or any one of these colours in combination with white.

**12.25.18 Characteristics of Unserviceability Flags**

An unserviceability flag should be at least 0.5 m square and red, orange or yellow or any one of these colours in combination with white.

**12.25.19 Characteristics of Unserviceability Marker Boards**

An unserviceability marker board should be at least 0.5 m in height and 0.9 m in length, with alternate red and white or orange and white vertical stripes.

## 12.26 DESIGN OF MANDATORY INSTRUCTION AND INFORMATION MARKINGS

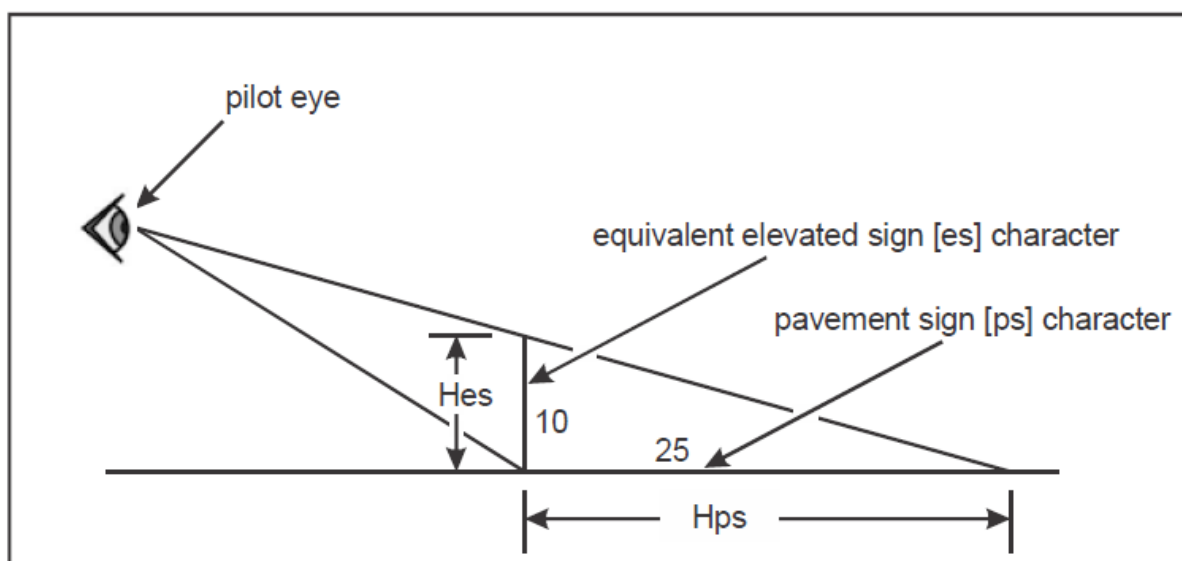
*Note 1: See 12.16 and 12.17 for specifications on the application, location and characteristics of mandatory instruction markings and information markings.*

*Note 2: The following details the form and proportions of the letters, numbers and symbols of mandatory instruction markings and information markings on a 20 cm grid.*

*Note 3: The mandatory instruction markings and information markings on pavements are formed as if shadowed (i.e., stretched) from the characters of an equivalent elevated sign by a factor of 2.5 as shown in Figure App 12-13a. The shadowing, however, only affects the vertical dimension. Therefore, the spacing of characters for pavement marking is obtained by first determining the applicable Code number and then using spacing values given in Table 11-3(f).*

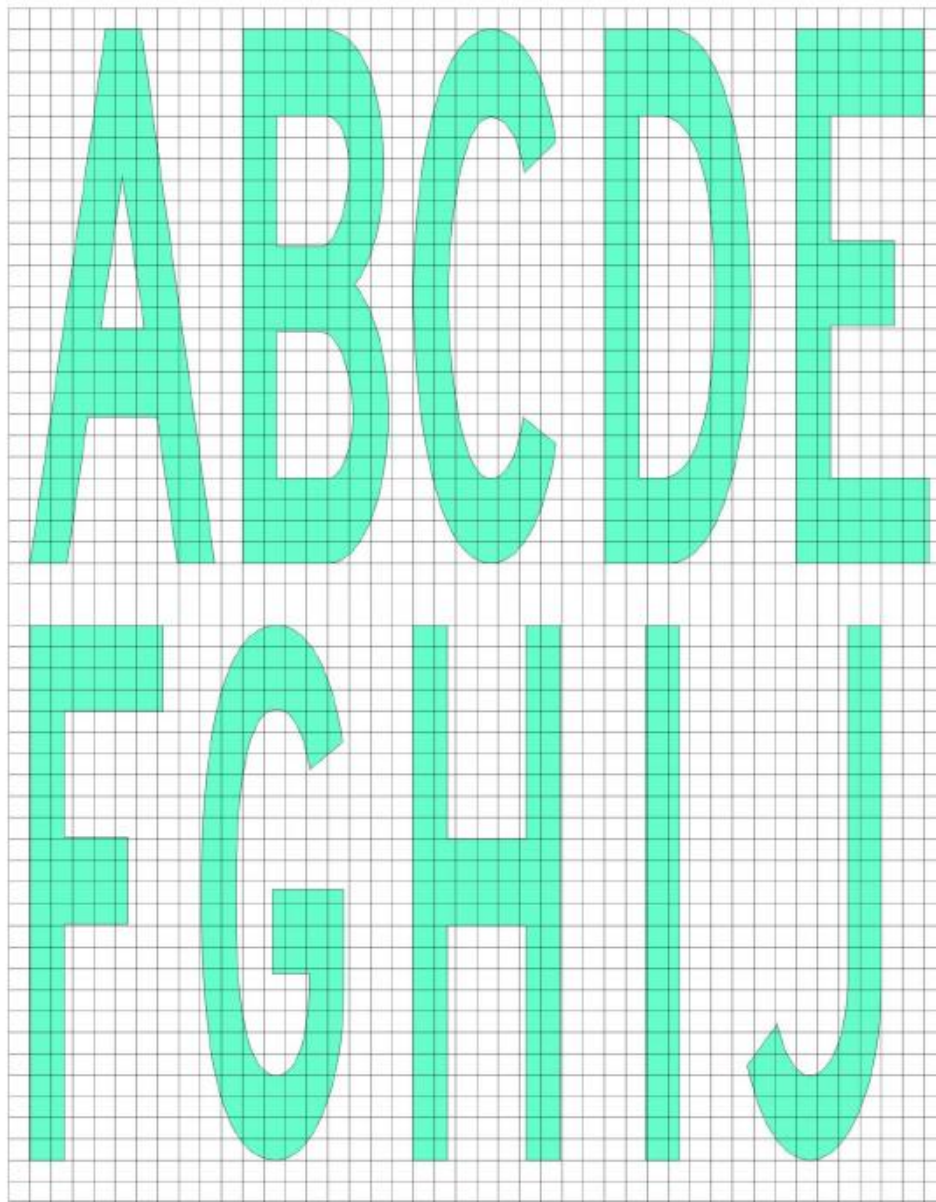
*For example, in the case of the runway designator "10" which is to have a height of 4000 mm (12.16.3.4 and 12.17.3.3), Table 11-3(b) indicates numeral to numeral code 1 and from Table 11-3(f) this code has a pavement marking spacing for "10" of 400 mm.*

Figure App 12-13a





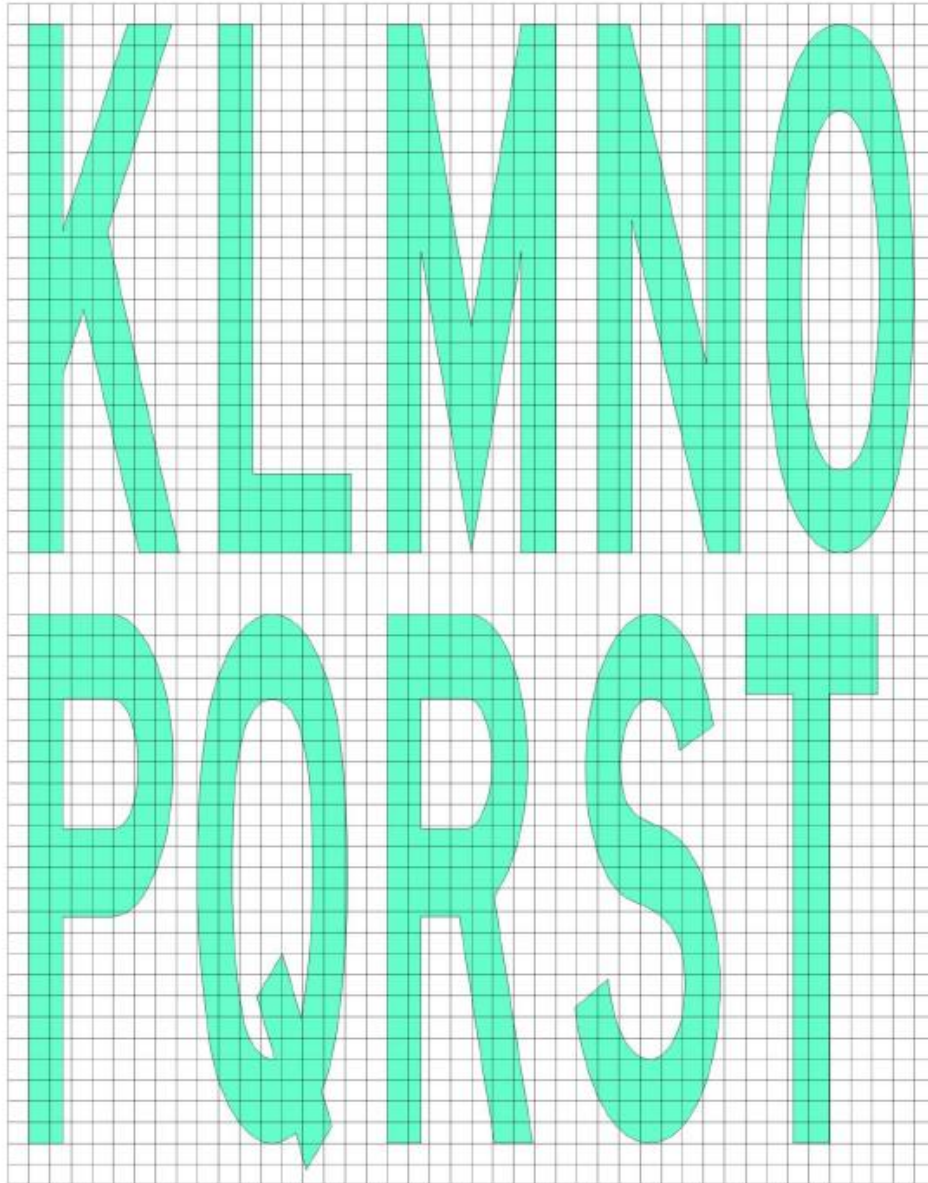
**Figure App 12-14**







**Figure App 12-14 (cont.)**





**Figure App 12-14 (cont.)**

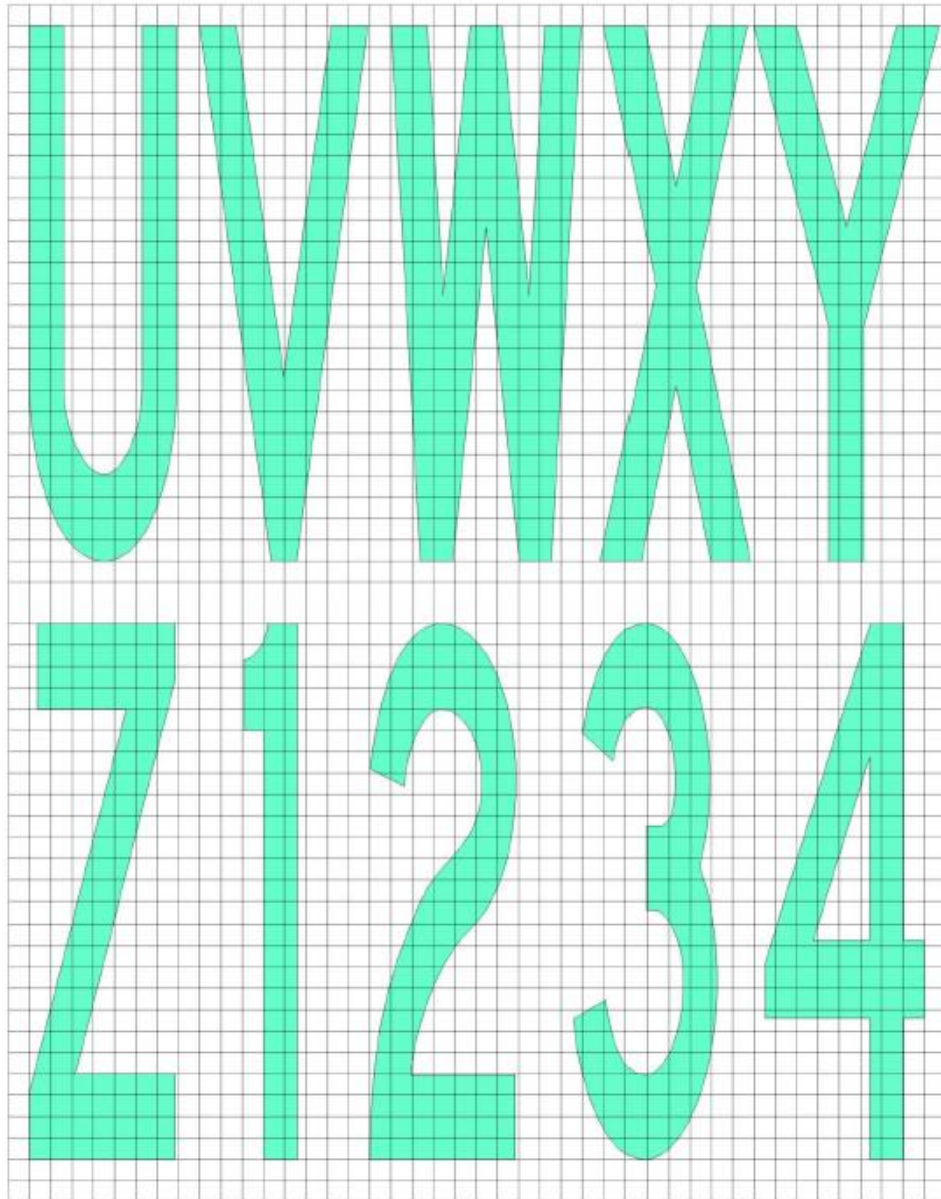
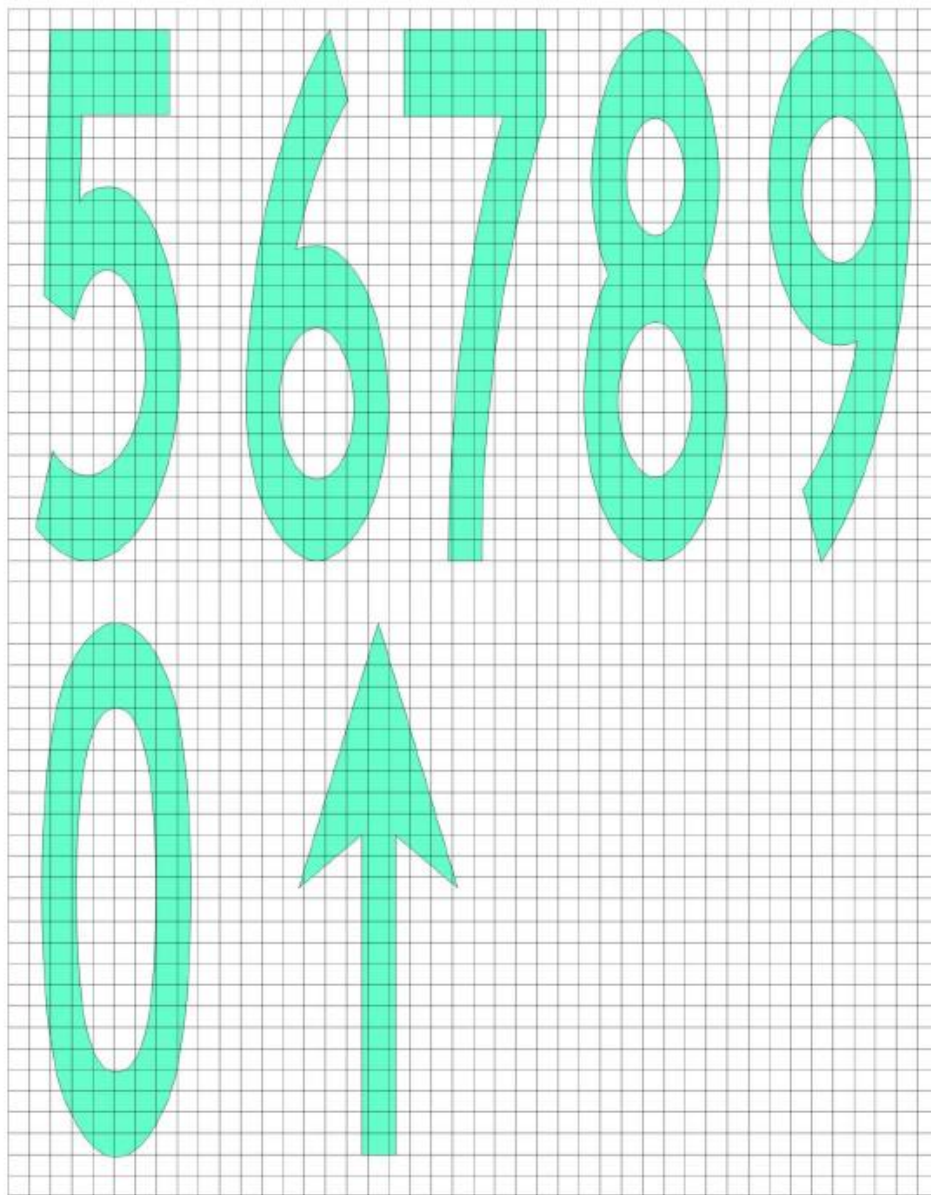


Figure App 12-14 (cont.)





## APPENDIX 13

### OBSTACLE CONTROL & MARKING

#### 13.1 OBSTACLE LIMITATION SURFACES

*Note: See Figure App 13-1*

##### 13.1.1 Outer Horizontal Surface

*Note: Guidance on the need to provide an outer horizontal surface and its characteristics is contained in the ICAO Airport Services Manual (Doc 9137), Part 6.*

##### **GM to 13.1.1: Outer Horizontal Surface**

- a) *The Outer Horizontal Surface is of particular importance for safe operations in areas of high ground or where there are concentrations of obstacles.*
- b) *Significant operational problems can arise from the erection of tall structures in the vicinity of aerodromes beyond the areas currently recognised in these regulations as areas in which restriction of new construction may be necessary. Such problems may be addressed through the provision of an Outer Horizontal Surface, which is a specified portion of a horizontal plane around an aerodrome beyond the limits of the conical surface.*
- c) *The Outer Horizontal Surface should extend from the periphery of the conical surface as shown in Figure App 13-1. It represents the level above which consideration needs to be given to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with the Conical and Inner Horizontal Surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome.*
- d) *As a broad specification for the Outer Horizontal Surface, tall structures can be considered to be of possible significance if they are both higher than 30 m above local ground level and higher than 150 m above aerodrome elevation within a radius of 15000m of the centre of the aerodrome where the Code Number is 3 or 4. The area of concern may need to be extended to coincide with the PANS OPS obstacle areas for the individual approach procedures at the airport under consideration.*
- e) *If it is of particular importance for safe operation on circuits, arrival routes towards the aerodrome or on departure or missed approach climb-paths, an Outer Horizontal Surface for non-precision approach runways should be established.*



### 13.1.2 Conical Surface

#### 13.1.2.1 *Description*

Conical Surface. A surface sloping upwards and outwards from the periphery of the Inner Horizontal Surface.

#### 13.1.2.2 *Characteristics*

The limits of the Conical Surface shall comprise:

- a) a lower edge coincident with the periphery of the Inner Horizontal Surface; and
- b) an upper edge located at a specified height above the Inner Horizontal Surface.

13.1.2.3 The slope of the Conical Surface shall be measured in a vertical plane perpendicular to the periphery of the Inner Horizontal Surface.

### 13.1.3 Inner Horizontal Surface

#### 13.1.3.1 *Description*

Inner Horizontal Surface. A surface located in a horizontal plane above an aerodrome and its environs.

#### 13.1.3.2 *Reserved*

13.1.3.3 The outer limits of the Inner Horizontal Surface are defined by circular arcs centred either on the geometric centre of the runway or on the intersection of the extended runway centre line with the end of the runway strip joined tangentially by straight lines or points established for such purpose as in Figure App 13-1B.

13.1.3.4 The height of the Inner Horizontal Surface shall be measured above an established elevation datum. The elevation datum used for the height of the Inner Horizontal Surface shall be:

- a) the elevation of the highest point of the lowest threshold of the related runway; or
- b) the elevation of the highest point of the highest threshold of the related runway; or
- c) the elevation of the highest point of the runway; or
- d) the aerodrome elevation.



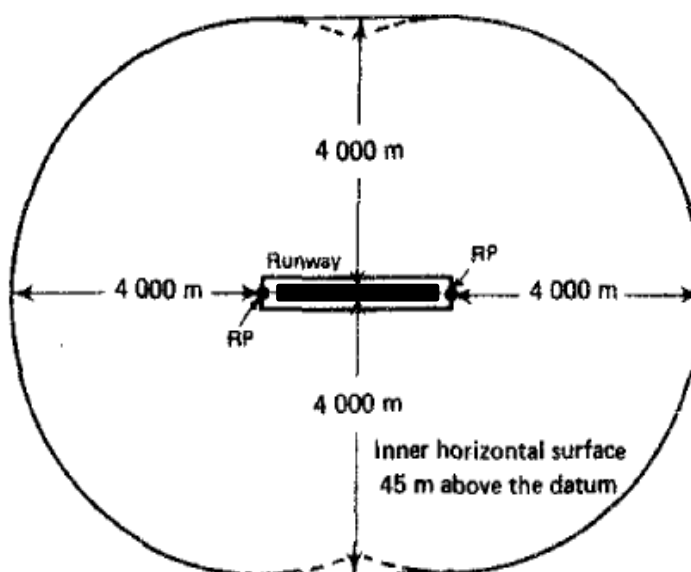


Figure App 13-1B Inner Horizontal Surface for a single runway, where the Runway Code Number is 4

#### **AMC to 13.1.3 Inner horizontal surface**

- a) *The shape of the Inner Horizontal Surface need not necessarily be circular. Guidance on determining the extent of the Inner Horizontal Surface is contained in the ICAO Doc 9137, Airport Services Manual, Part 6, Control of Obstacles.*
- b) *The limits of the Inner Horizontal Surface for Code 4 are defined as circles of radius 4000 m centred on the strip ends of the runway. These circles are joined by common tangents parallel to the runway centre line to form a racetrack pattern. The boundary of this pattern is the boundary of the Inner Horizontal Surface.*
- c) *For Code 1, 2 and 3 runways, the Inner Horizontal Surface is defined as a circle centred on the midpoint of the runway.*
- d) *To protect two or more runways, a more complex pattern could become necessary. In this situation, all the circles are joined tangentially by straight lines: illustrated in Figure App 13-1C.*
- e) *For more complex Inner Horizontal Surfaces, with runways on different levels or runways where the thresholds differ more than 6 m, a common elevation is not essential but where surfaces overlap, the lower surface should be regarded as dominant.*
- f) *Further guidance is contained in the ICAO Doc 9137, Airport Services Manual, Part 6, Control of Obstacles.*

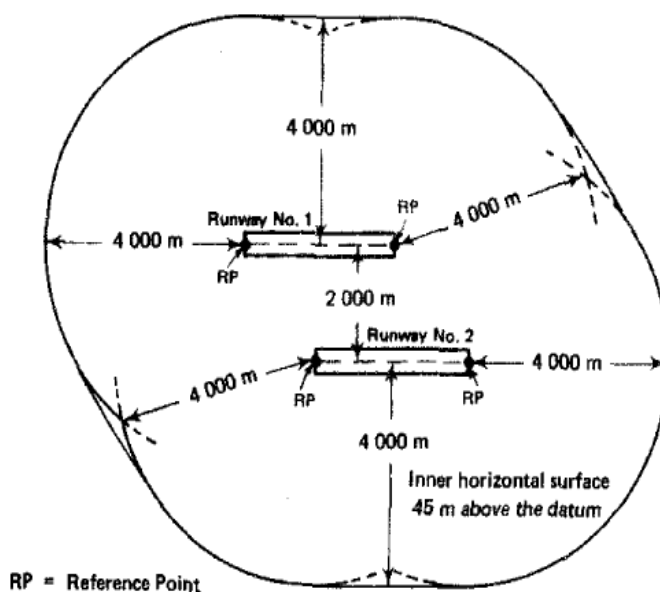


Figure App 13-1C Composite Inner Horizontal Surface for two parallel runways where the Runway Code Number is 4

#### 13.1.4 Approach Surface

##### 13.1.4.1 Description

Approach Surface. An inclined plane or combination of planes preceding the threshold.

##### 13.1.4.2 Characteristics

The limits of the Approach Surface shall comprise:

- an inner edge of specified length, horizontal and perpendicular to the extended centre line of the runway and located at a specified distance before the threshold;
  - two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the runway; and
  - an outer edge parallel to the inner edge.
- d) The above surfaces shall be varied when lateral offset, offset or curved approaches are utilized, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the lateral offset, offset or curved ground track.

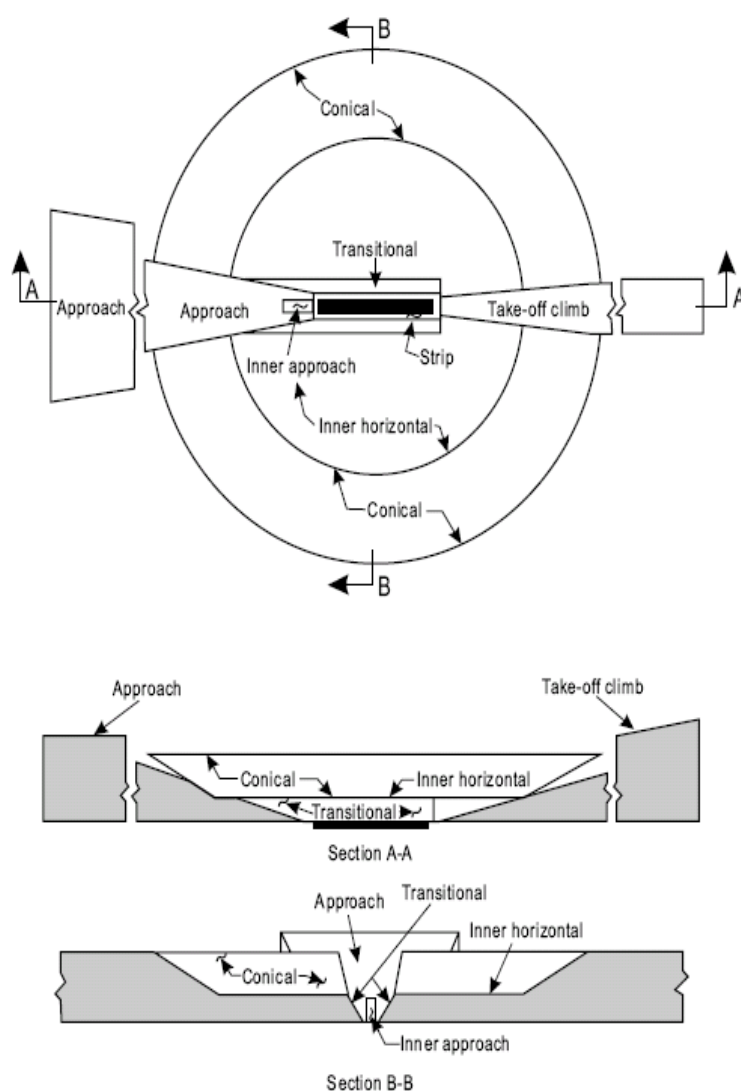
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- 13.1.4.3 The elevation of the inner edge shall be equal to the elevation of the mid-point of the threshold.
- 13.1.4.4 The slope(s) of the Approach Surface shall be measured in the vertical plane containing the centre line of the runway and shall continue containing the centre line of any lateral offset or curved ground track.

*Note: See Figure App 13-2*

**Figure App 13-1.**

**Obstacle Limitation Surfaces**

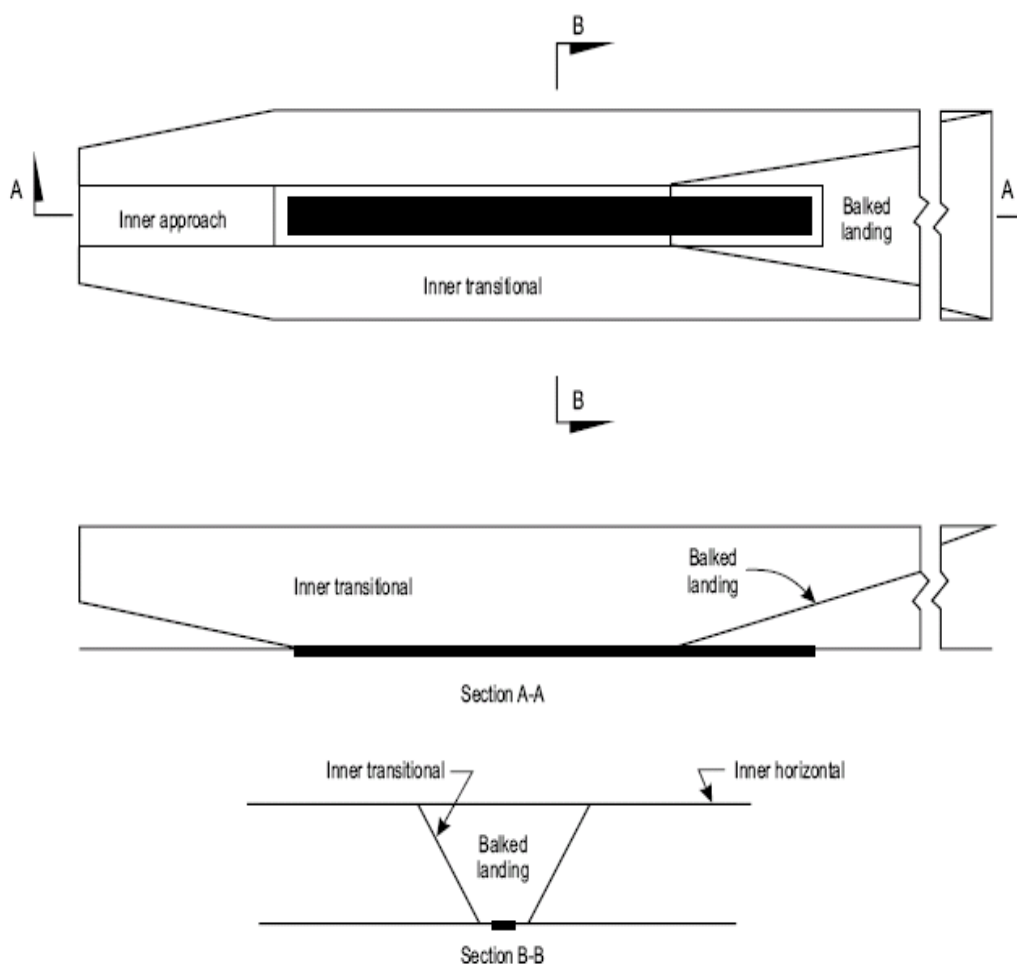


*See Figure App 13-2 for Inner Transitional and Balked Landing Obstacle Limitation Surfaces and ICAO Annex 14 – Appendix B for a three dimensional view.*



Figure App 13-2

Inner Approach, Inner Transitional and Balked Landing Obstacle Limitation Surfaces



13.1.5 Inner Approach Surface

13.1.5.1 Description

Inner Approach Surface. A rectangular portion of the Approach Surface immediately preceding the threshold.

13.1.5.2 Characteristics

The limits of the Inner Approach Surface shall comprise:



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- a) an inner edge coincident with the location of the inner edge of the Approach Surface but of its own specified length;
- b) two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the centre line of the runway; and
- c) an outer edge parallel to the inner edge.

### 13.1.6 Transitional Surface

#### 13.1.6.1 Description

Transitional Surface. A complex surface along the side of the strip and part of the side of the Approach Surface, that slopes upwards and outwards to the Inner Horizontal Surface.

#### 13.1.6.2 Characteristics

The limits of a Transitional Surface shall comprise:

- a) a lower edge beginning at the intersection of the side of the Approach Surface with the Inner Horizontal Surface and extending down the side of the Approach Surface to the inner edge of the Approach Surface and from there along the length of the strip parallel to the runway centre line; and
- b) an upper edge located in the plane of the Inner Horizontal Surface.

#### 13.1.6.3 The elevation of a point on the lower edge shall be:

- a) along the side of the Approach Surface - equal to the elevation of the Approach Surface at that point; and
- b) along the strip - equal to the elevation of the nearest point on the centre line of the runway or its extension.

*Note: As a result of b) the transitional surface along the strip will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The intersection of the transitional surface with the inner horizontal surface will also be a curved or a straight line depending on the runway profile.*

#### 13.1.6.4 The slope of the Transitional Surface shall be measured in a vertical plane at right angles to the centre line of the runway.

### 13.1.7 Inner Transitional Surface

*Note: It is intended that the inner transitional surface be the controlling obstacle limitation surface for navigation aids, aircraft and other vehicles that must be near*



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*the runway and which is not to be penetrated except for frangible objects. The Transitional Surface described in 13.1.6 is intended to remain as the controlling obstacle limitation surface for buildings, etc.*

**13.1.7.1 Description**

Inner Transitional Surface. A surface similar to the Transitional Surface but closer to the runway.

**13.1.7.2 Characteristics**

The limits of an Inner Transitional Surface shall comprise:

- a) a lower edge beginning at the end of the Inner Approach Surface and extending down the side of the Inner Approach Surface to the inner edge of that surface, from there along the strip parallel to the runway centre line to the inner edge of the Balked Landing Surface and from there up the side of the Balked Landing Surface to the point where the side intersects the Inner Horizontal Surface; and
- b) an upper edge located in the plane of the Inner Horizontal Surface.

**13.1.7.3 The elevation of a point on the lower edge shall be:**

- a) along the side of the Inner Approach Surface and Balked Landing Surface - equal to the elevation of the particular surface at that point; and
- b) along the strip - equal to the elevation of the nearest point on the centre line of the runway or its extension.

*Note: As a result of b) the inner transitional surface along the strip will be curved if the runway profile is curved or a plane if the runway profile is a straight line. The intersection of the inner transitional surface with the inner horizontal surface will also be a curved or straight line depending on the runway profile.*

**13.1.7.4 The slope of the Inner Transitional Surface shall be measured in a vertical plane at right angles to the centre line of the runway.**

**13.1.8 Balked Landing Surface**

**13.1.8.1 Description**

Balked Landing Surface. An inclined plane located at a specified distance after the threshold, extending between the Inner Transitional Surface.



#### 13.1.8.2 **Characteristics**

The limits of the Balked Landing Surface shall comprise:

- a) an inner edge horizontal and perpendicular to the centre line of the runway and located at a specified distance after the threshold;
- b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centre line of the runway; and
- c) an outer edge parallel to the inner edge and located in the plane of the Inner Horizontal Surface.

13.1.8.3 The elevation of the inner edge shall be equal to the elevation of the runway centre line at the location of the inner edge.

13.1.8.4 The slope of the Balked Landing Surface shall be measured in the vertical plane containing the centre line of the runway.

#### 13.1.9 **Take-off Climb Surface**

##### 13.1.9.1 **Description**

Take-off Climb Surface. An inclined plane or other specified surface beyond the end of a runway or clearway.

##### 13.1.9.2 **Characteristics**

The limits of the Take-off Climb Surface shall comprise:

- a) an inner edge horizontal and perpendicular to the centre line of the runway and located either at a specified distance beyond the end of the runway or at the end of the clearway when such is provided and its length exceeds the specified distance;
- b) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate from the take-off track to a specified final width and continuing thereafter at that width for the remainder of the length of the Take-off Climb Surface; and
- c) an outer edge horizontal and perpendicular to the specified take-off track.

13.1.9.3 The elevation of the inner edge shall be equal to the highest point on the extended runway centre line between the end of the runway and the inner edge, except that



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when a clearway is provided the elevation shall be equal to the highest point on the ground on the centre line of the clearway.

- 13.1.9.4 In the case of a straight take-off flight path, the slope of the Take-off Climb Surface shall be measured in the vertical plane containing the centre line of the runway.
- 13.1.9.5 In the case of a take-off flight path involving a turn, the Take-off Climb Surface shall be a complex surface containing the horizontal normals to its centre line, and the slope of the centre line shall be the same as that for a straight take-off flight path.

**13.2 OBSTACLE LIMITATION REQUIREMENTS**

*Note: The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e. take-off or landing and type of approach, and are intended to be applied when such use is made of the runway. In cases where operations are conducted to or from both directions of a runway, then the function of certain surfaces may be nullified because of more stringent requirements of another lower surface.*

**13.2.1 Non-Instrument Runways**

- 13.2.1.1 The following obstacle limitation surfaces shall be established for a Non-Instrument Runway:
- a) Conical Surface;
  - b) Inner Horizontal Surface;
  - c) Approach Surface; and
  - d) Transitional Surfaces.

- 13.2.1.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table App 13-1.

- 13.2.1.3 New objects or extensions of existing objects shall not be permitted above an Approach or Transitional Surface except when, in the opinion of the Authority, the new object or extension will be shielded by existing terrain that is impractical to remove.

*Note: Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137), Part 6.*

- 13.2.1.4 New objects or extensions of existing objects shall not be permitted above the Conical Surface or Inner Horizontal Surface except when, in the opinion of the Authority, the object would be shielded by an existing immovable object, or after an



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Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

- 13.2.1.5 Existing objects above any of the surfaces required by 13.2.1.1 shall as far as practicable be removed except when, in the opinion of the Authority, the object is shielded by existing terrain, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

*Note: Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes.*

- 13.2.1.6 In considering proposed construction, account shall be taken of the possible future development of an Instrument Runway and consequent requirement for more stringent obstacle limitation surfaces.

**13.2.2 Non-Precision Approach Runways**

- 13.2.2.1 The following obstacle limitation surfaces shall be established for a non-precision approach runway:

- a) Conical Surface;
- b) Inner Horizontal Surface;
- c) Approach Surface; and
- d) Transitional Surfaces.

- 13.2.2.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table App 13-1, except in the case of the horizontal section of the Approach Surface (see Clause 13.2.2.3 in this Appendix).

- 13.2.2.3 The Approach Surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:

- a) a horizontal plane 150 m above the threshold elevation; or
- b) the horizontal plane passing through the top of any object that governs the obstacle clearance altitude/height (OCA/H);

whichever is the higher.

**Table App 13-1**

**Dimensions and Slopes of Obstacle Limitation Surfaces**

APPROACH RUNWAYS										
RUNWAY CLASSIFICATION										
	Non-instrument Code number				Non-precision approach Code number			Precision approach category		
								I Code number	II or III Code number	
Surface and dimensions <sup>a</sup>	1	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
<b>CONICAL</b>										
Slope	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
<b>INNER HORIZONTAL</b>										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
<b>INNER APPROACH</b>										
Width	-	-	-	-	-	-	-	90 m	120 m <sup>e</sup>	120 m <sup>e</sup>
Distance from threshold	-	-	-	-	-	-	-	60 m	60 m	60 m
Length	-	-	-	-	-	-	-	900 m	900 m	900 m
Slope	-	-	-	-	-	-	-	2.5 %	2 %	2 %
<b>APPROACH</b>										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10 %	10 %	10 %	10 %	15 %	15 %	15 %	15 %	15 %	15 %
<b>First section</b>										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5 %	4 %	3.33 %	2.5 %	3.33 %	2 %	2 %	2.5 %	2 %	2 %



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Second section										
Length	-	-	-	-	-	3 600 m <sup>b</sup>	3 600 m <sup>b</sup>	12 000 m	3 600 m <sup>b</sup>	3 600 m <sup>b</sup>
Slope	-	-	-	-	-	2.5 %	2.5 %	3 %	2.5 %	2.5 %
Horizontal section										
Length	-	-	-	-	-	8 400 m <sup>b</sup>	8 400 m <sup>b</sup>	-	8 400 m <sup>b</sup>	8 400 m <sup>b</sup>
Total length	-	-	-	-	-	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20 %	20 %	14.3 %	14.3 %	20 %	14.3 %	14.3 %	14.3 %	14.3 %	14.3 %
INNER TRANSITIONAL										
Slope	-	-	-	-	-	-	-	40 %	33.3 %	33.3 %
BALKED LANDING SURFACE										
Length of inner edge	-	-	-	-	-	-	-	90 m	120 m <sup>e</sup>	120 m <sup>e</sup>
Distance from threshold	-	-	-	-	-	-	-	<sup>c</sup>	1 800 m <sup>d</sup>	1 800 m <sup>d</sup>
Divergence (each side)	-	-	-	-	-	-	-	10 %	10 %	10 %
Slope	-	-	-	-	-	-	-	4 %	3.33 %	3.33 %

a) All dimensions are measured horizontally unless specified otherwise.

b) Variable length (see Clause 13.2.2.3 or 13.2.3.5 in this Appendix)

c) Distance to the end of strip

d) Or end of runway whichever is less

e) Where the Code Letter is F, the width is increased to 140 m except for those aerodromes that accommodate a code letter F aeroplane equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

Note: -- See ICAO Circular 301 — New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study.

13.2.2.4 New objects or extensions of existing objects shall not be permitted above an Approach Surface within 3 000 m of the inner edge or above a Transitional Surface





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except when, in the opinion of the Authority, the new object or extension would be shielded by existing terrain that is impractical to remove.

13.2.2.5 New objects or extensions of existing objects shall not be permitted above the Approach Surface beyond 3000 m from the inner edge, the Conical Surface or Inner Horizontal Surface except when, in the opinion of the Authority, the object would be shielded by an existing immovable object, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

13.2.2.6 Existing objects above any of the surfaces required by Clause 13.2.2 should as far as practicable be removed except when, in the opinion of the Authority, the object is shielded by existing terrain that is impractical to remove, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

13.2.3 **Precision Approach Runways**

*Note 1: See clause 13.2.6 for information regarding siting of equipment and installations on operational areas.*

*Note 2: Guidance on obstacle limitation surfaces for precision approach runways is given in the ICAO Airport Services Manual (Doc 9137), Part 6.*

13.2.3.1 The following obstacle limitation surfaces shall be established for all precision approach runways i.e. Category I, II and III:

- a) Conical Surface;
- b) Inner Horizontal Surface;
- c) Approach Surface;
- d) Inner Approach Surface
- e) Transitional Surfaces;
- f) Inner Transitional Surfaces, and
- g) Balked Landing Surface.

13.2.3.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table App 13-1, except in the case of the horizontal section of the Approach Surface (see Clause 13.2.3.3 in this Appendix).



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- 13.2.3.3 The Approach Surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:
- a) a horizontal plane 150 m above the threshold elevation; or
  - b) the horizontal plane passing through the top of any object that governs the obstacle clearance limit;
- whichever is the higher.
- 13.2.3.4 Fixed objects shall not be permitted above the Inner Approach Surface, the Inner Transitional Surface or the Balked Landing Surface, except for frangible objects which because of their function must be located on the strip. Mobile objects shall not be permitted above these surfaces during the use of the runway for landing.
- 13.2.3.5 New objects or extensions of existing objects shall not be permitted above an Approach Surface or a Transitional Surface except when, in the opinion of the Authority, the new object or extension would be shielded by existing terrain that is impractical to remove.
- 13.2.3.6 New objects or extensions of existing objects should not be permitted above the Conical Surface and the Inner Horizontal Surface except when, in the opinion of the Authority, an object would be shielded by an existing terrain, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.
- 13.2.3.7 Existing objects above an Approach Surface, a Transitional Surface, the Conical Surface and Inner Horizontal Surface shall as far as practicable be removed except when, in the opinion of the Authority, an object is shielded by existing terrain, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.
- 13.2.4 **Runways Meant for Take-off**
- 13.2.4.1 The obstacle limitation surface of Take-off Climb Surface shall be established for a runway meant for take-off.
- 13.2.4.2 The dimensions of the surface shall be not less than the dimensions specified in Table App 13-2, except that a lesser length may be adopted for the Take-off Climb Surface where such lesser length would be consistent with procedural measures adopted to govern the outward flight of aeroplanes.



**Table App 13-2**

**Dimensions and Slopes of Obstacle Limitation Surfaces**

Surface and Dimensions <sup>a</sup> (1)	Code Number		
	1 (2)	2 (3)	3 or 4 (4)
<b>TAKE-OFF CLIMB</b>			
Length of Inner Edge	60 m	80 m	180 m
Distance for Runway End <sup>b</sup>	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final Width	380 m	580 m	1 200 m 1 800 m <sup>c</sup>
Length	1 600 m	2 500 m	18 750 m
Slope	5%	4%	1.6% <sup>d</sup>

*a) All dimensions are measured horizontally unless specified otherwise*

*b) The Take-off Climb Surface starts at the end of the clearway if the clearway length exceeds the specified distance.*

*c) 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.*

*d) See Clause 13.2.4.3 and 13.2.4.5 in this Appendix.*

**13.2.4.3** The operational characteristics of aeroplanes for which the runway is intended shall be examined to see if it is desirable to reduce the slope specified in Table App 13-2. If the specified slope is reduced, a corresponding adjustment in the length of Take-off Climb Surface should be made so as to provide protection to a height of 300 m.

**13.2.4.4** New objects or extensions of existing objects shall not be permitted above a Take-off Climb Surface except when, in the opinion of the Authority, the new object or extension would be shielded by an existing terrain that is impractical to remove.

*Note: Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137), Part 6.*

**13.2.4.5** If no object reaches the 1.6 per cent (1:62.5) Take-off Climb Surface, new objects should be limited to preserve the existing obstacle free surface or preferably a surface down to a slope of 1.2 per cent (1:83).

**13.2.4.6** Existing objects that extend above a Take-off Climb Surface shall as far as practicable be removed except when, in the opinion of the Authority, an object is shielded by



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an existing terrain that is impractical to remove, or after an Aeronautical Study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

*Note: Because of transverse slopes on a strip or clearway, in certain cases portions of the inner edge of the Take-off Climb Surface may be below the corresponding elevation of the strip or clearway. It is not intended that the strip or clearway be graded to conform with the inner edge of the Take-off Climb Surface, nor is it intended that terrain or objects which are above the Take-off Climb Surface beyond the end of the strip or clearway, but below the level of the strip or clearway, be removed unless it is considered they may endanger aeroplanes. Similar considerations apply at the junction of a clearway and strip where differences in transverse slopes exist.*

**13.2.5 Objects outside the Obstacle Limitation Surfaces**

13.2.5.1 Arrangements should be made to enable the Appropriate Authority to be consulted concerning proposed construction beyond the limits of the Obstacle Limitation Surfaces that extend above a height established by that authority, in order to permit an Aeronautical Study of the effect of such construction on the operation of aeroplanes.

13.2.5.2 In areas beyond the limits of the Obstacle Limitation Surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special Aeronautical Study indicates that they do not constitute a hazard to aeroplanes.

*Note: This study may have regard to the nature of operations concerned and may distinguish between day and night operations.*

**13.2.6 Siting of Equipment and Installations on Operational Areas**

*Note 1: Requirements for obstacle limitation surfaces are specified in Appendix 13, 13.2*

*Note 2: The design of light fixtures and their supporting structures, light units of visual approach slope indicators, signs, and markers, is specified in Appendix 9, 9.1 9.6, Appendix 11 and Appendix 12, 12.18, respectively. Guidance on the frangible design of visual and non-visual aids for navigation is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 6.*



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- 13.2.6.1 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation shall be:
- a) on a runway strip, a Runway End Safety Area, a taxiway strip or within the distances specified in Appendix 8, Table App 8-1, column 11, if it would endanger an aircraft; or
  - b) on a clearway if it would endanger an aircraft in the air.
- 13.2.6.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located:
- a) on that portion of a runway strip within:
    - i) 75 m of the runway centre line where the Code Number is 3 or 4; or
    - ii) 45 m of the runway centre line where the Code Number is 1 or 2; or
  - b) on a Runway End Safety Area, a taxiway strip or within the distances specified in Table App 8-1; or
  - c) on a clearway and which would endanger an aircraft in the air;
- shall be frangible and mounted as low as possible.
- 13.2.6.3 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on the non-graded portion of a runway strip shall be regarded as an obstacle and shall be frangible and mounted as low as possible.
- Note: Guidance on the siting of navigation aids is contained in the ICAO Aerodrome Design Manual (Doc 9157), Part 6.*
- 13.2.6.4 Unless its function requires it to be there for air navigation purposes or for aircraft safety, no equipment or installation shall be located within 240 m from the end of the strip and within:
- a) 60 m of the extended centre line where the Code Number is 3 or 4; or
  - b) 45 m of the extended centre line where the Code Number is 1 or 2;
- of a Precision Approach Runway Category I, II or III.
- 13.2.6.5 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on or near a strip of a Precision Approach Runway Category I, II or III and which:
- a) is situated within 240 m from the end of the strip and within:



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- i) 60 m of the extended runway centre line where the Code Number is 3 or 4; or
- ii) 45 m of the extended runway centre line where the Code Number is 1 or 2; or
- b) penetrates the Inner Approach Surface, the Inner Transitional Surface or the Balked Landing Surface;

shall be frangible and mounted as low as possible.

*Note: See Appendix 9, 9.1.5 for the protection date for existing elevated approach lights.*

- 13.2.6.6 Any equipment or installation required for air navigation purposes or for aircraft safety purposes which is an obstacle penetrating the conical, inner horizontal, approach slope more than 3,000 m from the inner edge, or takeoff surface, shall be frangible and mounted as low as possible.

13.2.7 **Reserved**

13.2.8 **Other Objects**

- 13.2.8.1 Objects which do not project through the Approach Surface but which would nevertheless adversely affect the optimum siting or performance of visual or non-visual aids shall, as far as practicable, be removed.

- 13.2.8.2 Anything which may, in the opinion of the Authority after an Aeronautical Study, endanger aeroplanes on the Movement Area or in the air within the limits of the Inner Horizontal and Conical Surfaces shall be regarded as an obstacle and shall be removed in so far as practicable.

*Note: In certain circumstances, objects that do not project above any of the surfaces enumerated in 13.1 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.*



### 13.2.9 Objects to be Marked and/or Lighted

*Note: The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.*

*Note 2: An autonomous aircraft detection system may be installed on or near an obstacle (or group of obstacles such as wind farms), designed to operate the lighting only when the system detects an aircraft approaching the obstacle, in order to reduce light exposure to local residents, Guidance on the design and installation of an autonomous aircraft detection system is available in the Aerodrome Design Manual (Doc) 9157) Part 4. The availability of such guidance is not intended to imply that such a system has to be provided.*

#### 13.2.9.1 Objects within the Lateral Boundaries of the Obstacle Limitation Surfaces

13.2.9.2 Vehicles and other mobile objects, excluding aircraft, on the Movement Area of an aerodrome are obstacles and shall be marked and, if the vehicles and aerodrome are used at night or in conditions of low visibility, lighted, except that aircraft servicing equipment and vehicles used only on aprons may be exempt.

13.2.9.3 Elevated aeronautical ground lights within the Movement Area shall be marked so as to be conspicuous by day. Obstacle lights shall not be installed on elevated ground lights or signs in the Movement Area.

13.2.9.4 All obstacles within the distance specified in Table App 8-1, Column 11 or 12, from the centre line of a taxiway, an apron taxiway or aircraft stand taxilane shall be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.

13.2.9.5 A fixed obstacle that extends above a take-off climb surface within 3 000 m of the inner edge of the take-off climb surface shall be marked and, if the runway is used at night, lighted, except that:

- a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;
- b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;
- c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and



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- d) the lighting may be omitted where the obstacle is a light beacon and an aeronautical study indicates the light beacon light to be sufficient.

13.2.9.6 A fixed object, other than an obstacle, adjacent to a take-off climb surface shall be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when:

- a) the object is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;  
or
- b) the object is lighted by high-intensity obstacle lights by day.

13.2.9.7 A fixed obstacle that extends above an approach surface within 3 000 m of the inner edge or above a transitional surface shall be marked and, if the runway is used at night, lighted, except that:

- a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;
- b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;
- c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and
- d) the lighting may be omitted where the obstacle is a light beacon and an aeronautical study indicates the light beacon light to be sufficient.

13.2.9.8 A fixed obstacle that extends above a horizontal surface should be marked and, if the aerodrome is used at night, lighted, except that:

- a) such marking and lighting may be omitted when:
  - i) the obstacle is shielded by another fixed obstacle; or
  - ii) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or an aeronautical study shows the obstacle not to be of operational significance;
- b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;





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- c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and
- d) the lighting may be omitted where the obstacle is a light beacon and an aeronautical study indicates the light beacon light to be sufficient.

13.2.9.9 A fixed object that extends above an obstacle protection surface shall be marked and, if the runway is used at night, lighted.

*Note: See Chapter 9, 9.6 for information on the obstacle protection surface.*

13.2.9.10 Other objects inside the obstacle limitation surfaces should be marked and/or lighted if an aeronautical study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway or highway).

*Note: See note accompanying 13.2.8.2.*

13.2.9.11 Overhead wires, cables, etc., crossing a wadi, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an Aeronautical Study indicates that the wires or cables could constitute a hazard to aircraft, except that the marking of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.

13.2.9.12 **Objects Outside the Lateral Boundaries of the Obstacle Limitation Surfaces**

13.2.9.13 Obstacles in accordance with 13.2.5.1 should be marked and lighted, except that the marking may be omitted when the obstacle is lighted by High-Intensity Obstacle Lights by day.

13.2.9.14 Other objects outside the obstacle limitation surfaces should be marked and/or lighted if an Aeronautical Study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway, highway).

13.2.9.15 Overhead wires, cables, etc., crossing a wadi, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an Aeronautical Study indicates that the wires or cables could constitute a hazard to aircraft, except that the marking of the supporting towers may be omitted when they are lighted by High-intensity Obstacle Lights by day.



## 13.2.10 Marking and/or Lighting of Objects

### 13.2.10.1 General

- 13.2.10.1.1 The presence of objects which must be lighted, as specified in 13.2.9, shall be indicated by low-, medium- or high-intensity lights, or a combination of such lights.
- 13.2.10.1.2 Low-intensity obstacle lights on fixed objects, Types A, B, C, D and E, medium-intensity obstacle lights, types A, B and C, high-intensity obstacle lights Type A and B, shall be in accordance with the specifications in Table App 13-5. e.g. RVR transmissometers, windsock, glidepath, antennae etc.
- 13.2.10.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

### 13.2.10.2 Mobile Objects

#### **Marking**

- 13.2.10.2.1 All mobile objects to be marked shall be coloured or display flashing yellow beacons. Use of hazard lights on the apron areas is considered acceptable.

#### **Marking by Colour**

- 13.2.10.2.2 When mobile objects are marked by colour, a single conspicuous colour, preferably red or yellowish green, shall be used for emergency vehicles. Service vehicles should be coloured yellow.

#### **Marking by Flags**

- 13.2.10.2.3 Flags used to mark mobile objects shall be displayed around, on top of, or around the highest edge of the object. Flags shall not increase the hazard presented by the object they mark.
- 13.2.10.2.4 Flags used to mark mobile objects shall not be less than 0.9 m on each side and shall consist of a chequered pattern, each square having sides of not less than 0.3 m. The colours of the pattern shall contrast each with the other and with the background against which they will be seen. Orange and white or alternatively



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red and white shall be used, except where such colours merge with the background.

**Lighting**

- 13.2.10.2.5 Low-intensity obstacle lights, Type C, shall be displayed on vehicles and other mobile objects excluding aircraft.

*Note: See ICAO Annex 2 for lights to be displayed by aircraft.*

- 13.2.10.2.6 Low-intensity obstacle lights, Type C, displayed on vehicles associated with emergency or security shall be flashing-blue and those displayed on other vehicles shall be flashing-yellow or amber.

- 13.2.10.2.7 Low-intensity obstacle lights, Type D, shall be displayed on follow-me vehicles.

- 13.2.10.2.8 Low-intensity obstacle lights on objects with limited mobility such as aerobridges shall be fixed-red, and as a minimum be in accordance with the specifications for low-intensity obstacle lights, Type A, in Table App 13-7. The intensity of the lights shall be sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general levels of illumination against which they would normally be viewed.

13.2.10.3 **Fixed Objects**

*Note: The fixed objects of wind turbines are addressed separately in 13.2.11 and the fixed objects of overhead wires, cables, etc., and supporting towers are addressed separately in 13.2.12.*

- 13.2.10.3.1 All fixed objects to be marked shall, whenever practicable, be coloured, but if this is not practicable, markers or flags shall be displayed on or above them, except that objects that are sufficiently conspicuous by their shape, size or colour need not be otherwise marked.

**Marking by Colour**

- 13.2.10.3.2 An object should be coloured to show a chequered pattern if it has essentially unbroken surfaces and its projection on any vertical plane equals or exceeds 4.5 m in both dimensions. The pattern should consist of rectangles of not less than 1.5 m and not more than 3 m on a side, the corners being of the darker colour. The colours of the pattern should contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white should be used, except where such colours merge with the background. (See Figure App 13-3.)

- 13.2.10.3.3 An object should be coloured to show alternating contrasting bands if:



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- a) it has essentially unbroken surfaces and has one dimension, horizontal or vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or
- b) it is of skeletal type with either a vertical or a horizontal dimension greater than 1.5 m.

13.2.10.3.4 The bands should be perpendicular to the longest dimension and have a width approximately  $\frac{1}{7}$  of the longest dimension or 30 m, whichever is less. The colours of the bands should contrast with the background against which they will be seen. Orange and white should be used, except where such colours are not conspicuous when viewed against the background. The bands on the extremities of the object should be of the darker colour. (See Figures App 13-3 and App 13-4.)

*Note: Table App 13-3 shows a formula for determining band widths and for having an odd number of bands, thus permitting both the top and bottom bands to be of the darker colour.*

13.2.10.3.5 An object shall be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red should be used, except where such colours merge with the background.

*Note: Against some backgrounds it may be found necessary to use a different colour from orange or red to obtain sufficient contrast.*

**Marking by Flags**

13.2.10.3.6 Flags used to mark fixed objects shall be displayed around, on top of, or around the highest edge of, the object. When flags are used to mark extensive objects or groups of closely spaced objects, they shall be displayed at least every 15 m. Flags shall not increase the hazard presented by the object they mark.

13.2.10.3.7 Flags used to mark fixed objects shall not be less than 0.6 m on each side..

13.2.10.3.8 Flags use to mark fixed objects should be orange in colour or a combination of two triangular sections, one orange and the other white, or one red and the other white, except that where such colours merge with the background, other conspicuous colours should be used.

**Marking by Markers**

13.2.10.3.9 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in



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all directions in which an aircraft is likely to approach the object. The shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented by the object they mark is not increased.

- 13.2.10.3.10 A marker should be of one colour. When installed, white and red, or white and orange markers should be displayed alternately. The colour selected should contrast with the background against which it will be seen.

### **Lighting**

- 13.2.10.3.11 In the case of an object to be lighted, one or more low-, medium- or high-intensity obstacle lights shall be located as close as practicable to the top of the object.

*Note: Recommendations on how a combination of low-, medium- and/or high-intensity lights on obstacles should be displayed are given in ICAO Annex 14, Volume 1, Appendix 6.*

- 13.2.10.3.12 In the case of a chimney or other structure of like function, the top lights should be placed sufficiently below the top so as to minimize contamination by smoke, etc. (See Figure App 13-4).

- 13.2.10.3.13 In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance, such as a rod or an antenna, greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light shall be located at the highest practicable point and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.

- 13.2.10.3.14 In the case of an extensive object or of a group of closely spaced objects to be lighted that are:

- a) penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights shall be so arranged as to at least indicated the points or edges of the object highest in relation to the obstacle limitation surface or above the ground, and so as to indicate the general definition and the extent of the objects; and
- b) penetrating a sloping OLS, the top lights shall be so arranged as to at least indicate the points or edges of the object highest in relation to the OLS, and so as to indicate the general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the Landing Area shall be marked.



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- 13.2.10.3.15 When the obstacle limitation surface concerned is sloping and the highest point above the OLS is not the highest point of the object, additional obstacle lights should be placed on the highest point of the object.
- 13.2.10.3.16 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and
- a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and
  - b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.
- 13.2.10.3.17 High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object shall flash simultaneously.
- 13.2.10.3.18 The installation setting angles for high-intensity obstacle lights, Type A, should be in accordance with Table 13-4.
- Note: High-intensity obstacle lights are intended for day use as well as night use. Care is needed to ensure that these lights do not create disconcerting dazzle. Guidance on the design, location and operation of high-intensity obstacle lights is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*
- 13.2.10.3.19 Where, in the opinion of the Appropriate Authority, the use of high-intensity obstacle lights, Type A, or medium-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system should be provided. This system should be composed of high-intensity obstacle lights, Type A, or medium-intensity obstacle lights, Type A, as appropriate, for daytime and twilight use and medium-intensity obstacle lights, Type B or C, for night-time use.

**Lighting of Objects with a height less Than 45 m above Ground Level**

- 13.2.10.3.20 Low-intensity obstacle lights, Type A or B, should be used where the object is a less extensive one and its height above the surrounding ground is less than 45 m.
- 13.2.10.3.21 Where the use of low-intensity obstacle lights, Type A or B, would be inadequate or an early special warning is required, then medium- or high-intensity obstacle lights shall be used.
- 13.2.10.3.22 Low-intensity obstacle lights, Type B, should be used either alone or in combination with medium-intensity obstacle lights, Type B, in accordance with 13.2.10.3.23.



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- 13.2.10.3.23 Medium-intensity obstacle lights, Type A, B or C, should be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.

*Note: A group of buildings is regarded as an extensive object.*

**Lighting of objects with a Height 45 m to a Height less than 150 m above Ground Level**

- 13.2.10.3.24 Medium-intensity obstacle lights, Type A, B or C, should be used. . Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.
- 13.2.10.3.25 Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m. (see Clause 13.4.1.7)
- 13.2.10.3.26 Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.
- 13.2.10.3.27 Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.
- 13.2.10.3.28 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 13.2.10.3.11 except that where an object to be marked is





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surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

***Lighting of Objects with a Height 150 m or more above Ground Level***

- 13.2.10.3.29 High-intensity obstacle lights, Type A, shall be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and an Aeronautical Study indicates such lights to be essential for the recognition of the object by day.
- 13.2.10.3.30 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 13.2.10.3.11, except that where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.
- 13.2.10.3.31 Where, in the opinion of the Appropriate Authority, the use of high-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, medium-intensity obstacle lights, Type C, shall be used alone, whereas medium-intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.
- 13.2.10.3.32 Where an object is indicated by medium-intensity obstacle lights, Type A, , additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.
- 13.2.10.3.33 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.
- 13.2.10.3.34 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.



Figure App 13-3

Basic Marking Patterns

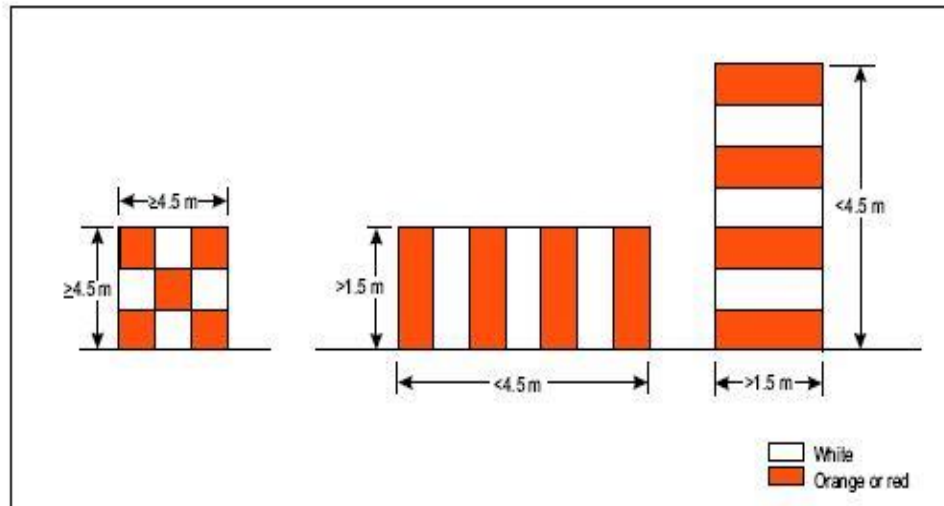
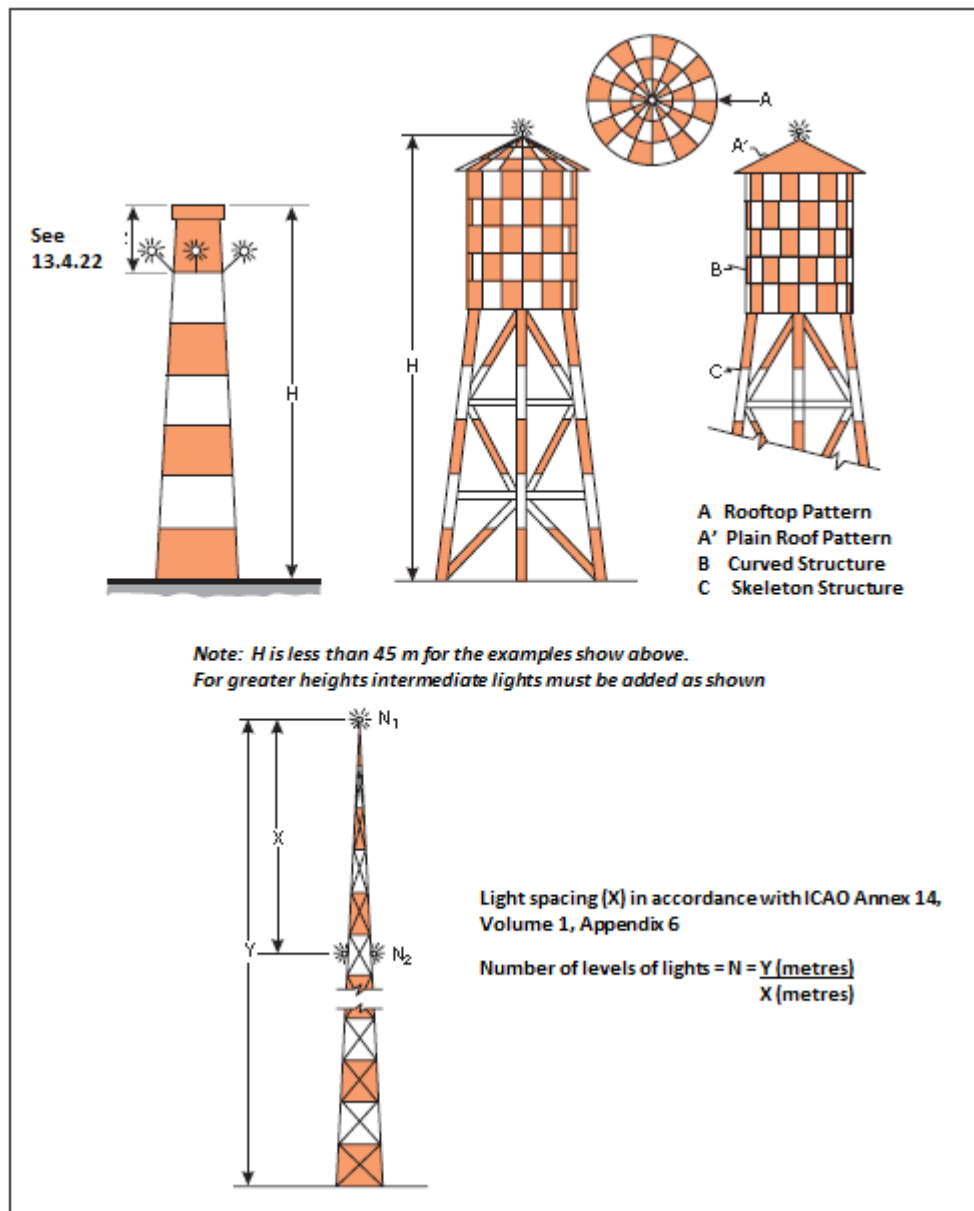


Figure App 13-4

Examples of Marking and Lighting of Tall Structures





**Table App 13-3**

**Marking Band Widths**

<b><i>Longest Dimension</i></b>		<b><i>Band Width</i></b>			
Greater than	Not exceeding				
1.5 m	210 m	1/7	of longest dimension		
210 m	270 m	1/9 "	"	"	"
270 m	330 m	1/11	"	"	"
330 m	390 m	1/13	"	"	"
390 m	450 m	1/15	"	"	"
450 m	510 m	1/17	"	"	"
510 m	570 m	1/19	"	"	"
570 m	630 m	1/21	"	"	"

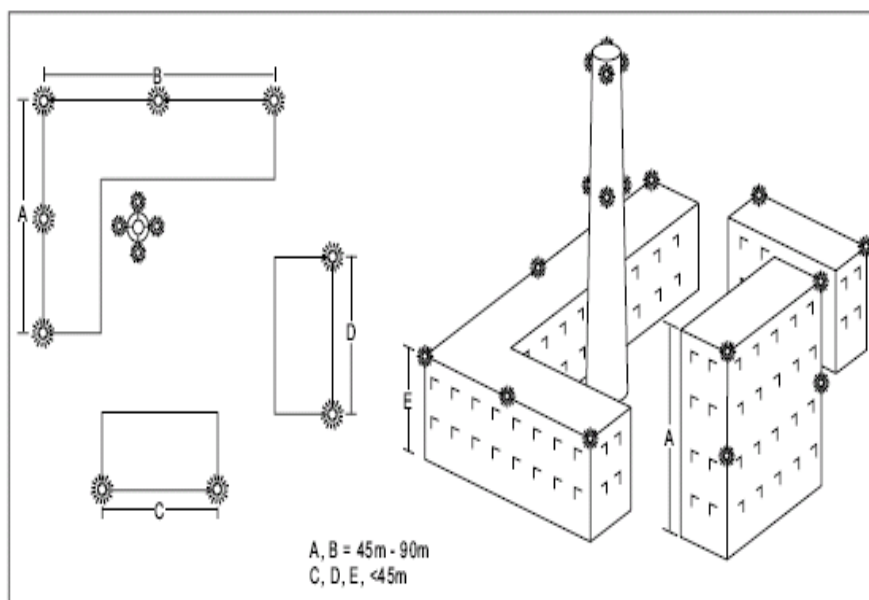
**Table App 13-4**

**Installation Setting Angles for High-intensity Obstacle Lights**

<b>Height of Light Unit Above Terrain</b>	<b>Angle of the Peak of the Beam above the Horizontal</b>
greater than 151 m AGL	0°
122 m to 151 m AGL	1°
92 m to 122 m AGL	2°
Less than 92 m AGL	3°

Figure App 13-5

### Lighting of Buildings



#### 13.2.11 Wind Turbines

13.2.11.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

*Note 1: Additional lighting or markings may be provided where in the opinion of the Authority such lighting or markings are deemed necessary.*

*Note 2: See 13.2.5.1 and 13.2.5.2*

#### Markings

13.2.11.2 The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an Aeronautical Study.

#### Lighting

13.2.11.3 When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm should be regarded as an extensive object and the lights should be installed:

- to identify the perimeter of the wind farm;
- respecting the maximum spacing, in accordance with 6.3.14, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;



## APPENDIX 13

- c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm; and
- d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and
- e) at locations prescribed in a), b) and d), respecting the following criteria:
  - i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle should be provided;
  - ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light. The lights should be installed to assure that the output of either light is not blocked by the other; and
  - iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, should be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be used.

*Note.— The above 13.2.11.3 e) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.*

- 13.2.11.4 The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.
- 13.2.11.5 Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with 13.2.11.3 e) or as determined by an aeronautical study.

### 13.2.12 Overhead wires, cables, etc., and supporting towers

#### **Marking**

- 13.2.12.1 The wires, cables, etc., to be marked should be equipped with markers; the supporting tower should be coloured.

#### **Marking by Colours**

- 13.2.12.2 The supporting towers of overhead wires, cables, etc., that require marking should be marked in accordance with 13.2.10.3.1 to 13.2.10.3.2, except that the marking



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of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.

**Marking by Markers**

13.2.12.3 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented by the object they mark is not increased.

13.2.12.4 A marker displayed on an overhead wire, cable, etc., should be spherical and have a diameter of not less than 60 cm.

13.2.12.5 The spacing between two consecutive markers or between a marker and a supporting tower should be appropriate to the diameter of the marker, but in no case should the spacing exceed:

- a) 30 m where the marker diameter is 60 cm progressively increasing with the diameter of the marker to
- b) 35 m where the marker diameter is 80 cm and further progressively increasing to a maximum of
- c) 40 m where the marker diameter is of at least 130 cm.

Where multiple wires, cables, etc., are involved, a marker should be located not lower than the level of the highest wire at the point marked.

13.2.12.6 A marker should be of one colour. When installed, white and red, or white and orange markers should be displayed alternately. The colour selected shall contrast with the background against which it will be seen.

13.2.12.7 When it has been determined that an overhead wire, cable, etc., needs to be marked but it is not practicable to install markers on the wire, cable, etc., then high-intensity obstacle lights, Type B, should be provided on their supporting towers.

**Lighting**

13.2.12.8 High-intensity obstacle lights, Type B, should be used to indicate the presence of a tower supporting overhead wires, cables, etc., where:



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- a) an Aeronautical Study indicates such lights to be essential for the recognition of the presence of wires, cables, etc.; or
- b) it has not been found practicable to install markers on the wires, cables, etc.

13.2.12.9 Where high-intensity obstacle lights, Type B, are used, they shall be located at three levels:

- at the top of the tower;
- at the lowest level of the catenary of the wires or cables; and
- at approximately midway between these two levels.

*Note: In some cases, this may require locating the lights off the tower.*

13.2.12.10 High-intensity obstacle lights, Type B, indicating the presence of a tower supporting overhead wires, cables, etc., should flash sequentially; first the middle light, second the top light and last, the bottom light. The intervals between flashes of the lights should approximate the following ratios:

Flash interval between	Ratio of cycle time
middle and top light	1/13
top and bottom light	2/13
bottom and middle light	10/13

*Note: High intensity obstacle lights are intended for day use as well as night use. Care is needed to ensure that these lights do not create disconcerting dazzle. Guidance on the design, operation and the location of high-intensity obstacle lights is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

13.2.12.11 Where, in the opinion of the Appropriate Authority, the use of high-intensity obstacle lights, B, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system should be provided. This system should be composed of high-intensity obstacle lights, Type B, for daytime and twilight use and medium-intensity obstacle lights, Type B, for night-time use. Where medium-intensity lights are used they should be installed at the same level as the high-intensity obstacle light Type B.



Table App 13-5

Characteristics of Obstacle Lights

1	2	3	4	5	6	7
Light Type	Colour	Signal Type/(Flash Rate)	Peak Intensity (cd) at given Background Luminance <sup>b</sup>			Light Distribution Table
			Day (Above 500 cd/m <sup>2</sup> )	Twilight (50-500 cd/m <sup>2</sup> )	Night (Below 50 cd/m <sup>2</sup> )	
Low-Intensity, Type A (Fixed Obstacle)	Red	Fixed	N/A	N/A	10	Table App 13-6
Low-Intensity, Type B (Fixed Obstacle)	Red	Fixed	N/A	N/A	32	Table App 13-6
Low-Intensity, Type C (Mobile Obstacle)	Yellow/Amber Blue (a)	Flashing (60-90 fpm)	N/A	40	40	Table App 13-6
Low-Intensity, Type D (Follow-Me Vehicle)	Yellow/Amber	Flashing (60-90 fpm)	N/A	200	200	Table App 13-6
Low intensity, Type E	Red	Flashing (c)	N/A	N/A	32	Table App 13-6 (type B)
Medium-Intensity Type A	White	Flashing (20-60 fpm)	20 000	20 000	2 000	Table App 13-7
Medium-Intensity Type B	Red	Flashing (20-60 fpm)	N/A	N/A	2 000	Table App 13-7
Medium-Intensity Type C	Red	Fixed	N/A	N/A	2 000	Table App 13-7
High-Intensity Type A	White	Flashing (40-60 fpm)	200 000	20 000	2 000	Table App 13-7
High-Intensity Type B	White	Flashing (40-60 fpm)	100 000	20 000	2 000	Table App 13-7

a) See 13.2.10.2.6.

b) For flashing lights, effective intensity as determined in accordance with the ICAO Aerodrome Design Manual (Doc 9157), Part 4

c) For wind turbine application, to flash at the same rate as the lighting on the nacelle.





Table App 13-6

Light Distribution for Low Intensity Obstacle Lights

	Minimum Intensity (a)	Maximum Intensity (a)	Vertical Beam Spread (f)	
			Minimum beam spread	Intensity
<b>Type A</b>	10cd (b)	N/A	10°	5cd
<b>Type B</b>	32cd (b)	N/A	10°	16cd
<b>Type C</b>	40cd (b)	400cd	12° (d)	20cd
<b>Type D</b>	200cd (b)	400cd	N/A (e)	N/A

*Note: This table does not include recommended horizontal beam spreads. 13.4.2.12 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.*

- a) 360° horizontal. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the ICAO Aerodrome Design Manual, Part 4.
- b) Between 2 and 10° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.
- c) Between 2 and 20° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.
- d) Peak intensity should be located at approximately 2.5° vertical.
- e) Peak intensity should be located at approximately 17° vertical.



Table App 13-7

**Light Distribution for Medium and High Intensity Obstacle Lights According to Benchmark Intensities of Table App 13-5**

Bench mark Intensity	Minimum Requirements					Recommendations				
	Vertical Elevation Angle (b)			Vertical Beam Spread (c)		Vertical Elevation Angle (b)			Vertical Beam Spread (c)	
	0°		-1°			0°	-1°	-10°		
	Minimum Average Intensity (a)	Minimum Intensity (a)	Minimum Intensity (a)	Minimum Beam Spread	Intensity (a)	Maximum Average Intensity (a)	Maximum Intensity (a)	Maximum Intensity (a)	Maximum Beam Spread	Intensity (a)
<b>200 000</b>	200 000	150 000	75 000	3°	75 000	250 000	112 500	7 500	7°	75 000
<b>100 000</b>	100 000	75 000	37 500	3°	37 500	125 000	56 250	3 750	7°	37 500
<b>20 000</b>	20 000	15 000	7 500	3°	7 500	25 000	11 250	750	N/A	N/A
<b>2 000</b>	2 000	1 500	750	3°	750	2 500	1 125	75	N/A	N/A

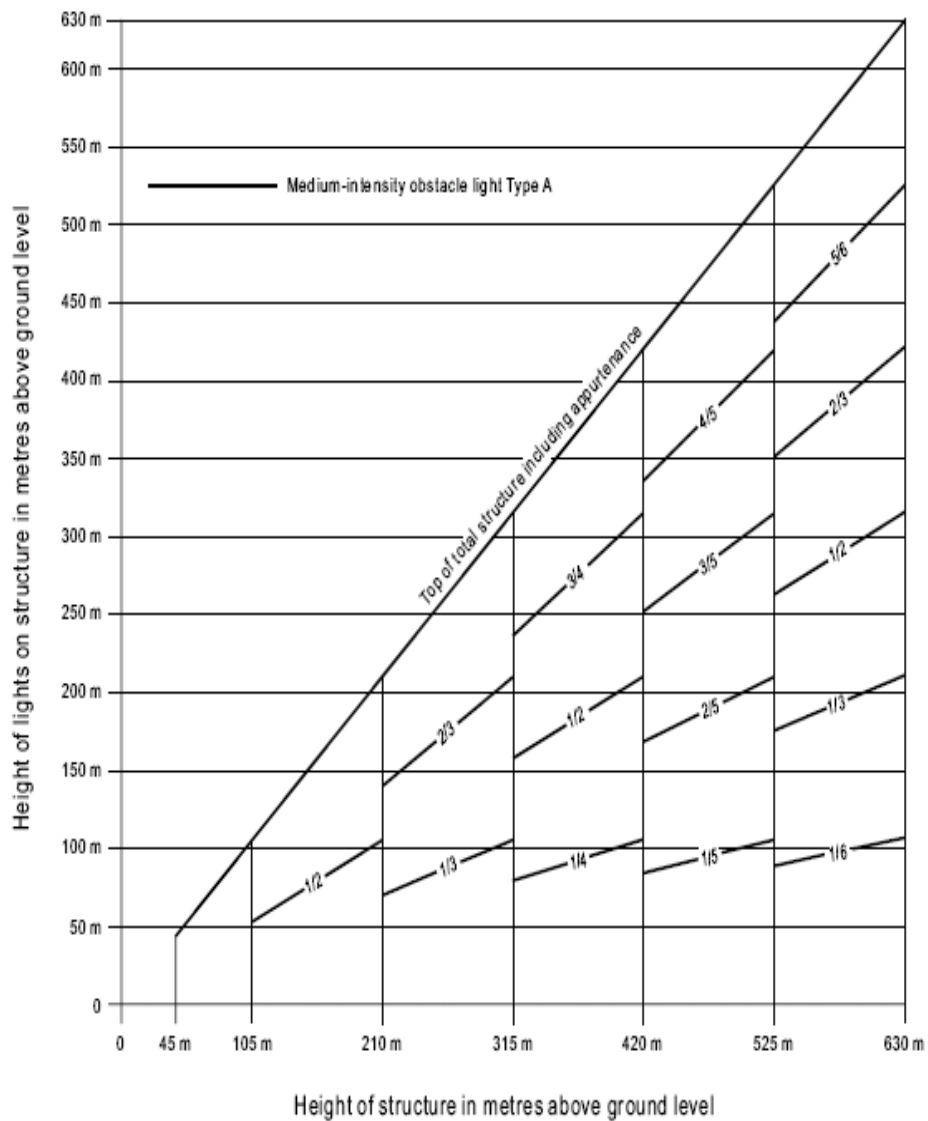
*Note: This table does not include recommended horizontal beam spreads. 6.2.1.3 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.*

- a) 360° horizontal. All intensities are expressed in Candela. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the ICAO Aerodrome Design Manual, Part 4.
- b) Elevation vertical angles are referenced to the horizontal when the light unit is levelled.
- c) Beam spread is defined as the angle between the horizontal plan and the directions for which the intensity exceeds that mentioned in the "intensity" column.

*Note: An extended beam spread may be necessary under specific configuration and justified by an Aeronautical Study.*

Figure App 13-6

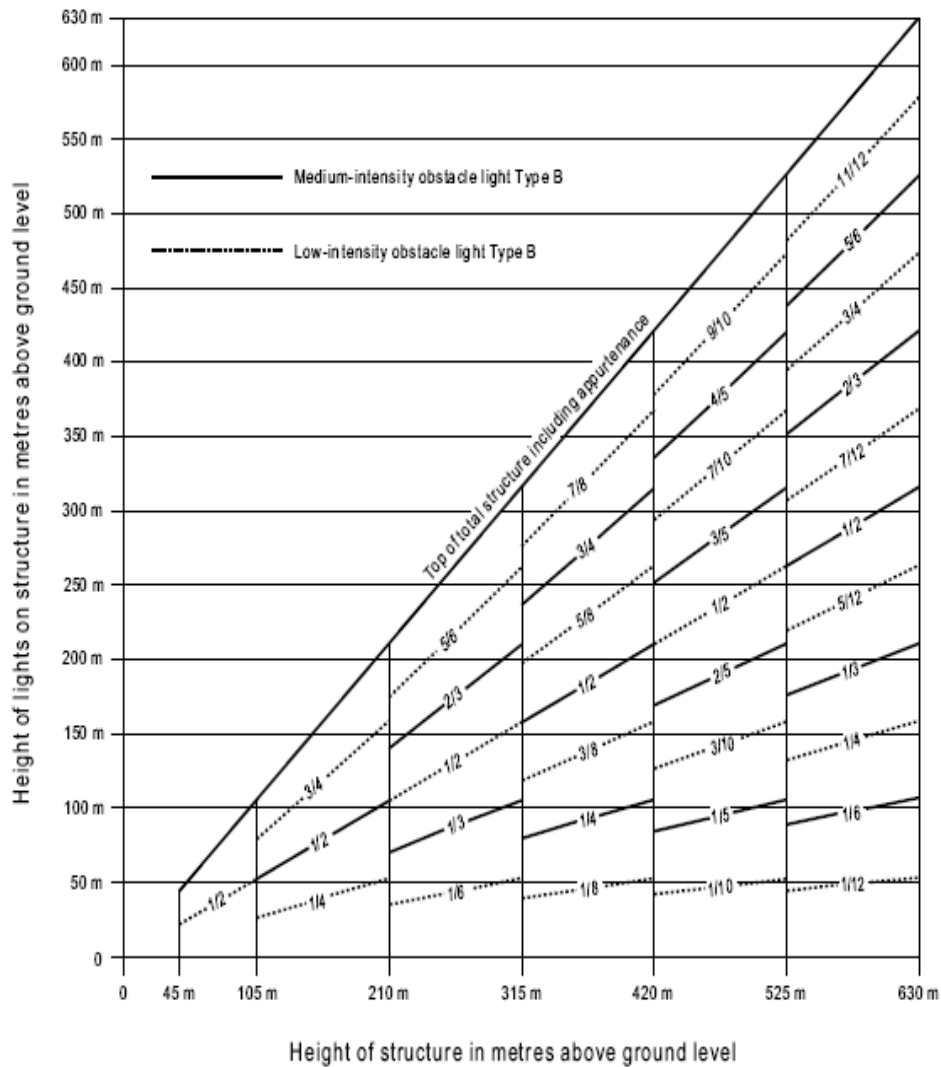
**Medium-Intensity Flashing-White Obstacle Lighting System  
Type A**



*Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level.  
If medium-intensity lighting is used, marking will also be required.*

Figure App 13-7

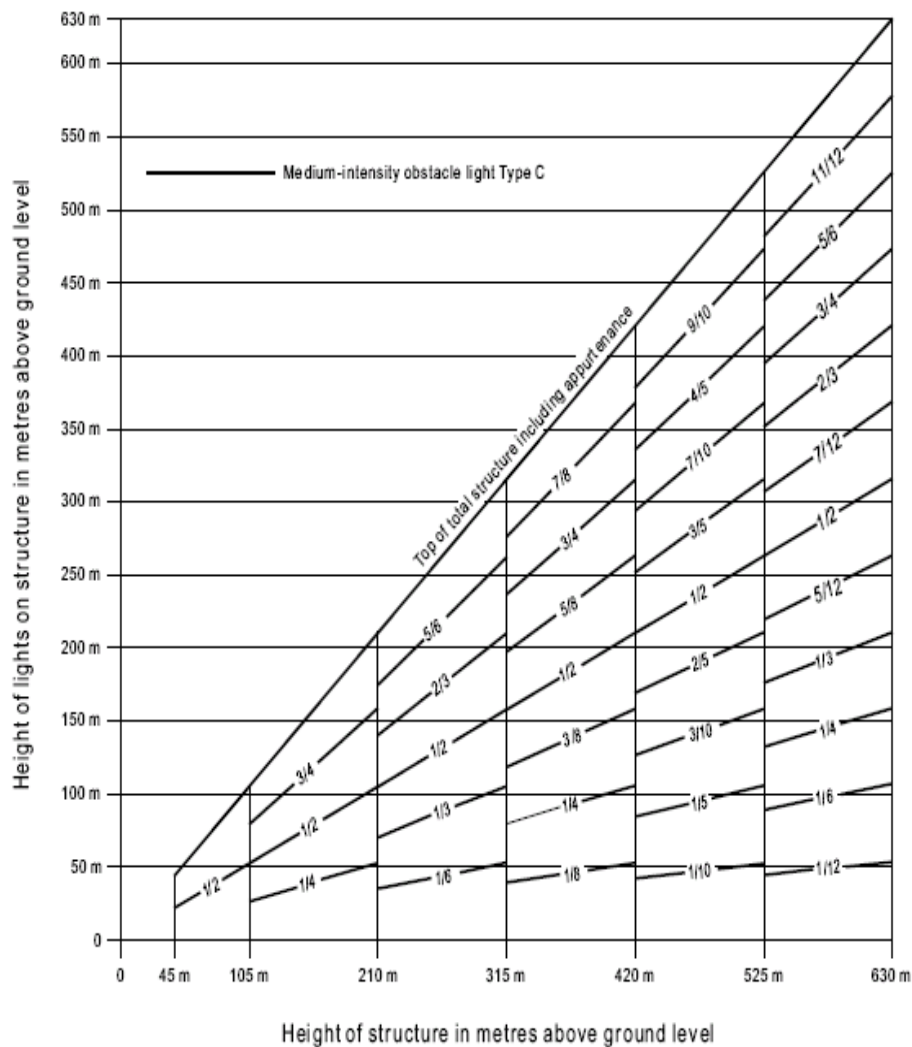
**Medium-Intensity Flashing-Red Obstacle Lighting System  
Type B**



Note.— For night-time use only.

Figure App 13-8

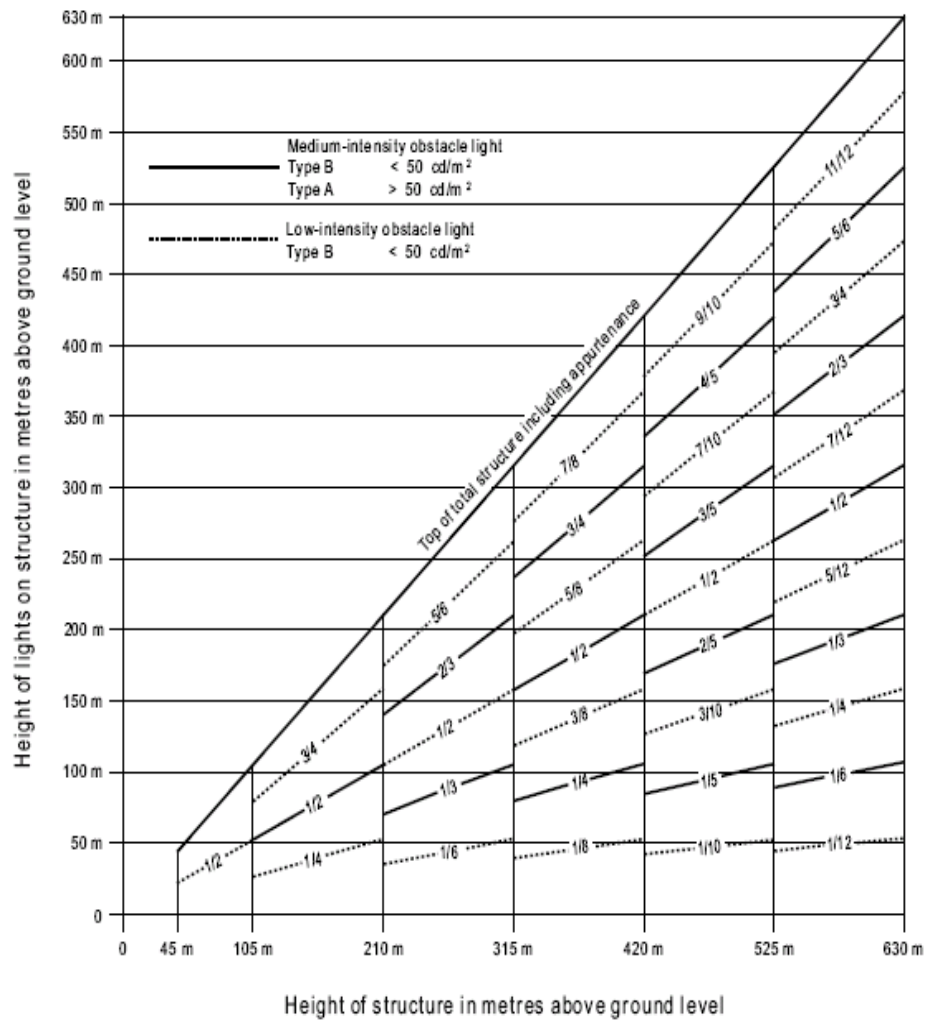
**Medium-Intensity Fixed-Red Obstacle Lighting System  
Type C**



Note.— For night-time use only.

Figure App 13-9

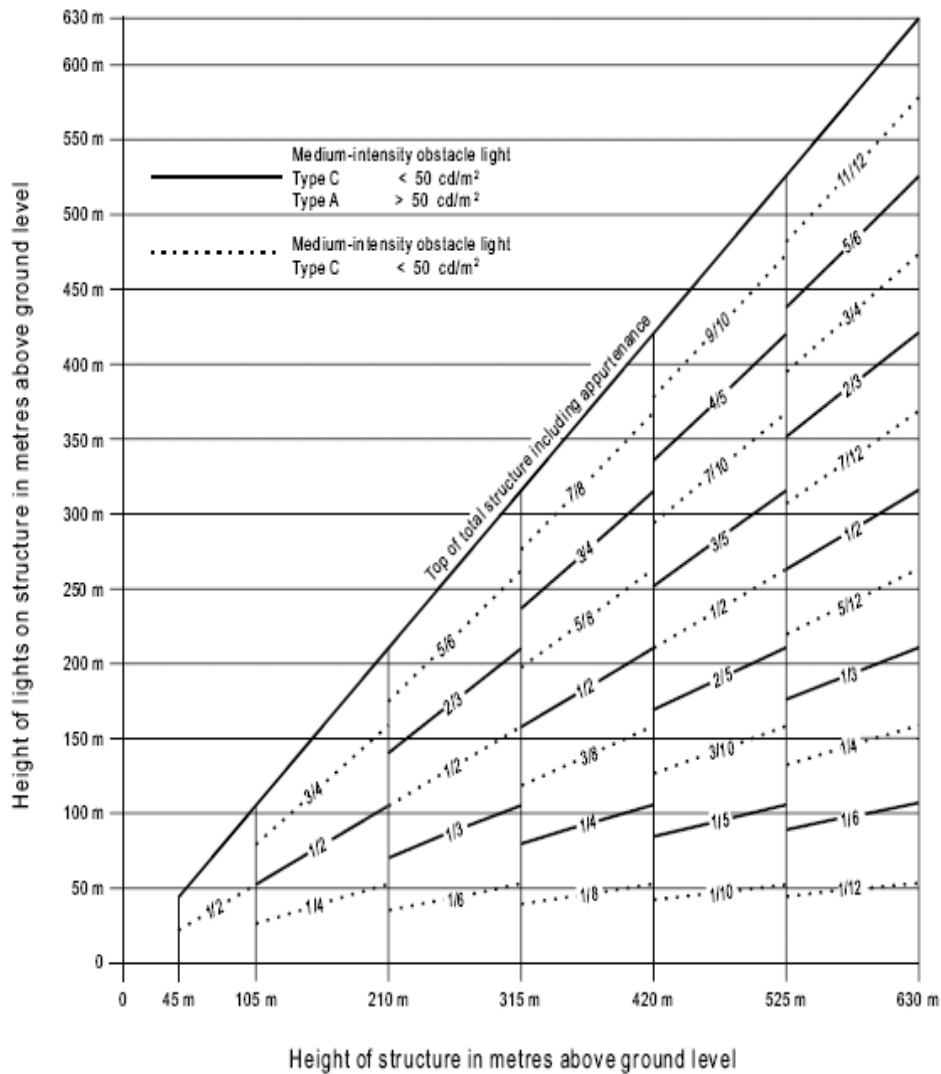
**Medium-Intensity Dual Obstacle Lighting System**  
**Type A/Type B**



*Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level.  
If medium-intensity lighting is used, marking will also be required.*

Figure App 13-10

**Medium-Intensity Dual Obstacle Lighting System  
Type A/Type C**



*Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level.  
If medium-intensity lighting is used, marking will also be required.*

Figure App 13-11

### High-Intensity Flashing-White Obstacle Lighting System Type A

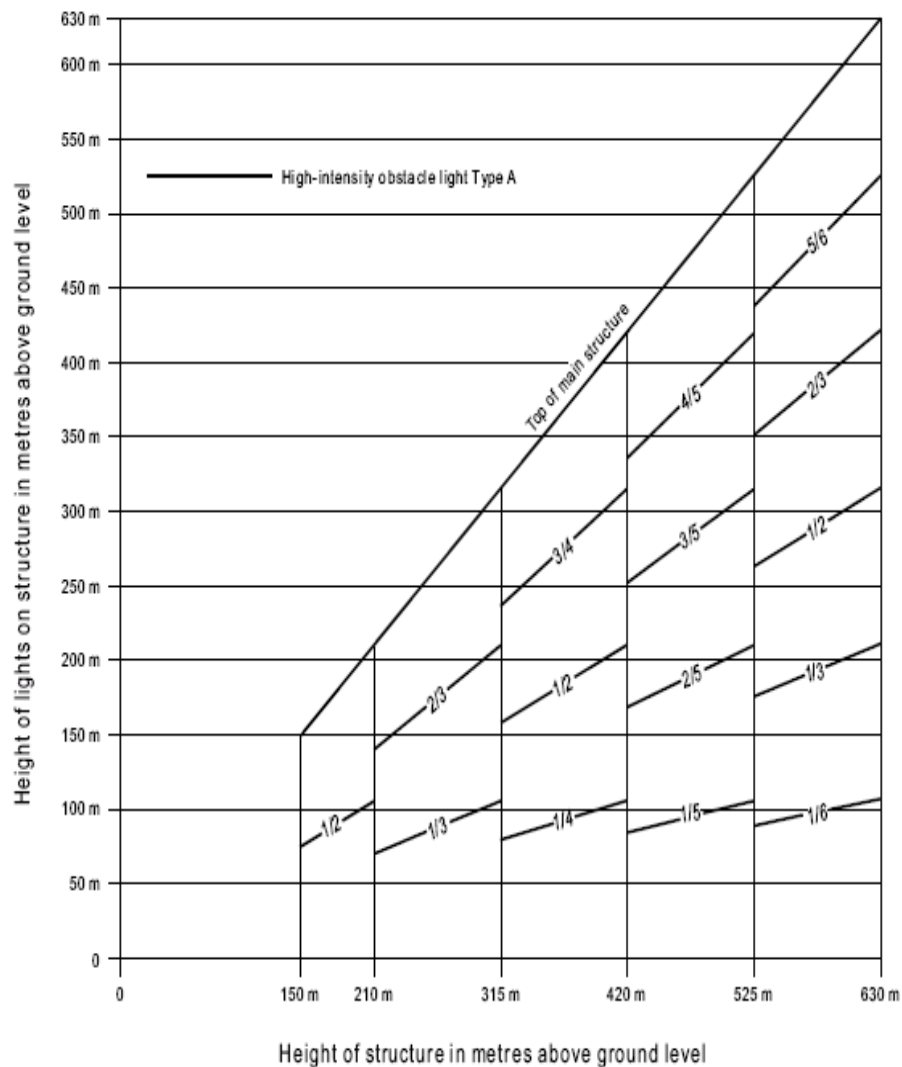
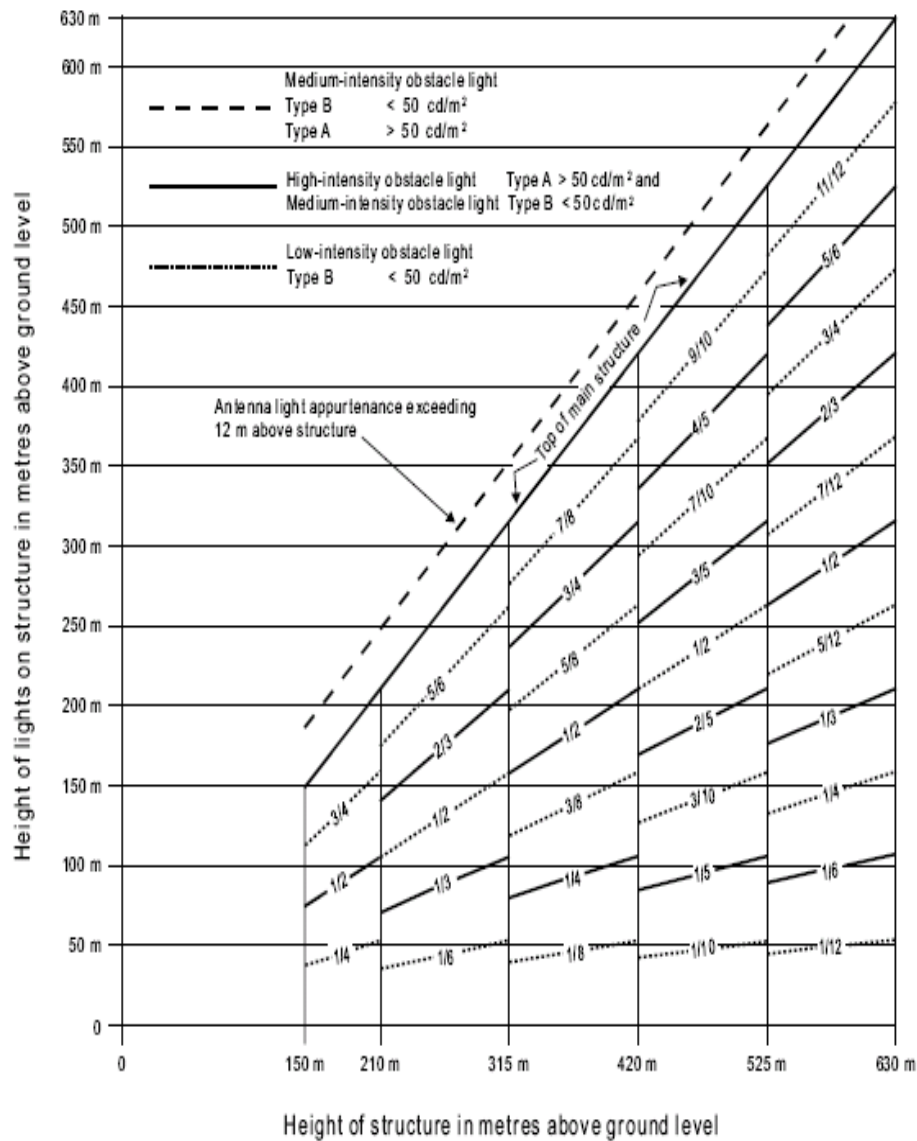




Figure App 13-12

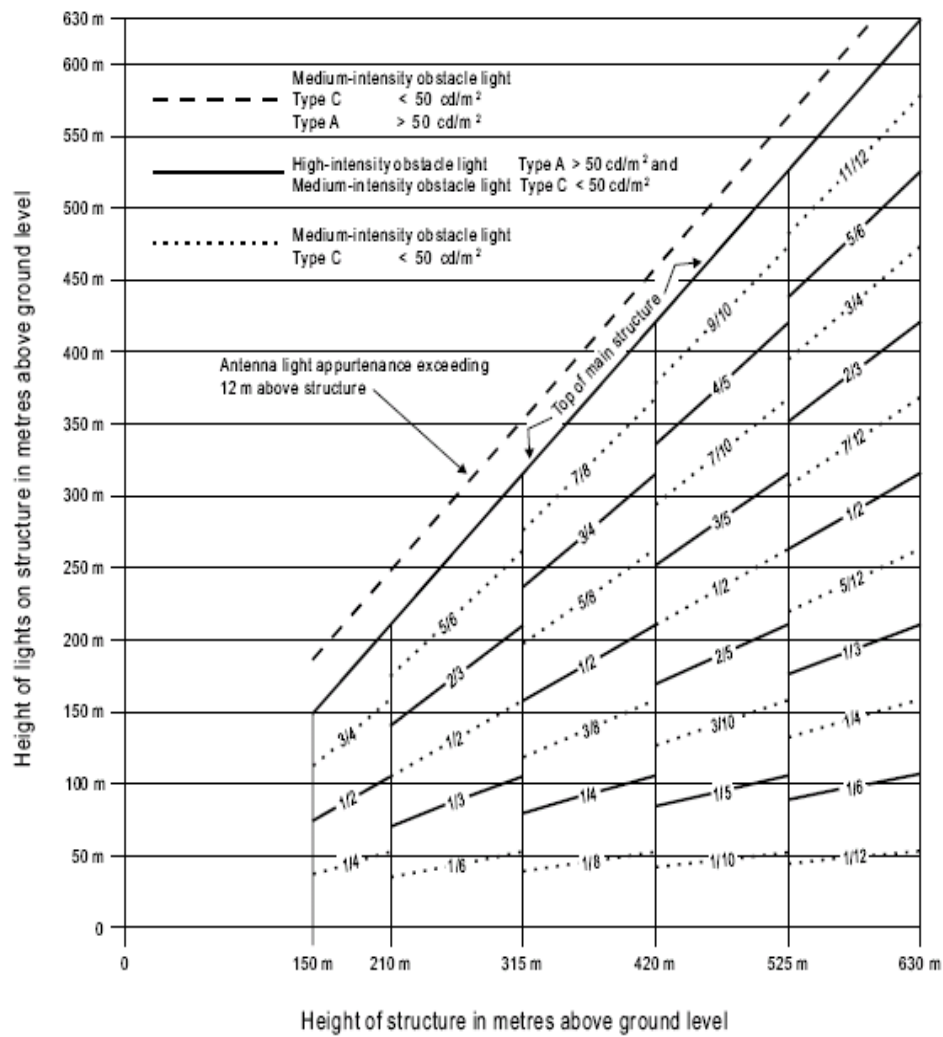
### High-/Medium-Intensity Dual Obstacle Lighting System Type A/Type B





**Figure App 13-13**

**High-/Medium-Intensity Dual Obstacle Lighting System  
Type A/Type C**





### 13.3 OBSTACLE SURVEYS

13.3.1 Obstacle Surveys shall be undertaken for all survey areas required to measure any changes at the periodic intervals described in Table 13.1

Survey Type	Aerodrome Classification	Survey	Periodicity
Geodetic Connection	1,2,3 and 4		An initial mandatory survey
Mandatory Aerodrome Survey Areas (Full Survey)	1,2,3 and 4		<ul style="list-style-type: none"> <li>a) Initial survey</li> <li>b) Within 5 Years, if no annual validation was conducted by a certified surveyor</li> <li>c) If any doubt exists as to the validity of a previous survey</li> </ul>
Validation Assessment	1,2,3 and 4		Annually after the mandatory surveys




**APPENDIX 14**

**RESERVED**



APPENDIX 15

BIRD STRIKE AND WILDLIFE REPORTING FORM

		<b>Bird Strike and Wildlife Hazard Reporting Form</b>		ROSI ID #: Date/Time Ref: Received by:
<b>PART I</b>				
<b>GENERAL DETAILS</b>				
Bird Strike <input type="checkbox"/>		Other Bird Hazard <input type="checkbox"/>		Other Wildlife Hazard <input type="checkbox"/>
Operator *		Aerodrome Name *		
Date of Strike/Sighting *		Time of Strike/Sighting (UTC) *		<input type="checkbox"/> Day <input type="checkbox"/> Dawn <input type="checkbox"/> Night <input type="checkbox"/> Dusk
Sky Condition <input type="checkbox"/> No Cloud <input type="checkbox"/> Some Cloud <input type="checkbox"/> Overcast		Precipitation <input type="checkbox"/> Fog <input type="checkbox"/> Rain		
<b>PART II</b>				
<b>Bird or Wildlife Details</b>				
Bird Species	Number of Birds Seen	Number of Birds Struck	Size of Bird	Pilot Warned of Birds?
	<input type="checkbox"/> 1 <input type="checkbox"/> 11-100 <input type="checkbox"/> 2-10 <input type="checkbox"/> more	<input type="checkbox"/> 1 <input type="checkbox"/> 11-100 <input type="checkbox"/> 2-10 <input type="checkbox"/> more	<input type="checkbox"/> Small <input type="checkbox"/> Large <input type="checkbox"/> Medium	<input type="checkbox"/> Yes <input type="checkbox"/> No
Other Wildlife Species	Number of Wildlife Seen	Number of Wildlife Struck	Size of Wildlife	Pilot Warned of Other Wildlife?
				<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>PART III</b>				
<b>Flight Details and Effect on Aircraft</b>				
Aircraft Make/Model	Engine Make/Model		Aircraft Registration	Runway Used
Location if Enroute	Height AGL (ft)	Speed (IAS) (kt)	Phase of Flight	<input type="checkbox"/> Parked <input type="checkbox"/> Taxi <input type="checkbox"/> Take-off Run <input type="checkbox"/> Enroute <input type="checkbox"/> Descent <input type="checkbox"/> Approach <input type="checkbox"/> Climb <input type="checkbox"/> Landing Roll
			Effect on Flight	<input type="checkbox"/> None <input type="checkbox"/> Precautionary Landing <input type="checkbox"/> Engines Shut Down <input type="checkbox"/> Aborted Take-off <input type="checkbox"/> Other (specify)
<b>PART IV</b>				
<b>Parts of Aircraft Struck or Damaged</b>				
Radome <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Windshield <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Nose (excluding above) <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 1 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 2 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 3 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 4 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 5 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Engine No. 6 <input type="checkbox"/> Struck <input type="checkbox"/> Damaged	Propeller <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Wing/Rotor <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Fuselage <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Landing Gear <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Tail <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Lights <input type="checkbox"/> Struck <input type="checkbox"/> Damaged Other (specify) <input type="checkbox"/> Struck <input type="checkbox"/> Damaged			
<b>PART V</b>				
Remarks (describe damage, injuries and other pertinent information) *				
Reporting Person Name *	Signature	Title	Organization *	
<b>INSTRUCTIONS:</b> If the online ROSI is not available, scan and email this ROSI form and any attachments to <a href="mailto:aor@gcaa.gov.ae">aor@gcaa.gov.ae</a> or fax to +971 2 405 4406.				
* Note: Items marked with * are mandatory				

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## **APPENDIX 16 Acceptable Means of Compliance & Guidance Material On Airside Driving Requirements**

Note: The acceptable means of compliance and guidance material in this Appendix are in support of the Airside Driving Requirements included in Chapter 4.24.

### **16.1 Airside Driving Rules**

#### **AMC1 to 4.24.1(a) Airside Driving Rules**

##### **Roles & Responsibilities**

##### **(a) General**

It is the responsibility of all Aerodrome Operators to establish and implement procedures for the training, assessment and authorisation of all drivers operating and for vehicles permitted on the movement area. These procedures are required to be documented within the Aerodrome Manual and include the following:

- (1) Details of the applicable traffic rules (including speed limits and the means of enforcement of the rules);
- (2) Details of requirements for vehicle serviceability requirements;
- (3) A description of the method for issuing driving permits for operating vehicles in the Movement Area; and
- (4) A description of the method for issuing vehicle permits/authorisation for vehicles and ground service equipment. Special attention needs to be given for the types of vehicles/equipment that will remain airside;

Aerodrome Operators should ensure that they have in place a system for the promulgation of Information to all ADP holders regarding any changes on the Airfield that may impact upon airside driving.

##### **(b) Nominated Person**

The Post Holder Operations, as the process owner, is responsible to ensure the implementation, maintenance and enforcement of the aerodrome's ADP scheme. Further, the Post Holder Operations is responsible to ensure that the safety management system principles and procedures of the aerodrome operator are applied to the continuous improvement and development of the aerodrome's ADP scheme.

##### **(c) Stakeholder Management**

Aerodrome Operators should ensure that third party staff operating airside meet the criteria stated in the ADP Scheme document issued by the Aerodrome Operators, and that its drivers hold a valid ADP.

Aerodrome Operators should ensure that any change to the third party staffs circumstances that may have an effect on any of the requirements of the ADP scheme is communicated to the Aerodrome Authority in a timely manner.

(d) Airside Driver Permit Holder

An Aerodrome Operator should ensure all applicants for an ADP hold a current UAE Driver's License applicable to the type of vehicle they intend to operate, and be fully conversant with the relevant rules, procedures and instructions of the aerodrome(s) where they drive, whilst ensuring they meet all minimum requirements as stated. The ADP procedure should include recognition of a "Certificate of Competence" for specialist vehicles such as ground handling equipment, e.g. aircraft tugs and high loaders, in addition to the UAE driving licence. The Aerodrome Operator should ensure that any change to the driver's circumstances, including status of their UAE Driver's License, that may have an effect on their ADP be communicated to the Aerodrome Operator in a timely manner.

**AMC2 to 4.24.1(a) Airside Driving Rules**

**Medical Requirements**

- (a) The aerodrome operator should implement medical standards as part of the criteria for holding an ADP. As a minimum the medical requirements should require the items listed below:
- (1) an initial and renewal medical declaration to include eyesight, colour perception, hearing, diabetes and blood pressure etc.
  - (2) medical assessments to relate to occupational age limits; and
  - (3) the requirement for a review following a driving accident or incident at work, when medical condition is identified as a potential cause.

(b) Renewal and Monitoring

All aspects of an airside driver health standard should be monitored within the period specified by the aerodrome operator or in accordance to the employees own company policy, and where necessary, examinations should be carried out by suitably qualified staff.

**GM1 to 4.24.1(a) Airside Driving Rules**

**Medical Requirements**

- (a) It is the responsibility of the aerodrome operator to decide what additional specific factors there might be about the workplace and vehicles which may impose additional medical fitness requirements over and above those required for driving on the public roads. This should be based on a local risk assessment by the aerodrome operator, which may include organisations that operate airside, and should relate to local procedures, environment, infrastructure, topography, and the complexity of the aerodrome and aircraft operations.
- (b) An ADP Holder should be required to disclose to the Aerodrome operator and their employer, any existing or new medical condition or prescribed medication which may affect their ability to drive safely. Where a health professional places a condition or restriction on a driver, this should be declared to and considered by the employer and medical advice obtained. The employer should inform the aerodrome operator of any such condition or restriction who should take appropriate action which may involve the suspension or removal of the ADP.





### **GM2 to 4.24.1(a) Airside Driving Rules**

The following does not include driving procedures for emergency vehicles attending to an emergency which may be addressed separately in the aerodrome emergency plan.

### **AMC1 to 4.24.1(b) Airside Driving Rules**

- (a) Airside driving rules should include the following, at the minimum:
- (1) speed limits;
  - (2) right of way;
  - (3) driving routes;
  - (4) vehicle condition requirements;
  - (5) use of vehicle lights;
  - (6) low visibility procedures;
  - (7) signs, markings, lights on the apron; and
  - (8) procedures for the entry to/exit from the apron areas in which aircraft and vehicle movements are combined.

### **GM1 to 4.24.1(b) Airside Driving Rules**

- (a) Generally, operations at an aerodrome are dependent on air traffic controllers, pilots and vehicle drivers using visual observations to estimate the respective relative position of aircraft and vehicles. Pilots and vehicle drivers rely on visual aids (lighting, markings and signage) to guide them along their assigned routes and to identify intersections and holding positions. As part of the Surface Movement Guidance and Control System (SMGCS) the aerodrome operator should establish and train aerodrome users on the characteristics and meaning of the standardized markings and signage implemented at the aerodrome. These should include, but are not limited to:

#### **Markings**

- (1) Boundary of responsibility line
- (2) Stand safety line
- (3) Stand-by areas – restricted for aircraft manoeuvres
- (4) Stand-by areas – height restricted
- (5) Stand divide line
- (6) Tractor pushback line and pushback limit line



- (7) Equipment staging area
- (8) Air bridge wheel position
- (9) Underground services including fuel hydrant markings
- (10) Service road
- (11) Vehicle limit line
- (12) Stand identification on service road
- (13) Taxiway and taxilane crossing
- (14) Pedestrian crossing
- (15) Pedestrian guide line

#### **Apron Signs**

- (1) Stand identification sign for aircraft
- (2) No-entry sign for aircraft
- (3) Sign attention to crossing aircraft for vehicles
- (4) Jet blast sign for vehicles
- (5) Examples of road and other traffic signs
- (6) Examples of emergency signs
- (7) FOD Bin

*NOTE: Refer to CAR PART IX – ADR, Appendix 12, and Airports Council International (ACI) Apron Markings and Signs Handbook for further information.*

- (b) Driving in airside areas presents many specific challenges requiring different knowledge and skills to be maintained to those required for public roads. Furthermore, poor discipline and lack of competence by airside drivers is one of the greatest hazards to aircraft operations. Holding a U.A.E. driving license does not ensure that a person competent to drive a vehicle in airside areas. The GCAA has established minimum standards for personal operating in airside areas and the purpose of this Part is to provide guidance which will give assurance that drivers operating in the airside environment are competent to do so. The overall aim for this Part is to promote and maintain a safe airside environment and to protect all individuals from an incident or accident.

#### **(c) Driving on Airside**

- (1) Speed

The driver of a vehicle should follow all speed limits, indicated by road signs and markings. Indicative limits are provided below; but all must be set based upon airport assessment;

On a runway or taxiway	65 km/h
Within the aircraft stand	5 km/h

Within Baggage Handling area	10km/h
On primary service roads	25 km/h
On secondary Service roads	25 -40km/h
On perimeter service roads	40 km/h

(2) Right of Way

Drivers are required, unless explicitly instructed by the Aerodrome Control Tower, to give way to aircraft, aircraft on tow or pushback and to emergency vehicles attending to emergency, for instance police and ambulance.

(d) Airside Service Roads

(1) Primary Service Roads (also known as inner GSE roads)

These are roads normally located front of aircraft parking stands and are meant for the movement of vehicles and equipment from the baggage areas or vehicle staging areas to individual aircraft stands without having to proceed on apron areas.

Drivers using service roads that cross in front of baggage handling areas should give way to vehicles towing baggage trolleys or ULD's going into or out of the baggage handling areas.

(2) Secondary Service Roads (also known as outer GSE roads)

- (i) These roads are normally located behind aircraft parking stands between the aircraft stand and the aircraft stand taxilane.
- (ii) Drivers should maintain the correct speed and look out and give way to all taxiing aircraft and aircraft moving onto or off a stand or being towed.
- (iii) When an aircraft is approaching, the driver should immediately stop if appropriate, or vacate the secondary service road and wait at the edge of an available aircraft stand until the aircraft is clear. The Driver should visually check that the area is clear of aircraft movement before proceeding.
- (iv) A driver should not use secondary service road as a short cut or to overtake.
- (v) If an aircraft on a stand has the anti-collision beacons on, the driver should not pass the stand and should remain clear until the anti-collision beacons have been switched off or the aircraft has vacated the stand.



(3) Perimeter service roads

These are roadways normally located near the fence surrounding the airport boundary and away from the apron areas.

(4) Driving Inside Aircraft Parking Stand

- (i) Drivers should not enter or park in an aircraft parking stand unless they are required for ground operations of the aircraft and possess an AVP/ADP with access to aircraft stand. The driver should park at the vehicle staging area if servicing an aircraft.
- (ii) While waiting in the Equipment Staging Area to service an arriving aircraft, drivers should park their vehicle with the handbrake engaged. When aircraft are entering the aircraft stand, the driver should stay clear of the Equipment Restraint Area and may only enter the Equipment Restraint Area after the aircraft chocks have been positioned and the ground engineer gives the Thumbs-up signal.
- (iii) A Marshaller should assist the driver while reversing towards the aircraft.
- (iv) Drivers should not drive or park under the wing or fuselage of an aircraft unless the vehicle is engaged in refuelling and maintenance service.
- (v) During pushback, the driver should again stay clear of the Equipment Restraint Area to ensure the safe movement of the aircraft.

(5) Safety Distance from Aircraft

The Aerodrome Operator in coordination with the respective ground handlers/airlines should define minimum safety distances to be kept during the servicing of an aircraft.

(6) Safety Distance from Taxing Aircraft

No driver should cross the movement area in front of the path of a taxing aircraft or an aircraft on tow or pushback. A driver should remain vigilant to the hazards of jet blast and a safety distance, as defined by the aerodrome operator, should be maintained behind a taxing aircraft.

(7) Vehicle Refuelling

- (i) Vehicle refuelling should only be carried out at dedicated vehicle refuelling locations declared by the Aerodrome Operator.
- (ii) To avoid vehicle breakdowns in operationally critical areas, drivers should complete a vehicle serviceability check prior to using the vehicle which should include a fuel level check.
- (iii) In the event that a vehicle does run out of fuel, the vehicle should be immediately towed to designated locations for refuelling.
- (iv) In the event of a fuel spillage the driver should follow airport reporting and cleaning procedures immediately.

(8) Driving Equipment

All drivers should be authorised and trained to operate the specific type and kind of equipment such as forklifts, boom lifts and scissor lifts as applicable. Pre start checks should be conducted prior to operating the equipment to ensure it is fully operational. While driving, the driver should watch out for any height limit surrounding structures and when approaching any blind area, the driver should drive with caution.

(9) Height Limit around Airside

The general height limit for airside roadways varies from 3.5m to 4.5m. A driver towing tall equipment exceeding 3.5m should take note of any overhanging building structures and height limit signs displayed and not use roads with a height limit lower than that of the equipment under tow.

(e) Driving during Low Visibility Conditions

- (1) During Low Visibility Conditions the aerodrome operator is required to ensure that persons and vehicles operating on the movement area are restricted to the essential minimum.
- (2) Aerodrome Operators should put in place specific training and authorisations for those drivers that may be required to operate on the manoeuvring area during Low Visibility conditions.
- (3) All non-essential traffic should remain off the aprons until the low visibility conditions have cleared and have been officially terminated unless necessary for the imminent movement/servicing of an aircraft.
- (4) Unless absolutely necessary, drivers should be required to stay on the marked apron road and not drive between stands or behind aircraft and all movement from one stand to another should be restricted to the marked apron road.
- (5) Vehicles operating airside during low visibility should display, as a minimum, head lights, flashing beacon, and any other lights to ensure identification during low visibility conditions.
- (6) Speed limits on the apron roads should be reduced and drivers required to drive according to the conditions.

(f) General Driving Conduct Rules (Points to remember)

- (1) Drivers should be required to carry their ADP at all times while operating on airside and be required to show it upon request from the Aerodrome Operator.
- (2) No person under the influence of alcohol; medicine or drugs should be permitted operate a vehicle or equipment at airside
- (3) No driver or passenger should consume any form of food while on airside.
- (4) Smoking is strictly prohibited airside, unless designated smoking areas are provided.
- (5) Use of mobile phone while driving airside should be prohibited. Where it is necessary to communicate using a mobile phone, i.e. where there is a communication failure with ATC

or essential communication with the aerodrome operator or the drivers company is required, the driver should park the vehicle in an area that is safe from aircraft movements.

(g) Passengers

No person, other than the driver of the vehicle, should travel in any vehicle within airside unless they are seated in a passenger seat provided in the vehicle, or standing in a section of the vehicle which has been specifically designed and constructed for standing passengers.

(h) Seat Belts

All vehicles should be installed with seat belts for the driver and, if applicable, passengers. All drivers and passengers should wear their seat belts while the vehicle is in motion.

(i) Airside Driving Rules of Thumbs

- (1) Never drive or walk in front of or behind an A/C with its engine running.
- (2) Never drive or park under A/C wings unless involved in aircraft servicing.
- (3) Never leave your vehicle unattended with the engine running.
- (4) Never reverse your vehicle near an aircraft without a marshaller
- (5) Never park equipment so that other vehicles / trucks are obstructed
- (6) Never park within the fuel zone during the refuelling process unless involved in refuelling activity
- (7) Never work close to the filling or ventilation openings of the aircraft fuel tanks during refuelling
- (8) Report all fuel, oil and other chemical spillages.
- (1) Keep the movement area clean of FOD.



## 16.2 Airside Driving Permit Scheme and Training Program

### AMC1 to 4.24.2(a) Airside Driving Permit Scheme and Training Program

#### Aerodrome Operating Areas

The Aerodrome Operator should separate the airside area into distinct operating areas, each operating area requiring a separate category of ADP. It is recommended that the airside is split into a minimum of 2 areas, the first area comprising the airside road system and aprons, while the second area consists of the taxiways and runways (the manoeuvring area). Depending on the complexity of the aerodrome, the manoeuvring area may be further split into that area excluding the runways, and that area including the runways.

#### Airside Driving Permit Categories

- (a) A separate ADP Category should be issued for each of the operating areas established above with the recommended ADP Categories as follows:

- (1) The Airside Roads and Aprons;

The airside roads and aprons permit is the initial permit awarded to a new driver who has successfully completed a local training course and assessment. The permit allows a driver to operate on airside roads and aprons, which may include controlled and uncontrolled taxiway crossings. The awarding of the permit allows the holder to progress their training to operate on the manoeuvring area, excluding runways.

- (2) The Manoeuvring Area excluding Runways;

The manoeuvring area (excluding runways) permit allows a driver to operate on the manoeuvring area but excludes operation on the runway. It is a pre-requisite for the candidate to successfully complete a radiotelephony course, prior to obtaining this permit. The holder of the permit should maintain competence in RTF throughout the validity period of the permit. RTF competence checks should be completed by persons approved by the aerodrome operator: this may be a training provider, their employer or the aerodrome operator itself.

- (3) The Manoeuvring Area including the Runway.

The manoeuvring area (including runways) permit allows a driver to operate on runway(s) once the RTF training course is successfully completed.

Where only a single ADP Category is required for operating on the manoeuvring area, the training and assessments should be based on Category 3 requirements listed below.

- (b) Category 2 and 3 ADP holders may be permitted to 'free range' on the manoeuvring area, however, this should be subject to assessment by the Airport Operator and should be on a case by case basis specific to defined tasks and roles, excluding low visibility operations. If the Aerodrome Operator permits free ranging on the manoeuvring area, the authorizations and scope needs to be defined and be part of the ADP licencing and



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training scheme. Any assessment or consideration to 'free ranging' should be documented through the LRST and be coordinated with aerodrome control tower. It should be made very clear, if 'free ranging' exists that at no time does this allow the entry onto a runway without aerodrome control tower authorization.

**AMC2 to 4.24.2(a) Airside Driving Permit Scheme and Training Programme**

**AIRSIDE ROADS AND APRONS AIRSIDE DRIVING PERMIT**

(a) Requirements

It is a requirement for the issue of an ADP that the applicant is:

- 1) Employed with an organisation authorized to operate at the aerodrome;
- 2) The holder of a current full UAE licence which permits the holder to drive a motor vehicle on public roads within the UAE;
- 3) In possession of an operational requirement to drive a vehicle on the airside;
- 4) Able to demonstrate the required driving competence; and
- 5) Able to demonstrate adequate language proficiency in the language normally used for airside operations at the aerodrome.

(b) The aerodrome operator shall set out the circumstances under which a permit will cease to be a valid and must be surrendered for cancellation. Such circumstances may include:

- 1) Cessation of the purpose for which the permit was issued;
- 2) Change of the holder's employer;
- 3) Loss of driving license for offences under the UAE's road traffic regulations;
- 4) Any defacing, alteration, or misuse of a permit;
- 5) Proof of disregard of aerodrome traffic rules; and
- 6) Any use of a permit in relation to a customs or immigration offence

(c) Revalidation requirements

- (1) The airside roads and aprons permit may be valid for up to two years and falls due for revalidation at the anniversary of the date of issue. In order to be revalidated, the competence of the permit holder must be demonstrated, and employers must check that the driver still holds the necessary current State, or foreign equivalent driving license.
- (2) Records of training and assessments for the airside roads and aprons permit should be retained. Third party trainers/assessors must ensure that records are available for audit by the aerodrome operator.

(d) Communication skills





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- (1) It is the responsibility of the employer to ensure that the driver is proficient in the language normally used for the airside operations at the aerodrome in order to complete the required training, competence assessments and designated activities on the aerodrome. Such proficiencies may include:
  - (i) The ability to complete the requisite driver training/familiarization;
  - (ii) The ability to undertake successfully the operational communication requirements that may be required of airside drivers, e.g. reporting an accident of incident on the airside;
  - (iii) The ability to read and understand relevant local safety information, e.g. information and mandatory aerodrome signs; and
  - (iv) The ability to understand verbal instruction or notifications given by the police or aerodrome operations staff.

**MANOEUVRING AREA AIRSIDE DRIVING PERMIT**

(e) Requirements

- (1) The applicant shall fulfil the following requirements for the issue of a manoeuvring area permit:
  - (i) Excluding Runway:
    1. As per an apron and airside roads permit, and demonstrate competence in RTF (see radiotelephony below); and
    2. Require access to the manoeuvring area.
  - (ii) Including Runway:
    1. As per AMC2 to 4.24.2(a) Airside Driving Permit Scheme and Training Programme (e)(1)(i) (excluding runway); and
    2. Require access to the runway.

(f) Revalidation requirements

- (1) Aerodrome operators shall ensure that drivers still hold the correct categories of licence for the public roads at all times.
- (2) ADP validity and renewal process
  - (i) Excluding Runway:
    1. Duration: up to two years; and
    2. Revalidation: competence should be maintained. This may be confirmed/assessed by a maintenance of competency scheme or refresher training, but in either case, must include appropriate assessments.
  - (ii) Including Runway:



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1. Duration: up to two years; and
2. Revalidation: competence should be maintained. This may be confirmed/ assessed by a maintenance of competency scheme or refresher training, but in either case, must include appropriate assessment.

(g) Maintenance of competence

- (1) The aerodrome operator should establish a system ensuring that drivers maintain competence in their driving rules, duties and procedures in those areas where they are permitted to drive. The aerodrome operator may delegate these functions to third party driver trainers, vehicle operators or other parties, but in such circumstances, will need to conduct regular audits in order to assess the effectiveness of the training and assessment of drivers and the assessment and record keeping of maintenance of competence of drivers. Such competence is additional to the continuing maintenance of competence to operate the vehicle/ piece of equipment.
- (2) Examples of the areas to be assessed include, but are not limited to:
  - (i) Pushback procedures;
  - (ii) Towing (on the apron and on the manoeuvring area);
  - (iii) Runway access;
  - (iv) Radiotelephony;
  - (v) Aerodrome topography;
  - (vi) General airside driving;
  - (vii) Vehicle check; and
  - (viii) Table-top discussions.

(h) Radiotelephony

- (1) The movement of vehicles on the manoeuvring area is ordinarily subject to authorization by aerodrome control tower. Depending on the complexity of the aerodrome, aerodrome control tower may operate a number of radio frequencies. Typically, in these cases, the aerodrome ground controller will be responsible for all vehicles operating on the taxiways, and the air controller will be responsible for all vehicles wishing to enter or cross the runway(s). It is essential that all vehicles required to be under positive control on the manoeuvring area are equipped with the appropriate radio communication devices tuned to the appropriate frequencies.
- (2) All drivers of vehicles operating on the manoeuvring area shall have an appropriate level of competence with respect to the use of RTF phraseology. For further guidance see AMC 69 UAE Radiotelephony Standards.



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- (3) The aerodrome operator shall establish a system of allocating RTF call signs to be used by vehicles, so that the potential for confusion between vehicles and aircraft is minimized. This is particularly important at aerodromes where the RTF frequency used by vehicles is the same as that used by aircraft, or where the RTF frequency used by vehicles is re-broadcast on the RTF frequency used by aircraft.
- (4) The ANSP shall be made aware of all radio call signs used at the aerodrome, whether or not they are used for communication with aerodrome control service.
- (5) All Category 2 and 3 ADP holders should receive specific training on radio telephony where they should be able to demonstrate a Level of English which should include verbal and reading comprehension.
- (6) The minimum level of English should be ICAO Level 4 English or equivalent. It is the responsibility of the Organisation to ensure that all staff have the required English level prior to applying for a Category 2 or 3 ADP, and to ensure they fully understand and are able to complete the required training, competence assessment and designated activities on the aerodrome.

*Note: ICAO language proficiency requirements contained in ICAO Annex 1.*

**AMC1 to 4.24.2 (b) Airside Driving Permit Scheme and Training Program**

**PROCEDURES FOR ISSUANCE OF DRIVING AUTHORISATIONS AND TEMPORARILY PERMITTING DRIVING OF VEHICLES, AND RELEVANT MONITORING ACTIVITIES**

- (a) The aerodrome operator should clearly identify responsibilities for:
  - (1) issuing Airside Driving Permits and temporary airside operations;
  - (2) ensuring that the prerequisites for maintaining a driving authorisation valid continue to be met;
  - (3) monitoring the compliance of the drivers with the driving rules applicable at the aerodrome, and taking appropriate action as the case may be. Such actions should include the possibility of suspension or revocation of the driving authorisation or of temporary airside operations.
- (b) Issuing such authorisations, temporarily permitting the driving of vehicles and ensuring that the prerequisites for maintaining a driving authorisation valid should be a controlled activity.
- (c) Irrespective of the organisational setup chosen, it should be ensured that information regarding drivers who:
  - (1) do not continue to meet the requirements for maintaining the validity of the relevant driving authorisation; or
  - (2) violate the driving requirements,



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is forwarded to the aerodrome unit(s) responsible for the issuance/revocation of the driving authorisations, in a timely manner, to take appropriate action depending on the case.

- (d) The established procedures should clearly indicate how cases of violations of the applicable driving requirements at the aerodrome are dealt with. They should especially take into account the seriousness of each violation and also address cases of repeated violations of the applicable driving requirements. The cases where a driver should be required to undergo additional training should also be addressed in the procedures.
- (e) Notwithstanding the value of SMS processes, aerodrome operators should implement rules and procedures to manage driving behaviour of personnel involved in aerodrome operations at the aerodrome. These actions should include recording of offences (e.g. speeding, bad parking, driving without lights, unsecured load) and implementation and enforcement of disciplinary measures such as the use of a points and/or fines system and the revocation of a driver's Airside Driver Permit (ADP).

Note.— Consequences for poor driving behaviour are not contradictory to an open reporting culture.

- (f) The aerodrome operator may include rules and procedures to manage driving behaviour. Consideration should be given by aerodrome operators to adopt a scheme such as recording 'offences' and possibly penalties in order to measure the level of poor behaviour or standards, and to identify where mitigation measures may be required. Considerations for an offence system to be included in the ADP scheme are:
  - 1) reference to by-laws, rules and penalties;
  - 2) who can issue warnings or infringement notices;
  - 3) infringement offences;
  - 4) sanctions and penalties, including those for serious or repeat offences;
  - 5) notification of infringements to the driver and employer;
  - 6) use of a points system and/or fines system;
  - 7) time limits for offences or points;
  - 8) appeal procedures.

#### **AMC2 to 4.24.2(b) Airside Driving Permit Scheme and Training Program**

##### **TEMPORARILY PERMITTING THE DRIVING OF VEHICLES**

- (a) When permitting temporarily the driving of a vehicle, the period for which the permission is valid and the areas in which the driver will be allowed to operate under escort should be specified.



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- (b) The escort of a vehicle whose driver has been issued a temporary airside operation should only be performed by the aerodrome operator directly or through a contracted organisation.

**AMC3 to 4.24.2(b) Airside Driving Permit Scheme and Training Program**

**Record Keeping**

- (a) Records of training and assessments for the airside driving permits should be retained. Third-party trainers/assessors must ensure that records are available for audit by the aerodrome operator.

**GM1 to 4.24.2(b) Airside Driving Permit Scheme and Training Program**

- (a) A suitable means should be provided for the secure storage of information relating to ADPs. The information should include:
- (1) identification number;
  - (2) name;
  - (3) date of birth;
  - (4) employer;
  - (5) name of training organization;
  - (6) name of trainer;
  - (7) date of completion of training;
  - (8) date of validation;
  - (9) assessment results;
  - (10) date of revalidation;
  - (11) infringement notices;
  - (12) type of permit held;
  - (13) driving history (accidents/incidents);
  - (14) State licence checks;



- (15) any required medical evidence; and
- (16) copies of self-declarations of fitness or approved declarations by an occupational health practitioner.
- (b) The information described above may be kept in any suitable format and made available for audit.

#### **AMC1 to 4.24.2(d) Airside Driving Permit Scheme and Training Program**

##### **TRAINING**

- (a) The aerodrome operator shall ensure that drivers of vehicles on the airside are properly trained. This may include, as appropriate to the driver's function, knowledge of:
  - (1) the geography of the aerodrome;
  - (2) aerodrome signs, markings and lights;
  - (3) RTF operating procedures;
  - (4) terms and phrases used in aerodrome control including the ICAO Radiotelephony Spelling Alphabet;
  - (5) rules of air traffic services as they relate to ground operations;
  - (6) aerodrome rules and procedures;
  - (7) hazards which may be encountered while driving on the movement area;
  - (8) emergency procedures, e.g. vehicle accident or breakdown; and
  - (9) rights of way.

Note. — Hazards encountered while driving on the movement area may include apron taxiway crossings, danger zones around aircraft, staff and passengers walking across aprons.

- (b) The driver shall be able to demonstrate competence, as appropriate, in:
  - (1) the operation or use of vehicle radio communication devices;
  - (2) understanding and complying with aerodrome control service and local procedures; and
  - (3) vehicle navigation on the aerodrome.
- (c) All three training programmes should consist of two main parts – classroom/theoretical aspects, which should include the use of prepared presentations, maps, diagrams, videos, booklets and checklists, as appropriate; and practical training and visual familiarization on the aerodrome with a suitably trained person. The time required for the practical training part will vary depending on the complexity of the aerodrome. Following the initial training, a refresher training should be organized after an agreed period of time.



- (d) The training framework requirements stipulated in CAR Part IX Chapter 2 apply to the Airside Driving Permit Scheme

#### **AMC2 to 4.24.2(d) Airside Driving Permit Scheme and Training Program**

##### **Airside Vehicle Driver**

The following elements should be considered when developing training programs and knowledge requirements for all categories of airside vehicle drivers:

- (a) Airside driving permit (ADP)
  - (1) the issuing authority, the validity of the permit in terms of time, conditions of use, and its transferability;
  - (2) ownership of the permit and control, and audit of permit issue;
  - (3) local enforcement, and driving offence procedures; and
  - (4) relationship to the UAE drivers licensing system.
- (b) National legislation and regulation
  - (1) UAE regulations related to general vehicle driving licenses;
  - (2) local government requirements; and
  - (3) GCAA requirements/guidance for driving airside.
- (c) Aerodrome regulations and requirements
  - (1) ATC procedures applicable to aerodromes as they relate to vehicles, particularly rights of way;
  - (2) the definition of movement areas, manoeuvring areas, aprons and stands;
  - (3) specific aerodrome regulations, requirements, and local instructions;
  - (4) local methods used to disseminate general information, and instructions to drivers; and
  - (5) local methods used to disseminate information regarding works in progress.
- (d) Personal responsibilities
  - (1) agreed aerodrome requirements concerning fitness to drive (medical and health standards);
  - (2) issue and use of personal protective equipment, such as high visibility clothing and hearing protection;
  - (3) general driving standards;
  - (4) no-smoking/no-alcohol, use of psychoactive substances and medicines requirements airside;



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- (5) responsibilities with respect to foreign object debris and fuel/oil spillage; and
- (6) the responsibility to ensure that a vehicle is suitable for the task, and is used correctly.
- (7) Implementation of 'sterile-cab' concept, avoiding disturbing and distracting activities while driving.
- (e) Vehicle standards
  - (1) condition and maintenance standards agreed at the aerodrome;
  - (2) the requirement to display obstruction lights and company insignia;
  - (3) the requirement for, and content of, daily vehicle inspections;
  - (4) agreed standards of aerodrome and company vehicle fault reporting and rectification; and
  - (5) requirements for the issue and display of airside vehicle permits.
  - (6) Serviceability of all essential communication systems with air traffic services and base operations.
- (f) General aerodrome layout
  - (1) the general geography of the local aerodrome;
  - (2) aviation terminology used such as runway, taxiway, apron, roads, crossings, runway-holding points;
  - (3) all aerodrome signs, markings and lighting for vehicles and aircraft;
  - (4) specific reference to signs, markings and lighting used to guard runways, and critical areas; and
  - (5) specific reference to any controlled/uncontrolled taxiway crossing procedures.
- (g) Airside traffic rules
  - (1) General rules
  - (2) Local rules
  - (3) Rules for operating in low visibility
  - (4) Speed limits, prohibited areas and no parking regulations
  - (5) Reversing procedure
- (h) Hazards of general airside driving
  - (1) the danger zones around aircraft;
  - (2) engine suction/ingestion and jet blast, prop wash;
  - (3) aircraft refuelling;
  - (4) foreign object debris and spillages;





- (5) vehicle reversing;
- (6) staff and passengers walking across aprons;
- (7) air bridges and other services such as fixed electrical ground power;
- (8) the general aircraft turnaround process;
- (9) aircraft emergency stop and fuel cut-off procedures;
- (10) hazardous cargo;
- (11) local vehicle towing requirements;
- (12) requirements for driving at night; and
- (13) requirements for driving in adverse weather conditions, particularly low visibility.
- (i) Security procedures
  - (1) Personal requirements (identification cards) and exemptions where applicable
  - (2) Vehicle security permits
  - (3) Security restricted areas
  - (4) Security critical areas
- (j) Penalties for non-compliance
  - (1) General penalties
  - (2) Local penalties
- (k) Human performance, including:
  - (1) Basic concepts of human factors;
  - (2) Basic aviation psychology, including:
    - (i) Attention and vigilance;
    - (ii) Perception;
    - (iii) Memory;
    - (iv) Human error;
    - (v) Decision-making;
    - (vi) Avoiding and managing errors;
    - (vii) Human behaviour, and
    - (viii) Human overload and underload
- (l) Local organisations
  - (1) the role of the aerodrome operator in setting and maintaining standards;
  - (2) the national aviation safety authority and its responsibilities;



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- (3) the national and/or local police, and their involvement with airside driving; and
- (4) other enforcement authorities dealing with vehicles, driving, health, and safety.
- (5) The role of the regulator
- (6) The role of the local aerodrome control service unit
- (m) Emergency procedures
  - (1) actions and responsibilities in a crisis situation (any accident or significant incident occurring on the aerodrome);
  - (2) action in the event of a vehicle accident;
  - (3) specific action in the event of a vehicle striking an aircraft;
  - (4) action in the event of fire;
  - (5) action in the event of an aircraft accident/incident; and
  - (6) action in the event of personal injury.
- (n) Communications
  - (1) radio procedures and phraseologies to be used if applicable;
  - (2) light signals used by Aerodrome Control Tower;
  - (3) procedures to be used by vehicle drivers if lost or unsure of position;
  - (4) local emergency telephone numbers; and
  - (5) how to contact the local aerodrome safety unit.
- (o) Practical training (visual familiarisation)
  - (1) airside service roads, taxiway crossings, and any restrictions during low visibility;
  - (2) aprons and stands;
  - (3) surface paint markings for vehicles and aircraft;
  - (4) surface paint markings that delineate the boundary between aprons and taxiways;
  - (5) parking areas and restrictions;
  - (6) speed limits and regulations; and
  - (7) hazards during aircraft turnarounds and aircraft movements.

**Manoeuvring Area Vehicle Driver:**

In addition to the training requirements listed above, drivers expected to operate on the manoeuvring area of the aerodrome should also receive training in the following areas. Any driver expected to drive on the manoeuvring area should also obtain an agreed period of experience in general airside driving before undertaking this training.

- (a) Aerodrome control Tower



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- (1) the Aerodrome Control Tower function and area of responsibility;
  - (2) the ground movement control function and area of responsibility;
  - (3) normal and emergency procedures used by Aerodrome Control Tower relating to aircraft;
  - (4) Aerodrome Control Tower frequencies used and normal handover/transfer points for vehicles;
  - (5) Aerodrome Control Tower call signs, vehicle call signs, phonetic alphabet, and standard phraseology; and
  - (6) demarcation of responsibilities between Aerodrome Control Tower and Apron Control if applicable.
- (b) Personal responsibilities
- (1) fitness to drive with particular emphasis on eyesight and colour perception;
  - (2) correct use of personal protective equipment;
  - (3) responsibilities with respect to FOD;
  - (4) responsibilities with respect safety reporting; and
  - (5) responsibilities with respect to escorting other vehicles on the manoeuvring area.
- (c) Vehicle standards
- (1) responsibility for ensuring the vehicle used is fit for the purpose and task and appropriately marked and lighted;
  - (2) requirements for daily inspection prior to operating on the manoeuvring area;
  - (3) particular attention to the display of obstruction and general lights; and
  - (4) serviceability of all essential communications systems with Aerodrome Control Tower and base operations.
- (d) Aerodrome layout
- (1) particular emphasis on signs, markings and lighting used on the manoeuvring area and used to protect the runway;
  - (2) description of equipment essential to air navigation such as instrument landing systems (ILS);
  - (3) description of protected zones related to ILS antenna;
  - (4) description of ILS protected areas, and their relation to runway-holding points;
  - (5) description of runway instrument/visual strip, cleared and graded area; and
  - (6) description of lighting used on the manoeuvring area with particular emphasis on those related to low visibility operations.
- (e) Hazards of manoeuvring area driving



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- (1) Engine suction/ingestion and blast, vortex, propellers and helicopter operations (if applicable);
  - (2) requirements for driving at night;
  - (3) requirements for operations in low visibility and other adverse weather conditions;
  - (4) procedures in the event of a vehicle or radio becoming unserviceable while on the manoeuvring area; and
  - (5) right of way of aircraft, towed aircraft, and rescue and fire fighting vehicles in an emergency.
- (f) Emergency procedures
- (1) actions to be taken in the event of a vehicle accident/incident;
  - (2) actions to be taken in the event of an aircraft accident/incident;
  - (3) actions to be taken if foreign object debris or other debris is found on runways and taxiways;
  - (4) procedures to be used by vehicle drivers if lost or unsure of their position; and
  - (5) local emergency telephone numbers.
- (g) Aircraft familiarisation
- (1) knowledge of aircraft types and ability to identify all types normally operating at the aerodrome;
  - (2) knowledge of airline call signs; and
  - (3) knowledge of aircraft terminology relating to engines, fuselage, control surfaces, undercarriage, lights, vents, etc.
- (h) Practical training (visual familiarisation)
- (1) all runways (including access and exit routes), holding areas, taxiways and aprons;
  - (2) all signs, surface markings and lighting associated with runways, holding positions, CAT I, II, and III operations;
  - (3) all signs, surface markings and lighting associated with taxiways;
  - (4) specific markings that demarcate the boundary between aprons and manoeuvring areas;
  - (5) navigation aids such as ILS, protected area, antenna, RVR equipment, and other meteorological equipment;
  - (6) hazards of operating around aircraft landing, taking off or taxiing; and
  - (7) any locally used naming convention for particular areas or routes.

**Radiotelephony**



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All drivers of vehicles operating on the manoeuvring area should be expected to display a high degree of competence with respect to the use of RTF phraseology and ICAO language requirements or an equivalent rating system meeting the same level of proficiency for air ground radiotelephony communications. Emphasis should be placed on the following areas:

- (a) Hierarchy of message priority
  - (1) Message priorities, an understanding of distress, alerting, control and information messages.
- (b) Phonetic alphabet
  - (1) Correct pronunciation of letters, words, and numbers.
- (c) Standard phraseology
  - (1) emphasis on the need for drivers to use standard phraseology; and
  - (2) the need for caution with certain phrases such as 'cleared' and 'go ahead'.
- (d) Call signs for aircraft, ATC, and vehicles
  - (1) an understanding of terminology and acronyms used by ATC and pilots;
  - (2) knowledge of the airline call signs used at the aerodrome; and
  - (3) knowledge of vehicle call signs, and that they should be appropriate to their function (e.g. 'Operations', 'Fire', 'Engineer') and numbered when more than one vehicle is used (e.g. 'Fire 2').
- (e) Read back procedures
  - (1) The need for vehicle drivers to use standard read back, in the same manner as pilots, for instructions such as 'enter/cross the runway', and if conditional clearances are used.
- (f) Readability scale
  - (1) Understanding and use of the readability scale from 1 to 5.
- (g) Lost or uncertain of position
  - (1) Understanding of local procedures for vehicle drivers are lost or uncertain of their position on the manoeuvring area.
- (h) Vehicle breakdown
  - (1) local procedure for vehicle breakdown on runways and taxiways; and
  - (2) procedure for notifying ATC of vehicle failure.
- (i) Radio failure
  - (1) understanding of the local procedure if radio failure occurs while on the runway or taxiway; and



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- (2) understanding of the light signals that can be used by ATC to pass instructions to vehicles.
- (j) Transmitting techniques and use of RTF
  - (1) understanding the reasons for listening out prior to transmitting;
  - (2) use of standard phraseology and ICAO air-ground radiotelephony communications procedures;
  - (3) words and sounds to be avoided;
  - (4) correct positioning of microphones to avoid voice distortion;
  - (5) avoidance of 'clipped' transmissions;
  - (6) awareness of regional accents and variations of speech; and
  - (7) speed of delivery of RTF phraseology.
- (k) Portable radios
  - (1) correct use of radios;
  - (2) effective range and battery life;
  - (3) screening/shielding effects on the aerodrome; and
  - (4) use of correct call signs, either related to a vehicle or a person.
- (l) Safety while using radios
  - (1) local instructions regarding the use of portable radios and hand-held microphones while driving a vehicle; and
  - (2) local instructions on the use of mobile telephones while operating airside.

**General Considerations**

- (a) Trainers and assessors should be suitably qualified and competent and the aerodrome operator should conduct continuous oversight of the content and quality of the training. It is for employers to select suitable tasks or equipment-specific to the training required. All training should be delivered by a trained and competent ADP holder for the respective level of training.
- (b) Where the responsibility for vehicle driver training (apron and manoeuvring area) and RTF training is delegated to a third-party provider, the aerodrome operator should institute an oversight programme as part of its safety management system to ensure that agreed standards are being maintained.
- (c) The framework for a vehicle driver training programme outlined above is intended only as a guide, and is based on current 'good practice'. It is incumbent on aerodrome operators to regularly review their vehicle driver training programmes against programmes and documentation available across the industry.
- (d) Assessment



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A defined assessment process should be in place that covers the same subjects as stated in the syllabus section above for the category of ADP and comprise of theory assessments and practicable assessments.

**AMC3 to 4.24.2(d) Airside Driving Permit Scheme and Training Programme**

**RATING SCALE**

The following table describes the different levels of language proficiency:

Level	Pronunciation Assumes a dialect or accent intelligible to the aeronautical community	Structure Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task	Vocabulary	Fluency	Comprehension	Interaction
Operational (Level 4)	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation, but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere	Vocabulary range and accuracy are usually sufficient to communicate effectively on common concrete and work related topics. Can often paraphrase successfully when lacking vocabulary particularly in unusual or	Produces stretches of language at an appropriate tempo. There may be occasional losses of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent	Comprehension is mostly accurate on common, concrete, and work related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn in events. Deals adequately with apparent misunderstandings by



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		with meaning.	unexpected circumstances.	effective communication. Can make limited use of discourse markers and connectors. Fillers are not distracting.	with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies	checking, confirming or clarifying.
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Note: operational Level (Level 4) is the minimum required proficiency level for radiotelephony communication.

#### 4.24.2(d) Airside Driving Permit Scheme and Training Program

##### Topography of the Aerodrome

##### Airside Road System and aprons

- (a) Aerodrome Operators should publish a map which covers the Airside Road system and should include the following as a minimum:
- (1) Height restrictions
  - (2) Width restrictions
  - (3) Speed limit
  - (4) Jet blast hotspots
  - (5) Access onto the Aerodrome
  - (6) RVP for Emergency vehicles
  - (7) Emergency vehicle access points
  - (8) Taxiway crossings if applicable
  - (9) Emergency contact numbers

##### Manoeuvring Area





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- (b) All Aerodrome Operators should ensure they have an up to date map of the manoeuvring area available to all Category 2 and 3 ADP holders, to show the following as a minimum:
- (1) Location and designation of runways and taxiways
  - (2) Runway holding positions and Intermediate holding positions
  - (3) Radiotelephony frequencies
  - (4) Taxiway designations
  - (5) RVP for emergency vehicles
  - (6) ILS critical and sensitive areas
  - (7) Emergency contact details
  - (8) Grid co-ordinates

These maybe on separate maps if required

### Road Tunnel System

- (a) If an Aerodrome has a road tunnel system, there should be a map of the system with any relevant restrictions.

### Airside Vehicle Requirements

#### AMC to 4.24.3 Airside Vehicle Requirements

- (a) General
- (1) Vehicles required to access the airside should be controlled by airport authority through the use of an Airside Vehicle Permit (AVP) scheme and all vehicles should display an AVP whilst airside. Exceptions may be made for visiting vehicles performing maintenance or other services but these vehicles should be escorted by a holder of an ADP.
  - (2) An AVP does not confer the right of entry and does not identify the driver or passengers. An AVP serves to identify the vehicle and is an acknowledgment by the airport authority that the vehicle is permitted to be used in the controlled or restricted areas specified on the permit when on official use.
  - (3) Airside Vehicle permits should only be issued to vehicles which have a justifiable reason to be on airside, and all others vehicles which cannot justify the use of airside access should be denied a permit or be removed from airside areas with immediate effect. Vehicles may be subject to search or further investigation by the police and airport security on behalf of the airport authority.



(b) Application Procedure

The Airport Authority should have in place processes and procedures for the application of an Airside Vehicle Permit (AVP). As vehicles should not be permitted to operate airside without first obtaining an AVP, the processes and procedures should be made available to all organisations on the aerodrome that require vehicles to be operated airside.

(c) Types of Airside Vehicle Permits (AVP)

There are two types of Airside Vehicle Permits that should be issued by airport Authorities; Standard and Temporary.

(1) Standard Airside Vehicle Permit

An Airside Vehicle Permit should be valid for a maximum of two years from the issue date for a specific vehicle. An Airside Vehicle Permit should only be issued for vehicles needing essential access to all restricted or controlled airside apron area, airside roads and manoeuvring areas on a regular basis. It is the responsibility of the vehicle owner/operator to apply for a renewal of an Airside Vehicle Permit as and when required.

(2) Temporary Airside Vehicle Permit

Valid for a specific period of time for a specific vehicle. A temporary AVP should be issued to vehicles that require short term access to perform a specific task, such as contractors delivering construction material.

(d) Administration

The Department/Sections at airport involved in processing of Airside Vehicle Permits should hold a register of all permits issued which should include as a minimum;

- (1) Company name;
- (2) Permit number;
- (3) Vehicle registration;
- (4) Vehicle make / model;
- (5) Reason for application; and
- (6) Date of issue

(e) Display of an Airside Vehicle Permit

An Airside Vehicle Permit should be clearly displayed on the windscreen of the vehicle in a position that minimizes obstruction to the driver's view while driving. Exemptions may be made for:

- (1) Emergency service vehicles that are called to an emergency
- (2) Vehicles participating in a major training exercise
- (3) Vehicles which are being escorted for a short period of time by another vehicle displaying an Airside Vehicle Permit; and



(f) Conditions of Issue

The following conditions should apply when issuing an Airside Vehicle Permit:

- (1) A permit should be subject to a signed declaration by the applicant, indicating that the details provided are accurate.
- (2) The permit should be issued to a specific vehicle.
- (3) The Airside Vehicle Permit should be non-transferable between vehicles, companies or persons and serve only to identify the vehicle, not the driver or passengers within.
- (4) The vehicle should have a current UAE vehicle registration (if applicable) with valid and airside specific insurance clause coverage as required.
- (5) The applicant should be responsible for returning an Airside Vehicle Permit to the relevant airport department management for cancelations in the following circumstances:
  - (i) When the purpose for which the pass was issued has ceased; and
  - (ii) When the vehicle ownership changes or when the vehicle permanently ceases operation airside
- (6) On request by airport management or airport security, the pass should be cancelled or returned if:
  - (i) The Airside Vehicle Permit is defaced, altered or bears markings not entered by the Airport Authority
  - (ii) The Airside Vehicle Permit is found on any vehicle other than that for which it was issued.

(g) Vehicle Requirements

(1) Vehicle Maintenance

- (i) The applicant or employer applying for an Airside Vehicle Permit should be responsible for the safe operation and condition of the vehicle / equipment used airside and should be required to certify;
- (ii) That the vehicle/equipment for which an Airside Vehicle Permit has been issued is, on a regular basis, properly inspected, maintained and serviced by an appropriately qualified person.
- (iii) The applicant or employer should be required to retain inspection and maintenance records and make them available to the airport operator upon request.

(2) Flashing Beacon

The vehicle should be equipped with an Omni-directional flashing beacon as per characteristics of Type C and D in Table App 13-5. The beacon should be installed on the



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highest point of the vehicle switched on at all times when the vehicle is operated airside.  
*Note: flashing blue/red lights are strictly used for emergency services and the Police.*

(3) Fuel and Hydraulic Systems

The vehicle fuel and hydraulic systems should be free of leaks.

(4) Fire Prevention

In order to prevent fire vehicles, the following precautions are highly recommended:

- (i) Regular vehicle maintenance and daily checks, especially for older vehicle
- (ii) Ensuring that a fire extinguisher is available in the vehicle at all times
- (iii) Vehicle/equipment should be switched off the engine before leaving the vehicle
- (iv) Always checking the vehicle for leakage of fluid before starting the engine.



## APPENDIX 17

### INDICATORS AND SIGNALLING DEVICES

#### 17.1 WIND DIRECTION INDICATOR

##### 17.1.1 Application

An aerodrome shall be equipped with at least one wind direction indicator.

##### 17.1.2 Location

A wind direction indicator shall be located so as to be visible from aircraft in flight or on the Movement Area and in such a way as to be free from the effects of air disturbances caused by nearby objects.

##### 17.1.3 Characteristics

- 17.1.3.1 The wind direction indicator should be in the form of a truncated cone made of fabric and should have a length of not less than 3.6 m and a diameter, at the larger end, of not less than 0.9 m. It should be constructed so that it gives a clear indication of the direction of the surface wind and a general indication of the wind speed. The colour or colours should be so selected as to make the wind direction indicator clearly visible and understandable from a height of at least 300 m, having regard to background. Where practicable, a single colour, preferably white or orange, should be used.
- 17.1.3.2 Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they should preferably be orange and white, red and white, or black and white, and should be arranged in five alternate bands, the first and last bands being the darker colour.
- 17.1.3.3 The location of at least one wind direction indicator should be marked by a circular band 15 m in diameter and 1.2 m wide. The band should be centred about the wind direction indicator support and should be in a colour chosen to give adequate conspicuity, preferably white.
- 17.1.3.4 Provision shall be made for illuminating at least one wind indicator at an aerodrome intended for use at night.

#### 17.2 LANDING DIRECTION INDICATOR

##### 17.2.1 Location

Where provided, a landing direction indicator shall be located in a conspicuous place on the aerodrome.



### **17.2.2 Characteristics**

17.2.2.1 The landing direction indicator should be in the form of a “T”.

17.2.2.2 The shape and minimum dimensions of a landing “T” shall be as shown in Figure App 17-1. The colour of the landing “T” shall be either white or orange, the choice being dependent on the colour that contrasts best with the background against which the indicator will be viewed. Where required for use at night the landing “T” shall either be illuminated or outlined by white lights.

## **17.3 SIGNALLING LAMP**

### **17.3.1 Application**

A signalling lamp shall be provided at a controlled aerodrome in the aerodrome control tower.

### **17.3.2 Characteristics**

17.3.2.1 A signalling lamp should be capable of producing red, green and white signals, and of:

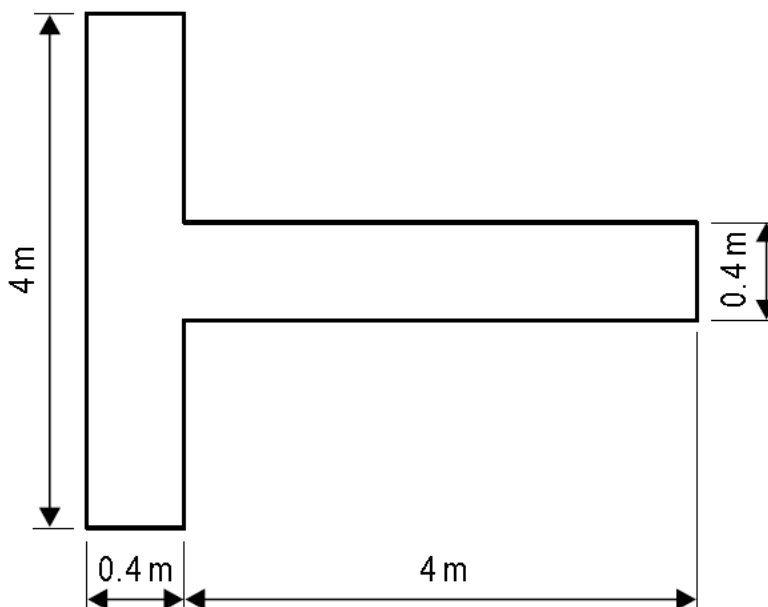
- a) being aimed manually at any target as required;
- b) giving a signal in any one colour followed by a signal in either of the two other colours; and
- c) transmitting a message in any one of the three colours by Morse Code up to a speed of at least four words per minute.

When selecting the green light, use should be made of the restricted boundary of green as specified in ICAO Annex 14, Volume 1, Appendix 1, 2.1.2.

17.3.2.2 The beam spread should be not less than 1° nor greater than 3°, with negligible light beyond 3°. When the signalling lamp is intended for use in the daytime the intensity of the coloured light should be not less than 6 000 cd.

Figure App 17 – 1

### Landing Direction Indicator



## 17.4 SIGNAL PANELS AND SIGNAL AREA

*Note: The inclusion of detailed specifications for a signal area in this section is not intended to imply that one has to be provided. ICAO Annex 14, Volume 1, Attachment A, Section 16, provides guidance on the need to provide ground signals. ICAO Annex 2, Appendix 1, specifies the shape, colour and use of visual ground signals. The Aerodrome Design Manual (Doc 9157), Part 4, provides guidance on their design.*

### 17.4.1 Location of Signal Area

The signal area should be located so as to be visible for all angles of azimuth above an angle of 10° above the horizontal when viewed from a height of 300 m.

### 17.4.2 Characteristics of Signal Area

- 17.4.2.1 The signal area shall be an even horizontal surface at least 9 m square.
- 17.4.2.2 The colour of the signal area should be chosen to contrast with the colours of the signal panels used, and it should be surrounded by a white border not less than 0.3 m wide.



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**RESERVED**





## APPENDIX 19

### AERODROME ON-NOTICE PROCESS

#### 19.1 SPECIAL ATTENTION

- 19.1.1 There may be occasions where holder of the Aerodrome Certificate or Landing Area Acceptance require a higher degree of regulatory safety oversight by the Authority, for instance where large or complex aerodrome developments are being undertaken, where significant operational changes are taking place or in order to achieve a satisfactory standard of regulatory compliance.
- 19.1.2 In addition, concerns may have been identified about the safety of aircraft operations at aerodromes, the maintenance of its facilities, equipment or the holder of Aerodrome Certificate or Landing Area Acceptance's organizational structure in meeting the Authority's requirements.
- 19.1.3 In these circumstances the aerodrome may be identified as requiring "Special Attention," which means that closer regulatory oversight will be applied.
- 19.1.4 In such cases the Authority may provide additional resource, which could involve additional visits by Inspectors, with the aim of supporting the holder of an Aerodrome Certificate or Landing Area Acceptance so as to achieve the required safety standards. The Authority will write to the holder of an Aerodrome Certificate or Landing Area Acceptance to explain the reasons for Special Attention being necessary and will request a meeting to discuss and agree the steps needed to return the operation to normal oversight.

#### 19.2 ON-NOTICE

- 19.2.1 There may be occasions when this additional oversight fails to produce the improvements or change necessary to maintain safety standards. Additionally, occasions may arise when the Authority detects unchecked trends in some operations that indicate safety standards are deteriorating. If left unchecked this could lead to a situation whereby the Authority is no longer satisfied as to the holder of an Aerodrome Certificate or Landing Area Acceptance's ability to ensure that the aerodrome is safe for use by aircraft.
- 19.2.2 In such circumstances the Authority will take action in a consistent manner that makes it clear to the holder of an Aerodrome Certificate or Landing Area Acceptance what must be undertaken to recover the situation. The Authority will also make clear what the consequences are, should the operation fail to adhere to an agreed recovery plan. In the event that the Authority has observed an adverse trend, which if unchecked, would lead it to cease to be satisfied as to the competence or ability of the holder of an Aerodrome Certificate or Landing Area Acceptance, the Authority will contact the holder of an Aerodrome Certificate or Landing Area Acceptance and arrange a meeting to set out the Authority's concerns. This may



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result in the holder of an Aerodrome Certificate or Landing Area Acceptance being placed "On-Notice."

- 19.2.3 It is important to recognize that every case is different and consequently will be judged on the individual circumstances.
- 19.2.4 The Authority will set out its concerns and request a recovery plan from the holder of an Aerodrome Certificate or Landing Area Acceptance to address the causes of the adverse trend. The recovery plan should provide deliverables that can be measured, including specific timescales. The recovery plan should set out clearly the "who, what, where and how." The need for, and adherence to, agreed timescales is particularly important.
- 19.2.5 The holder of an Aerodrome Certificate or Landing Area Acceptance will be informed that a failure to deliver, either in terms of quality and/or time, will result in firm regulatory action. This action may include the restrictions to operations or suspension of the Aerodrome Certificate, Landing Area Acceptance or Operating Approval.
- 19.2.6 Where the holder of an Aerodrome Certificate or Landing Area Acceptance completes the agreed actions in the recovery plan to the satisfaction of the Authority, the holder of an Aerodrome Certificate or Landing Area Acceptance will be informed in writing that they are no longer "On-Notice." In most cases the aerodrome will revert to "Special Attention" for a period to ensure that the improvements or changes are maintained and then return to normal levels of oversight.



## APPENDIX 20

### ACCEPTABLE MEANS OF COMPLIANCE & GUIDANCE MATERIAL ON AERODROME MANAGEMENT – SAFETY PROGRAMMES

#### **AMC 1 to Chapter 4, 4.8 a) – Aerodrome Management Safety Programmes**

*The Aerodrome Operator should:*

- a) *organise, coordinate and implement safety programmes to promote safety at the aerodrome. Such programmes include, but are not limited to:*
  - i. *runway safety;*
  - ii. *apron safety; and*
  - iii. *FOD prevention;*
- b) *coordinate and promote the exchange of information and the joint investigation of occurrences, serious incidents and accidents, with organisations operating or providing services at the aerodrome.*
- c) *The Aerodrome Operator should establish, coordinate and lead local safety committees, including a Local Runway Safety Team, dealing in particular with runway safety, apron safety, and the safety of the operations at the aerodrome in general. All relevant organisations operating or providing services at the aerodrome should participate in such safety committees.*
- d) *The local safety committees should be supported by Terms of Reference and convene regularly, identify and review local safety issues, examine possible solutions and need for action. Minutes of such meetings should be kept. Details relevant to the composition, structure, function, purpose and output of local safety committees should be included in the Aerodrome Manual.*

#### **AMC 2 to Chapter 4, 4.8 a) – Aerodrome Management Safety Programmes**

*The Aerodrome Operator should:*

- a) *Identify Hot Spots or potential Hot Spots at the aerodrome.*

*Note: See Definitions, Chapter 1, 1.3.3 for definition of Hot Spot.*
- b) *Once Hot Spots have been identified at an aerodrome, suitable strategies should be implemented to remove the hazard or when this is not immediately possible, to manage and mitigate the risk, including the publication of hot spot charts in the Aeronautical Information Publication.*



**GM 1 to Chapter 4, 4.8 a) - Aerodrome Management Safety Programmes**

**Manoeuvring Area/Apron Safety Committee**

- a) *The Aerodrome Operator should establish a Manoeuvring Area/Apron Safety Committee(s);*
- b) *The Manoeuvring Area/Apron Safety Committee(s) should have an advisory role to the Aerodrome Operator;*
- c) *Management of Manoeuvring Area/Apron Safety Committee(s):*

*The Manoeuvring Area/Apron Safety Committee(s) should be*

- i) *chaired by an Aerodrome Operator's official, responsible for aerodrome operations; and*
  - ii) *be attended by the Aerodrome Operator's Safety Manager.*
- d) *Composition of Manoeuvring Area/Apron Safety Committee(s)*

*Participation should include, but not limited to representatives of:*

- i) *aerodrome users active in flight operations;*
  - ii) *aircraft ground handling services providers;*
  - iii) *rescue firefighting services;*
  - iv) *aerodrome emergency services;*
  - v) *aerodrome operations;*
  - vi) *aerodrome wildlife management;*
  - vii) *aerodrome maintenance; and*
  - viii) *air navigation service provider(s).*
- e) *Tasks of Manoeuvring Area/Apron Safety Committee(s)*

*The tasks of the Manoeuvring Area /Apron Safety Committee(s) should be:*

- i) *to receive and evaluate reports on operational safety issues;*
  - ii) *to receive reports and statistical information on accidents and incidents, and propose solutions;*
  - iii) *to advise on Movement Area/apron safety issues such as:*
    - *promotion of apron safety discipline;*
    - *FOD prevention;*



- *developing measures for safety operations;*
- *considering actions to resolve Movement Area safety problems;*
- *apron equipment issues;*
- *attention to vehicle traffic issues;*
- *new and/or updated safety instructions;*
- *personal protective clothing/equipment issues;*
- *methods to develop and promote apron safety awareness initiatives;*
- *proposed aerodrome works;*
- *proposed changes/developments to the Movement Area;*
- *standard operating procedures; and*
- *heat, stress and fatigue, etc.*

**GM 2 to Chapter 4, 4.8 a) - Aerodrome Management Safety Programmes**

**Local Runway Safety Team**

**a) Context**

*As part of its runway safety programme, the Aerodrome Operator should establish and lead a Local Runway Safety Team and act on local runway safety issues, including runway incursion prevention.*

**b) Local Runway Safety Team Composition**

*Participation should include representatives from all interested parties with direct involvement in runway operations at the aerodrome, including, but is not limited, to:*

- i) aerodrome operations;*
- ii) aerodrome engineering and maintenance;*
- iii) air navigation service providers;*
- iv) aircraft operators that operate on the aerodrome;*
- v) rescue firefighting services;*
- vi) aerodrome emergency services; and*
- vii) drivers having access on the manoeuvring area.*

**c) Local Runway Safety Team Role**

*The role of the Local Runway Safety Team should be to advise the appropriate management on potential runway safety issues and to recommend mitigating measures.*



d) *Local Runway Safety Team Tasks*

*The Local Runway Safety Team may have the following tasks:*

- i) Identification of potential runway safety issues, including the need for the establishment of hot spots or other problem areas at the aerodrome and the review of the relevant entries of the AIP. This may be undertaken through the assessment of hazards and past events;*
- ii) developing and running local awareness campaigns that focus on local issues, for example, producing and distributing local hot spot maps, or other guidance material considered as necessary;*
- iii) assisting in verifying that communications between air traffic controllers, pilots and vehicle drivers are satisfactory and recommend educational training or procedural initiatives as required;*
- iv) making observations on a regular basis in different weather and light conditions to assess whether all visual aids are adequate and understandable by all parties concerned, or identify potential aerodrome design issues;*
- v) understanding the operating difficulties of personnel working in other areas, and recommending areas for improvement;*
- vi) development of joint training programmes on runway incursion prevention;*
- vii) provide advice prior to the implementation of changes to the aerodrome to identify potential for runway incursion;*
- viii) review and implement recommendations as appropriate from both the European Action Plans for the Prevention of Runway Incursions/Excursions documents.*
- ix) monitor the number, type and severity of runway safety events including incursions and excursions; and*
- x) periodically review airfield compliance issues, alternative means of compliance or deviations related to the runway.*

e) *Local Runway Safety Team Tasks*

*Strategies to manage and mitigate the risk from hot spots, depending on the case, may include, but are not limited to:*

- i) awareness campaigns;*
- ii) additional visual aids (signs, markings, and lighting);*



- iii) *establishment of alternative routings;*
- iv) *introducing changes to the design of parts of the aerodrome; and*
- v) *the mitigation of blind spots in the aerodrome control tower.*

**GM 3 to Chapter 4, 4.8 a) - Aerodrome Management Safety Programmes**

*Aerodrome charts showing hot spots should be produced locally, checked regularly for accuracy, revised as needed, distributed locally, and published in the AIP.*

*Note 1: The criteria used to establish and chart a hot spot are contained in the ICAO PANS-ATM (Chapter 7) and ICAO Annex 4 — Aeronautical Charts.*

*Note 2: Guidance material related to hot spots is also contained in the Manual on the Prevention of Runway Incursions (Doc 9870).*



## APPENDIX 21

### ACCEPTABLE MEANS OF COMPLIANCE & GUIDANCE MATERIAL ON PERSONNEL REQUIREMENTS

*Note: The guidance material in this Appendix is in support of the Personnel Requirements included in Chapter 2.*

#### 21.1 Nominated Persons

- 21.1.1 Acceptance from the Authority will be required for all persons nominated as Aerodrome Post Holders.
- 21.1.2 The Authority's acceptance of nominated Aerodrome Post Holders is based on the applicable Assessment Criteria in Tables App 21-1 through 21-6 and the applicant's demonstration of knowledge of the applicable regulations and an understanding of the proposed position.
- 21.1.3 Selection of the Post Holder is the responsibility of the applicable Aerodrome Operator. The revised regulation and Guidance Material aims to assist Aerodrome Operators to be satisfied that persons within the management structure possess the relevant operational safety competence, and be able to identify any gaps that may exist in the areas of competence for their particular aerodrome. The size, complexity and scale of operations of an aerodrome will be a component of the Operator's assessment process. The detailed scope of Post Holders accountabilities and responsibilities are likely to be affected by this assessment, which should be aligned with the aerodrome's SMS.
- 21.1.4 Regulation includes specific roles for which Aerodrome Post Holder acceptance by the Authority will be required. However, while the specific job title designations for the posts may differ, the scope should include the accountabilities and responsibilities as stated in the regulation.
- 21.1.5 Cases for interviews with nominated Aerodrome Post Holders include the following:
  - a) start of operations before issuing the first Aerodrome Certificate; or
  - b) change of Aerodrome Post Holders at a Certified Aerodrome.
- 21.1.6 Purpose of the interview between the Authority and the nominated Aerodrome Post Holder is as follows:
  - a) exchange of information between the intended nominated persons and the Authority for the latter to acquire information on the intended work areas and the applicant's competence level so as to verify their suitability for the post(s); and





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- b) to create good contact and understanding between the both parties, and to come to a mutual conclusion on, if necessary, possible solutions for training and personal development over time.
- c) The GCAA ANA process in acceptance of Post Holders is based on the applicant demonstrating knowledge of the applicable regulations, having an understanding of the role applied for and of the standards required by the Authority. The process includes a review of the submitted details to determine the suitability of the person for the role.

21.1.7 Possible agenda items include:

- a) information from the Authority on organisation and mission of the GCAA, the regulatory framework and specifically Safety Management System requirements;
- b) information from the nominated person concerning the intended work area;
- c) enforcement methodology of the GCAA;
- d) the role and responsibility of the Aerodrome Post Holder;
- e) expected competence requirement of the nominated person in relation to present personal status and experience presented in their curriculum vitae or equivalent documentation;
- f) discussion concerning depth of knowledge and understanding of the applicable legislation and regulations;
- g) the role and responsibility of the GCAA and of the nominated person;
- h) understanding of aviation in general and for the specific nominated post, how operators/activities at the aerodrome including Air Navigation Service Providers, and other aviation activities can impact aircraft safety; and
- i) distribution of delegated powers depending on the organisational situation.



## 21.2 Competence of Personnel

With focus on the competency of Aerodrome Post Holders, Assessment Criteria as included in Tables App-21 - 1 through 5 have been designed.

**AMC 1 to Appendix 21, 21.2 - Determination of Personnel Needs and Qualifications**  
– Reference: Chapter 2, paragraph 2.7.1 (b)

- a) *The Aerodrome Operator should determine the number of required personnel for the planned tasks.*
- b) *The Aerodrome Operator should determine the required personnel qualifications, in accordance with the applicable requirements. A documented system with defined responsibilities should be in place, in order to identify any need for changes with regard to personnel qualifications.*
- c) *Documentation should define the method by which staffing levels are determined in relation to the operation, maintenance and management of the aerodrome.*
- d) *Documentation should define the training requirements and training programme to ensure that personnel are adequately trained.*
- e) *Procedures should include the mechanisms that ensure only trained and competent personnel undertake the planned tasks and activities assigned to them.*

**AMC 2 to Appendix 21, 21.2 - Distribution of Rules and Procedures** - Reference: Chapter 2, paragraph 2.7.1 (b);

*The Aerodrome Operator should have a system in place to distribute the rules and procedures to personnel to enable them to exercise their duties and responsibilities safely and effectively.*

**AMC 3 to Appendix 21, 21.2 - Gap Analysis: Personnel Requirements** - Reference: Chapter 2, paragraph 2.7.1 (b);

*The Aerodrome Operator should conduct gap analysis in order to provide an assessment and demonstration of the following:*

- a) *That the Aerodrome Operator has a sufficient number of qualified personnel for the planned tasks and activities being performed.*
- b) *That there are a sufficient number of supervisors assigned to defined duties and responsibilities, taking into account the structure of the organisation and the number of personnel employed.*



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- c) *Those personnel involved in the operation, maintenance and management of the aerodrome are adequately trained in accordance with the organisation's training programme.*

**AMC 4 to Appendix 21, 21.2 - Gap Analysis: Minimum Number of Personnel, Personnel Requirements and Training Needs Analysis** - Reference: Chapter 2, paragraph 2.7.1 (b);

- a) *A gap analysis should be used as a tool to compare existing operations with the requirement to provide sufficient numbers of trained personnel appropriate for the scale and complexity of the aerodrome and its operations.*
- b) *As part of the gap analysis process, each assessment should refer to the following categorisation of "High" "Medium" or "Low" in relation to the scale, complexity and demands of the operation and for the provision of a dedicated aerodrome operations team:*

<b>High</b>	<i>One or more runways Complex in nature Significant developments Instrument runway Traffic density of ATS unit: high / medium</i>	<i>Dedicated operations team No extraneous or ancillary duties (Other than AEP response tasks)</i>
<b>Medium</b>	<i>One runway Instrument runway Traffic density of ATS unit: medium</i>	<i>Dedicated operations team Extraneous or ancillary duties allowable under assessment (Other than AEP response tasks)</i>
<b>Low</b>	<i>One runway Non-instrument runway No shift patterns Traffic density of ATS unit: low</i>	<i>Option to have a multi-tasked team allowable under assessment</i>

- c) *Once the gap analysis has been completed and fully documented, the staffing levels, resources and processes that have been identified as missing or inadequate will form the basis for an implementation plan, in order to become compliant with the regulations.*



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- d) *An example of elements to consider for the gap analysis, as part of the aerodrome Safety Management System process, is as follows:*
- i. *Aerodrome inspection requirements appropriate to the operational use of runway(s) and taxiways;*
  - ii. *Complexity of aerodrome layout, for example:*
    - A) *Scale of aerodrome (geographical)*
    - B) *Scale of aerodrome (number of runways and taxiways)*
    - C) *Scale of aerodrome (number of aprons and stands);*
  - iii. *complexity of operations i.e. CAT I, CAT II, CAT III, number of runways, movement rates;*
  - iv. *Low visibility operations;*
  - v. *Day and night use;*
  - vi. *Duty hours for operational staff with reference to the following list:*
    - A) *Compliance with the maximum allowable working hours as defined within the UAE Labour Law;*
    - B) *Sufficient break periods / rest-time;*
    - C) *An awareness of the problematic fatigue issues relating to the circadian body clock, to ensure so far as is reasonably possible, fatigue does not impair operational safety;*
    - D) *Environmental factors, such as extensive time spent in warm and hot weather conditions;*
    - E) *Operational duties required (day);*
    - F) *Operational duties required (night);*
    - G) *Handover time;*
    - H) *Shift patterns;*
    - I) *Maximum consecutive hours for both day and night duties (not exceeded); and*



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- J) *Maximum numbers of night duties worked in immediate succession (i.e. four);*
- vii. *The number and complexity of aerodrome development projects – inspections and oversight of contractors;*
- viii. *Aerodrome operations procedural requirements and activities, for example:*
  - A) *Aerodrome inspection requirements;*
  - B) *Marshaling duties;*
  - C) *Wildlife hazard control duties;*
  - D) *FOD management duties;*
  - E) *Follow-me requirements;*
  - F) *Fuel management; and*
  - G) *Control and management of aeronautical data;*
- ix. *Pavement maintenance, duties and inspections;*
- x. *Visual aids maintenance (signs, markings and markers), duties and inspections;*
- xi. *AGL maintenance, duties and inspections;*
- xii. *Allowance for annual leave, public holidays (in lieu), training, OJT training, special leave and sickness; and*
- xiii. *Sufficient operational administrative support staff (the number of support staff will depend on the complexity of the operations).*

**GM to Appendix 21, 21.2 - Qualification of Personnel:** Reference: Chapter 2, 2.7.1 (b)

- a) *The term 'qualified' denotes fitness or fit for the purpose. This may be achieved through fulfillment of the necessary conditions such as completion of required training, or acquisition of a diploma or degree, or through the gaining of suitable experience. It, also, includes the ability, capacity, knowledge or skill that matches or suits an occasion, or makes someone eligible for a duty, office, position, privilege or status.*



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- b) Certain posts may, by nature, be associated with the possession of certain qualifications in a specific field (e.g. rescue and firefighting, civil, mechanical or electrical engineering, wildlife biology, etc.). In such cases, the person occupying such a post is expected to possess the necessary qualifications.*



**Table App 21-1: Assessment Criteria for Aerodrome Accountable Manager**

<b>Performance Criteria</b>
Full control of the human resources required for the operations authorised to be conducted under the Aerodrome Certificate
Full control of the technical resources required for the operations authorised to be conducted under the Aerodrome Certificate
Full control of the financial resources required for the operations authorised to be conducted under the Aerodrome Certificate
Final authority over operations authorised to be conducted under the Aerodrome Certificate
Ultimate responsibility and accountability for the establishment, implementation and maintenance of the Management System
Ultimate responsibility and accountability for the establishment, implementation and maintenance of the safety policies and the authority and accountability for communication and promotion of the safety policy
Authority and accountability for establishment of the organisation's safety objectives and safety targets
Ultimate responsibility and accountability for the resolution of all safety issues
Authority and accountability for establishment, implementation and maintenance of the organisation's competence to learn from the analysis of data collected through its safety reporting system and others Safety Data Collection and Processes Systems (SDCPS) in place; and
Authority and accountability for establishment of a just culture which encourages safety reporting.
<b>Knowledge Criteria</b>
Knowledge and understanding of the documents that prescribe relevant aerodrome safety standards
Understanding of the requirements for competence of aerodrome management personnel, so as to ensure that competent persons are in place
Knowledge and understanding of safety, quality, and security management systems related principles and practices, and how these are applied within the organisation
Knowledge and understanding of the key issues of risk management within the aerodrome
GCAA regulatory framework (UAE Aviation Law/ CARs /AMCs / NOTACs)
GCAA State Safety Programme and Aerodrome SMS (CAR Part X)
GCAA Aerodrome Certification Process (AMC-30)



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GCAA Regulatory Oversight Process
GCAA Enforcement Process
<b>Supporting Documents</b>
Organisational Structure
Other relevant documents if requested by Authority

**Table App 21-2: Assessment Criteria for Aerodrome Post Holder: Aerodrome Safety**

<b>Performance Criteria</b>
Responsible individual and focal point for the development and maintenance of an effective Safety Management System
Ensure that processes needed for the SMS are established, implemented and maintained
Responsible directly to the Accountable Manager on the performance of the SMS and on any need for improvement
Ensure safety promotion throughout the organisation
The role of Aerodrome safety should include but are not limited to: <ul style="list-style-type: none"> <li>i. managing the SMS implementation;</li> <li>ii. performing/facilitating hazard identification and safety risk analysis;</li> <li>iii. monitoring corrective actions and evaluating their results;</li> <li>iv. providing periodic reports on the organisation's safety performance;</li> <li>v. maintaining records and safety documentation;</li> <li>vi. planning and facilitating staff safety training;</li> <li>vii. providing independent advice on safety matters;</li> <li>viii. monitoring safety concerns in the aviation industry and their perceived impact on the organisation's operations aimed at service delivery;</li> <li>ix. monitoring that processes for Safety Data Collection and Processes Systems (SDCPS) such as safety reporting and other safety data collection methods are established and implemented; and</li> <li>x. advising the Safety Review Board on safety issues.</li> </ul>
Ensure that the quality assurance processes are developed in a documented continuous monitoring audit approach
Ensure that the quality system provides the necessary assurance to meet the stated requirements for data quality, data traceability in accordance with the requirements of CAR Part IX
<b>Knowledge Criteria</b>





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Educated, trained and experienced in safety and quality management
Comprehensive Knowledge of the Aerodrome / SMS Manual
Technical background to understand the systems that support operations
GCAA Regulatory framework (CARs / AMC/ NOTACs)
GCAA State Safety Programme / Aerodrome SMS (CAR Part X)
GCAA Aerodrome Certification Process (AMC-30)
GCAA Aerodrome Projects (AMC-59)
GCAA Regulatory Oversight Process
GCAA Enforcement Process
<b>Supporting Documents</b>
Curriculum Vitae, Job Description and proof of relevant Training and Qualifications
Other relevant documents if requested by Authority



**Table App 21-3: Assessment Criteria for Aerodrome Post Holder: Aerodrome Operations**

<b>Performance Criteria</b>
Ensure that aerodrome certification requirements are met, and that the aerodrome operates in accordance with certificate conditions and regulatory requirements
Responsible for day-to-day aerodrome operations
Ensure an understanding by the aerodrome management of the certification requirement for and status of the Aerodrome Manual
Responsible for the management of the operational services of the aerodrome
Analyse auditing findings and inspections to the Authority, and initiate actions
Use feedback from auditing and inspections to recommend appropriate changes to airside safety management procedures and ensure implementation
Monitor airside planning and development for compliance
Develop proactive working relationships with aerodrome users
<b>Knowledge Criteria</b>
Educated, trained and experienced in safety and quality management
Practical experience and expertise in aerodrome operations or maintenance (or similar area) respectively
Comprehensive knowledge of the applicable requirements in the area of aerodromes
Appropriate level of knowledge of safety and quality management
Comprehensive knowledge of the Aerodrome / SMS Manual
GCAA Regulatory Framework (CAR Part IX / AMCs / NOTACs)
GCAA State Safety Program / SMS (CAR Part X)
GCAA Aerodrome Certification Process (AMC-30)
GCAA Aerodrome Projects (AMC-59)
GCAA Regulatory Oversight Process
GCAA Enforcement Process
<b>Supporting Documents</b>
Curriculum Vitae, Job Description and proof of relevant Training and Qualifications
Other relevant documents if requested by Authority

**Table App 21-4: Assessment Criteria for Aerodrome Post Holder: Aerodrome Maintenance**



<b>Performance Criteria</b>
Ensure that aerodrome certificating requirements are met, and that the aerodrome facilities are accurately reported (Aerodrome Manual/AIP) and in accordance with the regulatory requirements
Ensure aerodrome facilities are compatible with sizes, types and frequency of aircraft in accordance with company and legislative requirements
Ensure that maintenance policies, procedures and training fulfil the aims of the aerodrome and meet regulatory requirements
Ensure understanding of regulatory requirements specific to electrical systems
Ensure understanding of regulatory requirements specific to aeronautical ground lighting and other visual aids such as markings
Ensure understanding of regulatory requirements specific to aerodrome pavements
Ensure understanding of role as related to aerodrome reporting systems to include hazard identification, defect identification and reporting of safety critical information to the aerodrome Air Traffic Service Unit
Ensure basic understanding of aerodrome bird and wildlife hazard management programme
Ensure understanding of requirement for corrective and preventive maintenance programme
Ensure understanding of competency standards and evaluation programme for maintenance staff maintaining safety critical assets or working in safety critical areas (including both technical and operational (RT/Driving) competencies as necessary)
Ensure understanding of AMC-59 scope and process as applicable to both maintenance and facility development activities
<b>Knowledge Criteria</b>
Educated, trained and experienced in safety and quality management
Qualified in the role with appropriate education, experience and/or certification
Practical experience and expertise in aerodrome maintenance
Comprehensive knowledge of the applicable requirements in the areas of electrical systems, aeronautical ground lighting and pavements
Comprehensive knowledge of the Aerodrome / SMS Manual
Knowledge of applicable ICAO guidance materials such as Aerodrome Design Manual
GCAA Regulatory framework (CAR / AMC/ GM)
GCAA State Safety Programme / Aerodrome SMS (CAR Part X)
GCAA Regulatory Oversight Process
GCAA Enforcement Process
GCAA Process for the reporting and follow-up of accidents, incidents and emergencies on the aerodrome
<b>Supporting Documents</b>



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Curriculum Vitae, Job Description and proof of relevant Training and Qualifications  
Other relevant documents if requested by Authority

**Table App 21-5: Assessment Criteria for Aerodrome Post Holder: Rescue Firefighting Services (Chief Fire Officer)**

Performance Criteria
Ensure that aerodrome certificating requirements are met, and that the aerodrome operates in accordance with the regulatory requirements in the provision of RFS
Ensure emergency fire and rescue facilities are compatible with sizes, types and frequency of aircraft in accordance with company and legislative requirements
Ensure that rescue and firefighting, policies, procedures and training fulfil the aims of the aerodrome and meet regulatory requirements
Ensure that procedures for auditing driver training programmes are to established standards
Ensure the use of communication protocols and procedures is in accordance with regulations
Assess the feasibility of continuing aerodrome operations in an emergency situation
Ensure appliances and equipment meet all regulatory requirements
Establish an effective Incident Command & Control System
Knowledge Criteria
Educated, trained and experienced in safety and quality management
Qualified in the role with appropriate education, experience and/or certification
Practical experience and expertise in aerodrome RFS
Comprehensive knowledge of the applicable requirements in the areas of RFS and aerodromes
Comprehensive Knowledge of the Aerodrome / SMS Manual
GCAA Regulatory framework (CAR / AMC/ GM)
GCAA State Safety Programme / Aerodrome SMS (CAR Part X)
GCAA Regulatory Oversight Process
GCAA Enforcement Process
GCAA Process for the reporting and follow-up of accidents, incidents and emergencies on the aerodrome
Supporting Documents
Curriculum Vitae, Job Description and proof of relevant Training and Qualifications Other relevant documents if requested by Authority

**Table App 21-6: Assessment Criteria for Aerodrome Post Holder: Quality Assurance**



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Performance Criteria
Responsible directly to the Accountable Manager on matters affecting the adequacy, accuracy and timeliness of the quality assurance requirements in accordance with CAR Part IX
Be responsible for the compliance monitoring and quality management system implementation, maintenance, documentation, performance, effectiveness and oversight of the organisation
To ensure that the quality system provides the necessary assurance to meet the stated requirements for aeronautical data and data traceability to its origin in accordance with the requirements of GCAA regulations
To ensure quality indicators are monitored to identify existing problems or potential causes of problems within the system
To ensure corrective actions that have been identified within the system are corrected in a timely manner
To ensure preventive actions that have been identified within the system are remedied
To ensure an internal quality audit programme is implemented to audit the Aerodrome Operator's organisation for conformity with the procedures in its Aerodrome / SMS Manual and associated documentation and achievement of the goals set in its safety policy; and
To ensure the continuing suitability and effectiveness of the internal quality assurance system through the use of statistical analysis and managerial review procedures.
Knowledge Criteria
Educated, trained and experienced in safety and quality management
Comprehensive knowledge of the Aerodrome / SMS Manual
Technical background to understand the systems that support operation
GCAA Regulatory framework (CAR / AMC/ GM)
GCAA State Safety Programme / Aerodrome SMS (CAR Part X)
GCAA Aerodrome Certification Process (AMC-30)
GCAA Aerodrome Projects (AMC-59)
GCAA Regulatory Oversight Process
GCAA Enforcement Process
Supporting Documents
Curriculum Vitae, Job Description and proof of relevant Training and Qualifications
Other relevant documents if requested by Authority



## APPENDIX 22

### WATER AERODROMES

#### 22.1 GENERAL

22.1.1 All aircraft on water shall comply with requirements of the International Regulations for Preventing Collisions at Sea, harbour regulations and local byelaws that are not addressed in this document.

21.1.2 *Note: Reference to CAR Part III (General Regulations) Right of Way Rules, Water Operations shall be assessed and supported by the Aerodrome Operator's Safety Management System, based on CAR Part IX.*

**GM 1 to Appendix 22, 22.1.2:** *Operations on water differ significantly from those conducted on land and as such, the criteria for land aerodromes maybe inappropriate in some areas. Although based on the existing land aerodrome criteria, the different operational and safety risks when operating onto and from water, particularly in more challenging environments have to be addressed.*

22.1.3 The water aerodrome criteria are designed to cater for day, Visual Flight Rules (VFR) operations only; they do not cater for night, Instrument Meteorological Conditions (IMC).

**GM 1 to Appendix 22, 22.1.2:** *The process of granting an Aerodrome Certificate or Landing Area Acceptance for a water aerodrome is no different from that of a land aerodrome, and each application would be assessed on the ability to meet the relevant requirements. The following criteria focus on those factors where water aerodromes differ from land aerodromes. These factors primarily include the physical characteristics of the operating environment, mooring procedures and aerodrome emergency response services. The criteria shall therefore be considered in addition to criteria outlined elsewhere in CAR Part IX and CAR Part XI that apply to land and water aerodromes equally.*

#### 22.2 PHYSICAL CHARACTERISTICS

##### 22.2.1 Aerodrome Reference Point (ARP)

22.2.1.1 The Aerodrome Reference Point (ARP) shall be established. The ARP shall be located near the initial or planned geometric centre of the aerodrome.

22.2.1.2 An Aerodrome Reference Elevation shall be determined at the ARP.



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**AMC 1 to Appendix 22, 22.2.1.21:** *The Aerodrome Reference Elevation is located at the planned geometric centre of the Manoeuvring Area or of the main one if more than one is provided. The Aerodrome Reference Elevation should be determined from the chart height, or from the lowest recorded water level, converted to an elevation in feet above the local datum established by the emirate in which the aerodrome is located.*

**22.2.2 Movement Area**

22.2.2.1 Operators shall determine the area of any land and water on which seaplane operations may take place. It is this area that shall be the Movement Area.

22.2.2.2 One or more Manoeuvring Area(s) shall be established within the Movement Area from which all seaplane operations requiring the use of an aerodrome shall take place.

**22.2.3 Manoeuvring Area**

22.2.3.1 The available Manoeuvring Area shall be large enough to provide a choice of take-off and landing direction, dependent upon prevailing water surface and weather conditions.

22.2.3.2 The Manoeuvring Area shall encompass all parts of the water surface intended for the taking off and landing of seaplanes.

**AMC 1 to Appendix 22, 22.2.3:** *The Manoeuvring Area(s) should be square, rectangular or rhomboidal in shape.*

**AMC 2 to Appendix 22, 22.2.3:** *In other cases, such as on a narrow inlet, it may be more appropriate to provide a Manoeuvring Area that caters for take-off and landing in one direction and its reciprocal only, in a direction parallel to the longer sides of the Manoeuvring Area.*

**22.3 OBSTACLE LIMITATION SURFACES**

22.3.1 Declaration of the Obstacle Limitation Surfaces shall be made by the Aerodrome Operator and shall be supported by an Aeronautical Study.

**GM 1to Appendix 22 - 22.3.1:** *In order to ensure a high level of aviation safety, the Aeronautical Study should reflect the best practices in the field of water aerodromes; taking into account worldwide water aerodrome operational experience.*

22.3.2 To aid this process and for the purpose of providing the appropriate minimum strip width and obstacle limitation surfaces, operators are required to consult with their GCAA Flight Operations Inspector.



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- 22.3.3 When determining the extent of the Obstacle Limitation Surfaces, account shall be taken of all factors that significantly affect the performance of the largest seaplane likely to operate from the water aerodrome.

**GM 1 to Appendix 22, 22.3.3:** *Factors that significantly affect performance include, but are not limited to: maximum certificated take-off mass, operating procedures, temperature, wind, water surface condition and constraints by property boundaries or topographical features.*

**22.4 VISUAL AIDS**

- 22.4.1 The edges of each Manoeuvring Area shall be easily identifiable by pilots departing from or arriving at the water aerodrome.

- 22.4.2 **AMC 1 to Appendix 22, 22.4.1:** *When used, floating visual aids should be conspicuous and conform to maritime regulations or, where such regulations and requirements do not exist or are not applicable, the principle use of shapes, colours and lights specified in CAR Part IX shall be considered.*

*Note: Reference to the International Regulations for Preventing Collisions at Sea: Rules 3 and 18.*

- 22.4.3 Aeronautical Beacons Characteristics – Where operationally necessary, an aerodrome beacon shall be provided at each aerodrome intended for use at night.

- 22.4.4 When used the aerodrome beacon shall show either coloured flashes alternating with white flashes, or white flashes only. The frequency of total flashes shall be from 20 to 30 per minute. Where used, the coloured flashes emitted by beacons at land aerodromes shall be green, and coloured flashes emitted by beacons at water aerodromes shall be yellow. In the case of a combined water and land aerodrome, coloured flashes, if used, shall have the colour characteristics of whichever section of the aerodrome is designated as the principal facility.

**22.5 OPERATIONAL PROCEDURES**

- 22.5.1 Operational procedures shall be developed for safe seaplane taxiing and mooring in the proximity of other seaplanes and obstacles that minimise the risk of damage to occupied or unoccupied seaplanes, particularly where this might result from variations in wind direction; water current, depth and ebb; and flow of tide.
- 22.5.2 All reasonable measures shall be made to provide a Movement Area that is free from debris likely to cause damage to a seaplane. In particular, procedures should be established for the regular inspection of the Manoeuvring Area(s) to remove FOD.
- 22.5.3 Operators shall establish a bird/wildlife hazard management plan that includes the identification of the risks and hazards that may exist, and suitable mitigation





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measures. All reasonable measures shall be taken to discourage birds from gathering in the Movement Area and under anticipated departure and arrival flight paths.

**22.6 WATER AERODROME EMERGENCY RESPONSE**

- 22.6.1 The Aerodrome Operator shall provide and staff an effective aerodrome rescue response capability that can respond to an aircraft accident/incident, prior to the arrival of external emergency services.
- 22.6.2 The Aerodrome Operator shall conduct an assessment on the provision of an effective rescue response in the event of an aircraft accident/incident. Such an assessment shall be submitted to the GCAA for acceptance.
- 22.6.3 Aerodrome Rescue Team members shall receive initial and recurrent competence-based training relevant to their role and task, and shall at all times be physically capable of performing the tasks expected of them.

**AMC 1 to Appendix 22, 22.6: Procedures and Facilities**

- a) *Procedures for the enhancement of passenger and crew post-accident survival should be developed, and facilities, in terms of staff and equipment, appropriate to the type of seaplane operations anticipated at the water aerodrome, should be provided.*
- b) *Within the provision of these procedures and facilities, account should be taken of the effect that variable environmental conditions might have on the ability of the Aerodrome Rescue Team to respond rapidly to accidents and incidents.*

**AMC 2 to Appendix 22, 22.6: Support Boat**

- a) *Where provided, a support boat should be of a design and size that would allow survivors to be brought aboard, or it should be equipped with an adequate number of floatation devices of a design that would enable survivors to remove themselves from the water.*
- b) *In selecting the type of support boat to be operated it will first be necessary to consider the range of water surface conditions likely to be encountered, the depth of water in the response area, any sub-surface hazard, such as rocks and coral reefs, and possibility of the support boat undertaking rescues of an urgent nature.*



**AMC 3 to Appendix 22, 22.6: Response Time**

- a) *The Aerodrome Rescue Team should achieve a response time not exceeding 15 minutes to any point of the Movement Area in good visibility and water surface conditions.*
- b) *At a water aerodrome where the hours of operation are notified, the Aerodrome Rescue Team should be available 15 minutes before and after the times published. Where the hours of operation are not notified, the Aerodrome Rescue Team should be available prior to the engine start of the first departing seaplane, or to the first arriving seaplane commencing its final approach; and until the last arrival is moored, or 15 minutes after take-off of the final seaplane.*

**AMC 4 to Appendix 22, 22.6: Equipment**

*The Aerodrome Rescue Team should be appropriately equipped with all necessary equipment to enable it to conduct rescue and fire-fighting operations in an effective manner. The equipment to be deployed in effecting a rescue operation will vary with the environment in which the operation is to be conducted.*

*The basic equipment should include:*

- a) *Communications equipment, suitable for communications method for onshore and offshore communications should be assessed;*
- b) *Suitable medical first aid equipment;*
- c) *Life-support equipment, including life-jackets, foil blankets;*
- d) *Ropes/lines, boat hooks, loudhailers and tools, e.g. wire cutters and harness knives; and*
- e) *Containers holding inflatable life rafts which can be deployed at the accident site to accommodate survivors should be considered.*

**AMC 5 to Appendix 22, 22.6: Personnel and Provision of Training**

- a) *The number of personnel required is dependent on the scale of operations and should be determined through the process of an assessment.*
- b) *The equipment to be deployed in effecting a rescue operation will vary with the environment in which the operation is to be conducted. The training required by Aerodrome Rescue Team personnel delegated to these duties which will reflect the equipment provided*



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- c) *Within the provision of training, account should be taken of the effect that variable environmental conditions might have on the ability of the Aerodrome Rescue Team to respond rapidly to accidents and incidents.*

*Personnel operating on the support boat or providing an emergency response should be competent swimmers and should be provided with suitable water survivable equipment and suitable eye protection.*

**GM 1 to Appendix 22, 22.6: Water Contamination (fuel)**

- a) *Wind and water currents should be taken into consideration in order to prevent floating fuel from moving into areas where it would be hazardous. Care should be taken in the use of flares, flame floats or other pyrotechnics where fuel is present on the water.*
- b) *Pockets of fuel should either be broken up or moved with large velocity water nozzles or neutralized by covering them with foam. Calm surfaces will usually present more of a problem than choppy or rough surfaces.*
- c) *It can be anticipated that the impact of the seaplane into water might rupture fuel tanks and lines. It is reasonable to assume that quantities of fuel will be found floating on the surface of the water. All boats having exhausts at the waterline may present an ignition hazard if operated where this condition is present.*

**22.7 EMERGENCY RESPONSE PLANNING**

The Emergency Plan shall form part of the Aerodrome Manual – Part 5 and shall include arrangements for altering the rescue response; for the immediate notification of key aerodrome personnel and for summoning externally based emergency services.

**AMC 1 to Appendix 22, 22.7:** *Off-aerodrome emergency services (Civil Defence) should be given the opportunity to familiarise themselves with the Emergency Plan and the topography of the aerodrome.*

**AMC 2 to Appendix 22, 22.7:** *The Emergency Plan should consider the particular hazards associated with seaplane operations, including:*

- a) *Passenger evacuation into a further life-threatening environment, e.g. deep water.*
- b) *The onset of shock and its associated effects, during and following prolonged immersion in water.*



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- c) *The immediate toxicity and respiratory effects on survivors in the water following the ingestion of floating fuel and oils and their associated vapours, and fire suppressant foams, powders and gases.*

**AMC 3 to Appendix 22, 22.7:** *The Emergency Plan should contain processes and procedures to demonstrate an effective rescue response. The Authority may request an exercise to demonstrate effective and efficient procedures.*

**AMC 4 to Appendix 22, 22.7:** *The Emergency Plan should provide cooperation with the Search and Rescue Coordination Centre as is necessary.*

**GM 1 to Appendix 22, 22.7:** *The objective of aerodrome emergency planning is to anticipate the effects an emergency might have on life, property, and aerodrome operations, and to prepare a course, or courses, of action to minimise those effects, particularly in respect of saving lives.*

**GM 2 to Appendix 22, 22.7:** *Additional guidance on aircraft accidents in water is outlined in Appendix 6 to the ICAO Airport Services Manual (Doc 9137) Part 7: Airport Emergency Planning.*