STATE OF KUWAIT
DIRECTORATE GENERAL OF CIVIL AVIATION
AVIATION SAFETY

دولة الكويت
الإدارة العامة للطيران المدني
سلامة الطيران

2025/08/17

2025/97/SUPDT-R/41

All KCASR Stockholders and Users

Subject.: ***Notice of Proposed Amendment's (NPA) No. 2025-15 to Kuwait Civil Aviation Safety Regulations KCASR 14 – AERODROMES Volume I - Aerodromes Rev 5.***

Dear Sir,

Purpose:

The purpose of this NPA is to announce to the KCASR users the intention of the Directorate General of Civil Aviation to amend ***KCASR 14 – AERODROMES Volume I - Aerodromes*** (issue 4) to comply with ICAO standers and recommended practices up to amendment (18).

Action Required:

All users of KCASR are required to refer to DGCA/ASD website (https://kcasr.dgca.gov.kw) for reviewing the NPA and mail or email (safety@dgca.gov.kw) their comments to DGCA by 30/Sep/2025 using the attached NPA Response Sheet Forms No. 1500 or using NPA comments & feedback form on the website. If we do not receive your response by this date, it will be assumed that you do not have any comments on the proposal.

If required, the DGCA/Aviation Safety Department personnel are available to answer your questions on the interpretation and intended implementation of the proposed amendments.

This is for your information and distribution to the concerned parties.

Yours Sincerely,

President of Civil Aviation

Eng. Duaij Khalaf Alotaibi
Acting Director General DGCA

CC: Director General of Civil Aviation.
Dy. Dir. Gen. Kuwait. Intel. Airport Affairs.
Dy. Dir. Gen. for Air Navigation Services Affairs.
Safety Management Coordination Center (SMCC).
Head of Technical Office.
Civil Aviation Security Department.
Aviation Safety Director.
Air Transport Director.
Inspection & oversight Superintendent.
Head of Standards & Aviation Safety Regulations Division.

Notes on the presentation of the Amendment
Notice Of Proposed Amendment
(NPA)

The text of the amendment is arranged to show deleted text in Red Color and with a line through it, new text to be inserted is in Blue color as shown below:

~~Text to be deleted is in Red and shown with a line through it.~~	**Text to be deleted**
New text to be inserted is in Blue Color.	**New text to be inserted**
~~Text to be deleted is in Red and shown with a line through it~~, followed by the replacement text which is in Blue Color.	**New text to replace existing text**
. . . Indicates that remaining text is unchanged in front or following the reflected amendment.	**Text is unchanged**

Notice Of Safety Regulation Amendment
(NPA, NSRA and Revisions)

Side bar indicates that text is changed or added.

NPA RESPONSE FORM

NPA 2025-15

Please add your comments on the proposal by ticking [✓] the appropriate box below.

Any additional constructive comments, suggested amendments or alternative action will be welcome and may be provided on this response sheet or by separate correspondence.

☐ No comments on the proposal.

☐ Comments on the proposal. (Please provide explanatory comment).

Name:	Organization:
Address/Contact No:	
E-Mail:	
Signature:	Date:

الطيران المدني
Civil Aviation
State of Kuwait - دولة الكويت

Kuwait Civil Aviation Safety Regulations

KCASR 14 - AERODROMES

Volume I - Aerodromes

Amendment Record

Amendment No	Date of Issue	Remarks
1	Jun 2018	Part Rename
2	Jan 2019	NPA 2018-45-V1 Part Re-Issue Bassed on NSRA 2017-05 and upto ICAO Amendmant 14
3	Feb 2020	NPA 2019-40
4	Aug 2020	NPA 2020-09 Updated to ICAO Annex 14 Vol (Amendmant 16)
5	Jun 2022	NPA 2022-11 Updated to ICAO Annex 14 Vol (Amendmant 17)
6	Oct 2025	NPA 2025-15 Updated to ICAO Annex 14 Vol (Amendmant 18)

Abbreviations And Symbols

~~ACN~~	~~Aircraft classification number (Applicable until 27 November 2024)~~
~~ACR~~	~~Aircraft classification rating (Applicable as of 28 November 2024)~~
ADG	Aeroplane design group
ADP	Airside driver permit
AIP	Aeronautical information publication
APAPI	Abbreviated precision approach path indicator
aprx	Approximately
ARIWS	Autonomous runway incursion warning system
ASDA	Accelerate-stop distance available
ATS	Air traffic services
AT-VASIS	Abbreviated T visual approach slope indicator system
C	Degree Celsius CBR California bearing ratio
CAP	Civil Aviation Publication
CASP	Civil Aviation Safety Publication
cd	Candela
CIE	Commission Internationale de l'Éclairage
cm	Centimetre
CRC	Cyclic redundancy check
DGCA	Directorate General of Civil Aviation in Kuwait
DME	Distance measuring equipment
E	Modulus of elasticity
FOD	Foreign object debris
ft	Foot
GBAS	Ground-based augmentation system
GHSP	Ground handling service provider
GSE	Ground support equipment
ILS	Instrument landing system
isocandela	A line joining points that have the same luminous intensity
IMC	Instrument meteorological conditions
K	Degree Kelvin
kg	Kilogram
km	Kilometre
km/h	Kilometre per hour
kt	Knot
L	Litre
LCFZ	Laser-beam critical flight zone
LDA	Landing distance available
LFFZ	Laser-beam free flight zone
LSFZ	Laser-beam sensitive flight zone
m	Metre
max	Maximum
MLS	Microwave landing system
mm	Millimetre
mnm	Minimum
MN	Meganewton
MPa	Megapascal
MSL	Mean sea level
NFZ	Normal flight zone

NM	Nautical mile
NU	Not usable
OCA/H	Obstacle clearance altitude/height
OES	Obstacle evaluation surfaces
OFS	Obstacle free surfaces
OFZ	Obstacle free zone
OLS	Obstacle limitation surface
PAPI	Precision approach path indicator
PCN	Pavement classification number (Applicable until 27 November 2024)
PCR	Pavement classification rating (Applicable as of 28 November 2024)
RESA	Runway end safety area
RDRS	Runway distance remaining sign
RFF	Rescue and firefighting
RVR	Runway visual range
SBAS	Satellite-based augmentation system
SMS	Safety management system
TODA	Take-off distance available
TORA	Take-off run available
T-VASIS	T visual approach slope indicator system
ULD	Unit load device
VMC	Visual meteorological conditions
VOR	Very high frequency omnidirectional radio range
VHMP	Wildlife hazard management programme
WIP	Work in progress

Symbols

°	Degree
=	Equals
`	Minute of arc
μ	Friction coefficient
>	Greater than
<	Less than
%	Percentage
±	Plus or minus
V_{at}	Indicated airspeed at threshold
V_{so}	Stalling speed or the minimum steady flight speed in the landing configuration
V_{s1g}	Stalling speed or the minimum steady flight speed in a specified configuration

References

KCASR 00

Civil Aviation Publications:

Kuwait SSP Manual

Surface Movement Guidance and Control System

Airside Safety Managment

Safety Management Systems (SMS) Guidance for Organizations

Safety Performance Indicators (SPIs)

Aerodrome GM

Aerodrome Certification Procedures (ACP)

Airport Emergency Planning (AEP)

Apron Management Services (AMS)

Calculation of Declared Distances

Pavement Surface Conditions (PSC)

Prevention of Runway Incursion (PRI)

Rescue Fire Fighting (RFF) / Eng lish

Visual Aids (VA)

Wildlife Reduction and Control (WRC)

Electrical Systems

Aeronautical Studies

Safeguarding of Aerodrome

Global Reporting Format for Runway Surface Condition

Civil Aviation Publications:

Laser Illumination of Aircraft and ATC Towers

Wildlife Hazards

ICAO Publications:

ICAO Annex 14, Aerodromes - Volume I, Aerodrome design and operation;

ICAO Annex 14, Aerodromes – Volume II, Heliports;

ICAO Annexes (relevant parts) 2, 3, 4, 6, 10, 11, 14, 15, 16, 17 and 19;

ICAO Doc 4444, Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM);

ICAO Doc 8071, Manual on Testing of Radio Navigation Aids;

ICAO Doc 8126, Aeronautical Information Services Manual;

ICAO Doc 8168, Procedures for Air Navigation Services - Aircraft Operations Volumes I and II (PANS-OPS);

ICAO Doc 8643, Aircraft Type Designators;

Aerodrome Traffic Density

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.

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.

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 Study. A study of an aeronautical problem to identify possible solutions and select a solution that is acceptable to the Kuwait DGCA without degrading safety.

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 certificating 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: 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 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 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.

Alternative Means of Compliance. Alternative means of compliance are those that propose an alternative to an existing Acceptable Means of Compliance (AMC) or those

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.

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.

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

Foreign Object Debris (FOD). An inanimate object within the movement area 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.

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.

Ground handling. Services necessary for an aircraft's arrival at, and departure from, an airport, other than air traffic services.

Hazard Beacon. An aeronautical beacon used to designate a danger 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.

Obstacle limitation surfaces. A series of surfaces that define the volume of airspace at and around an aerodrome to be kept free of obstacles in order to permit the intended aeroplane operations to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome.

OLS Obstacle limitation surface OMGWS Outer main gear wheel span

OMGWS Outer main gear wheel span

PAPI Precision approach path indicator

Orthometric Height. Height of a point related to the geoid, generally presented as a mean sea level (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.

Point-in-space approach (PinS). The Point-in-space approach is based on 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 ICAO 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.

Protection area. An area within a taxi-route and around a helicopter stand which provides separation from objects, the FATO, other taxi-routes and helicopter stands, for safe manoeuvring of helicopters.

Rejected take-off area. A defined area on a heliport suitable for helicopters operating in performance class 1 to complete a rejected take-off.

1.3.3 Temporal reference system

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

1.3.5 When a different temporal reference system is used, this shall be indicated in GEN 2.1.2 of the Aeronautical Information Publication (AIP).

Note.— See PANS-AIM (Doc 10066), Appendix 2.

1.4 Certification of aerodromes

Note.— When an aerodrome is granted a certificate, it signifies to aircraft operators and other organizations operating on the aerodrome that, at the time of certification, the aerodrome meets the specifications regarding the facility and its operation, and that it has, according to the Kuwait DGCA, the capability to maintain these specifications for the period of validity of the certificate. The certification process also establishes the baseline for continued monitoring of compliance with the specifications. "Information on the status of certification of aerodromes would need to be provided to the appropriate aeronautical information services for promulgation in DGCA Aeronautical Information Publication (AIP). See 2.13.1 KCASR 15 and ICAO PANS-AIM (Doc 10066), Appendix 2, AD 1.5."

1.4.1 The DGCA shall certify aerodromes used for international operations in accordance with the specifications contained in this Part as well as other relevant ICAO specifications.

Note.— Specific procedures on the stages of certifying an aerodrome are given in Kuwait Aerodrome Certification Procedures Guidance Material and ICAO PANS-Aerodromes (Doc 9981). Further guidance on aerodrome certification can be found in Aerodrome Certification Procedures & ICAO Manual on Certification of Aerodromes (*Doc 9774*).

1.4.2 The operator of an aerodrome within the State of Kuwait intended for public use shall be in possession of an Aerodrome Certificate issued by DGCA in accordance with specifications contained in this Part as well as other relevant ICAO specifications .

1.4.3 For all other civil aerodromes, prior to commencing the operation, the aerodrome operator should obtain the applicable certificate, unless in case of necessity (emergency and unusual circumstances) or an authorization is issued by DGCA.

1.4.4 As part of the certification process, The DGCA shall ensure that an aerodrome manual which will include all pertinent information on the aerodrome site,

facilities, services, equipment, operating procedures, organization and management including a safety management system, is submitted by the applicant for approval/acceptance prior to granting the aerodrome certificate.

Note 1.— Contents of an aerodrome manual, including procedures for its submission and approval/acceptance, verification of compliance and granting of an aerodrome certificate, are available in ICAO PANS-Aerodromes (Doc 9981).

Note 2.— The intent of a safety management system is to have in place an organized and orderly approach in the management of aerodrome safety by the aerodrome operator. KCASR 19 — Safety Management contains the safety management provisions applicable to certified aerodromes. Overarching guidance on safety management systems is provided in Safety Management Systems (SMS) Guidance for Organization s & the ICAO Safety Management Manual (SMM) (Doc 9859) and Aerodrome Certification Procedure in ICAO Manual on Certification of Aerodromes (Doc 9774). Procedures on the management of change; conduct of safety assessment; reporting and analyses of safety occurrences at aerodromes; runway safety and continuous monitoring to enforce compliance with applicable specifications so that hazards are identified and risks are assessed and mitigated, are specified in ICAO PANS-Aerodromes (Doc 9981).

1.4.5 An application for an Aerodrome Certificate shall be submitted to the Kuwait DGCA not later than 26 weeks prior to intended operation. for approval, the application shall be using the form as published on the ASD website.

1.4.6 Grant of an aerodrome certificate:

(a) Before granting an Aerodrome Certificate, the Kuwait DGCA must be satisfied that:

(1) The aerodrome facilities, services and equipment are in accordance with KCASR 14 Volume I Aerodromes and other relevant ICAO SARPs as determined by the Kuwait DGCA;

(2) The aerodrome manual prepared for the applicant's aerodrome and submitted with the application contains all the pertinent information on the aerodrome site, facilities, services, equipment, operating procedures and management including a safety management system;

(3) An acceptable safety management system is in place at the aerodrome and documented within the aerodrome manual;

(4) The applicant and their staff have the necessary competence to operate and maintain the aerodrome properly;

(5) The aerodrome operating procedures make satisfactory provision for the safety of aircraft; and

(6) Payment of the appropriate aerodrome certification fee has been received.

(b) The Kuwait DGCA may refuse to grant an Aerodrome Certificate to an applicant. In such cases, the Kuwait DGCA must notify the applicant, in writing, of its reasons no later than 60 working days after making that decision.

1.7 Exemptions

1.7.1 The Kuwait DGCA may exempt, in writing, an aerodrome operator from complying with specific provisions of these regulations. However, before the Kuwait DGCA decides to exempt the aerodrome operator, the Kuwait DGCA must take into account all safety-related aspects.

1.7.2 An exemption is subject to the aerodrome operator complying with the conditions and procedures specified by the Kuwait DGCA in the aerodrome certificate as being necessary in the interest of safety.

1.7.3 When an aerodrome does not meet the requirement of a standard or practice specified in a regulation, the Kuwait DGCA may determine, after carrying out aeronautical studies, only if and where permitted by the standards and practices, the alternative conditions and procedures that are necessary to ensure a level of safety equivalent to that established by the relevant standard or practice (see **also 1.7.5).**

1.7.4 Any accepted deviation from a standard or practice and conditions and procedures referred to shall be set out in an endorsement on the aerodrome certificate.

1.7.5 An alternative means of compliance to that specified in this part may be proposed through the submission to the Kuwait DGCA of an aeronautical study. An aeronautical study is a study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety. An aeronautical study shall:

(a) assess the impact of a proposed deviation from the requirements;

(b) present alternative means of ensuring the safety of aircraft operations; and

(c) estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation.

Note Guidance can be found in Aerodorme Certificationn Procedures & Aeronautical Studies.

~~1.8 Airport design (Applicable until 2 November 2022)~~

~~1.8.1 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.~~

~~Note.— Guidance on all aspects of the planning of aerodromes including security considerations is contained in ICAO Airport Planning Manual (Doc 9184), Part 1.~~

~~1.8.2 The design of aerodromes should take into account, where appropriate, land-use and environmental control measures.~~

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

1.8 Aeroplane Design Group

(Applicable as of 21 November 2030)

Note.— The intent of the Aeroplane Design Group (ADG) is to provide a method for interrelating the specifications for the management of obstacles around aerodromes. The ADG utilizes two criteria related to the aeroplane performance characteristics and dimensions. The first criterion is based on the indicated

airspeed of the aircraft at threshold and the second criterion on the aeroplane wingspan.

See Chapter 4 on the application of ADG for the provisions of obstacle restriction and removal.

1.8.1 An ADG shall be determined for each runway in accordance with the characteristics of the critical aeroplane for which the runway is intended.

1.8.2 The ADG shall be determined from Table 1-2, by selecting the ADG corresponding to the highest values of indicated airspeed at threshold and wingspan of the aeroplanes for which the runway is intended.

Note.— Indicated airspeed at threshold (Vat) is equal to the stall speed Vso multiplied by 1.3, or stall speed Vs1g multiplied by 1.23 in the landing configuration at the maximum certificated landing mass. If both Vso and Vs1g are available, the higher resulting Vat applies.

Table 1-2. Aeroplane Design Group

(see 1.8.2)

(Applicaple as of 21 November 2030)

Aeroplane Design Group	Indicated airspeed At threshold		Wingspan
I	Less than 169 km/h (91 kt)	and	Up to but not including 24 m
IIA	Less than 169 km/h (91 kt)	and	24 m up to but not including 36 m
IIB	169 km/h (91 kt) up to but not including 224 km/h (121 kt)	and	Up to but not including 36 m
IIC	224 km/h (121 kt) up to but not including 307 km/h (166 kt)	and	Up to but not including 36 m
III	Less than 307 km/h (166 kt)	and	36 m up to but not including 52 m
IV	Less than 307 km/h (166 kt)	and	52 m up to but not including 65 m
V	Less than 307 km/h (166 kt)	and	65 m up to but not including 80 m

Note 1*.— Detailed specifications concerning the application of the aeroplane design group are given in the Airport Services Manual, Part 6 — Control of Obstacles (Doc 9137).*

Note 2.— *The following examples illustrate how the ADG is determined.*

Example 1*.— If the critical aeroplane that the runway is intended to serve has an indicated airspeed at threshold of 161 km/h (87 kt) and a wingspan of 20 m, then the aeroplane design group would be I.*

Example 2*.— If the critical aeroplane that the runway is intended to serve has an indicated airspeed at threshold of 224 km/h (121 kt) and a wingspan of 52 m, then the aeroplane design group would be IV.*

1.8 Airport design and master plan ~~(Applicable as of 3 November 2022)~~

Introductory Note.— 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.

1.8.1 Recommendation.— A master plan containing detailed plans for the development of aerodrome infrastructure should be established for aerodromes deemed relevant by States.

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 1.5.3).*

Note 2*. A master plan may be required when the lack of capacity at an airport, due to conditions such as, but not limited to expected traffic growth, changing weather and climatic conditions or major works to address safety or environmental concerns, would put the connectivity of a geographical area at risk or cause severe disruption to the air transport network.*

1.8.2 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 .

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

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~~ KCASR 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*

aerodrome will fully comply with the requirements in this Part. See KCASR 15, 5.2.2.2 (c) on ~~a~~ the State's responsibilities for the listing of its differences to the related ICAO Procedures in its Aeronautical Information Publication.

Note *KCASR 00 provides the adoption of ICAO PANS w ithin th e Kuwait Civil Aviation Regulatory system.*

1.~~9~~10.1 When the aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome, the compatibility between the operation of the aeroplane and aerodrome infrastructure and operations shall be assessed and appropriate measures developed and implemented in order to maintain an acceptable level of safety during operations.

Note.— Procedures to assess the compatibility of the operation of a new aeroplane with an existing aerodrome can be found in ICAO PANS-Aerodromes (Doc 9981).

1.~~9~~10.2 Information concerning alternative measures, operational procedures and operating estrictions implemented at an aerodrome arising from 1.7.1 shall be promulgated.

Note 1.-See PANS-AIM (Doc 10066), Appendix 2,, AD 2.20, on the provision of a detailed description of local traffic rgulations.

Nate 2.-See ICAO PANS-Aerodromes (Doc 9981), Chapter 3, section 3.6, on promulgation of safety information.

Chapter 2. Aerodrome DATA

Aeronautical data

Determination and reporting of aerodrome-related aeronautical data shall be in accordance with the accuracy and integrity classification required to meet the needs of the end-users of aeronautical data.

Note.— Specifications concerning the accuracy and integrity classification related to aerodrome-related aeronautical data are contained in PANS-AIM (Doc 10066), Appendix 1.

2.1.1 Aerodrome mapping data should be made available to the aeronautical information services for aerodromes deemed relevant by the DGCA where safety and/or performance-based operations suggest possible benefits.

Note.— Aerodrome mapping databases related provisions are contained in Part 15, Chapter 5 and PANS-AIM (Doc 10066), Chapter .

2.1.2 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 1.— It is intended that the selection of the features to be collected match a defined operational need.

Note 2.— 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-99C — User Requirements for Aerodrome Mapping Information.

2.1.3 Digital data error detection techniques shall be used during the transmission and/or storage of aeronautical data and digital data sets..

Note.— Detailed specifications concerning digital data error detection techniques are contained in PANS-AIM (Doc 10066).

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 services authority in degrees, minutes and seconds.

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 services authority.

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 services authority.

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 services authority.

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

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.

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
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
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 services authority 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 services authority 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 services authority 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 authority 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 services authority.

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

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:

the pavement classification number (PCN);
pavement type for ACN-PCN determination;
subgrade strength category;
maximum allowable tire pressure category or maximum allowable tire pressure value; and
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 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:

~~2.6.7 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 (see example 2 below).*~~

~~2.6.7.1 Subgrade strength category:~~

	~~Code~~
~~**High strength: characterized by K = 150 MN/m3 and representing all K values above 120 MN/m3 for rigid pavements, and by CBR = 15 and representing all CBR values above 13 for flexible pavements.**~~	~~**A**~~
~~**Medium strength: characterized by K = 80 MN/m3 and representing a range in K of 60 to 120 MN/m3 for rigid pavements, and by CBR = 10 and representing a range in CBR of 8 to 13 for flexible pavements.**~~	~~**B**~~
~~**Low strength: characterized by K = 40 MN/m3 and representing a range in K of 25 to 60 MN/m3 for rigid pavements, and by CBR = 6 and representing a range in CBR of 4 to 8 for flexible pavements.**~~	~~**C**~~
~~**Ultra low strength: characterized by K = 20 MN/m^3 and representing all K values below 25 MN/m^3 for rigid pavements, and by CBR = 3 and representing all CBR values below 4 for flexible pavements.**~~	~~**D**~~

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 10.2.1 where the pavement is used by aircraft with tire pressures in the upper categories.

2.6.7.2 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.

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

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 390 000 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 390 000 kg.*~~

~~2.6.8 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 2.6.2 and 2.6.3.~~

~~*Note.— Attachment A, Section 20, details a simple method for regulating overload operations while 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.*~~

~~2.6.9 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 Aircraft Classification Rating Pavement Classification Rating ACR PCR Method &* the Aerodrome Design Manual *(Doc9157, 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 PCR 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 PCRs may be reported if the strength of the pavement is subject to significant seasonal variation.*

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 Aircraft Classification Rating Pavement Classification Rating ACR PCR Method the Aerodrome the 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 purpose of determining the ACN- 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 ACN-PCN ACR-PCR determination, subgrade strength category, maximum allowable tire pressure category and evaluation method shall be reported using the following codes:

a) 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 (see example 2 below).*

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

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

a) take-off run available;

b) take-off distance available;

c) accelerate-stop distance available; and

d) landing distance available.

***Note**.— Guidance on calculation of declared distances is given in Attachment A & Calculation of declared .*

2.9 Condition of the movement area and related facilities

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

***Note**.— The nature, format and conditions of the information to be provided are specified in the PANS-AIM (Doc 10066) and the PANS-ATM (Doc 4444).Specific procedures pertaining toworks in progress on the movement area and to the reporting of such works are specified in the PANS-Aerodromes (Doc 9981).*

2.9.2 The condition of the movement area and the operational status of related facilities shall be monitored, and reports on matters of operational significance 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) snow, slush, ice, or frost on a runway, a taxiway or an apron; ~~(applicable until 3 November 2021).~~

d) water on a runway, a taxiway or an apron;~~(applicable until 3 November 2021)~~

e) snow banks or drifts adjacent to a runway, a taxiway or an apron;~~(applicable until 3 November 2021)~~

f) anti-icing or de-icing liquid chemicals or other contaminants on a runway, taxiway or apron;

g) other temporary hazards, including parked aircraft;

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

i) failure of the normal or secondary power supply.

Note 1.— *Until 3 November 2021 Other contaminants may include mud, dust, sand, volcanic ash, oil and rubber. Part 6, Volume I — International Commercial Air Transport — Aeroplanes, Attachment C provides guidance on the description of runway surface conditions. Additional guidance is included in ICAO Airport Services Manual (Doc 9137), Part 2.*

Note 2. — *Until 3 November 2021 Particular attention would have to be given to the simultaneous presence of snow, slush, ice, wet ice, snow on ice with anti-icing or de-icing liquid chemicals.*

Note 3. — *Until 3 November 2021 See 2.9.11 for a list of winter contaminants to be reported.*

Note 1.— *As of 4 November 2021, 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 the PANS-Aerodromes (Doc 9981).*

Note 2.— *As of 4 November 2021, 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), e) and f).*

Note 3.— *As of 4 November 2021, origin and evolution of data, assessment process and the procedures are prescribed in the PANS-Aerodromes (Doc 9981). These procedures are intended to fulfil the requirements to achieve the desired level of safety for aeroplane operations prescribed by Annex 6 and Annex 8 and to provide the information fulfilling the syntaxrequirements for dissemination specified in Annex 15 and the PANS-ATM (Doc 4444).*

~~2.9.3 (Until 3 November 2021) To facilitate compliance with 2.9.1 and 2.9.2, inspections of the movement area shall be carried out each day at least once where the code number is 1 or 2 and at least twice where the code number is 3 or 4.~~

~~*Note. — (Until 3 November 2021) Guidance on carrying out daily inspections of the movement area is given in ICAO Airport Services Manual (Doc 9137), Part 8 and in ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*~~

2.9.3 As of 4 November 2021, to facilitate compliance with 2.9.1 and 2.9.2, the following inspections shall be carried out each day:

a) for the movement area, at least once where the aerodrome reference code number is 1 or 2 and at least twice where the aerodrome reference code number is 3 or 4; and

b) for the runway(s), inspections in addition to a) whenever the runway surface conditions may have changed significantly due to meteorological conditions.

Note 1.— Procedures on carrying out daily inspections of the movement area are given in the PANS-Aerodromes (Doc 9981). Further guidance is available in the Airport Services Manual (Doc 9137), Part 8, in Surface Movement Guidance and Control System& the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and in the Advanced Surface Movement Guidance and 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.

~~2.9.4 (Until 3 November 2021) Personnel assessing and reporting runway surface conditions required in 2.9.2 and 2.9.8 should be trained and competent to meet criteria set by the DGCA.~~

~~*Note.— (Until 4 November 2020) Guidance on criteria is included in ICAO* Airport Services Manual *(Doc 9137), Part 8, Chapter 7.*~~

2.9.4 As of 4 November 2021, personnel assessing and reporting runway surface conditions required in 2.9.2 and 2.9.5 shall be trained and competent to perform their duties.

Note 1.— Guidance on training of personnel is given in Attachment A, Section 6 ~~[applicable 4 November 2021]~~.

Note 2.— Information on training for personnel assessing and reporting runway surface conditions is available in the PANS-Aerodromes (Doc 9981).

~~**Water on a runway [applicable until 3 November 2021]**~~

~~2.9.5 Whenever water is present on a runway, a description of the runway surface conditions should be made available using the following terms:~~

~~***D*AMP** — the surface shows a change of colour due to moisture.~~

~~**WET** — the surface is soaked but there is no standing water.~~

~~***STANDING WATER* —** *for aeroplane performance purposes, a runway where more than 25 per cent of the runway surface area (whether in isolated areas or not) within the required length and width being used is covered by water more than 3 mm deep.*~~

~~2.9.6 Information that a runway or portion thereof may be slippery when wet shall be made available.~~

Note.— The determination that 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 ICAO Airport Services Manual (Doc 9137), Part 2.

2.9.7 Notification shall be given to aerodrome users when the friction level of a paved runway or portion thereof is less than that specified by the State in accordance with 10.2.3.

Note.— Guidance on conducting a runway surface friction characteristics evaluation programme that includes determining and expressing the minimum friction level is provided in Attachment A, Section 7.

Snow, slush, ice or frost on a runway [applicable until 3 November 2021]

Note 1.— The intent of these specifications is to satisfy the SNOWTAM and NOTAM promulgation requirements contained in KCASR 15 and the PANS-AIM (Doc 10066).

Note 2.— Runway surface condition sensors may be used to detect and continuously display current or predicted information on surface conditions such as the presence of moisture, or imminent formation of ice on pavements.

2.9.8 Whenever an operational runway is contaminated by snow, slush, ice or frost, the runway surface condition shall be assessed and reported.

Note.— Guidance on assessment of snow- and ice-covered paved surfaces is provided in Attachment A, Section 6.

2.9.9 Runway surface friction measurements made on a runway that is contaminated by slush, wet snow or wet ice should not be reported unless the reliability of the measurement relevant to its operational use can be assured.

Note.— Contaminant drag on the equipment's measuring wheel, amongst other factors, may cause readings obtained in these conditions to be unreliable.

2.9.10 When friction measurements are taken as part of the assessment, the performance of the friction measuring device on compacted snow- or ice-covered surfaces should meet the standard and correlation criteria set or agreed by the DGCA.

~~*Note.— Guidance on criteria for, and correlation between, friction measuring devices is included in ICAO* Airport Services Manual *(Doc 9137), Part 2.*~~

~~2.9.11 Whenever snow, slush, ice or frost is present and reported, the description of the runway surface condition should use the following terms:~~

~~*DRY SNOW;*~~
~~*WET SNOW;*~~
~~*COMPACTED SNOW;*~~
~~*WET COMPACTED SNOW;*~~
~~*SLUSH;*~~
~~*ICE;*~~
~~*WET ICE;*~~
~~*FROST;*~~
~~*DRY SNOW ON ICE;*~~
~~*WET SNOW ON ICE;*~~
~~*CHEMICALLY TREATED;*~~
~~*SANDED*~~

~~***and should include, where applicable, the assessment of contaminant depth.***~~

~~2.9.12 Whenever dry snow, wet snow or slush is present on a runway, an assessment of the mean depth over each third of the runway should be made to an accuracy of approximately 2 cm for dry snow, 1 cm for wet snow and 0.3 cm for slush~~.

Runway surface condition(s) for use in the runway condition report ~~[applicable 4 November 2021]~~

Introductory Note.— The philosophy of the runway condition report is that the aerodrome operator assesses the runway surface conditions whenever water, snow, slush, ice or frost are present on an operational runway. From this assessment, a runway condition code (RWYCC) and a description of the runway surface are reported which can be used by the flight crew for aeroplane performance calculations. This report, 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 may be taken into consideration. See Attachment A, Section 6, for further details. The PANS-Aerodromes (Doc 9981) & Global Reporting Format for Runway Surface Condition contains procedures on the use of the runway condition report and assignment of the RWYCC in accordance with the runway condition assessment matrix (RCAM).

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

Note.— Friction measurements on loose contaminants such as snow and slush, in particular, are unreliable due to drag effects on the measurement wheel.

2.9.9 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 by the State, 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 the PANS-Aerodromes (Doc 9981).

Note 2.— See 2.9.1 and 2.13 concerning the provision of information to, and coordination between, appropriate authorities.

2.9.10 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 by the State in accordance with 10.2.3.

Note 1.— Guidance on determining and expressing the minimum friction level is provided in Assessment, Measurement and Reporting of Runway Surface Conditions (Cir ~~329~~355).

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.

2.10 Disabled aircraft removal

Note.— See 9.3 for information on disabled aircraft removal services.

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 9.2 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 9.2 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 units and aeronautical information services units 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 5.3.5.2. For an AT-VASIS, PAPI or APAPI installation, the side of the runway on which the lights are installed, i.e. left or right, shall be given;

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

d) nominal approach slope angle(s). For a T-VASIS or an AT-VASIS this shall be angle Θ according to the formula in Figure 5-18 and for a PAPI and an APAPI this shall be angle (B + C) ÷ 2 and (A + B) ÷ 2, respectively as in Figure 5-20; and

e) minimum eye height(s) over the threshold of the on-slope signal(s). For a T-VASIS or an AT-VASIS this shall be the lowest height at which only the wing bar(s) are visible; however, the additional heights at which the wing bar(s) plus one, two or three fly-down light units come into view may also be reported if such information would be of benefit to aircraft using the approach. For a PAPI this shall be the setting angle of the third unit from the runway minus 2□, i.e. angle B minus 2□, and for an APAPI this shall be the setting angle of the unit farther from the runway minus 2□, i.e. angle A minus 2□.

2.13 Coordination between aeronautical information services and aerodrome authorities

2.13.1 To ensure that aeronautical information services units obtain 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 aeronautical information services and aerodrome authorities responsible for aerodrome services to report to the responsible aeronautical information services unit, with a minimum of delay:

a) information on the status of certification of aerodromes and aerodrome conditions (ref. 1.4, 2.9, 2.10, 2.11 and 2.12);

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

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

2.13.2 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 aeronautical information services for the preparation, production and issue of relevant material for promulgation. To ensure timely provision of the information to aeronautical information services, close coordination between those services concerned is therefore required.

2.13.3 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 Part 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.

Note.— Detailed specifications concerning the AIRAC system are contained in PANS-AIM (Doc 10066), Chapter 6.

2.13.4 The aerodrome services responsible for the provision of raw aeronautical information/data to the aeronautical information services shall do that while taking into account accuracy and integrity requirements required to meet the needs of the end-user of aeronautical data.

Note 1.— Specifications concerning the accuracy and integrity classification of aerodrome-related aeronautical data are contained in PANS-AIM (Doc 10066), Appendix 1.

Note 2.— Specifications for the issue of NOTAM and SNOWTAM are contained in KCASR 15, Chapter 6 and PANS-AIM (Doc 10066), Appendices 3 and 4, respectively.

3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by the State of Kuwait.

3.1.24 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 Attachment A, Section 7.

Additional guidance is included in ICAO Airport Services Manual (Doc 9137), Part 2.

3.1.25 Measurements of the surface 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 Attachment A, Section 7.

Additional guidance is included in Pavement Surface Conditions & ICAO Airport Services Manual (Doc 9137), Part 2.

3.1.26 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 Attachment A, Section 8.

Note 2.— Guidance on methods used to measure surface texture is given in Pvement Surface Conditions & ICAO Airport Services Manual (Doc 9137), Part 2.

Note 3.— Guidance on design and methods for improving surface texture is given in ICAO Aerodrome Design Manual (Doc 9157), Part 3.

3.1.27 When the surface is grooved or scored, the grooves or scorings should 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 ICAO Aerodrome Design Manual (Doc 9157), Part 3

3.3.5 The nose wheel steering angle to be used in the design of the runway turn pad should not exceed 45 degrees.

3.3.6 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:

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 m
Clearance	1.50 m	2.25 m	3 m[a] or 4 m[b]	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.

Slopes on runway turn pads

3.3.7 The longitudinal an d 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.

Slopes on runway turn pads

3.3.8 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.

Strength of runway turn pads

Length of runway strips

3.4.2 A strip shall extend before the threshold and beyond the end of the runway or stopway for a distance of at least:

— 60 m where the code number is 2, 3 or 4;

— 60 m where the code number is 1 and the runway is an instrument one; and

— 30 m where the code number is 1 and the runway is a non-instrument one.

Width of runway strips

3.4.3 A strip including a precision approach runway shall, wherever practicable, extend laterally to a distance of at least:

— 140 m where the code number is 3 or 4; and

— 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.

3.4.4 A strip including a non-precision approach runway should extend laterally to a distance of at least:

— 140 m where the code number is 3 or 4; and

— 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.

3.4.5 A strip including a non-instrument runway should 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:

— 75 m where the code number is ~~3 or~~ 4;

— 55 m where the code number is 3;

— 40 m where the code number is 2; and

— 30 m where the code number is 1.

Objects on runway strips

Note.— See 9.9 for information regarding siting of equipment and installations on runway strips.

3.4.6 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 ICAO 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 3.4.16.

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 a net. Procedures on wildlife management are specified in the PANS-Aerodromes (Doc 9981). Furtherguidance can be found in Wildlife Reduction and Control & ICAO Airport Services Manual (Doc 9137), Part 3.

3.4.7 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, and satisfying the relevant frangibility requirement in Chapter 5, 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.

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 Chapter 4, section 4.1 for characteristics of inner transitional surface.*

Grading of runway strips

3.4.8 That portion of a strip of an instrument runway within a distance of at least:

— 75 m where the code number is 3 or 4; and

— 40 m where the code number is 1 or 2;

from the centre line of the runway and its extended centre line should provide a graded area for aeroplanes 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 Attachment A, Section 9.

3.4.9 That portion of a strip of a non-instrument runway within a distance of at least:

— 75 m where the code number is ~~3 or~~ 4;

— 55 m where the code number is 3;

— 40 m where the code number is 2; and

— 30 m where the code number is 1;

from the centre line of the runway and its extended centre line should provide a graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

3.4.10 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.

3.4.11 That portion of a strip to at least 30 m before the start of a runway should be prepared against blast erosion in order to protect a landing aeroplane from the danger of an exposed edge.

Note 1.— The area provided to reduce the erosive effects of jet blast and propeller wash may be referred to as a blast pad.

Note 2.— Guidance on protection against aeroplane engine blast is available in ICAO Aerodrome Design Manual (Doc 9157), Part 2.

3.4.16 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 would 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.

Strength of runway strips

3.4.17 That portion of a strip of an instrument runway within a distance of at least:

— 75 m where the code number is 3 or 4; and

— 40 m where the code number is 1 or 2;

from the centre line of the runway and its extended centre line should be so prepared or constructed as to minimize 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.

Note.— Guidance on preparation of runway strips is given in ICAO Aerodrome Design Manual (Doc 9157), Part 1.

3.4.18 That portion of a strip containing a non-instrument runway within a distance of at least:

— 75 m where the code number is ~~3 or~~ 4;

— 55 m where the code number is 3;

— 40 m where the code number is 2; and

— 30 m where the code number is 1;

Table 3-1. Taxiway minimum separation distances

Distance between taxiway centre line and runway centre line (metres)									Taxiway centre line to taxiway centre line (metres)	Taxiway, other than aircraft stand taxilane, centre line to object (metres)	Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres)	Aircraft stand taxilane centre line to object (metres)
	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	152	-	42	52	~~87~~67	-	32	20	38.5	16.5
C	88	88	158	158	48	58	~~93~~73	93	44	26	40.5	22.5
D	-	-	166	166	-	-	~~101~~ 81	101	63	37	59.5	33.5
E	-	-	172.5	172.5	-	-	~~107.5~~ 87.5	107.5	76	43.5	72.5	40
F	-	-	180	180	-	-	~~115~~ 95	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. The basis for development of these distances is given in the Aerodrome Design Manual (Doc 9157), Part 2.*

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. See the Aerodrome Design Manual (Doc 9157), Part 2.*

3.11 Taxiway strips

Note.— *Guidance on characteristics of taxiway strips is given in ICAO Aerodrome Design Manual (Doc 9157), Part 2.*

General

3.11.1 A taxiway, other than an aircraft stand taxilane, shall be included in a strip.

Width of taxiway strips

3.11.2 A taxiway strip should 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 3-1, column 11.

Objects on taxiway strips

Note.— See 9.9 for information regarding siting of equipment and installations on taxiway strips.

3.11.3 The taxiway strip should provide an area clear of objects which may endanger taxiing aeroplanes.

Note 1.— 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. For further guidance, see ICAO Aerodrome Design Manual (Doc 9157), Part 2.

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 3.11.6.

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 a net. Guidance on wildlife control and reduction can be found in Widife Control and Reduction & ICAO Airport Services Manual (Doc 9137), Part 3.

Grading of taxiway strips

3.11.4 The centre portion of a taxiway strip should provide a graded area to a distance from the centre line of the taxiway of at not less than that given by the following tabulation:

— 10.25 m where the OMGWS is up to but not including 4.5 m
— 11 m where the OMGWS is 4.5 m up to but not including 6 m
— 12.50 m where the OMGWS is 6 m up to but not including 9 m
— 18.50 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is D
— 19 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is E
— 22 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is F

b) elevation in excess of 2 000 m (6 600 ft) and up to 4 000 m (13 320 ft); 13 m plus 1.5 m for every 100 m (330 ft) in excess of 2 000 m (6 600 ft); and

c) elevation in excess of 4 000 m (13 320 ft) and up to 5 000 m (16 650 ft); 43 m plus 2 m for every 100 m (330 ft) in excess of 4 000 m (13 320 ft).

Table 3-2. 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[b]	60 m[b]	90 m[a,b]	90 m[a,b,c]
Precision approach categories II and III	—	—	90 m[a,b]	90 m[a,b,c]
Take-off runway	30 m	40 m	75 m	75 m

Table 3-2. 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	55 m	75 m
Non-precision approach	40 m	40 m	75 m	75 m
Precision approach category I	60 mb	60 mb	90 ma,b	90 ma,b
Precision approach categories II and III	—	—	90 ma,b	90 ma,b
Take-off runway	30 m	40 m	55 m	55 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 KCASR 10, Volume I, Attachments C and G, respectively (see also 3.12.6).

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 120 m, a distance greater than 90 m may be necessary to ensure that a holding aircraft is clear of the obstacle free zone. For examplea 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.*

3.12.8 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 3-2 should be further increased 5 m for every metre the bay or position is higher than the threshold.

3.12.9 Until 20 November 2030,The location of a runway-holding position established in accordance with 3.12.3 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.

3.12.9 As of 21 November 2030, the location of a runway-holding position established in accordance with 3.12.3 shall be such that a holding aircraft or vehicle will not infringe the inner approach surface, inner transitional surfaces, balked landing surface, approach surface, take-off climb surface or ILS/MLS critical/sensitive area or interfere with the operation of other radio navigation aids.

3.13 Aprons

General

3.13.1 Aprons should 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.

3.13.2 The design of aprons should take into consideration criteria for safe ground handling, including:

a) sufficient space between aircraft stands to enable personnel and equipment to move safely and efficiently;

b) adequate apron markings, apron signs and apron floodlighting;

c) adequate staging and storage areas for ground support equipment (GSE);

d) positioning of fixed ground services;

e) storage areas for unit load devices (ULD);

f) adequate access and egress routes for fuel, GSE and emergency vehicles;

g) clearly delineated and visible access and egress routes for passengers;

h) new technologies (electric charging points, autonomous vehicles, etc.);

i) avoidance of rear of aircraft stand service roads wherever practicable; and

j) appropriate protection for persons, equipment and infrastructure from jet blast and propeller wash.

Note.— *Further guidance on apron design and markings is given in the Aerodrome Design Manual (Doc 9157), Part 4 — Visual Aids, and the Airport Planning Manual (Doc 9184), Part 1— Master Planning.*

Size of aprons

3.13.~~2~~3 The total apron area should be adequate to permit expeditious handling of the aerodrome traffic at its maximum anticipated density.

Strength of aprons

3.13.~~3~~4 Each part of an apron should 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.

Slopes on aprons

3.13.~~4~~5 Slopes on an apron, including those on an aircraft stand taxilane, should be sufficient to prevent accumulation of water on the surface of the apron but should be kept as level as drainage requirements permit.

3.13.~~5~~6 On an aircraft stand the maximum slope should not exceed 1 per cent.

Clearance distances on aircraft stands

3.13.~~6~~7 An aircraft stand should provide the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand 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

When special circumstances so warrant, these clearances may be reduced at a nose-in aircraft stand, where the code letter is D, E or F:

a) between the terminal, including any fixed passenger boarding bridge, and the nose of an aircraft; and

b) over any portion of the stand provided with azimuth guidance by a visual docking guidance system.

Note.— On aprons, consideration also has to be given to the provision of service roads and to manoeuvring and storage area for ground equipment (see ICAO Aerodrome Design Manual (Doc 9157), Part 2, for guidance on storage of ground equipment).

Chapter 4. OBSTACLE RESTRICTION AND REMOVAL

(Applicable as of 21 November 2030)

~~*Note 1.— The objectives of the specifications in this chapter are to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely and to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.*~~

~~*Note 2.— Objects which penetrate the obstacle limitation surfaces contained in this chapter may in certain circumstances cause an increase in the obstacle clearance altitude/height for an instrument approach procedure or any associated visual circling procedure or have other operational impact on flight procedure design. Criteria for flight procedure design are contained in ICAO Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168).*~~

~~*Note 3.— The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in 5.3.5.42 to 5.3.5.46.*~~

~~4.1 Obstacle limitation surfaces~~

~~*Note.— See Figure 4-1.*~~

~~Table 4-1. Dimensions and slopes of obstacle limitation surfaces — Approach runways~~

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 dimensionsa	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)
CONICAL										
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
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2000 m	2500 m	4000 m	4000 m	3500 m	4000 m	4000 m	3500 m	4000 m	4000 m
INNER APPROACH										

Width	–	–	–	–	–	–	–	90 m	120 m	120 m
Distance from threshold	–	–	–	–	–	–	–	60 m	60 m	60 m
Length	–	–	–	–	–	–	–	900 m	900 m	900 m
Slope	–	–	–	–	–	–	–	2.5 %	2 %	2 %
APPROACH										
Length of inner edge	60 m	80 m	~~150~~ 110 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 %
First section										
Length	1600 m	2500 m	3000 m	3000 m	2500 m	3000 m	3000 m	3000 m	3000 m	3000 m
Slope	5 %	4 %	3.33 %	2.5 %	3.33 %	2 %	2 %	2.5 %	2 %	2 %

Second section										
Length	–	–	–	–	–	3600 m[b]	3600 m[b]	12000 m	3600 m[b]	3600 m[b]
Slope	–	–	–	–	–	2.5 %	2.5 %	3 %	2.5 %	2.5 %
Horizontal section										
Length	–	–	–	–	–	8400 m[b]	8400 m[b]	–	8400 m[b]	8400 m[b]
Total length	–	–	–	–	–	15000 m	15000 m	15000 m	15000 m	15000 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[c]	120 m[c]
Distance from threshold	–	–	–	–	–	–	–	c	1800 md	1800 md
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 4.2.9 or 4.2.17);

(c) Distance to the end of strip Or end of runway whichever is less;

(d) Where the code letter is F (Table 1-1), the width is increased to 155 140 m. For information onexcept for those aerodromes that accommodate a code letter F aeroplanes equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre,

Note.— sSee Circulars 301, — New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study 345 and Chapter 4 of the PANS-Aerodromes, Part I (Doc 9981) for further information.

CHAPTER 4. OBSTACLE RESTRICTION AND REMOVAL

(Applicable as of 21 November 2030)

Note 1.— *This chapter describes the management of obstacles within the aerodrome boundary and in its vicinity. The following specifications allow States to define the airspace around aerodromes to be maintained free from obstacles and the airspace where flexibility can be applied in managing*

the obstacle environment. This permits the existing and intended aeroplane operations at the aerodromes to be conducted safely and prevent the aerodromes from becoming restricted and eventually unusable by thegrowth of obstacles.

This is achieved by establishing obstacle limitation surfaces (OLS) consisting of obstacle free surfaces (OFS) and obstacle evaluation surfaces (OES).

***Note 2**.— The lateral and vertical extent of the OLS are being used in defining the requirements for the collection of terrain and obstacle data sets. Provisions on terrain and obstacle data sets are contained in Annex 15 — Aeronautical Information Services, Chapter 5.*

***Note 3.—** The establishment of, and requirements for, an obstacle protection surface for visualapproach slope indicator systems are specified in Chapter 5, 5.3.5.41 to 5.3.5.45.*

4.1 General

4.1.1 Kuwait DGCA/ASD shall establish a process to prevent the growth of obstacles, both fixed and mobile, that may affect the safety or regularity of flight operations at an aerodrome.

***Note 1**.— Specifications concerning the process to be established by the State are contained in PANS-Aerodromes (Doc 9981), Part II, Chapter 10.*

***Note 2**.— Taxiing aircraft, aircraft on tow and traversing vehicles are considered mobile objects whereas buildings, parked aircraft and vehicles are considered fixed objects.*

4.2 Obstacle free surfaces (OFS)

***Note.—** The purpose of the obstacle free surfaces is to establish airspace that preserves the accessibility of the aerodrome and the safety of operations by protecting aeroplanes during approaches and go-arounds.*

4.2.1 Approach surface

***Note1.—** The purpose of the approach surface is to establish the airspace to be maintained free from obstacles to protect an aeroplane in the visual phase of the approach-to-land manoeuvres following standard 3.0° approach. See Figure 4-1.*

4.2.1.1 Description. An inclined surface preceding the threshold.

4.2.1.2 Characteristics. The limits of the approach surface shall comprise:

a) 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;

b) 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

c) an outer edge parallel to the inner edge.

4.2.1.3 The surface mentioned in 4.2.1.2 shall be varied when lateral offset, angular offset or curved approaches are utilized; 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, angular offset or curved ground track.

4.2.1.4 The elevation of the inner edge shall be equal to the elevation of the midpoint of the threshold.

4.2.1.5 The slope of the approach surface shall be measured:

a) when straight-in approaches are utilized — in the vertical plane containing the centre line of the runway and its extension; and

b) when lateral offset, angular offset or curved approaches are utilized — along any straight part of the approach, in the vertical plane containing the centre line of the lateral offset, angular offset or curved ground track or, along any curved part of the approach, in the vertical plane tangent with the curved ground track.

4.2.1.6 Except where the approach surface is raised to comply with approach angles greater than 3.0°, the slope of the approach surface shall not be greater than, and their other dimensions not less than, those specified in Table 4-1 for non-instrument runways and Table 4-2 for instrument runways.

4.2.1.7 The slope of the approach surface should not be increased to facilitate the growth of obstacles.

Note.— *The slope of the approach surface is intended to adapt to approach operations that have a slope higher than 3.0°. Specifications concerning the modification of the approach surface are containedin PANS-Aerodromes (Doc 9981), Part II, Chapter 10.*

4.2.1.8 Where the approach angle is lower than 3.0°, the slope of the approach surface shall be decreased.

4.2.1.9 Where the slope of the obstacle protection surface of a visual approach slope indicator system is lower than that indicated in Table 4-1 and Table 4-2, the slope of the approach surface shall be decreased to match that of the obstacle protection surface.

Note.— *See Chapter 5, 5.3.5 on the obstacle protection surface.*

4.2.1.10 Where the slope of the approach surface is reduced, corresponding adjustment in the length of the approach surface shall be made to provide protection to a height equal to that reached with the slopes and lengths in Table 4-1 and Table 4-2.

4.2.1.11 On instrument approach runways, where the obstacle clearance height is higher than 150 m (500 ft) above the threshold, the length of the approach surface shall not be less than:

a) the value indicated in Table 4-2; or

b) that necessary to reach the obstacle clearance height;

whichever is greater.

Table 4-1. Dimensions and slopes of approach surface — Non-instrument runways

Aeroplane design groub	I	IIA-IIB	IIC	III	IV	V
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m
Length of inner edge	60 m[ab]	80 m[cd]	100 m[d]	125 m	135 m	150 m
Divergence	10%	10%	10%	10%	10%	10%
Length	1600 m[e]	2500 m[e]	2500 m[e]	2500 m[e]	2500 m[e]	2500 m[e]
Slope	5%[f]	4%[f]	3.33%[f]	3.33%[f]	3.33%[f]	3.33%[f]

[a] Where runway width is above 23 m and up to 30 m, the length of inner edge is increased to 80 m.

[b] Where runway width is above 30 m, the length of inner edge is increased to 100 m.

[c] Where runway width is above 30 m and up to 45 m, the length of inner edge is increased to 100 m.

[d] Where runway width is above 45 m, the length of inner edge is increased to 110 m.

[e] See 4.2.1.10.

f See 4.2.1.8 and 4.2.1.9.

Table 4-2. Dimensions and slopes of approach surface — Instrument runways

Aeroplane design groub	I	IIA-IIB	IIC	III	IV	V
Distance from threshold	60 m	60 m	60 m	60 m	60 m	60 m
Length of inner edge	110 m[a]	125 m[b]	155 m[c]	175 m	185 m	200 m
Divergence	10%	10%	10%	10%	10%	10%
Length	4500 m[d]	4500 m[d]	4500 m[d]	4500 m[d]	4500 m[d]	4500 m[d]
Slope	3.33%[e]	3.33%[e]	3.33%[e]	3.33%[e]	3.33%[e]	3.33%[e]

a When the runway width is above 30 m, the length of inner edge is increased to 125 m.

b When the runway width is above 30 m, the length of inner edge is increased to 140 m.

c When the runway width is 30 m or less, the length of inner edge is decreased to 140 m.

d See 4.2.1.10 and 4.2.1.11.

e See 4.2.1.8 and 4.2.1.9.

4.2.2 Transitional surfaces

Note.— *The purpose of the transitional surfaces is to establish the airspace to be maintained free from fixed obstacles to protect an aeroplane in the overflight of the runway or go-around manoeuvre following a standard 3.0° approach, beyond the approach surface. See Figure 4-1.*

4.2.2.1 Description.— Transitional surfaces. A complex surface along and at a specified distance from the runway centre line and part of the side of the approach surface that slopes upwards and outwards to a specified height.

4.2.2.2 Characteristics.— The limits of a transitional surface shall comprise:

a) a lower edge beginning on the side of the approach surface at the elevation of the upper edge and extending down the side of the approach surface to the inner edge of the approach surface and from there along a line extending parallel to and at a specified distance from the runway centre line and its extension, to the end of the strip; and

b) an upper edge located at 60 m above the elevation of the highest threshold of the runway.

4.2.2.3 The elevation of a point on the lower edge shall be:

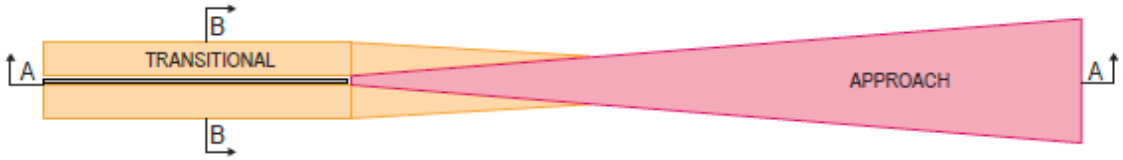
a) along the side of the approach surface — equal to the elevation of the approach surface at that point; and

b) along the runway centre line and its extension after the threshold — 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 surfaces along the line parallel to the runway centre line will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The upper edge of the transitional surfaces will also be a curved or a straight line depending on the runway profile.*

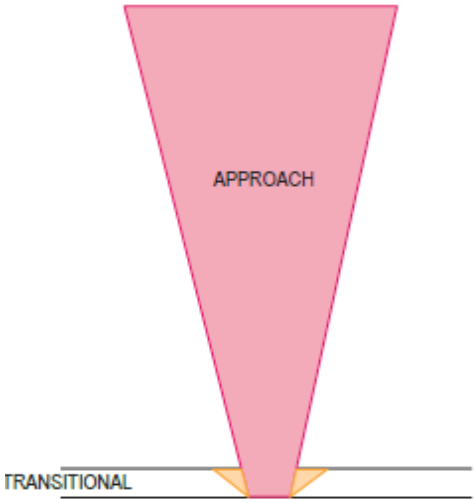
4.2.2.4 The slope of the transitional surfaces shall be measured in a vertical plane perpendicular to the vertical plane containing the runway centre line or its extension.

4.2.2.5 The slope of the transitional surface shall not be greater than 20 per cent.

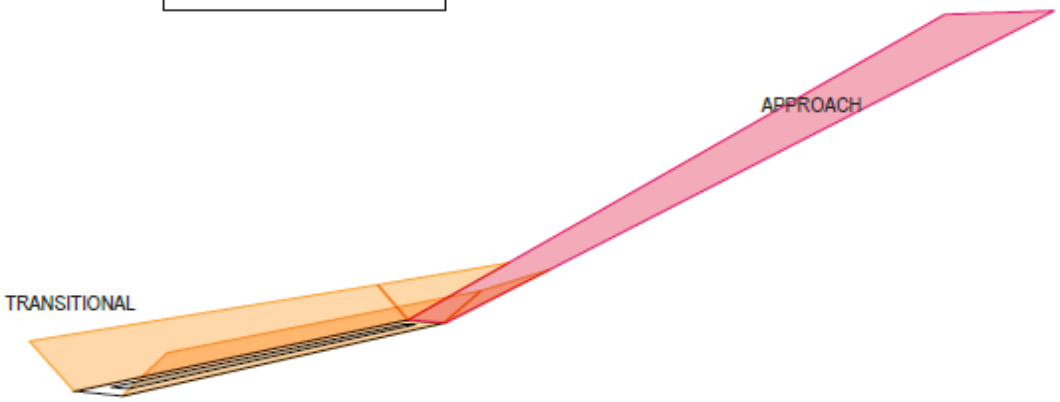


PLAN VIEW

CROSS SECTION A-A



CROSS SECTION B-B



AXONOMETRIC VIEW

Figure 4-1. Approach surface and transitional surfaces

4.2.3 Inner approach surface

Note.— *The inner approach surface protects an aeroplane against fixed and mobile obstacles before the threshold, in the descent phase of the balked landing or late go-around manoeuvres following a standard 3.0° approach. See Figure 4-2 and Figure 4-3.*

4.2.3.1 Description.— Inner approach surface. A rectangular portion of the approach surface immediately preceding the threshold.

4.2.3.2 Characteristics.— The limits of the inner approach surface shall comprise:

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.

4.2.3.3 The surface mentioned in 4.2.3.2 shall be varied when lateral offset, angular offset or curved approaches are utilized; two sides originating at the ends of the inner edge and extending parallel to the extended centre line of the lateral offset, angular offset or curved ground track.

4.2.3.4 The dimensions of the inner approach surface for non-instrument runway shall not be less than those specified in Table 4-3.

4.2.3.5 The dimensions of the inner approach surface for non-precision approach runway shall not be less than those specified in Table 4-4.

4.2.3.6 The dimensions of the inner approach surface for precision approach runway shall not be less than those specified in Table 4-5.

4.2.3.7 If the slope of the approach surface is reduced, the length of the inner approach surface shall be increased to provide protection to a height of 45 m (150 ft).

Table 4-3. Dimensions of inner approach surface — Non-instrument runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Length of inner edge	60 m	80 m	100 m	110 m	120 m	120 m[a]
Length	900 m[b]	1125 m[b]	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]

a The length of inner edge is increased to 140 m on those aerodromes that accommodate a code letter F aeroplane that is not equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

b See 4.2.3.7.

Table 4-4. Dimensions of inner approach surface — Non-precision approach runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Length of inner edge	80 m	80 m	120 m	120 m	120 m	120 m[a]

Length	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]

a The length of inner edge is increased to 140 m on those aerodromes that accommodate a code letter F aeroplane that is not equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

b See 4.2.3.7.

Table 4-5. Dimensions of inner approach surface — Precision approach runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Length of inner edge	90 m	90 m	120 m	120 m	120 m	120 m[a]
Length	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]	1350 m[b]

a The length of inner edge is increased to 140 m on those aerodromes that accommodate a code letter F aeroplane that is not equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

b See 4.2.3.7.

4.2.4 Inner transitional surfaces

Note.— *The inner transitional surfaces aim at establishing the airspace to be maintained free from fixed and mobile obstacles to protect an aeroplane in the climb phase of the balked landing or late go-around manoeuvres following a standard 3.0° approach, beyond the inner approach surface. See Figure 4-2 and Figure 4-3.*

4.2.4.1 Description. Inner transitional surfaces:

a) Non-instrument and non-precision approach runways — A complex surface at a specified distance from the runway centre line consisting of two successive sections: a first section that rises vertically to a given height, followed by a second inclined section that slopes upwards and outwards to a specified height; and

b) Precision approach runways — A surface similar to the transitional surface but closer to the runway.

4.2.4.2 Characteristics. On non-instrument and non-precision approach runways:

a) the limits of the vertical section of the inner transitional surface shall comprise:

1) a lower edge beginning on the side of the inner approach surface at a specified height above the inner edge of that surface, extending down the side of the inner approach surface to its inner edge, from there along a line parallel to and at a specified distance from the runway centre line, and its extension, to a specified length after the threshold and from there, vertically to a specific height; and

2) an upper edge parallel to, and at a specified height above, the runway centre line;

b) the limits of the inclined section of the inner transitional surface shall comprise:

1) a lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the upper edge of the

vertical section, from there along the upper edge of the vertical section; and

2) an upper edge parallel to and at 60 m above the elevation of the highest threshold of the runway.

4.2.4.3 Characteristics. On precision approach runways, the limits of the 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 a line parallel to and at a specified distance from the runway centre line and its extension to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the upper edge; and

b) an upper edge located at 60 m above the elevation of the highest threshold of the runway.

4.2.4.4 On non-instrument and non-precision approach runways, the elevation of a point shall be:

a) on the lower edge of the vertical section:

1) along the side of the inner approach surface — equal to the elevation of the inner approach surface at that point; and

2) after the inner edge of the inner approach surface — equal to the elevation of the nearest point on the centre line of the runway or its extension;

b) on the upper edge of the vertical section — equal to a specific height above the nearest point on the centre line of the runway or its extension;

c) on the lower edge of the inclined section:

1) along the side of the inner approach surface — equal to the elevation of the inner approach surface at that point; and

2) along the upper edge of the lower section — equal to the elevation of the upper edge of the lower section at that point.

Note.— *As a result of a), b) and c) the two sections of the inner transitional surfaces along the centre line of the runway will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The upper edges of both sections of the inner transitional surfaces will also be curved or straight lines depending on the runway profile.*

4.2.4.5 On precision approach runways, 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 runway centre line and its extension — 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 surfaces along the centre line of the runway will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The upper edge of the inner transitional surfaces will also be a curved or a straight line depending on the runway profile.

4.2.4.6 The slope of the inner transitional surfaces shall be measured:

a) between the inner edges of the inner approach surface and balked landing surface: in a vertical plane perpendicular to the vertical plane containing the runway centre line and its extension;

b) before the inner edge of the inner approach surface:

1) where straight-in approaches are utilized: in a vertical plane perpendicular to the vertical plane containing the runway centre line and its extension; and

2) where lateral offset, angular offset or curved approaches are utilized: along any straight part of the approach, in a vertical plane perpendicular to the vertical plane containing the straight part of the approach or, along any curved part of the approach, in the vertical plane tangent with the curved ground track.

4.2.4.7 The slope of the inner transitional surfaces for non-instrument runway shall not be greater than, and the height of the vertical section not lower than, that specified in Table 4-6.

4.2.4.8 The slope of the inner transitional surfaces for non-precision approach runway shall not be greater than, and the height of the vertical section not lower than, that specified in Table 4-7.

4.2.4.9 The slope of the inner transitional surfaces for precision runway shall not be greater than that specified in Table 4-8.

Table 4-6. Dimensions of inner transitional surfaces — Non-instrument runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Height of the vertical section	6 m	6 m	8.4 m	10 m	5 m	5 m
Slope of the inclined section	40%	40%	33.3%	33.3%	33.3%	33.3%
Length	a	a	1800 m[b]	1800 m[b]	1800 m[b]	1800 m[b]

a To the end of the strip.

b Or to the end of the runway, whichever is less.

Table 4-7. Dimensions of inner transitional surfaces — Non-precision approach runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Height of the vertical section	6 m	6 m	5 m	5 m	5 m	5 m
Slope of the inclined section	40%	40%	33.3%	33.3%	33.3%	33.3%
Length	a	a	1800m[b]	1800m[b]	1800m[b]	1800m[b]

a To the end of the strip.

b Or to the end of the runway, whichever is less.

Table 4-8. Slopes of inner transitional surfaces — Precision approach runways

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Slope	40%	40%	33.3%	33.3%	33.3%	33.3%
Length	a	a	a	a	a	a

a See 4.2.4.3.

4.2.5 Balked landing surface

Note.— *The balked landing surface is intended to be implemented on precision approach runways, where the balked landing might be initiated at low height above the threshold and the climb phase of the manoeuvre is not necessarily covered by the inner transitional surfaces. The balked landing surface aims at establishing the airspace to be maintained free from fixed and mobile obstacles to protect an aeroplane in the climb phase of the balked landing or late go-around manoeuvres following a standard 3.0° approach, beyond the inner transitional surfaces. See Figure 4-3.*

4.2.5.1 Description.— Balked landing surface. An inclined surface located at a specified distance after the threshold, extending between the inner transitional surfaces.

4.2.5.2 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 at 60 m above the elevation of the highest threshold of the runway.

4.2.5.3 The elevation of the inner edge shall be equal to the elevation of the nearest point on the runway centre line.

4.2.5.4 The slope of the balked landing surface shall be measured in the vertical plane containing the centre line of the runway and its extension;

4.2.5.5 The slope of the balked landing surface shall not be greater than, and its other dimensions not less than, those specified in Table 4-9.

Table 4-9. Dimensions and slopes of balked landing surface

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Distance from threshold	a	a	1800m[b]	1800m[b]	1800m[b]	1800m[b]
Length of inner edge	90 m	90 m	120 m	120 m	120 m	120 m[c]
Divergence (each side)	10%	10%	10%	10%	10%	10%

Slope	5%	4%	3.33%	3.33%	3.33%	3.33%

a. End of the strip.

b. Or end of runway whichever is less.

c. The length of inner edge is increased to 140 m on those aerodromes that accommodate a code letter F aeroplane that is not equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

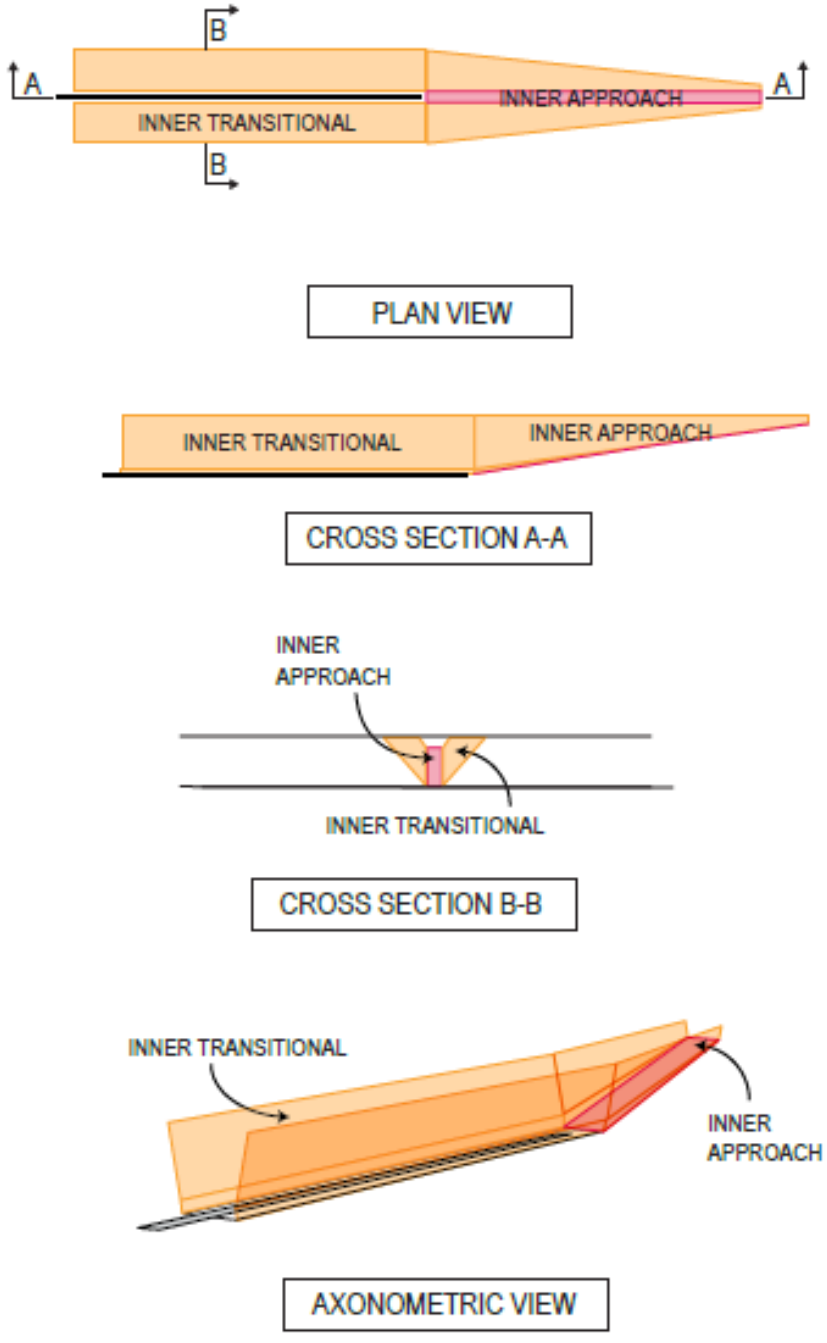


Figure 4-2 Inner approach and inner transitional surfaces on a non-precision approach runway

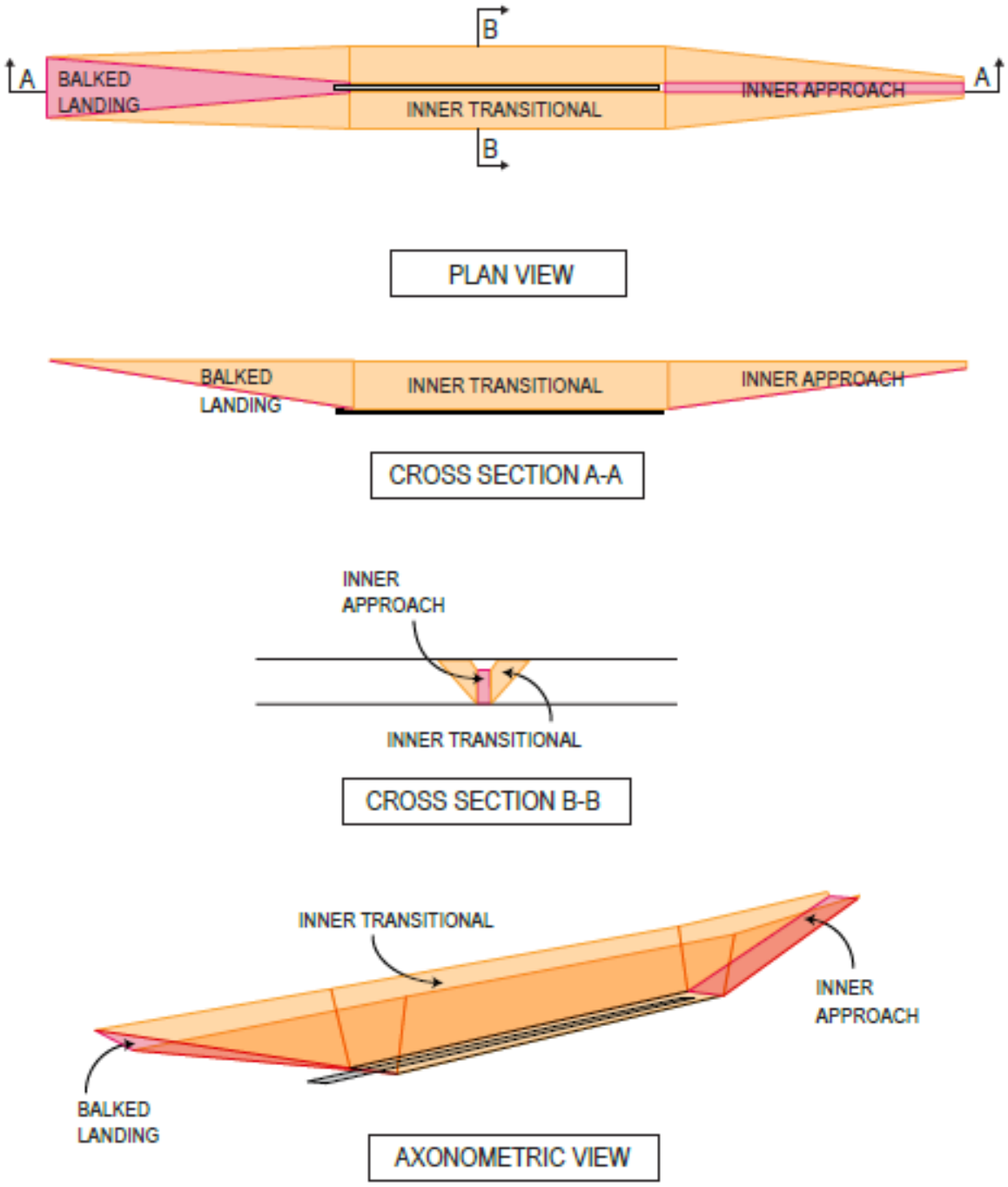


Figure 4-3 Obstacle free zone on a precision approach runway

4.3 Obstacle evaluation surfaces (OES)

Note 1.— *The purpose of the obstacle evaluation surfaces is to establish the airspace necessary to determine the acceptability of obstacles by evaluating their impact on existing and/or intended aeroplane operations at an aerodrome. The impact is evaluated on safety, regularity and demand of the operations identified by States.*

Note 2.— *The OES detailed in the following specifications address most common flight operations and operating minima. When the flight operations differ (e.g. variance in alignment, approach slope, approach minima) specific obstacle evaluation surfaces may need to be established. Depending on the flight operations and procedures available at an aerodrome, the OES may have specifications as specified in the following provisions or may be varied to fit the operations at the aerodrome (e.g. in case of increased minima or where circling does not occur on one side of the runway). There will be instances where additional obstacle evaluation surfaces, beyond what are specified in this section, may be required as the OES or its variations do not satisfactorily cover the local aeroplane operations specific to the aerodrome.*

Note 3*.— Detailed specifications on the variation of the OES and their design are contained in PANS-Aerodromes (Doc 9981).*

4.3.1 General

4.3.1.1 kuwait DGCA/ASD shall ensure that the obstacle evaluation surfaces specified in 4.5.2 have been established to protect the existing and/or intended aeroplane operations at an aerodrome.

4.3.1.2 The characteristics and dimensions of the obstacle evaluation surfaces should be in accordance with the provisions contained in 4.3.2 to 4.3.6.

4.3.1.3 Where it is necessary to preserve the accessibility of an aerodrome to existing and planned operations, the provisions applicable to OFS contained in 4.4.4 to 4.4.8 should apply to the identified obstacle evaluation surface.

Note.— *Detailed specifications are contained in PANS-Aerodromes (Doc 9981), Part II, Chapter 10.*

4.3.2 Horizontal surface

Note.— *The purpose of the horizontal surface is to protect the airspace for circling procedures. The horizontal surface also provides some protection for visual circuits and terminal instrument flight procedures, including PBN approaches, early turning missed approaches and early turning departures. The design of the horizontal surface is consistent with the dimensions of the visual manoeuvring area provided in PANS-OPS, (Doc 8168, Volume II, Part 1, Section 4, Chapter 7).*

4.3.2.1 Description.— Horizontal surface. A surface, or a combination of surfaces, located in a horizontal plane, or in a series of horizontal planes, above an aerodrome and its environs.

4.3.2.2 Characteristics.— The outer limits of the horizontal surface should be circular arcs centred on runway thresholds joined tangentially by straight lines.

4.3.2.3 The height of the horizontal surface shall be measured above the aerodrome elevation.

4.3.2.4 A horizontal surface should have a radius of not less than, and a height of not greater than, those specified in Table 4-10.

Table 4-10. Dimensions of horizontal surface

Aeroplane design group	I-IIA	IIB	IIC	III	IV	V
Radius	3350 m	5350 m	10750 m	10750 m	10750 m	10750 m
Height	45 m	60 m	90 m	90 m	90 m	90 m

Note.— *Where a runway is intended for the operations of aeroplanes of different aeroplane design groups, all the horizontal surfaces specified by the radii and heights associated with these groups are retained and the horizontal surface is composed of multiple surfaces located at different heights above the aerodrome elevation.*

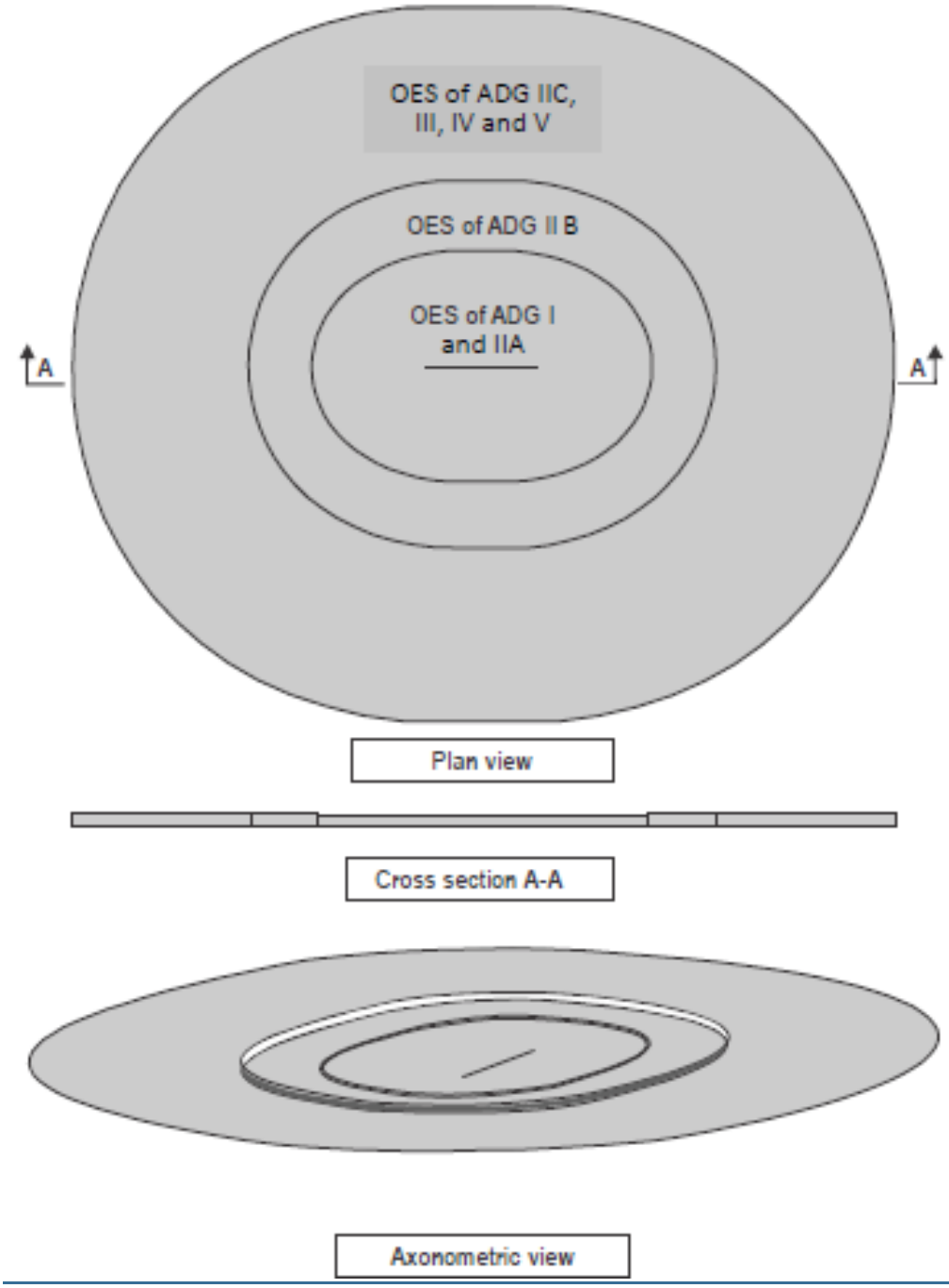


Figure 4-4. Horizontal surface

4.3.3 Surface for straight-in instrument approaches

Note.— *The purpose of the surface for straight-in instrument approaches is to establish the airspace where obstacles may have an impact on straight-in instrument approaches, where the horizontal surface(s) or parts thereof are not established. As a single obstacle evaluation surface cannot address the variety of*

all possible instrument approach procedures, only most common straight-in instrument approaches other than precision approaches are considered. The surfaces for precision approaches are established in 4.3.4.

4.3.3.1 Description.— Surface for straight-in instrument approaches. A combination of surfaces, located in a series of horizontal planes above an aerodrome and its environs.

4.3.3.2 Characteristics.— The surface for straight-in instrument approaches should consist of:

a) a lower part corresponding to the horizontal surface applicable to ADG I;

b) an upper part corresponding to that part of the horizontal surface applicable to ADG II and III extending beyond the lateral limit of the lower section and delineated by the rectangle of following sides:

1) two shorter sides perpendicular to and centred on the runway centre line and its extension; and

2) two longer sides extending parallel to the runway centre line and its extension from a given distance before and after the thresholds of the runway.

Note.— *The characteristics of the surface for straight-in instrument approaches specified in 4.3.3.2 are applicable to all ADGs.*

4.3.3.3 The heights of the lower section and upper section shall be measured above the aerodrome elevation.

4.3.3.4 The heights of the surface for straight-in instrument approaches should not be greater than, and its other dimensions not less than, those specified in Table4-11.

Table 4-11. Dimensions of surface for straight-in instrument approaches

Aeroplane design group		I to V
Lower section	Height	45 m
	Length	Horzontal OES as per ADG I
Upper section	Height	60 m
	Length of shorter side	7410 m
	Length of longer side from the threshold or thresholds	5350 m

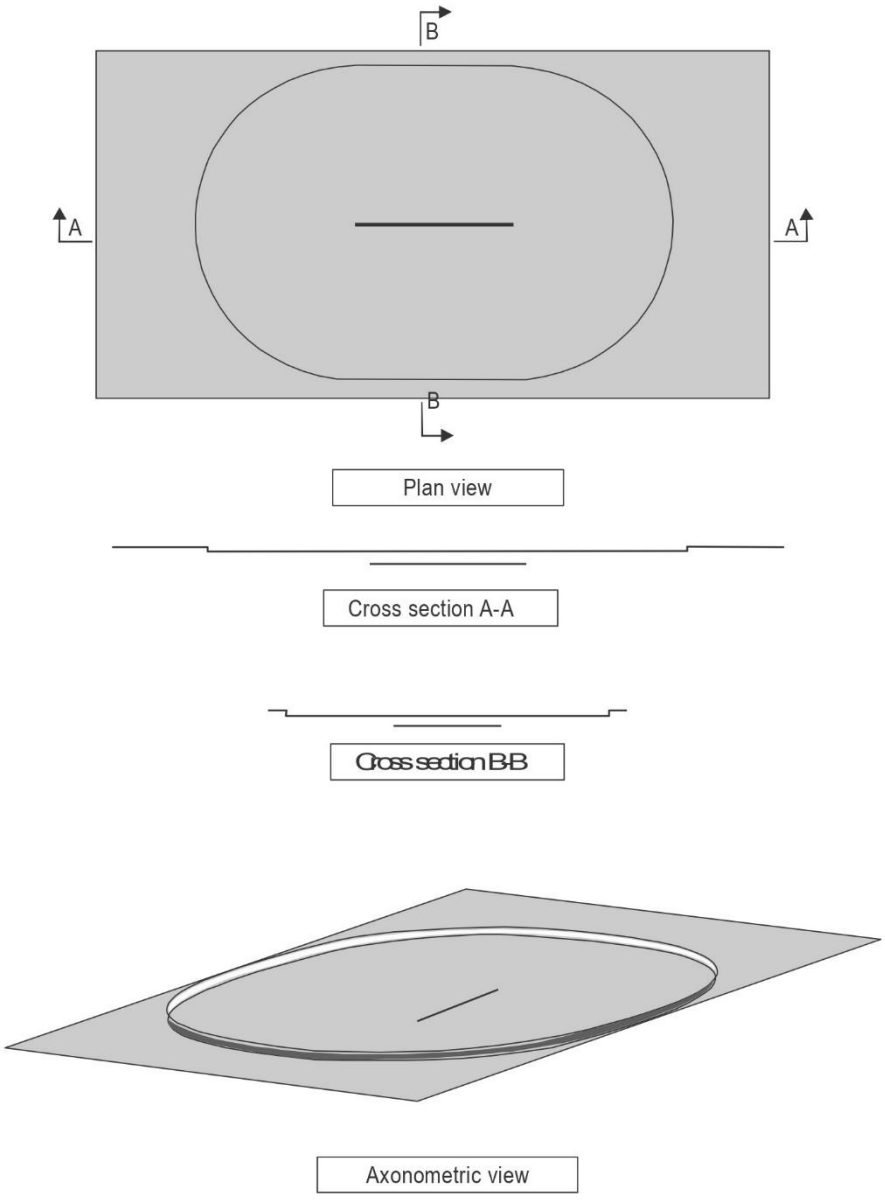


Figure 4-5. Surface for straight-in instrument approaches

4.3.4 Surface for precision approaches

Note.— *The purpose of the surface for precision approaches is to establish the airspace where obstacles may have an impact on common straight-in precision approach procedures (using ILS or MLS, groundbased augmentation system (GBAS) or satellite-based augmentation system (SBAS) CAT I). The design of the surface is consistent with the dimensions of the basic ILS surfaces provided in PANS-OPS (Doc 8186)*

Volume II, Part II, Section I, Chapter 1. Adjustments to the surface may be necessary in case of offset procedures.

4.3.4.1 Description.— Surface for precision approaches. A complex surface composed of:

a) an approach component consisting of an inclined surface preceding the threshold;

b) a missed approach component consisting of an inclined surface located at a specific distance after the threshold;

c) transitional components consisting of complex surfaces at a specified distance from the runway centre line and along the approach component and missed approach component, that slopes upwards and outwards; and

d) a lower component specified by a rectangular surface within the inner edges of the above components.

Note.— *The transitional components consist of a pair of surfaces, located on either side of the runway centre line. Each surface of this pair is called a transitional component.*

4.3.4.2 Characteristics.— The limits of the approach component of the surface for precision approaches should comprise:

a) 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;

b) 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 to a specified distance and diverging uniformly thereafter at another specified rate for the remainder of the length of the approach component; and

c) an outer edge parallel to the inner edge.

4.3.4.3 The elevation of the inner edge of the approach component shall be equal to the elevation of the midpoint of the threshold.

4.3.4.4 The slope of the approach component should be measured in the vertical plane containing the centre line of the runway and its extension.

4.3.4.5 Characteristics.— The limits of the missed approach component of surface for precision approaches should comprise:

a) an inner edge of specified length, horizontal and perpendicular to the extended 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 extended centre line of the runway to a specified distance and diverging uniformly thereafter at another specified rate for the remainder of the length of the missed approach component; and

c) an outer edge parallel to the inner edge.

4.3.4.6 The elevation of the inner edge of the missed approach component shall be equal to the elevation of the midpoint of the threshold.

Note.— *In some cases, the inner edge of the missed approach component may be below the elevation of the midpoint of the threshold, for example where runways slope upward.*

4.3.4.7 The slope of the missed approach component should be measured in the vertical plane containing the centre line of the runway and its extension.

4.3.4.8 Characteristics.— The limits of the transitional component of the surface for precision approaches should comprise:

a) a lower edge beginning on the side of the approach component at the elevation of the upper edge and extending down the side of the approach component to the inner edge of the approach component, from there along a line extending horizontally to the inner edge of the missed approach component, and from there extending up the side of the missed approach component to the upper edge; and

b) an upper edge located at 300 m above the threshold elevation.

4.3.4.9 The elevation of a point on the lower edge of the transitional component shall be:

a) along the side of the approach component and missed approach component — equal to the elevation of the particular surface at that point; and

b) between the inner edges of the approach component and missed approach component — equal to the elevation of the midpoint of the threshold.

Note.— *In some cases, the lower edge of the transitional component may be below the elevation of the midpoint of the threshold, for example where runways slope upward.*

4.3.4.10 The slope of the transitional component should be measured in the vertical plane perpendicular to the centre line of the runway and its extension.

4.3.4.11 Characteristics.— The limits of the lower component of the surface for precision approaches should comprise:

a) two shorter sides corresponding with the inner edge of the approach component and missed approach component; and

b) two longer sides corresponding with the inner edges of the transitional components.

4.3.4.12 The elevation of a point on the lower component shall be equal to the elevation of the midpoint of the threshold.

4.3.4.13 The slopes of the different components of the surface for precision approach runways should not be greater than, and their other dimensions not less than, those specified in Table 4-12.

Table 4-12. Dimensions of surface for precision approaches

Aeroplane design group		I to V
	Distance from threshold	60 m
	Length of inner edge	300 m

Approach component	1st section	Length	3000 m
		Divergence (each side)	15%
		Slope	2%
	2nd section	Length	9600 m
		Divergence (each side)	15%
		Slope	2.5%
Missed approach component		Distance after threshold	900 m
		Length of inner edge	300 m

Aeroplane design group		I to V
1st section	Length	1800 m
	Divergence (each side)	17.48%
	Slope	2.5%
2nd section	Length	10200 m
	Divergence (each side)	25%
	Slope	2.5%
Transitional component	Slope	14.3%

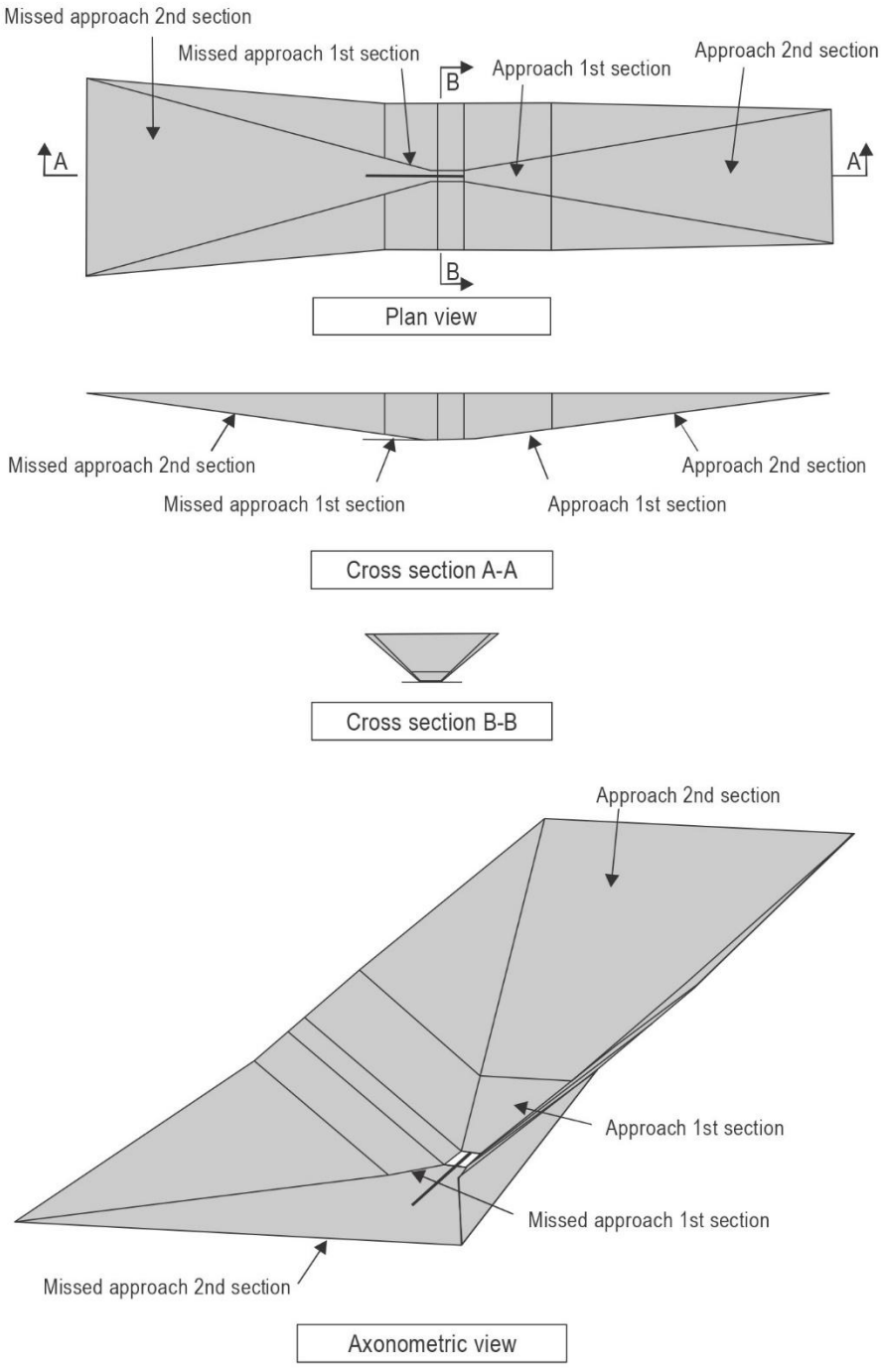


Figure 4-6. Surface for precision approaches

4.3.5 Instrument departure surface

Note.— *The purpose of the instrument departure surface is to establish the airspace where obstacles may have an impact on aircraft following an omnidirectional instrument departure procedure. The design of the instrument departure surface is consistent with the dimensions provided in PANS-OPS (Doc 8168, Volume II, Part I, Section 3, Chapter 4).*

4.3.5.1 Description.— Instrument departure surface. An inclined surface, along the runway centre line and its extension after the end of the take-off distance available.

4.3.5.2 Characteristics.— The limits of the instrument departure surface should comprise:

a) an inner edge of specified length, horizontal and perpendicular to the centre line of the runway and located at the end of the take-off distance available;

b) 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 to a specified distance and diverging uniformly thereafter at another specified rate for the remainder of the length of the instrument departure surface; and

c) an outer edge parallel to the inner edge.

4.3.5.3 The elevation of the inner edge shall be 5 m above the elevation of the runway centre line and its extension at the end of the take-off distance available.

4.3.5.4 The slope of the instrument departure surface shall be measured in the vertical plane containing the centre line of the runway and its extension.

4.3.5.5 The slope of the instrument departure surface should not be greater than, and its other dimensions not less than, those specified in Table4-13.

Table 4-13. Dimensions of instrument departure surface

Aeroplane design group		**I to V**
Length of inner edge		**300 m**
Slope		**2.5%**
First section	**Length**	**3500 m**
	Divergence	**26.8%**
Second section	**Length**	**8300 m**
	Divergence	**57.8%**

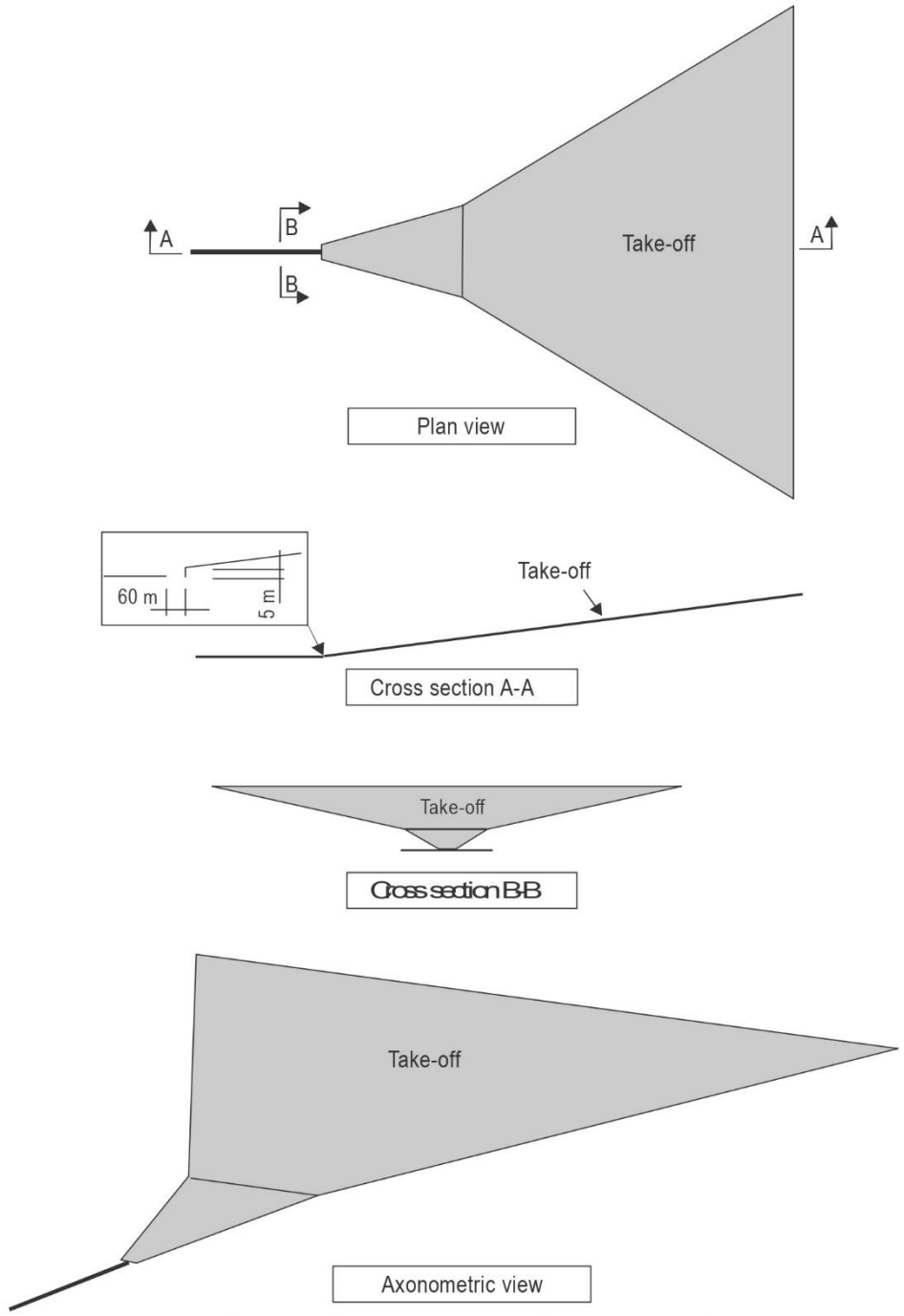


Figure 4-7. Instrument departure surface

4.3.6 Take-off climb surface

***Note 1**.— The purpose of the take-off climb surface is to establish the airspace where obstacles may*

have an impact on aircraft operating limitations during take-off under non-critical operating conditions.

The design of the take-off climb surface is consistent with the take-off obstacle clearance limitations provided in the Aeroplane Performance Manual (Doc 10064, Chapter 3), and Annex 6, Part I.

***Note 2**.— Obstacles that have no impact on aircraft operating limitations during take-off under non-critical operating conditions could have an impact in case of engine failure or abnormal (e.g. extreme weather conditions) and emergency situations (e.g. system failure).*

4.3.6.1 Description.— Take-off climb surface. An inclined surface beyond the end of the take-off distance available.

4.3.6.2 Characteristics.— The limits of the take-off climb surface should comprise:

a) an inner edge horizontal and perpendicular to the centre line of the runway and located at a specified distance beyond the end of the runway or at the end of the take-off distance available;

b) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate from the take-off ground 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.

4.3.6.3 The above surface should vary when take-off flight paths involving turns are utilized; two sides originating at the end of the inner edge and diverging uniformly at a specified rate from the extended centre line of the take-off ground track to a specified final width, and extending thereafter parallel to the take-off ground track for the remainder of the length of the take-off climb surface.

4.3.6.4 The elevation of the inner edge shall be equal to the highest point on the extended runway centre line between the end of the take-off run available and the inner edge of the take-off climb surface.

4.3.6.5 The slope of the take-off climb surface shall be measured:

a) in the vertical plane containing the centre line of the runway and its extension where straight take-off flight path are utilized;

b) along any straight part of the take-off flight path, in the vertical plane containing the centre line of the take-off flight path or, along any curved part of the take-off flight path, in the vertical plane tangent with the take-off flight path where take-off flight paths involving turns are utilized.

4.3.6.6 On runways intended for operations of aeroplanes with a maximum certificated take-off mass up to 5 700 kg, the slope of the take-off climb surface should not be greater than, and its other dimensions not less than, those specified in Table4-14, except that:

a) a lesser length should 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; and

b) a higher slope should be adopted for the take-off climb surface where such slope would be consistent with the operational characteristics of the critical aeroplane operating out of the runway and the local conditions.

4.3.6.7 On runways intended for operations of aeroplanes with a maximum certificated take-off mass greater than 5 700 kg, the slope of the take-off climb surface should not be greater than, and its other dimensions not less than, those specified in Table 4-15, except that:

a) a lesser length should 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; and

b) a higher slope should be adopted for the take-off climb surface where such slope would be consistent with the operational characteristics of the critical aeroplane operating out of the runway and the local conditions.

4.3.6.8 The slope of the take-off climb surface should not be increased to facilitate the growth of obstacles.

***Note**.— The slope of the take-off climb surface is intended to adapt to the operations of aeroplanes whose climb performances on take-off climb are such that a slope of 2 per cent is not necessary. However, this slope is not intended to be increased to enable the growth of obstacles. Specifications concerning the increase of the slope of the take-off climb surface are contained in PANS-Aerodromes (Doc 9981), Part II, Chapter 10.*

4.3.6.9 The operational characteristics of aeroplanes for which the runway is intended should be examined to see if it is desirable to reduce the slope specified in Table 4-14 and Table 4-15 to 1.6 per cent when critical operating conditions are to be catered to. If the specified slope is reduced, corresponding adjustment in the length of the take-off climb surface should be made so as to provide protection to a height equal to that reached with the slopes and lengths in Table 4-14 and 4-15.

Table 4-14. Dimensions of take-off climb surface – runways with operations of aeroplanes with a mass up to 5 700 kg

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Distance from runway endb	30 m	60 m	-	-	-	-
Length of inner edge	60 m	80 m	-	-	-	-
Divergence (each side)	10%	10%	-	-	-	-
Final width	380 m	580 m	-	-	-	-
Length	1600 m	2500 m	-	-	-	-
Slope	5%	4%	-	-	-	-

a. Aeroplanes with a mass up to but not including 5 700 kg generally belong to aeroplane design groups I, IIA and IIB.

b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.

Table 4-15. Dimensions of take-off climb surface – runways with operations of aeroplanes with a mass above 5 700 kg

Aeroplane design group	I	IIA-IIB	IIC	III	IV	V
Distance from TODA	-	-	-	-	-	-
Length of inner edge	144 m	156 m	156 m	172 m	180 m	180 m
Divergence (each side)	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
Final width	1800 m[a]	1800 m[a]	1800m[a]	1800m[a]	1800m[a]	1800m[a]
Length	10000 m	10000 m	10000 m	10000 m	10000 m	10000 m
Slope	5%	4%	2%	2%	2%	2%

a Where given operational conditions and performances are met, the final width can be decreased. Specifications concerning this reduction are contained in the Airport Services Manual (Doc 9137), Part 6.

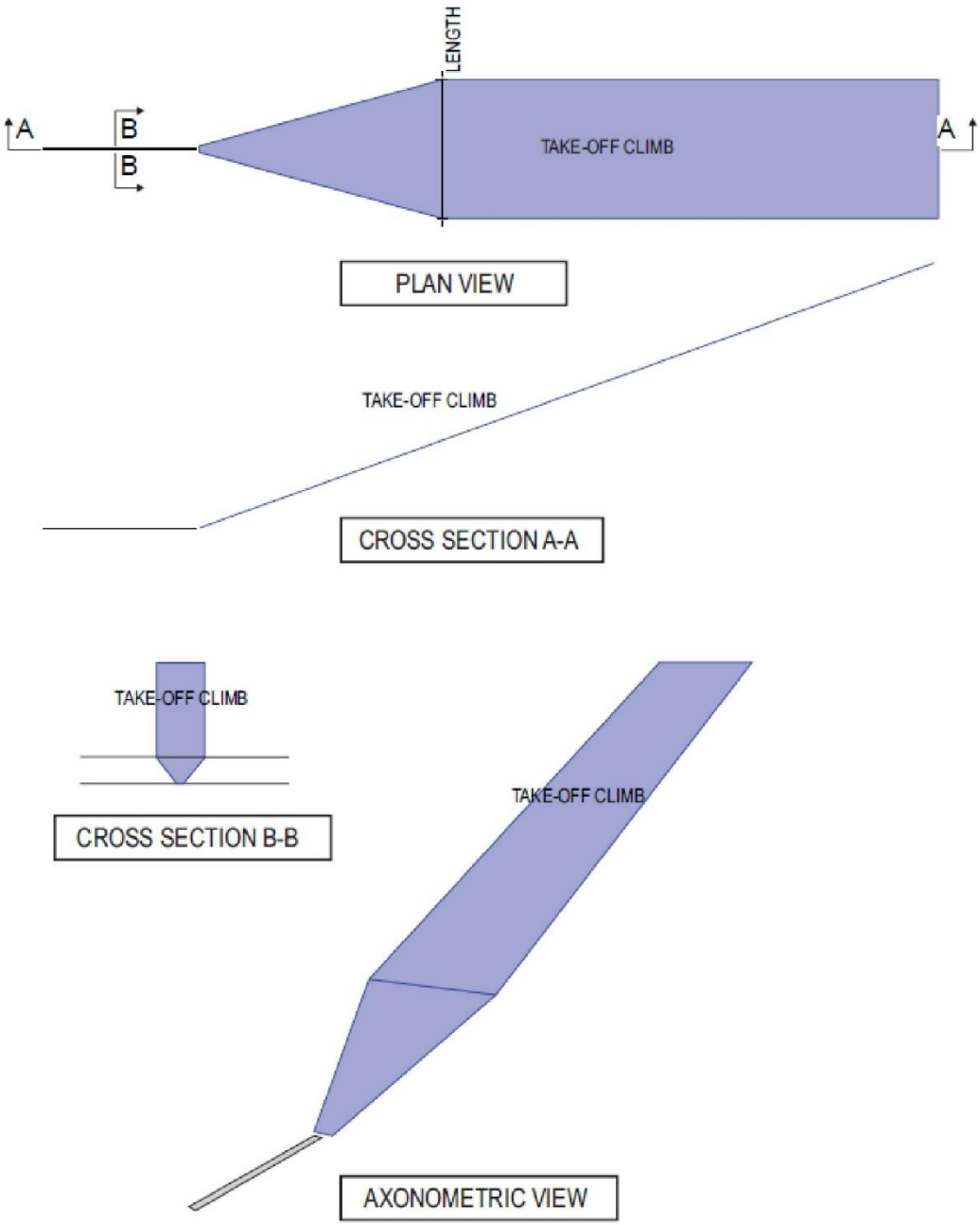


Figure 4-8 Take-off climb surface

4.4 Obstacle limitation requirements

Obstacle free surfaces

4.4.1 Fixed objects shall not be permitted above the inner approach surface, inner transitional surfaces and balked landing surface and that complex surface extending between the lower edges of the inner transitional surfaces. Visual aids required for air navigation purposes or those objects required for aircraft safety purposes, and which must project into the airspace above the inner approach surface, inner transitional surfaces and balked landing surface or that complex surface extending between the lower edges of the inner transitional surfaces are permitted.

Note.— *Specifications concerning objects required for aircraft safety purposes are provided in the Airport Services Manual (Doc 9137), Part 6 – Control of Obstacles. Such objects may for example consist of arresting systems, arresting cables, arresting beds, FOD detection systems, wildlife hazard equipment.*

4.4.2 Visual aids required for air navigation purposes or those fixed objects required for aircraft safety purposes and which project into the airspace above the inner approach surface, inner transitional surfaces and balked landing surface or that complex surface extending between the lower edges of the inner transitional surfaces shall be frangible and mounted as low as possible.

4.4.3 Mobile objects shall not be permitted above the inner approach surface, inner transitional surfaces, balked landing surface and that complex surface extending between the lower edges of the inner transitional surfaces during the use of the runway for landing.

4.4.4 New objects or extensions of existing objects shall not be permitted above the approach surface and transitional surfaces and the complex surface extending between the lower edges of the transitional surfaces. Equipment and installations required for air navigation or for aircraft safety purposes, and which must project into the airspace above the approach surface and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces are permitted.

4.4.5 Equipment and installations required for air navigation or for aircraft safety purposes and which must project into the airspace above the approach surface and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces shall be frangible and mounted as low as possible.

4.4.6 Existing obstacles above the approach surface, and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces should as far as practicable be removed.

4.4.7 States shall ensure that existing terrain and/or obstacles that cannot be removed and penetrate the approach surface and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces are only permitted when, after aeronautical study, it is determined that the obstacles do not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

Note.— *Detailed specifications concerning aeronautical study are provided in PANS-Aerodromes (Doc 9981), Part II, Chapter 10.*

Obstacle evaluation surfaces

4.4.8 kuwait DGCA/ASD shall ensure that obstacles penetrating the obstacle evaluation surfaces are only permitted when, after aeronautical study, it is determined that the

obstacles do not adversely affect the safety or significantly affect the regularity of the existing and intended operations of aeroplanes.

Note.— *Detailed specifications concerning aeronautical study is given in PANS-Aerodromes (Doc 9981), Part II, Chapter 10*

4.5 Obstacle limitation surfaces requirements

Note 1.— *The requirements for obstacle free surfaces are specified on the basis of the intended use of a runway and are intended to be applied when such use is made of the runway.*

Note 2.— *The requirements for obstacle evaluation surfaces are specified on the basis of the intended use and/or intended operations on the runway. When different obstacle evaluation surfaces overlap each other, each individual surface must be considered as they have specific functions.*

4.5.1 Obstacle free surfaces

4.5.1.1 The following obstacle free surfaces shall be established for a non-instrument or non-precision approach runway:

a) approach surface;

b) transitional surfaces;

c) inner approach surface; and

d) inner transitional surfaces.

4.5.1.2 The following obstacle free surfaces shall be established for a precision approach runway:

a) Approach surface;

b) transitional surfaces;

c) inner approach surface;

d) inner transitional surfaces; and

e) balked landing surface.

4.5.2 Obstacle evaluation surfaces

4.5.2.1 The following obstacle evaluation surfaces shall be established:

a) in case of circling approach and/or visual circuits — the horizontal surface specified in 4.3.2 or a specific OES;

b) in case of straight-in instrument approaches other than precision approaches, where the horizontal surface is not established — the surface for straight-in instrument approaches specified in 4.3.3 or a specific OES;

c) in case of precision approach procedure — the surface for precision approaches specified in 4.3.4 or a specific OES;

d) in case of instrument departure procedure — the instrument departure surface specified in 4.3.5 or a specific OES;

e) in case of take-off operations — the take-off climb surface specified in 4.3.6 or a specific OES; and

f) in case of operations different from the above — specific OES.

Note 1.— *Operations mentioned in f) may include curved approach, VFR circuit patterns, etc.*

Note 2.— *Specifications and further guidance related to specific OES are contained in PANS-Aerodromes (Doc 9981) and in the Airport Services Manual (Doc 9137), Part 6—Control of Obstacles."*

4.6 Objects outside the obstacle free surfaces and obstacle evaluation surfaces

4.6.1 In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 100 m or more above ground elevation should be regarded as obstacles, unless an aeronautical study indicates that they do not constitute a hazard to the operations of intended aeroplane.

Note 1.— The objectives of the specifications in this chapter are to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely and to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

Note 2.— Objects which penetrate the obstacle limitation surfaces contained in this chapter may in certain circumstances cause an increase in the obstacle clearance altitude/height for an instrument approach procedure or any associated visual circling procedure or have other operational impact on flight procedure design. Criteria for flight procedure design are contained in ICAO Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168).

Note 3.— The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in 5.3.5.42 to 5.3.5.46.

4.7~~1~~ Obstacle limitation surfaces

Note.— See Figure 4-1.

Table 4-1. Dimensions and slopes of obstacle limitation surfaces — Approach runways

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 dimensionsa	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)
CONICAL										
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
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2000 m	2500 m	4000 m	4000 m	3500 m	4000 m	4000 m	3500 m	4000 m	4000 m
INNER APPROACH										
Width	–	–	–	–	–	–	–	90 m	120 m	120 m
Distance from threshold	–	–	–	–	–	–	–	60 m	60 m	60 m
Length	–	–	–	–	–	–	–	900 m	900 m	900 m
Slope	–	–	–	–	–	–	–	2.5 %	2 %	2 %
APPROACH										
Length of inner edge	60 m	80 m	~~150~~ 110 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 %
First section										
Length	1600 m	2500 m	3000 m	3000 m	2500 m	3000 m	3000 m	3000 m	3000 m	3000 m
Slope	5 %	4 %	3.33 %	2.5 %	3.33 %	2 %	2 %	2.5 %	2 %	2 %

Second section										
Length	–	–	–	–	–	3600 m[b]	3600 m[b]	12000 m	3600 m[b]	3600 m[b]
Slope	–	–	–	–	–	2.5 %	2.5 %	3 %	2.5 %	2.5 %
Horizontal section										
Length	–	–	–	–	–	8400 m[b]	8400 m[b]	–	8400 m[b]	8400 m[b]
Total length	–	–	–	–	–	15000 m	15000 m	15000 m	15000 m	15000 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[c]	120 m[c]
Distance from threshold	–	–	–	–	–	–	–	c	1800 md	1800 md
Divergence (each side)	–	–	–	–	–	–	–	10 %	10 %	10 %
Slope	–	–	–	–	–	–	–	4 %	3.33 %	3.33 %

Outer horizontal surface

Note.— Guidance on the need to provide an outer horizontal surface and its characteristics is contained in Safeguarding of Aerodrome the Airport Services Manual (Doc 9137), Part 6.

Conical surface

4.7~~1~~.1 Description.— Conical surface. A surface sloping upwards and outwards from the periphery of the inner horizontal surface.

4.7~~1~~.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.

4.71.3 The slope of the conical surface shall be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

Inner horizontal surface

4.71.4 Description.— Inner horizontal surface. A surface located in a horizontal plane above an aerodrome and its environs.

4.71.5 Characteristics.— The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose.

Note.— *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 Safeguarding of Aerodrome & ICAO Airport Services Manual (Doc 9137), Part 6.*

4.71.6 The height of the inner horizontal surface shall be measured above an elevation datum established for such purpose.

Note.— Guidance on determining the elevation datum is contained in ICAO Airport Services Manual (Doc 9137), Part 6.

Approach surface

4.71.7 Description.— Approach surface. An inclined plane or combination of planes preceding the threshold.

4.71.8 Characteristics.— The limits of the approach surface shall comprise:

a) 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;

b) 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;

c) an outer edge parallel to the inner edge; and

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.

4.7~~1~~.9 The elevation of the inner edge shall be equal to the elevation of the midpoint of the threshold.

4.7~~1~~.10 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 4-2.

Inner approach surface

4.7~~1~~.11 Description.— Inner approach surface. A rectangular portion of the approach surface immediately preceding the threshold.

4.7~~1~~.12 Characteristics.— The limits of the inner approach surface shall comprise:

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.

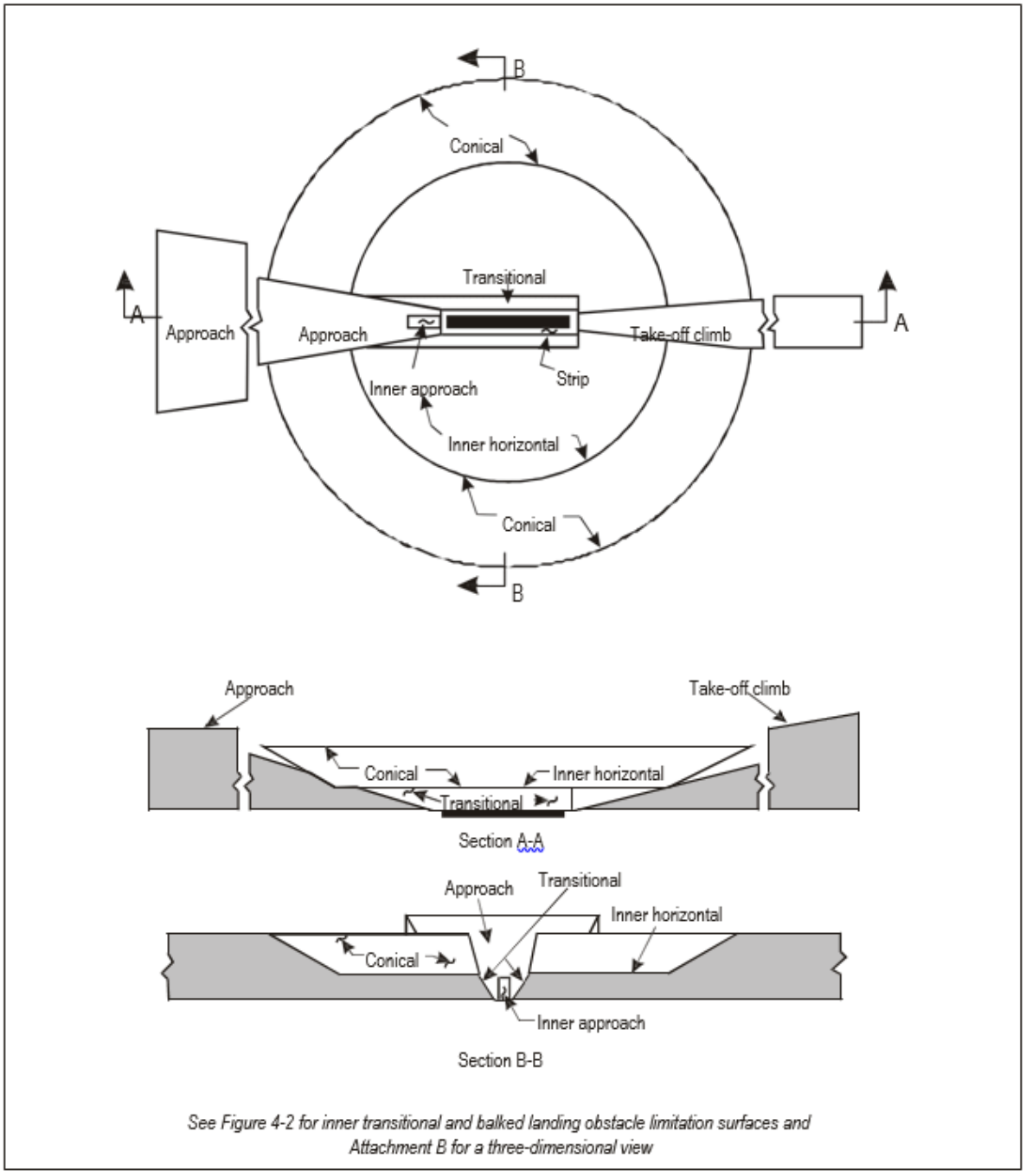


Figure 4-1. Obstacle limitation surfaces

Figure 4-9 obstacle limitation surface

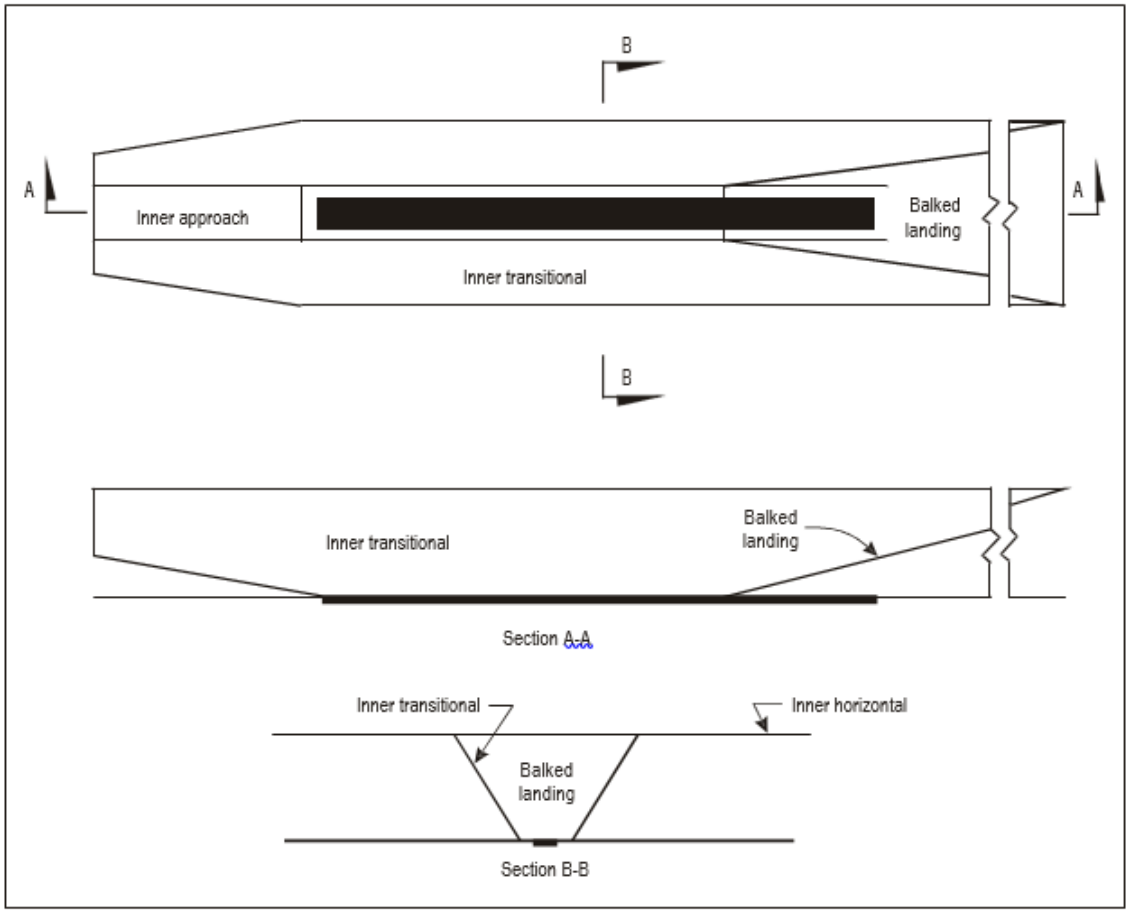


Figure 4-2. Inner approach, inner transitional and balked landing obstacle limitation surfaces

Figure 4-10 Inner approach, inner transitional and balked landing obstacle limitation surface

Transitional surface

4.7~~1~~.13 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.

4.7~~1~~.14 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.

4.7~~1~~.15 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.

4.7~~1~~.16 The slope of the transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway.

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 the runway and which is not to be penetrated except for frangible objects. The transitional surface described in 4.1.13 is intended to remain as the controlling obstacle limitation surface for buildings, etc.

4.7~~1~~.17 Description.— Inner transitional surface. A surface similar to the transitional surface but closer to the runway.

4.7~~1~~.18 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.

4.7~~1~~.19 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.

4.7~~1~~.20 The slope of the inner transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway.

Balked landing surface

4.7~~1~~.21 Description.— Balked landing surface. An inclined plane located at a specified distance after the threshold, extending between the inner transitional surface.

4.7~~1~~.22 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.

4.7~~1~~.23 The elevation of the inner edge shall be equal to the elevation of the runway centre line at the location of the inner edge.

4.7~~1~~.24 The slope of the balked landing surface shall be measured in the vertical plane containing the centre line of the runway.

Take-off climb surface

4.7~~1~~.25 Description.— Take-off climb surface. An inclined plane or other specified surface beyond the end of a runway or clearway.

4.7~~1~~.26 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.

4.7~~1~~.27 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 when a clearway is provided the elevation shall be equal to the highest point on the ground on the centre line of the clearway.

4.7~~1~~.28 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.

4.7~~1~~.29 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.

4.82 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.

Non-instrument runways

4.82.1 The following obstacle limitation surfaces shall be established for a non-instrument runway:

— conical surface;

— inner horizontal surface;

— approach surface; and

— transitional surfaces.

4.82.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1.

4.82.3 New objects or extensions of existing objects shall not be permitted above an approach or transitional surface except when, in the opinion of the appropriate 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 Safeguarding of Aerodrome ICAO Airport Services Manual (Doc 9137), Part 6.

4.82.4 New objects or extensions of existing objects should not be permitted above the conical surface or inner horizontal surface except when, in the opinion of the appropriate authority, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.82.5 Existing objects above any of the surfaces required by 4.2.1 should as far as practicable be removed except when, in the opinion of the appropriate authority, the object is shielded by an existing immovable object, or after 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.

4.8~~2~~.6 In considering proposed construction, account should be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

Non-precision approach runways

4.8~~2~~.7 The following obstacle limitation surfaces shall be established for a non-precision approach runway:

— conical surface;

— inner horizontal surface;

— approach surface; and

— transitional surfaces.

4.8~~2~~.8 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1, except in the case of the horizontal section of the approach surface (see 4.2.9).

4.8~~2~~.9 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.

4.82.10 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 except when, in the opinion of the appropriate 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 Safeguarding of Aerodrome & ICAO Airport Services Manual (Doc 9137), Part 6.

4.82.11 New objects or extensions of existing objects should not be permitted above the approach surface beyond 3 000 m from the inner edge, the conical surface or inner horizontal surface except when, in the opinion of the appropriate authority, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.82.12 Existing objects above any of the surfaces required by 4.2.7 should as far as practicable be removed except when, in the opinion of the appropriate authority, the object is shielded by an existing immovable object, or after 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.

Precision approach runways

Note 1.— See 9.9 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 Safeguarding of Aerodrome & ICAO Airport Services Manual (Doc 9137), Part 6.

4.82.13 The following obstacle limitation surfaces shall be established for a precision approach runway category I:

— conical surface;

— inner horizontal surface;

— approach surface; and

— transitional surfaces.

4.82.14 The following obstacle limitation surfaces should be established for a precision approach runway category I:

— inner approach surface;

— inner transitional surfaces; and

— balked landing surface.

4.82.15 The following obstacle limitation surfaces shall be established for a precision approach runway category II or III:

— conical surface;

— inner horizontal surface;

— approach surface and inner approach surface;

— transitional surfaces;

— inner transitional surfaces; and

— balked landing surface.

4.82.16 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1, except in the case of the horizontal section of the approach surface (see 4.2.17).

4.82.17 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.

4.82.18 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.

4.82.19 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 appropriate 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 Safeguarding of Aerodrome & the Airport Services Manual (Doc 9137), Part 6.

4.82.20 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 appropriate authority, an object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.82.21 Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface should as far as practicable be removed except when, in the opinion of the appropriate authority, an object is shielded by an existing immovable object, or after 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.

Runways meant for take-off

4.82.22 The following obstacle limitation surface shall be established for a runway meant for take-off:

— take-off climb surface.

4.82.23 The dimensions of the surface shall be not less than the dimensions specified in Table 4-2, 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.

4.82.24 The operational characteristics of aeroplanes for which the runway is intended should be examined to see if it is desirable to reduce the slope specified in Table 4-2 when critical operating conditions are to be catered to. If the specified slope is reduced, corresponding adjustment in the length of the take-off climb surface should be made so as to provide protection to a height of 300 m.

Note.— When local conditions differ widely from sea level standard atmospheric conditions, it may be advisable for the slope specified in Table 4-2 to be reduced. The degree of this reduction depends on the divergence between local conditions and sea level standard atmospheric conditions, and on the performance characteristics and operational requirements of the aeroplanes for which the runway is intended.

4.82.25 New objects or extensions of existing objects shall not be permitted above a take-off climb surface except when, in the opinion of the appropriate 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 Safeguarding of Aerodrome & ICAO Airport Services Manual (Doc 9137), Part 6.

4.82.26 If no object reaches the 2 per cent (1:50) take-off climb surface, new objects should be limited to preserve the existing obstacle free surface or a surface down to a slope of 1.6 per cent (1:62.5).

Table 4-2. Dimensions and slopes of obstacle limitation surfaces

RUNWAYS MEANT FOR TAKE-OFF

Surface and dimensions[a] (1)	Code number 1 (2)	2 (3)	3 or 4 (4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end[b]	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[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2%[d]

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 4.2.24 and 4.2.26.

4.8~~2~~.27 Existing objects that extend above a take-off climb surface should as far as practicable be removed except when, in the opinion of the appropriate authority, an object is shielded by an existing immovable object, or after 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.

4.93 Objects outside the obstacle limitation surfaces

4.39.1 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.

4.93.2 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.

4.104 Other objects

4.104.1 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 should, as far as practicable, be removed.

4.104.2 Anything which may, in the opinion of the appropriate authority after aeronautical study, endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces should be regarded as an obstacle and should be removed in so far as practicable.

Note.— In certain circumstances, objects that do not project above any of the surfaces enumerated in 4.1 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.

~~Chapter 4.~~Chapter 5. VISUAL AIDS FOR NAVIGATION

5.1 Indicators and signalling devices

5.1.1 Wind direction indicator

Application

5.1.1.1 An aerodrome shall be equipped with at least one wind direction indicator.

Location

5.1.1.2 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.

Characteristics

5.1.1.3 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. 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.

5.1.1.4 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.

5.1.1.5 Provision should be made for illuminating at least one wind indicator at an aerodrome intended for use at night.

5.1.2 Landing direction indicator

Location

5.1.2.1 Where provided, a landing direction indicator shall be located in a conspicuous place on the aerodrome.

Characteristics

5.1.2.2 The landing direction indicator should be in the form of a “T”

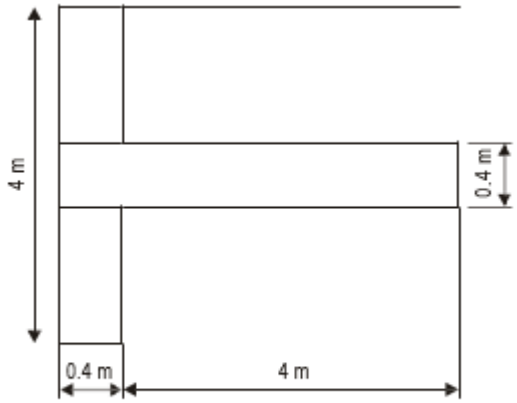


Figure 5-1. Landing direction indicator

5.1.2.3 The shape and minimum dimensions of a landing “T” shall be as shown in Figure 5-1. 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.

5.1.3 Signalling lamp

Application

5.1.3.1 A signalling lamp shall be provided at a controlled aerodrome in the aerodrome control tower.

Characteristics

5.1.3.2 Recommendation.— 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 Appendix 1, 2.1.2.

5.1.3.3 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.

5.1.4 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. Attachment A, Section 17, provides guidance on the need to provide ground signals. KCASR 2, Appendix 1, specifies the shape, colour and use of visual ground signals. Visual Aids & The Aerodrome Design Manual (Doc 9157), Part 4, provides guidance on their design.

Location of signal area

5.1.4.1 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.

Characteristics of signal area

5.1.4.2 The signal area shall be an even horizontal surface at least 9 m square.

5.1.4.3 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.

5.2 Markings

5.1.1 General

Interruption of runway markings

5.2.1.1 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.

5.2.1.2 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.

5.2.1.3 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.

Note.— See 5.2.8.7 regarding the manner of connecting runway and taxiway centre line markings.

Colour and conspicuity

5.2.1.4 Runway markings shall be white.

Note 1.— It has been found that, on runway surfaces of light colour, the conspicuity of white markings can be improved by outlining them in black.

Note 2.— It is preferable that the risk of uneven friction characteristics on markings be reduced in so far as practicable by the use of a suitable kind of paint.

Note 3.— Markings may consist of solid areas or a series of longitudinal stripes providing an effect equivalent to the solid areas.

5.2.1.5 Taxiway markings, runway turn pad markings and aircraft stand markings shall be yellow.

5.2.1.6 Apron safety lines shall be of a conspicuous colour which shall contrast with that used for aircraft stand markings.

5.2.1.7 At aerodromes where operations take place at night, pavement markings should be made with reflective materials designed to enhance the visibility of the markings.

Note.— Guidance on reflective materials is given in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Unpaved taxiways

5.2.1.8 An unpaved taxiway should be provided, so far as practicable, with the markings prescribed for paved taxiways.

5.2.2 Runway designation marking

Application

5.2.2.1 A runway designation marking shall be provided at the thresholds of a paved runway.

5.2.2.2 A runway designation marking should be provided, so far as practicable, at the thresholds of an unpaved runway.

Location

5.2.2.3 A runway designation marking shall be located at a threshold as shown in Figure 5-2 as appropriate.

Note.— If the runway threshold is displaced from the extremity of the runway, a sign showing the designation of the runway may be provided for aeroplanes taking off.

Characteristics

5.2.2.4 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 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.

Runway centre line marking

Application

5.2.3.1 A runway centre line marking shall be provided on a paved runway.

Location

5.2.3.2 A runway centre line marking shall be located along the centre line of the runway between the runway designation markings as shown in Figure 5-2, except when interrupted in compliance with 5.2.1.1.

Characteristics

5.2.3.3 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.

5.2.3.4 The width of the stripes shall be not less than:

— 0.90 m on precision approach category II and III runways;

— 0.45 m on non-precision approach runways where the code number is 3 or 4, and precision approach category I runways; and

— 0.30 m on non-precision approach runways where the code number is 1 or 2, and on non-instrument runways.

5.2.4 Threshold marking

Application

5.2.4.1 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.~~

~~5.2.4.2 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.~~

5.2.4.~~3~~2 A threshold marking should be provided, so far as practicable, at the thresholds of an unpaved runway.

Note.—Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4, shows a form of marking which has been found satisfactory for the marking of downward slopes immediately before the threshold.

Location

5.2.4.~~4~~3 The stripes of the threshold marking shall commence 6 m from the threshold.

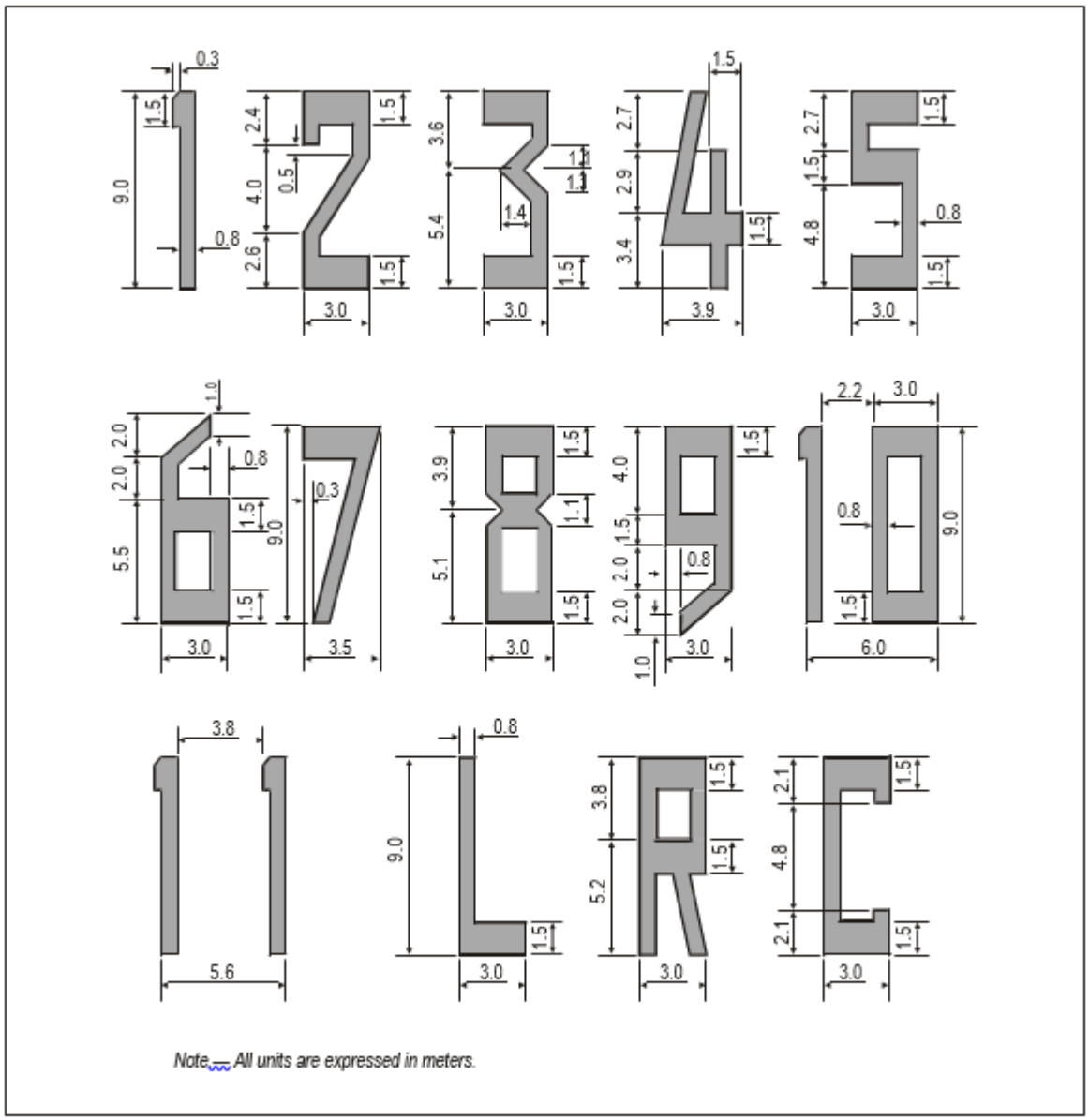


Figure 5-3. Form and proportions of numbers and letters for runway designation markings

Characteristics

5.2.4.~~5~~4 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 5-2 (A) and (B) for a runway width of 45 m. The number of stripes shall be in accordance with the runway width as follows:

Runway width	Number of stripes
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 5-2 (C).

5.2.4.~~6~~5 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 within a threshold marking there shall be a minimum of three stripes on each side of the centre line of the runway. 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.

Transverse stripe

5.2.4.~~7~~6 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 5-4 (B) should be added to the threshold marking.

5.2.4.~~8~~7 A transverse stripe shall be not less than 1.80 m wide.

Arrows

5.2.4.~~9~~8 Where a runway threshold is permanently displaced, arrows conforming to Figure 5-4 (B) shall be provided on the portion of the runway before the displaced threshold.

5.2.4.~~10~~9 When a runway threshold is temporarily displaced from the normal position, it shall be marked as shown in Figure 5-4 (A) or 5-4 (B) and all markings prior to the displaced threshold shall be obscured except the runway centre line marking, which shall be converted to arrows.

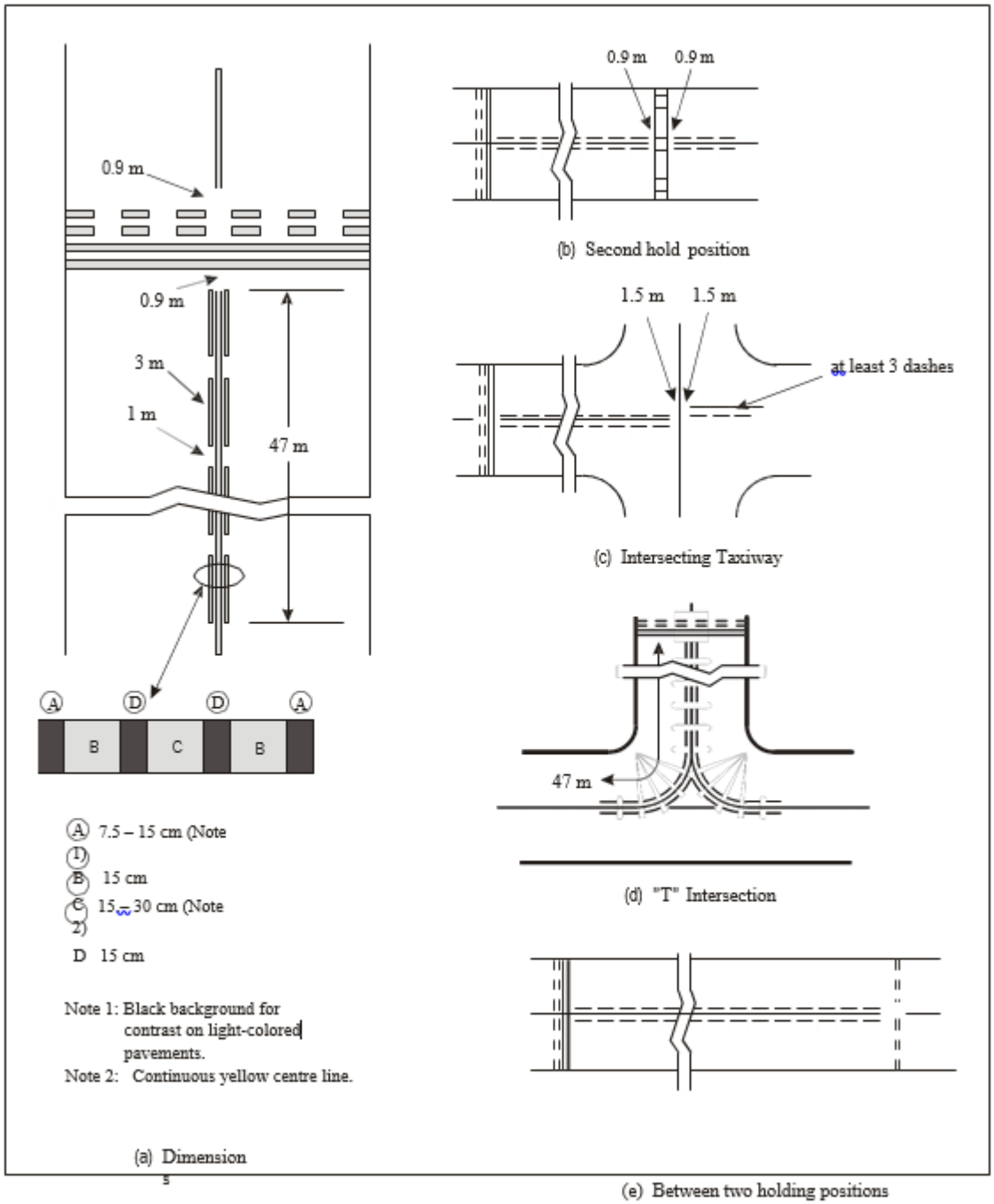


Figure 5-7. Enhanced taxiway centre line marking

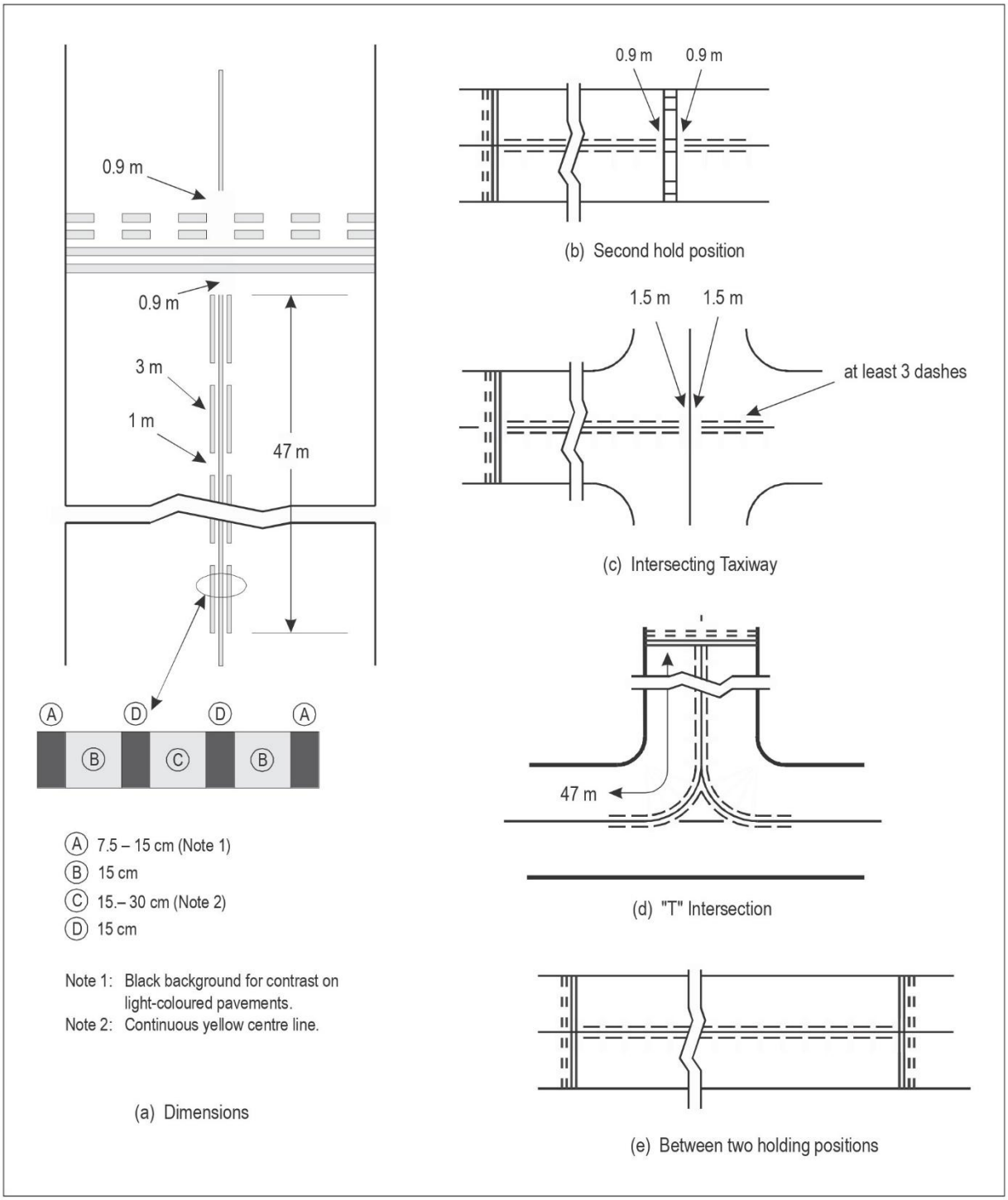


Figure 5-7. Enhanced taxiway centre line marking

5.2.13.10 If more than one turn bar and/or stop line is required, they should be coded.

5.2.13.11 An alignment bar should 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 should have a width of not less than 15 cm.

5.2.13.12 A stop line should 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.

5.2.14 Apron safety lines

Note.— Guidance on apron safety lines is contained in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Application

5.2.14.1 Apron safety lines should be provided on a paved apron as required by the parking configurations and ground facilities.

Location

5.2.14.2 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.

Characteristics

5.2.14.3 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.

5.2.14.4 An apron safety line should be continuous in length and at least 10 cm in width.

5.2.15 Road-holding position marking

Application

5.2.15.1 A road-holding position marking shall be provided at all road entrances to a runway.

Location

5.2.15.2 The road-holding position marking shall be located across the road at the holding position.

Characteristics

5.2.15.3 The road-holding position marking shall be in accordance with the local road traffic regulations.

5.2.16 Mandatory instruction marking

Note.— *Guidance on mandatory instruction marking is given in Visual Aids & the Aerodrome Design Manual (Doc 9157), Part 4.*

Application

5.2.16.1 Where it is impracticable to install a mandatory instruction sign in accordance with 5.4.2.1, a mandatory instruction marking shall be provided on the surface of the pavement.

5.2.16.2 Where operationally required, such as on taxiways exceeding 60 m in width, or to assist in the prevention of a runway incursion, a mandatory instruction sign should be supplemented by a mandatory instruction marking.

Location

5.2.16.3 The mandatory instruction marking on taxiways where the ~~code letter is A, B, C or D~~ OMGWS is up to but not including 9 m 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 5-10 (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.

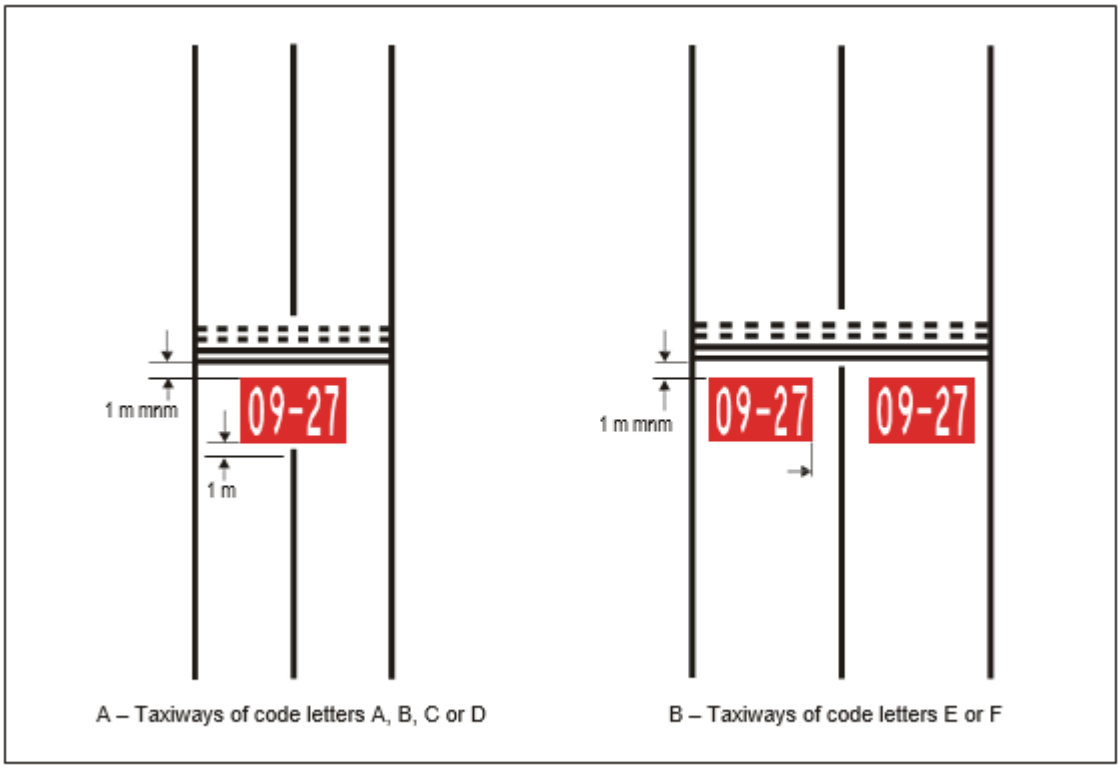


Figure 5-10. Mandatory instruction marking

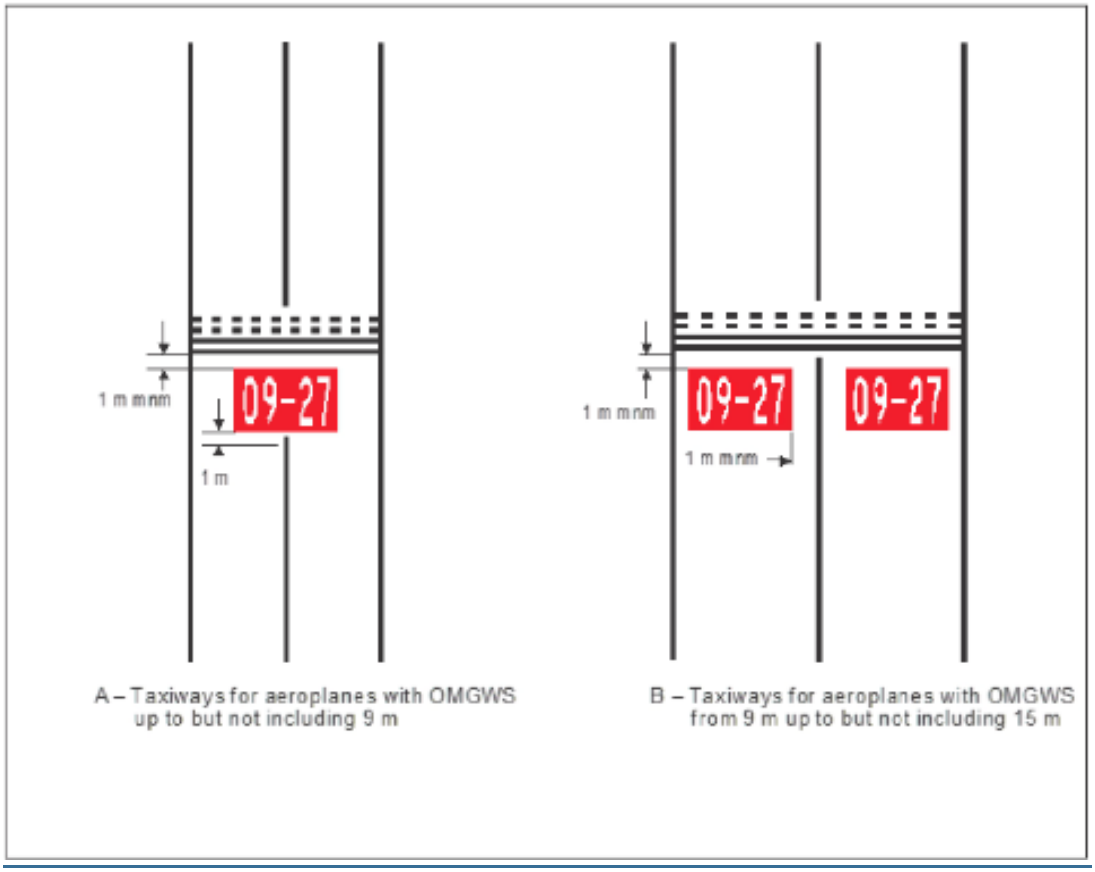


Figure 5-10. Mandatory instruction marking

5.2.16.4 The mandatory instruction marking on taxiways where the OMGWS from 9 m up to but not including 15 m ~~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 5-10 (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.

5.2.16.5 Except where operationally required, a mandatory instruction marking should not be located on a runway.

Characteristics

5.2.16.6 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.

5.2.16.7 A NO ENTRY marking shall consist of an inscription in white reading NO ENTRY on a red background.

5.2.16.8 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.

5.2.16.9 The character height should be 4 m for inscriptions where the OMGWS is from 6 m up to but not including 15 m~~code letter is C, D, E or F~~, and 2 m where the OMGWS is up to but not including 6 m~~code letter is A or B~~. The inscriptions should be in the form and proportions shown in Appendix 3.

5.2.16.10 The background should be rectangular and extend a minimum of 0.5 m laterally and vertically beyond the extremities of the inscription.

5.2.17 Information marking

Note.— Guidance on information marking is contained in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Application

5.2.17.1 Where an information sign would normally be installed and is impractical to install, as determined by the appropriate authority, an information marking shall be displayed on the surface of the pavement.

5.2.17.2 Where operationally required an information sign should be supplemented by an information marking.

5.2.17.3 An information (location/direction) marking should 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.

5.2.17.4 An information (location) marking should be displayed on the pavement surface at regular intervals along taxiways of great length.

Location

5.3 Lights

5.3.1 General

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 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 and are maintained over time. (See Attachment A, Section 15, on intensity. Guidance on maintenance criteria for aeronautical ground lights and on the use of a site standard is contained in the Aerodrome Design Manual (Doc 9157), Part 4).*

Lights which may endanger the safety of aircraft

5.3.1.1 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.

Laser emissions which may endanger the safety of aircraft

5.3.1.2 To protect the safety of aircraft against the hazardous effects of laser emitters, the following protected zones should be established around aerodromes:

— a laser-beam free flight zone (LFFZ)

— a laser-beam critical flight zone (LCFZ)

— a laser-beam sensitive flight zone (LSFZ).

Note 1.— Figures 5-11, 5-12 and 5-13 may be used to determine the exposure levels and distances that adequately protect flight operations.

Note 2.— The restrictions on the use of laser beams in the three protected flight zones, LFFZ, LCFZ and LSFZ, refer to visible laser beams only. Laser emitters operated by the authorities in a manner compatible with flight safety are excluded. In all navigable airspace, the irradiance level of any laser beam, visible or invisible, is expected to be less than or equal to the maximum permissible exposure (MPE) unless such emission has been notified to the authority and permission obtained.

Note 3.— The protected flight zones are established in order to mitigate the risk of operating laser emitters in the vicinity of aerodromes.

5.3.1.5 When an approach light fixture or supporting structure is not in itself sufficiently conspicuous, it shall be suitably marked.

Elevated lights

5.3.1.6 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.

Surface lights

5.3.1.7 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.

5.3.1.8 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 Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

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 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 Attachment A, Section 16, and Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4).*

5.3.1.9 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.

5.3.1.10 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

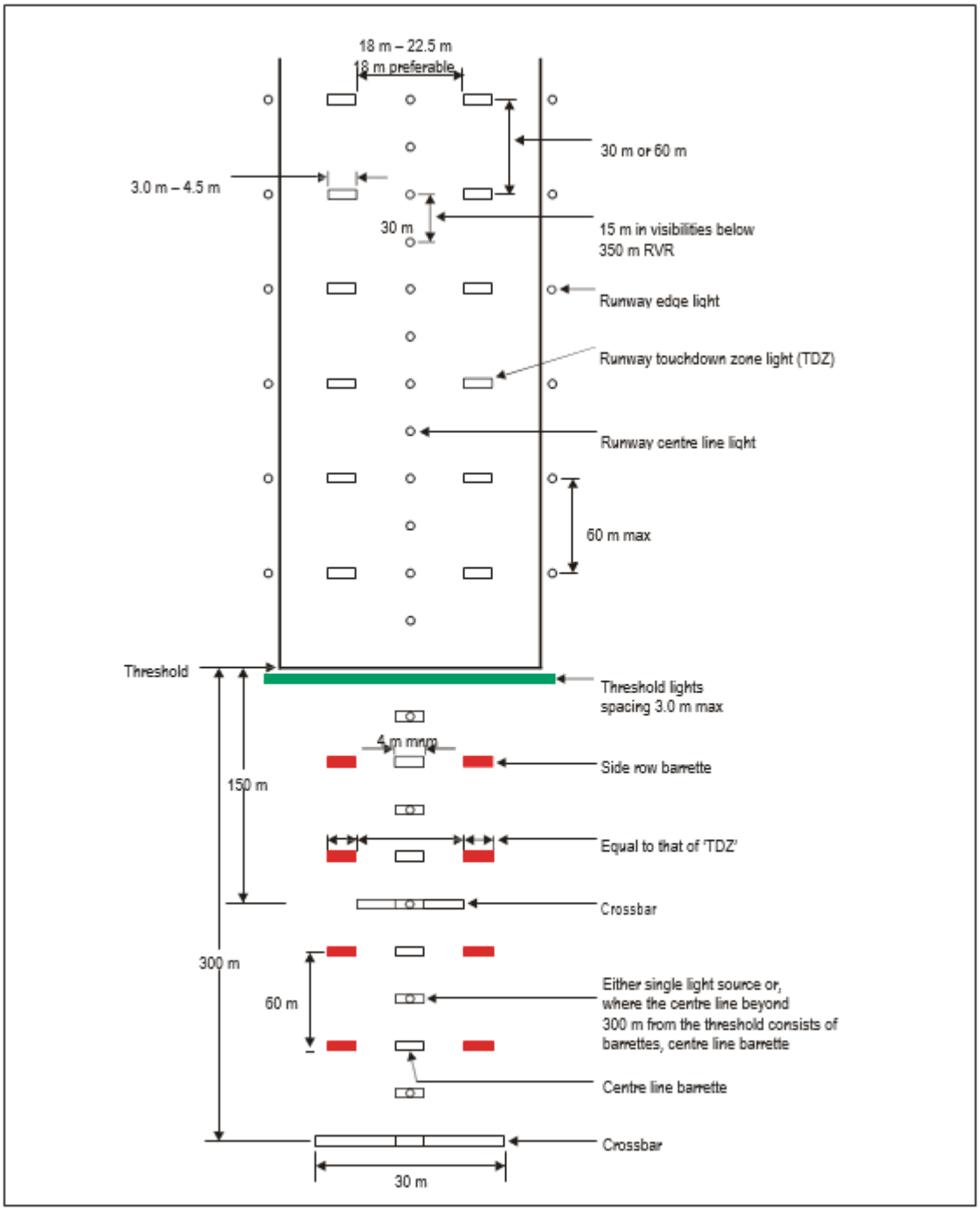


Figure 5-15. Inner 300 m approach and runway lighting for precision approach runways, categories II and III, where the serviceability levels of the lights specified as maintenance objectives in Chapter 10 can be demonstrated

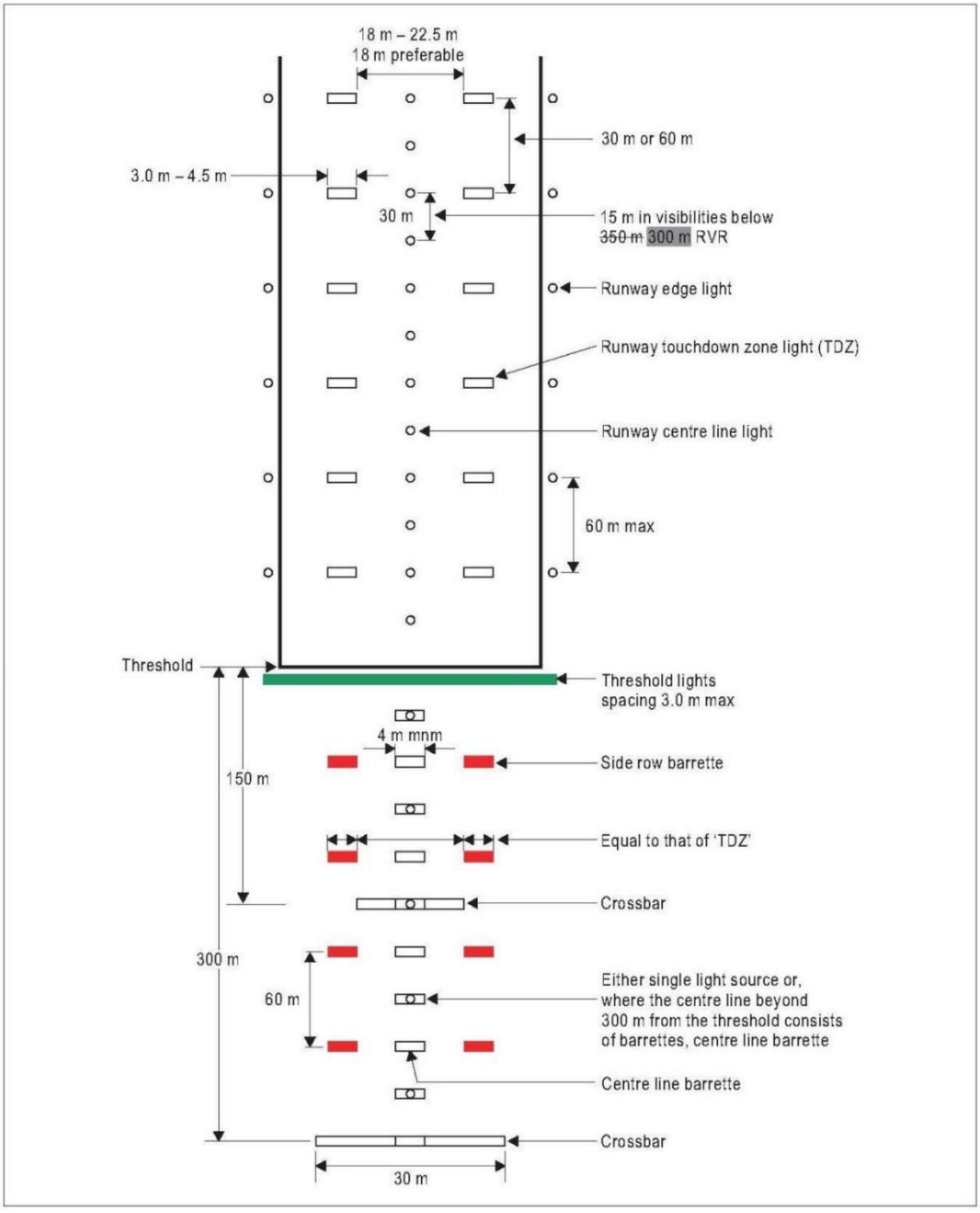


Figure 5-15. Inner 300 m approach and runway lighting for precision approach runways, categories II and III, where the serviceability levels of the lights specified as maintenance objectives in Chapter 10 can be demonstrated

5.3.4.28 Where the additional crossbars described in 5.3.4.27 are incorporated in the system, the outer ends of these crossbars shall lie on two straight lines that

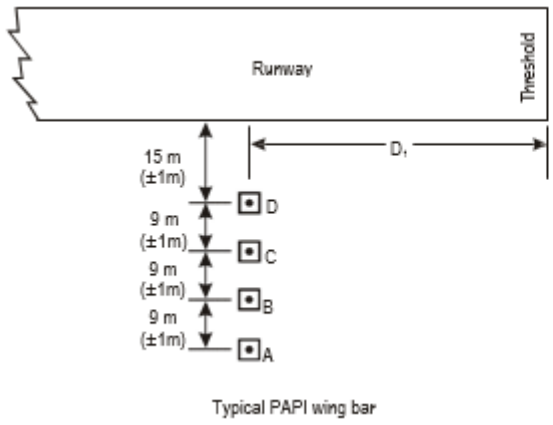
5.3.5.32 The light intensity distribution of the light units shall be as shown in Appendix 2, Figure A2-23.

Note.— See ICAO Visual Aids & Aerodrome Design Manual (Doc 9157), Part 4, for additional guidance on the characteristics of light units.

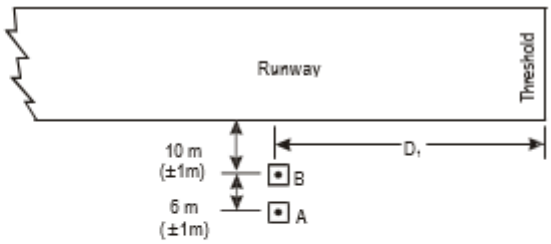
5.3.5.33 Suitable intensity control shall be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

5.3.5.34 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.

5.3.5.35 The light units shall be so designed that deposits of condensation, snow, ice, 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.



Typical PAPI wing bar



Typical APAPI wing bar

INSTALLATION TOLERANCES

a) 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 5-20, angle B for a PAPI and angle A for an APAPI) provides the wheel clearance over the threshold specified in Table 5-2 for the most demanding amongst aeroplanes regularly using the runway.

b) 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 aeroplanes 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 aeroplanes concerned. The correction factor is obtained by multiplying the average eye- to-antenna height of those aeroplanes 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 5-2.

Note.— See Section 5.2.5 for specifications on aiming point marking. Guidance on the harmonization of PAPI, ILS and/or MLS signals is contained in *ICAO Aerodrome Design Manual* (Doc 9157), Part 4.

c) If a wheel clearance, greater than that specified in a) above is required for specific aircraft, this can be achieved by increasing D_1.

d) Distance D1 shall be adjusted to compensate for differences in elevation between the lens centres of the light units and the threshold.

e) 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.

f) A spacing of 6 m (±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 (±1 m) from the runway edge.

Note.— Reducing the spacing between light units results in a reduction in usable range of the system.

g) The lateral spacing between APAPI units may be increased to 9 m (±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 (±1 m) from the runway edge.

igure 5-19. Siting of PAPI and APAPI

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 5.3.5.42 to 5.3.5.46 concerning the related obstacle protection surface.

5.3.5.41 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.

Obstacle protection surface

Note.— The following specifications apply to T-VASIS, AT-VASIS, PAPI and APAPI.

5.3.5.42 An obstacle protection surface shall be established when it is intended to provide a visual approach slope indicator system.

5.3.5.43 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 5-3 and in Figure 5-21.

5.3.5.44 New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when, in the opinion of the appropriate 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 Aerodrome Safeguarding & ICAO Airport Services Manual (Doc 9137), Part 6.

5.3.5.45 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 aeronautical study it is determined that the object would not adversely affect the safety of operations of aeroplanes.

5.3.5.46 Where an aeronautical study indicates that an existing object extending above an obstacle protection surface (OPS) could adversely affect the safety of operations of aeroplanes, 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°; and

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 Visual Aids & the Aerodrome Design Manual (Doc 9157), Part 4.

Note 2.— The displacement of the system upwind of the threshold reduces the operational landing distance.

5.3.6 Circling guidance lights

Application

5.3.6.1 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.

Location

5.3.6.2 The location and number of circling guidance lights should be adequate to enable a pilot, as appropriate, to:

a) 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

b) 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.

5.3.6.3 Circling guidance lights should 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.

Note.— Guidance on installation of circling guidance lights is given in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Characteristics

5.3.6.4 Circling guidance lights should be fixed or flashing lights of an intensity and beam spread adequate for the conditions of visibility and ambient light in which it is intended to make visual circling approaches. The flashing lights should be white, and the steady lights either white or gaseous discharge lights.

5.3.6.5 The lights should 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.

5.3.7 Runway lead-in lighting systems

Application

5.3.7.1 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 Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Location

5.3.7.2 A runway lead-in lighting system should consist of groups of lights positioned so as to define the desired approach path and so that one group may be

Characteristics

5.3.11.4 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.

5.3.11.5 Runway end lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-8.

5.3.12 Runway centre line lights

Application

5.3.12.1 Runway centre line lights shall be provided on a precision approach runway category II or III.

5.3.12.2 Runway centre line lights should be provided on a precision approach runway category I, particularly when the runway is used by aircraft with high landing speeds or where the width between the runway edge lights is greater than 50 m.

5.3.12.3 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 the order of 400 m.

5.3.12.4 Runway centre line lights should be provided on a runway intended to be used for take- off with an operating minimum of an RVR of the order of 400 m or higher when used by aeroplanes with a very high take-off speed, particularly where the width between the runway edge lights is greater than 50 m.

Location

5.3.12.5 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 10.5.7 or 10.5.11, as appropriate, can be demonstrated and the runway is intended for use in runway visual range conditions of ~~350~~ 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.

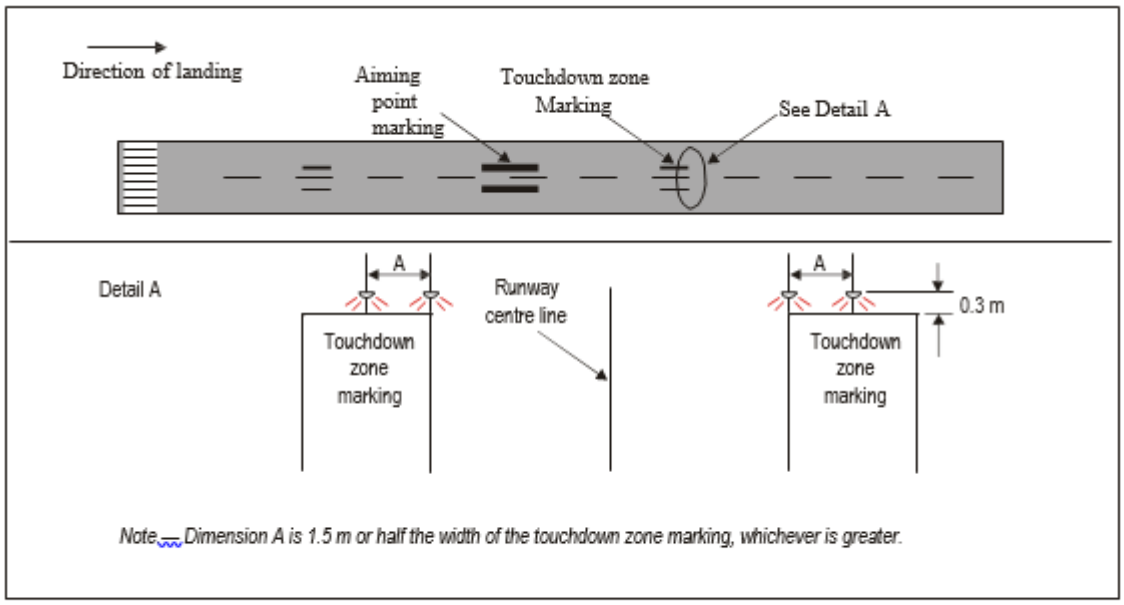


Figure 5-24. Simple touchdown zone lighting

5.3.15 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.

Application

5.3.15.1 Rapid exit taxiway indicator lights should be provided on a runway intended for use in runway visual range conditions less than a value of ~~350~~ 300 m and/or where the traffic density is heavy.

Note.— See Attachment A, Section 15.

5.3.15.2 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 5-25, in full.

Application

5.3.16.1 Stopway lights shall be provided for a stopway intended for use at night.

Location

5.3.16.2 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.

Characteristics

5.3.16.3 Stopway lights shall be fixed unidirectional lights showing red in the direction of the runway.

5.3.17 Taxiway centre line lights

Application

5.3.17.1 Taxiway centre line lights shall be provided on an exit taxiway, taxiway, de-icing/anti-icing facility and apron intended for use in runway visual range conditions less than a value of ~~350~~ 300 m in 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.

5.3.17.2 Taxiway centre line lights should be provided on a taxiway intended for use at night in runway visual range conditions of ~~350~~ 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, narrow taxiway or in snow conditions, this may be done with taxiway edge lights or markers.

5.3.17.3 Taxiway centre line lights should be provided on an exit taxiway, taxiway, de-icing/ anti-icing facility 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.

5.3.17.4 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 ~~350~~ 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 8.2.3 for provisions concerning the interlocking of runway and taxiway lighting systems.

5.3.17.5 Taxiway centre line lights should 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.

Characteristics

5.3.17.6 Except as provided for in 5.3.17.8, 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 aeroplanes on or in the vicinity of the taxiway.

5.3.17.7 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 5-26). The first light 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 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 Part 10, Volume I, Attachments C and G.

Note 4.— See 5.4.3 for specifications on runway vacated signs.

5.3.17.8 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.

a) Appendix 2, Figure A2-12, A2-13, or A2-14, for taxiways intended for use in runway visual range conditions of less than a value of ~~350~~ 300 m; and

b) Appendix 2, Figure A2-15 or A2-16, for other taxiways.

5.3.17.10 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 ~~350~~ 300 m should be in accordance with the specifications of Appendix 2, Figure A2-12. The number of levels of brilliancy settings for these lights should be the same as that for the runway centre line lights.

5.3.17.11 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 should be in accordance with the specifications of Appendix 2, Figure A2-17, A2-18 or A2-19.

Note.— High-intensity centre line lights should only be used in case of an absolute necessity and following a specific study.

Location

5.3.17.12 Recommendation.— Taxiway centre line lights 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.

Taxiway centre line lights on taxiways

Location

5.3.17.13 Taxiway centre line lights on a straight section of a taxiway should be spaced at longitudinal intervals of not more than 30 m, except that:

a) larger intervals not exceeding 60 m may be used where, because of the prevailing meteorological conditions, adequate guidance is provided by such spacing;

b) intervals less than 30 m should be provided on short straight sections; and

c) on a taxiway intended for use in RVR conditions of less than a value of ~~350~~ 300 m, the longitudinal spacing should not exceed 15 m.

5.3.17.14 Taxiway centre line lights on a taxiway curve should continue from the straight portion of the taxiway at a constant distance from the outside edge of the taxiway curve. The lights should be spaced at intervals such that a clear indication of the curve is provided.

5.3.17.15 On a taxiway intended for use in RVR conditions of less than a value of ~~350~~ 300 m, the lights on a curve should not exceed a spacing of 15 m, and on a curve of less than 400 m radius the lights should be spaced at intervals of not greater than 7.5 m. This spacing should extend for 60 m before and after the curve.

Note 1.— Spacings on curves that have been found suitable for a taxiway intended for use in RVR conditions of ~~350~~ 300 m or greater are:

Curve radius	Light spacing
up to 400 m	7.5 m
401 m to 899 m	15 m
900 m or greater	30 m.

Note 2.— See 3.9.5 and Figure 3-2.

Taxiway centre line lights on rapid exit taxiways

Location

5.3.17.16 Taxiway centre line lights on a rapid exit taxiway should 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 aeroplane can be expected to reach normal taxiing speed. The lights on that portion parallel to the runway centre line should always be at least 60 cm from any row of runway centre line lights, as shown in Figure 5-27.

5.3.17.17 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.

Taxiway centre line lights on other exit taxiways

Location

5.3.17.18 Taxiway centre line lights on exit taxiways other than rapid exit taxiways should 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 should be at least 60 cm from any row of runway centre line lights, as shown in Figure 5-27.

5.3.17.19 The lights should be spaced at longitudinal intervals of not more than 7.5 m.

Taxiway centre line lights on runways

Location

5.3.17.20 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 350 m should be spaced at longitudinal intervals not exceeding 15 m.

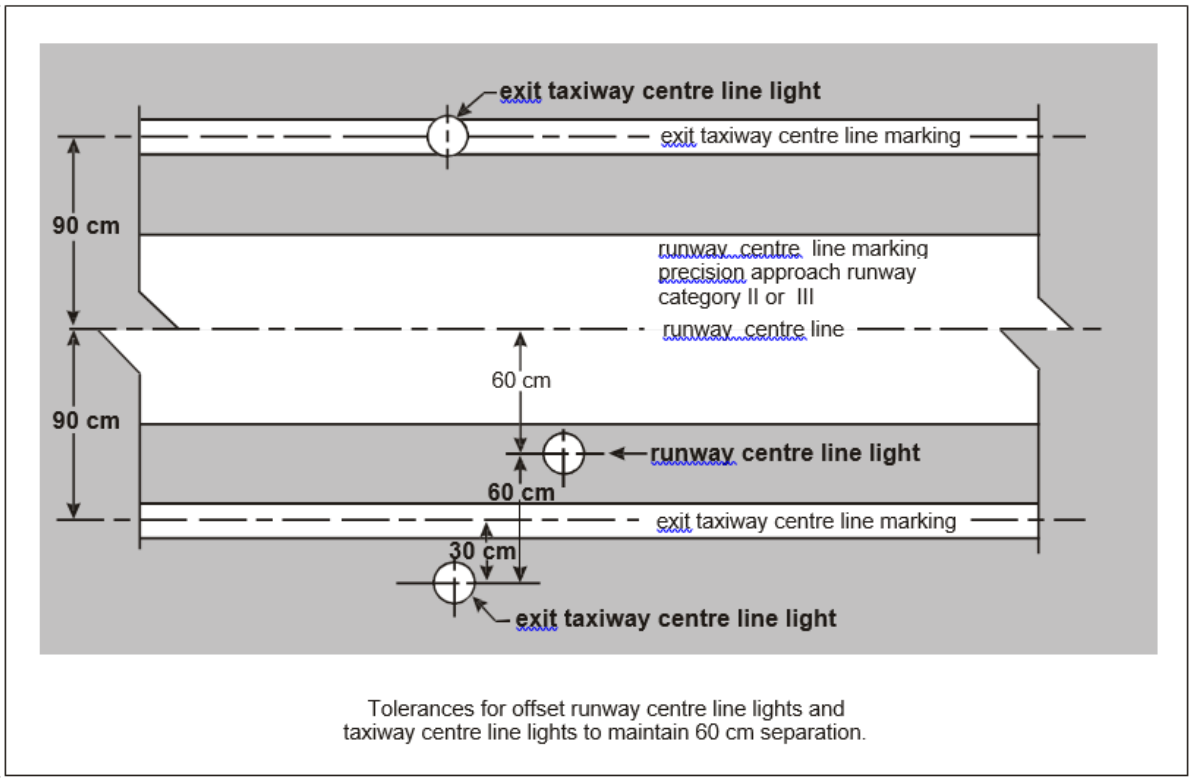


Figure 5-27. Offset runway and taxiway centre line lights

5.3.18 Taxiway edge lights

Application

5.3.18.1 Taxiway edge lights shall be provided at the edges of a runway turn pad, holding bay, de-icing/anti-icing facility, 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.

Note.— See 5.5.5 for taxiway edge markers.

5.3.18.2 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.

Note.— See 8.2.3 for provisions concerning the interlocking of runway and taxiway lighting systems.

Location

5.3.18.3 Taxiway edge lights on a straight section of a taxiway and on a runway forming part of a standard taxi-route should be spaced at uniform longitudinal intervals of not more than 60 m. The lights on a curve should be spaced at intervals less than 60 m so that a clear indication of the curve is provided.

Note.— Guidance on the spacing of taxiway edge lights on curves is given in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.

5.3.18.4 Taxiway edge lights on a holding bay, de-icing/anti-icing facility, apron, etc., should be spaced at uniform longitudinal intervals of not more than 60 m.

5.3.18.5 Taxiway edge lights on a runway turn pad should be spaced at uniform longitudinal intervals of not more than 30 m.

5.3.18.6 The lights should be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, de-icing/anti-icing facility, apron or runway, etc., or outside the edges at a distance of not more than 3 m.

Characteristics

5.3.18.7 Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 75° above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxiing in either direction. At an intersection, 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.

5.3.18.8 The intensity of taxiway edge lights shall be at least 2 cd from 0° to 6°

vertical, and 0.2 cd at any vertical angles between 6° and 75°.

5.3.19 Runway turn pad lights

Application

5.3.19.1 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 aeroplane to complete a 180 degree turn and align with the runway centre line.

5.3.19.2 Runway turn pad lights should be provided on a runway turn pad intended for use at night.

Location

5.3.19.3 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.

5.3.19.4 Runway turn pad lights on a straight section of the runway turn pad marking should be spacedat longitudinal intervals of not more than 15 m.

5.3.19.5 Runway turn pad lights on a curved section of the runway turn pad marking should not exceed a spacing of 7.5 m.

Characteristics

5.3.19.6 Runway turn pad lights shall be unidirectional fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or approaching the runway turn pad.

5.3.19.7 Runway turn pad lights shall be in accordance with the specifications of Appendix 2, Figure A2-13, A2-14 or A2-15, as appropriate.

5.3.20 Stop bars

Application

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.

5.3.20.1 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 ~~350~~ 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:

1) aircraft on the manoeuvring area to one at a time; and

2) vehicles on the manoeuvring area to the essential minimum.

5.3.20.2 Where there is more than one stop bar associated with a taxiway/runway intersection, only one shall be illuminated at any given time.

5.3.20.3 A stop bar should be provided at an intermediate holding position when it is desired to supplement markings with lights and to provide traffic control by visual means.

Location

5.3.20.11 Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications of Appendix 2, Figure A2-17 or A2-19.

5.3.20.12 The lighting circuit shall be designed so that:

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 Electrical Systems & ICAO Aerodrome Design Manual (Doc 9157), Part 5.

5.3.21 Intermediate holding position lights

Note.— See 5.2.11 for specifications on intermediate holding position marking.

Application

5.3.21.1 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 350 m.

5.3.21.2 Intermediate holding position lights should be provided at an intermediate holding position where there is no need for stop-and-go signals as provided by a stop bar.

Location

5.3.21.3 Intermediate holding position lights shall be located along the intermediate holding position marking at a distance of 0.3 m prior to the marking.

Characteristics

Note.— Runway incursions may take place in all visibility or weather conditions. The use of runway guard lig. Runway guard lights is to 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 5-29.

Application

5.3.23.1 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 1 200 m where the traffic density is heavy.

***Note 1**. Runway guard lights, Configuration B may supplement Configuration A when deemed necessary.*

***Note 2**. Guidance on the design, operation and the location of runway guard lights Configuration* B is given in Visual Aids & the Aerodrome Design Manual (Doc 9157), Part 4.

5.3.23.2 As part of runway incursion prevention measures, runway guard lights, Configuration A or B, should 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.

5.3.23.3 Configuration B runway guard lights should not be collocated with a stop bar.

5.3.23.4 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.

Location

5.3.23.5 Runway guard lights, Configuration A, shall be located at each side of the taxiway on the holding side of the runway-holding position marking.

5.3.23.6 Runway guard lights, Configuration B, shall be located across the taxiway on the holding side of the runway-holding position marking.

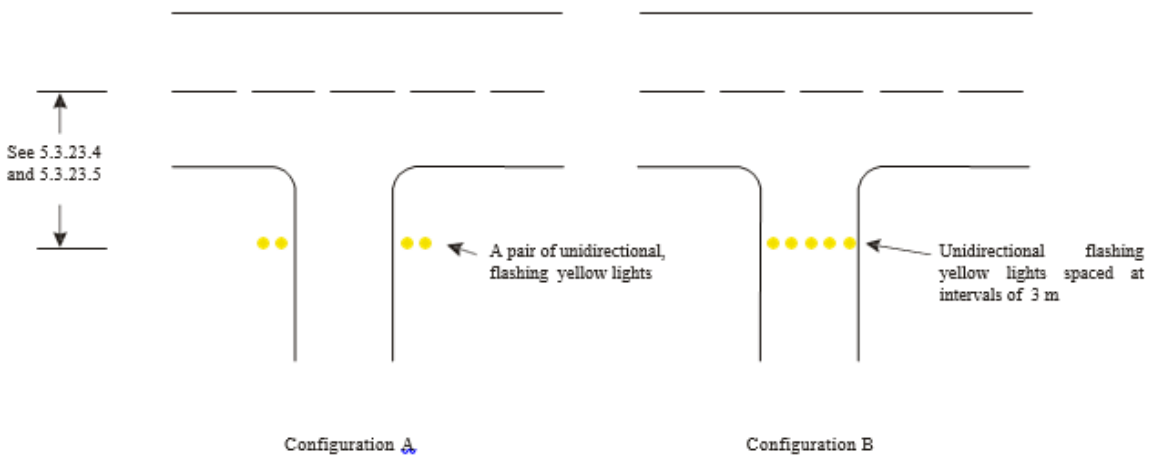


Figure 5-29. Runway guard lights

Characteristics

5.3.23.7 Runway guard lights, Configuration A, shall consist of two pairs of yellow lights.

5.3.23.8 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 should be located above each lamp.

Note.— Some other device or design, e.g. specially designed optics, may be used in lieu of the visor.

5.3.23.9 Runway guard lights, Configuration B, shall consist of yellow lights spaced at intervals of 3 m across the taxiway.

5.3.23.10 The light beam shall be unidirectional and shall show yellow in the direction of approach to the runway holding position.

***Note**. For guidance on orientation and aiming of runway guard lights, see Visual Aids & the Aerodrome Design Manual (Doc 9157) Part 4*

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.

5.3.24 Apron floodlighting

(see also 5.3.17.1 and 5.3.18.1)

Application

5.3.24.1 Apron floodlighting should be provided on an apron, on a de-icing/anti-icing facility and on a designated isolated aircraft parking position intended to be used at night.

***Note 1**.— Where a de-icing/anti-icing facility is located in close proximity to the runway and permanent floodlighting could be confusing to pilots, other means of illumination of the facility may be required.*

***Note 2**.— The designation of an isolated aircraft parking position is specified in 3.14.*

***Note 3**.— Guidance on apron floodlighting is given in Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

Location

5.3.24.2 Apron floodlights should 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 should be such that an aircraft stand receives light from two or more directions to minimize shadows.

Characteristics

5.3.24.3 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.

5.3.24.4 The average illuminance should be at least the following: Aircraft stand:

— horizontal illuminance — 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and

— vertical illuminance — 20 lux at a height of 2 m above the apron in relevant directions. 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.

5.3.25 Visual docking guidance system

Application

5.3.25.1 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.

Note.— *The factors to be considered in evaluating the need for a visual docking guidance system are in particular: the number and type(s) of aircraft using the aircraft stand, weather conditions, space available on the apron and the precision required for manoeuvring into the parking position due to aircraft servicing installation, passenger ~~loading~~ boarding bridges, etc. See Visual Aids & ICAO Aerodrome Design Manual (Doc 9157), Part 4 — Visual Aids for guidance on the selection of suitable systems.*

Characteristics

5.3.25.2 The system shall provide both azimuth and stopping guidance.

5.3.25.3 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.

Note.— Care is required in both the design and on-site installation of the system to ensure that reflection of sunlight, or other light in the vicinity, does not degrade the clarity and conspicuity of the visual cues provided by the system.

5.3.25.4 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.

5.3.25.5 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.

5.3.25.6 The accuracy of the system shall be adequate for the type of passenger boarding~~loading~~ bridge and fixed aircraft servicing installations with which it is to be used.

g) a warning indication if the aircraft goes beyond the appropriate stop position.

5.3.26.7 The A-VDGS shall be capable of providing docking guidance information for all aircraft taxi speeds encountered during the docking manoeuvre.

Note.— *See Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4, for an indication of the maximum aircraft speeds relative to distance to the stopping position.*

5.3.26.8 The time taken from the determination of the lateral displacement to its display shall not result in a deviation of the aircraft, when operated in normal conditions, from the stand centre line greater than 1 m.

5.3.26.9 The information on displacement of the aircraft relative to the stand centre line and distance to the stopping position, when displayed, should be provided with the accuracy specified in Table 5-4.

5.3.26.10 Symbols and graphics used to depict guidance information shall be intuitively representative of the type of information provided.

Note.— The use of colour would need to be appropriate and need to follow signal convention, i.e. red, yellow and green mean hazard, caution and normal/correct conditions, respectively. The effects of colour contrasts would also need to be considered.

5.3.26.11 Information on the lateral displacement of the aircraft relative to the stand centre line shall be provided at least 25 m prior to the stop position.

Note.— The indication of the distance of the aircraft from the stop position may be colour-coded and presented at a rate and distance proportional to the actual closure rate and distance of the aircraft approaching the stop point.

5.3.26.12 Continuous closure distance and closure rate shall be provided from at least 15 m prior to the stop position.

5.3.26.13 Where provided, closure distance displayed in numerals should be provided in metre integers to the stop position and displayed to 1 decimal place at least 3 m prior to the stop position.

5.3.27.4 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.

5.3.27.5 The lights indicating a stop position shall be fixed unidirectional lights showing red.

5.3.27.6 The intensity of the lights should be adequate for the condition of visibility and ambient light in which the use of the aircraft stand is intended.

5.3.27.7 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.

5.3.28 Road-holding position light

Application

5.3.28.1 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 ~~350~~ 300 m.

5.3.28.2 A road-holding position light should 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 of values between ~~350~~ 300 m and 550 m.

~~550 m.~~

Location

5.3.28.3 A road-holding position light shall be located adjacent to the holding position marking 1.5 m (±0.5 m) from one edge of the road, i.e. left or right as appropriate to the local traffic regulations.

Note.— See 9.9 for the mass and height limitations and frangibility requirements of navigation aids located on runway strips.

Characteristics

5.3.28.4 The road-holding position light shall comprise:

a) a controllable red (stop)/green (go) traffic light; or

b) a flashing-red light.

5.3.30.10 RELs and THLs should be automated to the extent that the only control over each system will be to disable one or both systems.

5.4 Signs

5.4.1 General

Note.— Signs shall be either fixed message signs or variable message signs. Guidance on signs is contained in Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Application

5.4.1.1 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 9.8.1.

Note.— See 5.2.17 for specifications on information marking.

5.4.1.2 A variable message sign should be provided where:

a) the instruction or information displayed on the sign is relevant only during a certain period of time; and/or

b) there is a need for variable predetermined information to be displayed on the sign to meet the requirements of 9.8.1.

Characteristics

5.4.1.3 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 5-5~~.~~, except for runway distance remaining signs (see 5.4.8).

5.4.1.4 Mandatory instruction signs and information signs~~Signs~~ shall be rectangular, as shown in Figures 5-30 and 5-31 with the longer side horizontal.

5.4.1.5 The only signs on the movement area utilizing red shall be mandatory instruction signs.

5.4.1.6 The inscriptions on a sign shall be in accordance with the provisions of Appendix 4.

Table 5-5. Location distances for taxiing guidance signs including runway exit signs

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
Code number	Legend	Fcae (Min.)	Installed (Max.)		

5.4.2.17 The inscription on a runway-holding position sign at a runway-holding position established in accordance with

3.12.3 shall consist of the taxiway designation and a number.

5.4.2.18 Where installed, the inscriptions/symbol of Figure 5-30 shall be used.

5.4.3 Information signs

Note1.— *See Figure 5-31 for pictorial representations of information signs.*

Note 2.— *See Chapter 7, 7.4.3 for specifications related to unserviceability signs providing information on operational restrictions and construction works at aerodromes.*

Application

5.4.3.1 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.

5.4.3.2 Information signs shall include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs and intersection take-off signs.

5.4.3.3 A runway exit sign shall be provided where there is an operational need to identify a runway exit.

5.4.3.4 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.

Note.— See 5.3.17 for specifications on colour coding taxiway centre line lights.

5.4.3.5 An intersection take-off sign should be provided when there is an operational need to indicate the remaining take-off run available (TORA) for intersection take-offs.

5.4.3.6 Where necessary, a destination sign should be provided to indicate the direction to a specific destination on the aerodrome, such as cargo area, general aviation, etc.

d) adjacent direction signs shall be delineated by a vertical black line as shown in Figure 5-31.

5.4.3.35 A taxiway shall be identified by a designator that is used only once on an aerodrome comprising a single letter, two letters or a combination of a letter or letters followed by a number.

5.4.3.36 When designating taxiways, the use of words such as inner and outer should be avoided wherever possible .

5.4.3.37 When designating taxiways, the use of the letters I, O or X shall not be used to avoid confusion with the numerals 1, 0 and closed marking.

5.4.3.38 The use of numbers alone on the manoeuvring area shall be reserved for the designation of runways.

5.4.3.39 Apron stand designators should not be the same as taxiway designators.

5.4.4 VOR aerodrome checkpoint sign

Application

5.4.4.1 When a VOR aerodrome checkpoint is established, it shall be indicated by a VOR aerodrome checkpoint marking and sign.

Note.— See 5.2.12 for VOR aerodrome checkpoint marking.

Location

5.4.4.2 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.

Characteristics

5.4.4.3 A VOR aerodrome checkpoint sign shall consist of an inscription in black on a yellow background.

5.4.4.4 The inscriptions on a VOR checkpoint sign should be in accordance with one of the alternatives shown in Figure 5-33 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.

~~4.3 NM — is an example of the distance in nautical miles to a DME collocated with the VOR concerned.~~

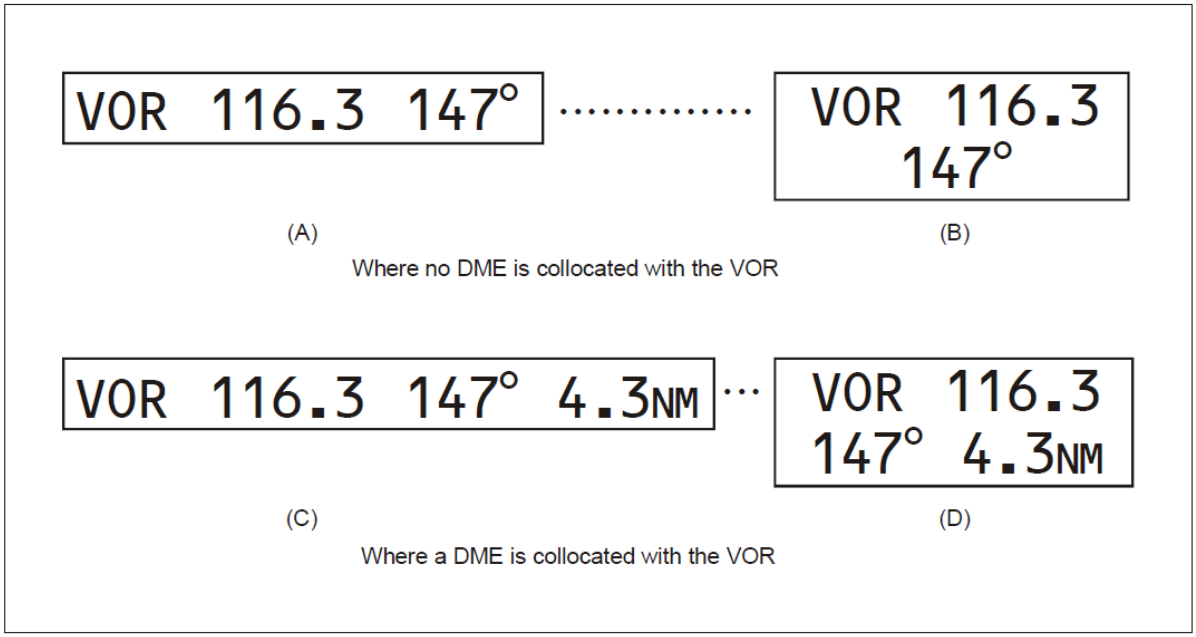


Figure 5-33. VOR aerodrome checkpoint sign

Note.— Tolerances for the bearing value shown on the sign are given in KCASR 10, Volume I, Attachment E. It will be noted that a checkpoint can only be used operationally when periodic checks show it to be consistently within ±2 degrees of the stated bearing.

5.4.5 Aerodrome identification sign

Application

5.4.5.1 An aerodrome identification sign should be provided at an aerodrome where there is insufficient alternative means of visual identification.

Location

5.4.5.2 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.

Characteristics

5.4.5.3 The aerodrome identification sign shall consist of the name of the aerodrome.

5.4.5.4 The colour selected for the sign should give adequate conspicuity when viewed against its background.

Note.— Examples of road-holding position signs are contained in Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

5.4.7.5 A road-holding position sign intended for night use shall be retroreflective or illuminated.

5.4.8 Runway distance remaining signs

Note 1.— *The inclusion of detailed specifications for runway distance remaining signs (RDRS) in this section is not intended to imply that an RDRS has to be provided. Attachment A, Section 23, provides guidance on the need to provide RDRSs. Guidance on installing RDRSs is given in the Aerodrome Design Manual (Doc 9157), Part 4.*

Note 2*.— Runway excursions may take place in all visibility or weather conditions. The use of RDRS can form part of effective runway excursion prevention measures. The purpose of RDRSs is to provide pilots with distance-to-go information to the extremity of the runway, to enhance situational awareness and enable pilots to decide whether to commence a go-around or to apply braking action for more efficient rollout and runway exit speeds. It is essential that pilots operating at aerodromes with RDRS be familiar with the purpose of these signs.*

Note 3.— *Provisions related to the identification of hazards and management of safety risks, including the need for safety risk assessment related to runway safety, is available in PANS-Aerodromes (Doc 9981), Chapter 8.*

Location

5.4.8.1 Where provided, runway distance remaining signs (RDRS) shall be placed along the full length of the runway at longitudinal spacing of approximately 300 m, parallel and equidistant from the runway centre line.

Note.— *Displaced threshold areas that are used for take-off and/or roll-out are treated as part of the runway for purposes of locating the signs.*

5.4.8.2 Runway distance remaining signs shall be placed outside the edges of the runway at a distance shown in Table 5-6.

Characteristics

5.4.8.3 Where provided, an RDRS shall consist of an inscription in white on a black background.

5.4.8.4 The installed height of the RDRS shall not exceed the dimension shown in the appropriate column of Table 5-6. All RDRSs on one runway shall be the same size.

Table 5-6. Location distances for runway distance remaining signs

Sign height (mm)				Perpendicular distance from defined runway pavement edge to near side of sign
Code number	Legend	Face (min.)	Installed (max)	
1 or 2	640	760	1070	6 – 10.5 m
3 or 4	1000	1200	1520	15 – 22.5 m
3 or 4	1200	1500	1600	25 m or more

~~Chapter 5.~~Chapter 6. VISUAL AIDS FOR DENOTING OBSTACLES

6.1 Objects to be marked and/or lighted

***Note 1**. 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 Visual Aids 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.*

6.1.1 Objects within the lateral boundaries of the obstacle limitation surfaces

6.1.1.1 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.

6.1.1.2 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.

6.1.1.3 All obstacles within the distance specified in Table 3-1, 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.

6.1.1.4 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 should 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

accordance with Visual Aids the *Aerodrome Design Manual* (Doc 9157), 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.

f) Beam spread is defined as the angle between the horizontal plane and the directions for which the intensity exceeds that mentioned in the "intensity" column.

Table 6-3. Light distribution for medium- and high-intensity obstacle lights according to benchmark intensities of Table 6-1

Benchmark 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 intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum beam spread	Intensity (a)
200 000	200 000	150 000	75 000	3°	75 000	250 000	112 500	7 500	7°	75 000
100 000	100 000	75 000	37 500	3°	37 500	125 000	56 250	3 750	7°	37 500
20 000	20 000	15 000	7 500	3°	7 500	25 000	11 250	750	N/A	N/A
2 000	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 Visual Aids *ICAO Aerodrome Design Manual* (Doc 9157), 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 plane 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.

Lighting

6.2.2.5 Low-intensity obstacle lights, Type C, shall be displayed on vehicles and other mobile objects excluding aircraft.

Note.— See Part 2 for lights to be displayed by aircraft.

6.2.2.6 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.

6.2.2.7 Low-intensity obstacle lights, Type D, shall be displayed on follow-me vehicles.

6.2.2.8 Low-intensity obstacle lights on objects with limited mobility such as passenger boarding~~aero~~bridges shall be fixed-red, and as a minimum be in accordance with the specifications for low-intensity obstacle lights, Type A, in Table 6-1. 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.

6.2.3 Fixed objects

Note.— The fixed objects of wind turbines are addressed separately in 6.2.4 and the fixed objects of overhead wires, cables, etc., and supporting towers are addressed separately in 6.2.5.

Marking

6.2.3.1 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

6.2.3.2 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 6-1.)

6.2.3.3 An object should be coloured to show alternating contrasting bands if:

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.

a) penetrating a horizontal obstacle limitation surface (OLS) or located outside an 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 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.

6.2.3.14 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.

6.2.3.15 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.

6.2.3.16 High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object shall flash simultaneously.

6.2.3.17 The installation setting angles for high-intensity obstacle lights, Type A, should be in accordance with Table 6-5.

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 Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

6.2.3.18 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.

6.2.5.7 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

6.2.5.8 High-intensity obstacle lights, Type B, should be used to indicate the presence of a tower supporting overhead wires, cables, etc., where:

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.

6.2.5.9 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.

6.2.5.10 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 Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

~~Chapter 6.~~Chapter 7. VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS

7.1 Closed runways and taxiways, or parts thereof

7.1.1 General

7.1.1.1 When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.

7.1.1.2 Lighting systems provided for a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes.

Note.— *Lighting systems provided for a runway include both approach and runway lighting systems.*

7.1.1.3 In addition to closed markings, as specified in 7.1.2 and 7.1.3, when a closed runway or taxiway or portion thereof is intercepted by runway or taxiway which can be used at night, unserviceability lights shall be placed across the entrance to the closed area at intervals not exceeding 3 m (see 7.4.2).

7.1.2 Closed runway marking

Application

7.1.2.1~~1~~ A closed runway marking shall be displayed on a runway ~~or taxiway~~ or portion thereof which is permanently closed to the use of all aircraft.

7.1.2.2 A closed runway 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 and adequate warning by air traffic services is provided.

Location

7.1.~~3~~2.3 ~~On a runway a~~ A closed runway marking shall be placed at each extremity~~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~~.

Characteristics

7.1.2.4~~4~~ The closed runway marking shall be of the form and proportions as detailed in Figure 7-1, Illustration a)~~, when displayed on a runway, and shall be of the form and proportions as detailed in Figure 7-1, 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 1. *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.*

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 (Doc 9981)*

7.1.3 Closed taxiway marking

Application

7.1.3.1 A closed taxiway marking shall be displayed on a runway or taxiway or portion thereof which is permanently closed to the use of all aircraft.

7.1.3.2 A closed taxiway marking should be displayed on a temporarily closedrunway or taxiway or portion thereof, except that such marking may be omitted when the closing is of short duration and adequate warning by air traffic services is provided.

Location

7.1.3.3 A closed taxiway a closed marking shall be placed at least at each extremity of the taxiway or portion thereof closed.

Characteristics

7.1.3.4 The closed taxiway marking shall be yellow and of the form and proportions as detailed in Figure 7-1, Illustration b).

Note 1.— *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.*

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 (Doc 9981)*

7.1.4 Closed runway lighting

Application

7.1.4.1 Recommendation.— Where operationally desirable, at an aerodrome provided with runway lighting, closed runway lighting should be provided on runway (s) that are temporarily closed or temporarily restricted for take-off.

Note 1*.— The purpose of the closed runway lighting is to reduce the likelihood of unintended landings during periods of poor visibility or at night whenever the runway lighting must be switched on for electrical maintenance.*

Note 2.— *In dusk or poor visibility conditions by day, lighting can be more effective than markings.*

Note 3.— *The closed runway lighting is intended to be controlled either automatically or manually by air traffic services or by the aerodrome operator.*

Location

7.1.4.2 A closed runway lighting shall be placed on the centre line near each extremity of the runway temporarily declared closed.

Note.— *Placement of a closed runway lighting would enhance the situational awareness of the runway closure to the pilot.*

Characteristics

7.1.4.3 The closed runway lighting as viewed by the pilot shall be of the equivalent elevated form and proportions as detailed in Figure 7-2, showing a minimum of five lights uniformly spaced on each branch, with a minimum interval as specified by Table 7-1.

~~7.1.5 When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.~~

~~7.1.6 Lighting on a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes.~~

~~7.1.7 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 7.4.4).~~

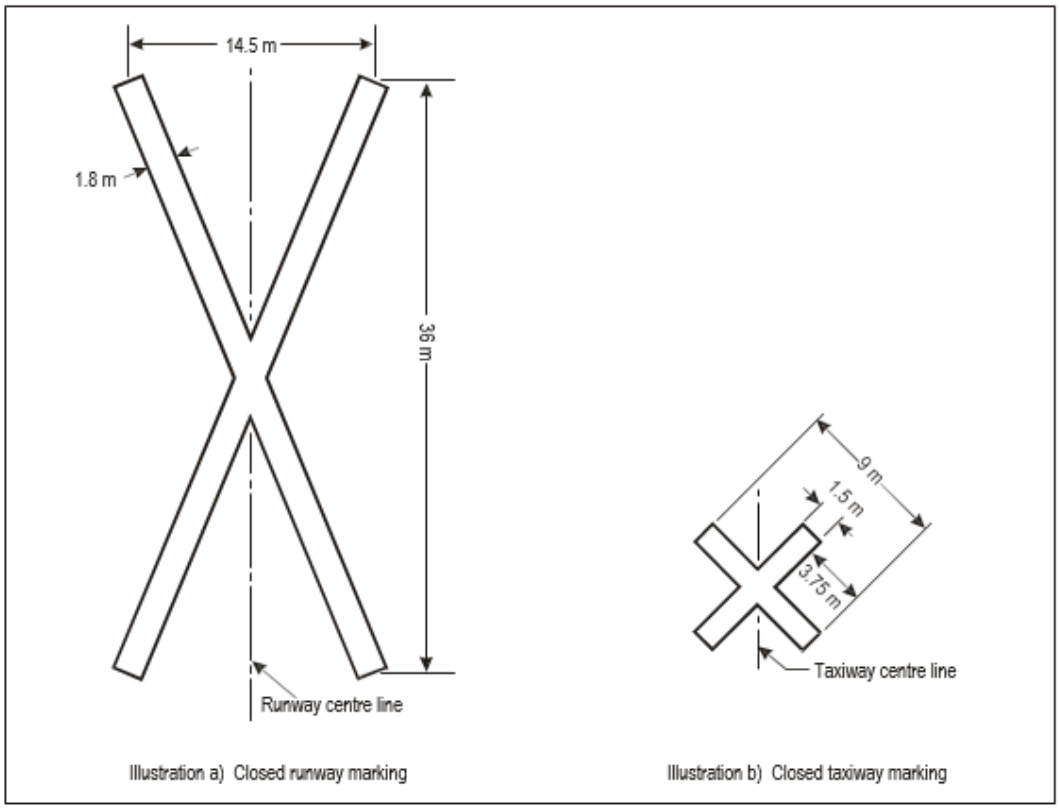


Figure 7-1. Closed runway and taxiway markings

Number of lights per branch	Minimum interval between lights centres
5	1.5 m
7	1.0 m
9	0.8 m

Note 1.— *The closed runway lighting may be either fixed or mobile.*

Note 2.— *The fixed closed runway lighting may be formed as if shadowed (i.e. stretched) from the equivalent elevated structure (see Appendix 3, Note 3). Guidance on the sizing of a fixed closed runway lighting is given in the Aerodrome Design Manual (Doc 9157), Part 4.*

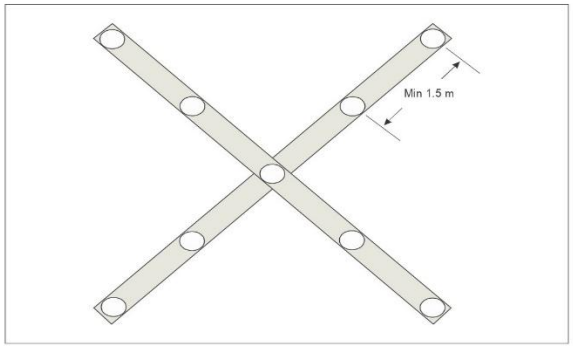


Figure 7-2. Example of equivalent elevated closed runway lighting with five lights per branch

7.1.4.4 Closed runway lights shall show flashing variable white in the direction of approach to the runway, at a rate of one second on and one second off.

7.1.4.5 Closed runway lights shall automatically revert to fixed lights in the event of the flashing system failure.

7.1.4.6 Closed runway lights shall be in accordance with the specifications in Appendix 2, Figure A2-27.

~~7.1~~7.2 Non-load-bearing surfaces

Application

7.2.1 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.

Note.— The marking of runway sides is specified in 5.2.7.

Location

7.2.2 A taxi side stripe marking should 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.

Characteristics

7.2.3 A taxi side stripe marking should 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 Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

~~7.2~~7.3 Pre-threshold area

Application

7.3.1 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 should be marked with a chevron marking.

Location

7.3.2 A chevron marking should point in the direction of the runway and be placed as shown in Figure 7-2.

Characteristics

7.3.3 A chevron marking should be of conspicuous colour and contrast with the colour used for the runway markings; it should preferably be yellow. It should have an overall width of at least 0.9 m.

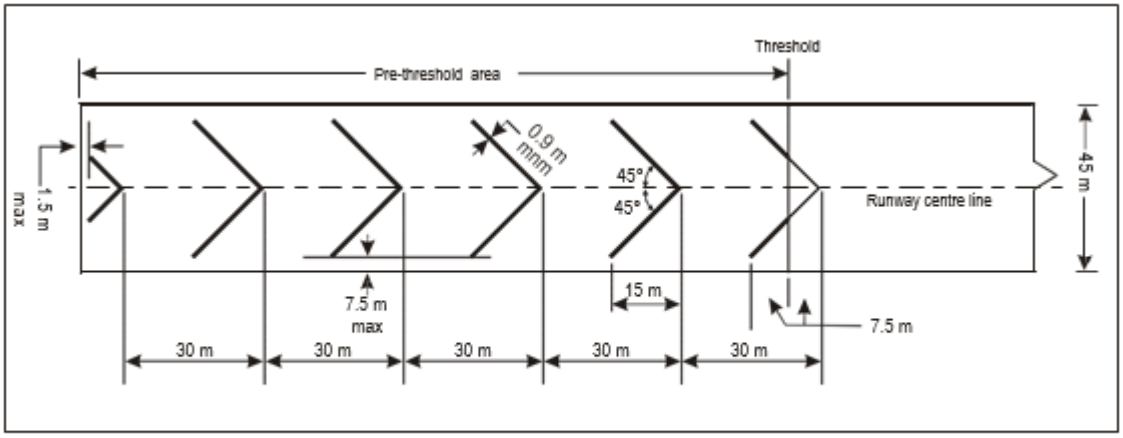


Figure 7-2. Pre-threshold marking

7.4 Unserviceable areas

7.4.1 Unserviceability markings

Application

7.4.1.1 Where operationally required, unserviceability signs should be supplemented by unserviceability markings on the surface of the pavement.

7.4.1.2 Where it is impracticable to install an unserviceability sign in accordance with *7.4.3.1*, an unserviceability marking shall be provided on the surface of the pavement.

Location

7.4.1.3 Unserviceability markings should 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.

Characteristics

7.4.1.4 Unserviceability markings shall consist of an inscription in black upon an orange background.

7.4.1.5 The inscriptions should be in the form and proportions shown in Appendix 3.

7.4.1.6 The background should be rectangular and extend a minimum of 0.5 m laterally and vertically beyond the extremities of the inscription.

7.4.2 Unserviceability lights

7.4.2.1 Unserviceability ~~markers~~ lights shall be provided on a movement area used at night,~~displayed~~ wherever any portion of ~~a taxiway, apron or holding bay~~ the movement area 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 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 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.*

***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 (Doc 9981).*

Location

7.4.2.2 Unserviceability ~~markers and~~ lights shall be placed at intervals sufficiently close so as to delineate the unserviceable area.

***Note.—** Guidance on the location of unserviceability lights is given in Attachment A, Section 14.*

~~**Characteristics of unserviceability markers**~~

~~7.4.3 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones or marker boards.~~

Characteristics ~~of unserviceability lights~~

7.4.~~4~~2.3 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.

7.4.3 Unserviceability signs

***Note 1.—** Temporary changes to the movement area may include, inter alia, reduction in the runway length, reduction in the maximum allowable wingspan, taxiway closure or any other closure to the movement area. Unserviceability signs provide relevant information to aerodrome users to maintain an acceptable level of safety during aircraft and vehicle operations, by reducing the risk of confusion and enhancing the awareness of such temporary changes.*

***Note 2.—** Unserviceability signs can be used to indicate temporary closed or restricted areas, as well*

as to provide information on operational restrictions to aerodrome users.

Application

7.4.3.1 Unserviceability signs shall be provided where there is an operational need to indicate temporary changes to runway declared distances.

7.4.3.2 Unserviceability signs should be provided where there is an operational need to indicate temporary changes to taxiways and aprons.

7.4.3.3 Existing signs shall be removed or obscured at an aerodrome if they provide inadequate or misleading information regarding unserviceability areas.

7.4.3.4 The information provided by unserviceability signs shall not be in conflict with the information provided by the appropriate aeronautical information services.

Note . *The information provided by unserviceability signs supplements that which is provided by the appropriate aeronautical information services unit.*

Location

7.4.3.5 Unserviceability signs shall be located where operationally needed on the movement area. The location distances on the manoeuvring area shall be as per taxiing guidance signs in Table 5-5.

7.4.3.6 The location of unserviceability signs shall not visually obscure or provide conflicting information with existing operationally required visual aids.

Characteristics

7.4.3.7 Unserviceability 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 unserviceability signs shall not exceed the dimension for taxiing guidance signs shown in Table 5-5.

7.4.3.8 Unserviceability signs shall be rectangular, as shown in Figure 7-3, with the longer side horizontal.

7.4.3.9 The inscriptions on an unserviceability sign shall be in accordance with the provisions of Appendix 4.

7.4.3.10 Unserviceability signs shall consist of an inscription in black on an orange background. Unserviceability signs shall be supplemented by a black outline measuring 10 mm in width for runways where the code number is 1 or 2, and 20 mm in width for runways where the code number is 3 or 4.

7.4.3.11 The inscription on an unserviceability sign shall consist of a legible, clear and simple message, only providing the useful and necessary information for the safety of the operation.

Note.— *See Figure 7-3 for examples of unserviceability signs.*

7.4.3.12 Unserviceability signs shall be retroreflective in accordance with the provisions of Appendix 4.

7.4.3.13 Where there is a need to enhance the conspicuity of unserviceability signs, they should be supplemented by two red or yellow simultaneously flashing lights. The intensity and the beam spread of these lights should be in accordance with the specifications in Appendix 2, Figure A2-24.

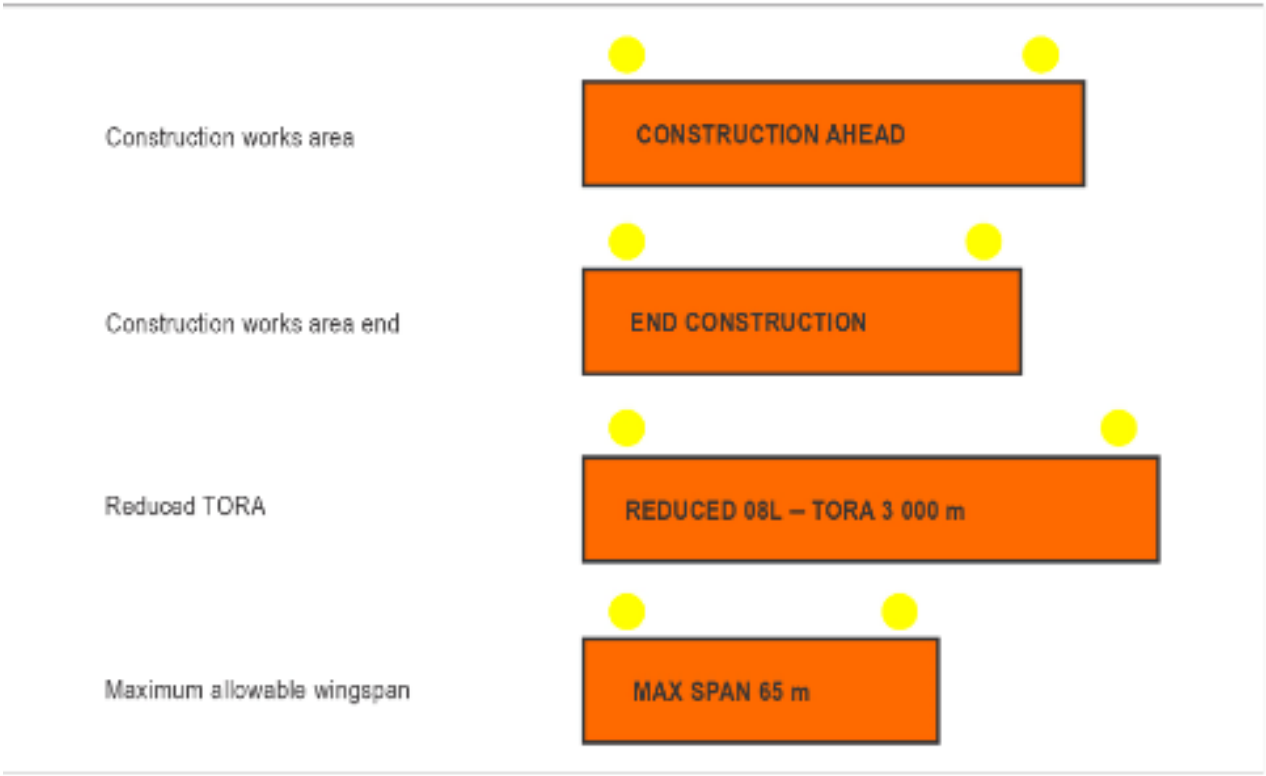


Figure 7-3. Examples of unserviceability signs

7.4.4 Unserviceability markers

Application

7.4.4.1 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.

Note.— Unserviceability markers 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.

Location

7.4.4.2 Unserviceability markers shall be placed at intervals sufficiently close, so as to delineate the unserviceable area.

Characteristics

7.4.4.3 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones or marker boards.

~~**Characteristics of unserviceability cones**~~

7.4.4.~~5~~ 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.

~~Characteristics of unserviceability flags~~

7.4.4.5~~6~~ 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.

~~Characteristics of unserviceability marker boards~~

7.4.4.6~~7~~ 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.

~~Chapter 7.~~Chapter 8. ELECTRICAL SYSTEMS

8.1 Electrical power supply systems for air navigation facilities

Introductory 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.

8.1.1Adequate primary power supply shall be available at aerodromes for the safe functioning of air navigation facilities.

8.1.2The 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 Electrical Systems ICAO Aerodrome Design Manual (Doc 9157), Part 5.

8.1.3Electric power supply connections to those facilities for which secondary power is required should be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.

8.1.4The time interval between failure of the primary source of power and the complete restoration of the services required by 8.1.10 should be as short as practicable, except that for visual aids associated with non-precision, precision approach or take-off runways the requirements of Table 8-1 for maximum switch-over times should apply.

Note.— A definition of switch-over time is given in Chapter 1.

8.1.5The provision of a definition of switch-over time shall not require the replacement of an existing secondary power supply before 1 January 2010. However, 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 Table 8-1 for maximum switch-over times as defined in Chapter 1.

Visual aids

Application

8.1.6For a precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-1 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.

8.1.7For 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 Table 8-1 shall be provided.

8.1.8At an aerodrome where the primary runway is a non-precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-1 should be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.

8.1.9At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of 8.1.4 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 5.3.2 is provided and capable of being deployed in 15 minutes.

8.1.10 The following aerodrome facilities should 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 and the 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) all obstacle lights which, in the opinion of the appropriate authority, are essential to ensure the safe operation of aircraft;

c) approach, runway and taxiway lighting as specified in ~~8.1.6 to~~ 8.1.9;

d) closed runway lighting, if provided in accordance with 7.1.4.1 and connected to the primary power supply;

~~d~~e) meteorological equipment;

~~e~~f) essential security lighting, if provided in accordance with 9.11;

~~f~~g) essential equipment and facilities for the aerodrome responding emergency agencies;

~~g~~h) floodlighting on a designated isolated aircraft parking position if provided in accordance with 5.3.24.1; and

~~h~~i) illumination of apron areas over which passengers may walk.

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

8.1.11 Requirements for a secondary power supply should be met by either of the following:

— 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

— 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 Electrical Systems ICAO Aerodrome Design Manual (Doc 9157), Part 5.

8.2 System design

8.2.1 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 Table 8-1 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 Electrical Systems ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

8.2.2 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.

8.2.3 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.

8.2.4 The electrical systems for the power supply and the control of the closed runway lighting shall be so designed that the closed runway lighting system is operated independently of runway lighting systems.

8.3 Monitoring

***Note.—** Guidance on this subject is given in Electrical Systems ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

8.3.1 A system of monitoring should be employed to indicate the operational status of the lighting systems.

8.3.2 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.

8.3.3 Where a change in the operational status of lights has occurred, an indication should 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.

8.3.4 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 should be monitored automatically

so as to provide an indication when the serviceability level of any element falls below the minimum serviceability level specified in 10.5.7 to 10.5.11, as appropriate. This information should be automatically relayed to the maintenance crew.

8.3.5 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 should be monitored automatically to provide an indication when the serviceability level of any element falls below the minimum level specified by the appropriate authority below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position.

Note.— *Guidance on air traffic control interface and visual aids monitoring is included in Electrical Systems ICAO Aerodrome Design Manual (Doc 9157), Part 5.*

~~Chapter 8.~~Chapter 9. AERODROME OPERATIONAL SERVICES, EQUIPMENT AND INSTALLATIONS

9.1 Aerodrome emergency planning

General

Introductory Note.— Aerodrome emergency planning is the process of preparing an aerodrome to cope with an emergency occurring at the aerodrome or in its vicinity. The objective of aerodrome emergency planning is to minimize the effects of an emergency, particularly in respect of saving lives and maintaining aircraft operations. The aerodrome emergency plan sets forth the procedures for coordinating the response of different aerodrome agencies (or services) and of those agencies in the surrounding community that could be of assistance in responding to the emergency. Guidance material to assist the appropriate authority in establishing aerodrome emergency planning is given in Airport Emergency Planning ICAO Airport Services Manual (Doc 9137), Part 7.

9.1.1 An aerodrome emergency plan shall be established at an aerodrome, commensurate with the aircraft operations and other activities conducted at the aerodrome.

9.1.2 The aerodrome emergency plan shall provide for the coordination of the actions to be taken in an emergency occurring at an aerodrome or in its vicinity.

Note 1.— *Examples of emergencies are: aircraft emergencies, sabotage including bomb threats, unlawfully seized aircraft, dangerous goods occurrences, building fires, natural disaster and public health emergencies.*

Note 2.— *Examples of public health emergencies are increased risk of travellers or cargo spreading a serious communicable disease internationally through air transport and severe outbreak of a communicable disease potentially affecting a large proportion of aerodrome staff.*

9.1.3 The plan shall coordinate the response or participation of all existing agencies which, in the opinion of the appropriate authority, could be of assistance in responding to an emergency.

Note 1.— *Examples of agencies are:*

— on the aerodrome: air traffic control units, rescue and firefighting services, aerodrome administration, medical and ambulance services, aircraft operators, ground handling service providers, security services, and police;

— off the aerodrome: fire departments, police, health authorities (including medical, ambulance, hospital and public health services), military, and harbour patrol or coast guard.

9.2.2 Where an aerodrome is located close to water/swampy areas, or difficult terrain, and where a significant portion of approach or departure operations takes place over these areas, specialist rescue services and firefighting equipment appropriate to the hazard and risk shall be available.

Note 1.— Special firefighting equipment need not be provided for water areas; this does not prevent the provision of such equipment if it would be of practical use, such as when the areas concerned include reefs or islands.

Note 2.— The objective is to plan and deploy the necessary life-saving flotation equipment as expeditiously as possible in a number commensurate with the largest aeroplane normally using the aerodrome.

Note 3.— Additional guidance is available in Rescue and Firefighting Chapter 13 of ICAO Airport Services Manual (Doc 9137), Part 1.

Level of protection to be provided

9.2.3 The level of protection provided at an aerodrome for rescue and firefighting shall be appropriate to the aerodrome category determined using the principles in 9.2.5 and 9.2.6, except that, where the number of movements of the aeroplanes in the highest category normally using the aerodrome is less than 700 in the busiest consecutive three months, the level of protection provided shall be not less than one category below the determined category.

Note.— Either a take-off or a landing constitutes a movement.

9.2.4 The level of protection provided at an aerodrome for rescue and firefighting should be equal to the aerodrome category determined using the principles in 9.2.5 and 9.2.6.

9.2.5 The aerodrome category shall be determined from Table 9-1 and shall be based on the longest aeroplanes normally using the aerodrome and their fuselage width.

Note.— To categorize the aeroplanes using the aerodrome, first evaluate their overall length and second, their fuselage width.

9.2.6 If, after selecting the category appropriate to the longest aeroplane's overall length, that aeroplane's fuselage width is greater than the maximum width in Table 9-1, column 3, for that category, then the category for that aeroplane shall actually be one category higher.

***Note 1**. See guidance in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1, for categorizing aerodromes, including those for all-cargo aircraft operations, for rescue and firefighting purposes.*

***Note 2**. Principles and procedures on training, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981). Further guidance on the training of personnel, rescue equipment for difficult environments and other facilities and services for rescue and firefighting is given in Attachment A, Section 18, and in Rescue and Firefighting ICAO Airport Services Manual ~~(Doc 9137)~~(Doc 9137), Part 1.*

9.2.7 During anticipated periods of reduced activity, the level of protection available shall be no less than that needed for the highest category of aeroplane planned to use the aerodrome during that time irrespective of the number of movements.

Table 9-1. Aerodrome category for rescue and firefighting

Aerodrome category (1)	Aeroplane overall length (2)	Maximum fuselage width (3)
1	0 m up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49 m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Extinguishing agents

9.2.8 Both principal and complementary agents should normally be provided at an aerodrome.

***Note.—** Descriptions of the agents may be found in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.*

9.2.9 The principal extinguishing agent should be:

a) a foam meeting the minimum performance level A; or

b) a foam meeting the minimum performance level B; or

c) a foam meeting the minimum performance level C; or

d) a combination of these agents;

except that the principal extinguishing agent for aerodromes in categories 1 to 3 should preferably meet a performance level B or C foam.

Note.— Information on the required physical properties and fire extinguishing performance criteria needed for a foam to achieve an acceptable performance level A, B or C rating is given in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.

9.2.10 The complementary extinguishing agent should be a dry chemical powder suitable for extinguishing hydrocarbon fires.

Note 1.— When selecting dry chemical powders for use with foam, care must be exercised to ensure compatibility.

Note 2.— Alternate complementary agents having equivalent firefighting capability may be utilized. Additional information on extinguishing agents is given in Rescue and Firefighting the Airport Services Manual (Doc 9137), Part 1.

9.2.11 The amounts of water for foam production and the complementary agents to be provided on the rescue and firefighting vehicles shall be in accordance with the aerodrome category determined under 9.2.3, 9.2.4, 9.2.5, 9.2.6 and Table 9-2, except that for aerodrome categories 1 and 2 up to 100 per cent of the water may be substituted with complementary agent.

For the purpose of agent substitution, 1 kg of complementary agent shall be taken as equivalent to 1.0 L of water for production of a foam meeting performance level A.

Note 1.— The amounts of water specified for foam production are predicated on an application rate of 8.2 L/min/m2 for a foam meeting performance level A, 5.5 L/min/m2 for a foam meeting performance level B and 3.75 L/min/m2 for a foam meeting performance level C.

Note 2.— When any other complementary agent is used, the substitution ratios need to be checked.

9.2.12 At aerodromes where operations by aeroplanes larger than the average size in a given category are planned, the quantities of water should be recalculated and the amount of water for foam production and the discharge rates for foam solution should be increased accordingly.

Note.— Guidance on the determination of quantities of water and discharge rates based on the largest theoretical aeroplane in a given category is available in Rescue and Firefighting Chapter 2 of the Airport Services Manual (Doc 9137), Part 1.

9.2.13 From 1 January 2015, at aerodromes where operations by aeroplanes larger than the average size in a given category are planned, the quantities of water shall be recalculated and the amount of water for foam production and the discharge rates for foam solution shall be increased accordingly.

Note.— Guidance on the determination of quantities of water and discharge rates based on the largest overall length of aeroplane in a given category is available in Rescue and Firefighting Chapter 2 of the Airport Services Manual (Doc 9137), Part 1

Table 9-2. Minimum usable amounts of extinguishing agents

	Foam meeting performance level A		Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Aerodrome category	Water (L)	Discharge rate foam solution/ minute (L)	Water (L)	Discharge rate foam solution/ minute (L)	Water (L)	Discharge rate foam solution/ minute (L)	Dry chemical powders (kg)	Discharge Rate (kg/second)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	350	350	230	230	160	160	45	2.25
2	1 000	800	670	550	460	360	90	2.25
3	1 800	1 300	1 200	900	820	630	135	2.25
4	3 600	2 600	2 400	1 800	1 700	1 100	135	2.25
5	8 100	4 500	5 400	3 000	3 900	2 200	180	2.25
6	11 800	6 000	7 900	4 000	5 800	2 900	225	2.25
7	18 200	7 900	12 100	5 300	8 800	3 800	225	2.25
8	27 300	10 800	18 200	7 200	12 800	5 100	450	4.5
9	36 400	13 500	24 300	9 000	17 100	6 300	450	4.5
10	48 200	16 600	32 300	11 200	22 800	7 900	450	4.5

Note.— The quantities of water shown in columns 2, 4 and 6 are based on the average overall length of aeroplanes in a given category.

9.2.14 The quantity of foam concentrates separately provided on vehicles for foam production shall be in proportion to the quantity of water provided and the foam concentrate selected.

9.2.15 The amount of foam concentrate provided on a vehicle should be sufficient to produce at least two loads of foam solution.

9.2.16 Supplementary water supplies, for the expeditious replenishment of rescue and firefighting vehicles at the scene of an aircraft accident, should be provided.

9.2.17 When a combination of different performance level foams are provided at an aerodrome, the total amount of water to be provided for foam production should be calculated for each foam type and the distribution of these quantities

should be documented for each vehicle and applied to the overall rescue and firefighting requirement.

9.2.18 The discharge rate of the foam solution shall not be less than the rates shown in Table 9-2.

9.2.19 The complementary agents shall comply with the appropriate specifications of the International Organization for Standardization (ISO).*

9.2.20 The discharge rate of complementary agents should be no less than the values shown in Table 9-2.

9.2.21 Dry chemical powders should only be substituted with an agent that has equivalent or better firefighting capabilities for all types of fires where complementary agent is expected to be used.

Note.— Guidance on the use of complementary agents can be found in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.

9.2.22 A reserve supply of foam concentrate, equivalent to 200 per cent of the quantities identified in Table 9- 2, should be maintained on the aerodrome for vehicle replenishment purposes.

Note.— Foam concentrate carried on fire vehicles in excess of the quantity identified in Table 9-2 can contribute to the reserve.

9.2.23 A reserve supply of complementary agent, equivalent to 100 per cent of the quantity identified in Table 9-2, should be maintained on the aerodrome for vehicle replenishment purposes. Sufficient propellant gas should be included to utilize this reserve complementary agent.

9.2.24 Category 1 and 2 aerodromes that have replaced up to 100 per cent of the water with complementary agent should hold a reserve supply of complementary agent of 200 per cent.

9.2.25 Where a major delay in the replenishment of the supplies is anticipated, the amount of reserve supply in 9.2.22, 9.2.23 and 9.2.24 should be increased as determined by a risk assessment.

Note.— *See Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1 for guidance on the conduct of a risk analysis to determine the quantities of reserve extinguishing agents.*

Rescue equipment

9.2.26 Rescue equipment commensurate with the level of aircraft operations should be provided on the rescue and firefighting vehicle(s).

Note.— *Guidance on the rescue equipment to be provided at an aerodrome is given in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.*

Response time

9.2.27 The operational objective of the rescue and firefighting service shall be to achieve a response time not exceeding three minutes to any point of each operational runway, in optimum visibility and surface conditions.

9.2.28 The operational objective of the rescue and firefighting service should be to achieve a response time not exceeding two minutes to any point of each operational runway, in optimum visibility and surface conditions.

9.2.29 The operational objective of the rescue and firefighting service should be to achieve a response time not exceeding three minutes to any other part of the movement area, in optimum visibility and surface conditions.

Note 1.— Response time is considered to be the time between the initial call to the rescue and firefighting service, and the time when the first responding vehicle(s) is (are) in position to apply foam at a rate of at least 50 per cent of the discharge rate specified in Table 9-2.

Note 2.— Optimum visibility and surface conditions are defined as daytime, good visibility, no precipitation with normal response route free of surface contamination, e.g. water, ice or snow.

9.2.30 To meet the operational objective as nearly as possible in less than optimum conditions of visibility, especially during low visibility operations, suitable guidance, equipment and/or procedures for rescue and firefighting services should be provided.

Note.— *Additional guidance is available in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.*

9.2.31 Any vehicles, other than the first responding vehicle(s), required to deliver the amounts of extinguishing agents specified in Table 9-2 shall ensure continuous agent application and shall arrive no more than four minutes from the initial call.

9.2.32 Any vehicles, other than the first responding vehicles(s), required to deliver the amounts of extinguishing agents specified in Table 9-2 should ensure continuous agent application and should arrive no more than three minutes from the initial call.

9.2.41 The minimum number of rescue and firefighting vehicles provided at an aerodrome should be in accordance with the following tabulation:

Aerodrome category	Rescue and firefighting vehicles
1	1
2	1
3	1
4	1
5	1
6	2
7	2
8	3
9	3
10	3

***Note**.— Guidance on minimum characteristics of rescue and firefighting vehicles is given in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.*

Personnel

9.2.42 All rescue and firefighting personnel shall be properly trained to perform their duties in an efficient manner and shall participate in live fire drills commensurate with the types of aircraft and type of rescue and firefighting equipment in use at the aerodrome, including pressure-fed fuel fires.

***Note 1.—** Guidance to assist the appropriate authority in providing proper training is given in Attachment A, Section 18, and Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.*

***Note 2**.— Fires associated with fuel discharged under very high pressure from a ruptured fuel tank are known as "pressure-fed fuel fires".*

9.2.43 The rescue and firefighting personnel training programme shall include training in human performance, including team coordination.

Note.— Guidance material to design training programmes on human performance and team coordination can be found in ICAO Human Factors Training Manual (Doc 9683).

9.2.44 During flight operations, sufficient trained and competent personnel should be designated to be readily available to ride the rescue and firefighting vehicles and to operate the equipment at maximum capacity. These personnel should be deployed in a way that ensures that minimum response times can be achieved and that continuous agent application at the appropriate rate can be

fully maintained. Consideration should also be given for personnel to use hand lines, ladders and other rescue and firefighting equipment normally associated with aircraft rescue and firefighting operations.

9.2.45 In determining the minimum number of rescue and firefighting personnel required, a task resource analysis should be completed and the level of staffing documented in the Aerodrome Manual.

Note. — Guidance on the use of a task resource analysis can be found in Rescue and Firefighting ICAO Airport Services Manual (Doc 9137), Part 1.

9.2.46 All responding rescue and firefighting personnel shall be provided with protective clothing and respiratory equipment to enable them to perform their duties in an effective manner.

9.3 Disabled aircraft removal

Note.— Guidance on removal of a disabled aircraft, including recovery equipment, is given in ICAO Airport Services Manual (Doc 9137), Part 5. See also Part 13 — Aircraft Accident and Incident Investigation concerning protection of evidence, custody and removal of aircraft.

9.3.1 A plan for the removal of an aircraft disabled on, or adjacent to, the movement area should be established for an aerodrome, and a coordinator designated to implement the plan, when necessary.

9.3.2 The disabled aircraft removal plan should be based on the characteristics of the aircraft that may normally be expected to operate at the aerodrome, and include among other things:

a) a list of equipment and personnel on, or in the vicinity of, the aerodrome which would be available for such purpose; and

b) arrangements for the rapid receipt of aircraft recovery equipment kits available from other aerodromes.

9.4 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.*

9.4.1 The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:

a) the establishment of a national procedure for recording and reporting wildlife strikes to aircraft;

b) the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and

c) an ongoing evaluation of the wildlife hazard by competent personnel.

Note.— See Part 15, Chapter 5.

9.4.2 Wildlife strike reports shall be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

Note.— The IBIS is designed to collect and disseminate information on wildlife strikes to aircraft. Information on the system is included in ICAO Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332).

9.4.3 Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

Note. *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 Wildlife Reduction and Control the Airport Services Manual (Doc 9137), Part 3.*

9.4.4 The appropriate authority shall take action to 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. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

9.4.5 The DGCA will give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.

9.5 Apron management service

***Note**. Guidance for ensuring the safety of individuals and aircraft in airside areas is given in CAP: Airside Safety Management.*

9.5.1 When warranted by the volume of traffic and operating conditions, an appropriate apron management service should be provided on an apron by an aerodrome ATS unit, by another aerodrome operating authority, or by a cooperative combination of these, 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.

9.5.2 When the aerodrome control tower does not participate in the apron management service, procedures should 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-Aerodromes (Doc 9981). Guidance on an apron management service is given in ICAO Airport Services Manual (Doc 9137), Part 8, and in ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

9.5.3 An apron management service shall be provided with radiotelephony communications facilities.

9.5.4 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 ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

9.5.5 Aircraft should be allocated to an aircraft stand or apron area appropriate to the aircraft characteristics.

9.5.6 A risk assessment should be carried out if there is a need to allocate aircraft parking to areas other than aircraft stands or apron areas.

***Note .—**The need to allocate aircraft to other areas could arise from situations such as mass diversions, special events, adverse weather conditions, contingency requirements, work in progress, etc..*

9.5.7 When allocating an aircraft to an aircraft stand, the following parameters should be considered:

a) parking aids;

b) facilities serving the aircraft stand;

c) proximity of infrastructure;

d) other parked aircraft in the neighbouring aircraft stands;

e) aircraft stand dependencies; and

f) jet blast and propeller wash related protection.

Apron Safety

9.5.~~5~~8 An emergency vehicle responding to an emergency shall be given priority over all other surface movement traffic.

9.5.~~6~~9 A vehicle operating on an apron shall:

a) give way to an emergency vehicle; an aircraft taxiing, about to taxi, or being pushed or towed; and

b) give way to other vehicles in accordance with local regulations.

9.5.10 Aircraft shall be guided while arriving on or departing from the aircraft stand.

Note.— *Means for guidance can be a visual docking guidance systems, personnel, lighting or markings.*

9.5.~~7~~11 An aircraft stand shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand.

9.5.12 Emergency stop procedures shall be in place to stop an aircraft when entering the stand if the safety of operations on the aircraft stand is compromised.

Note*. Procedures on the training of operational personnel and on apron safety and operations, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 7.*

9.5.13 Personnel, other than those required to assist the initial arrival and departure of the aircraft, shall not be allowed to approach the aircraft when anti-collision lights are turned on and engines are running.

Note.— *This does not apply to helicopter operations as per Annex 6, Part 3.*

9.5.14 Parked aircraft shall be appropriately secured to prevent any unintended movement.

9.6 Aircraft fuelling – Safety considerations ~~Ground servicing of aircraft~~

9.6.1 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 Fueling operations~~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.

9.6.2 When aircraft refuelling operations take place while passengers are embarking, on board or disembarking, ground equipment shall be positioned so as to allow:

a) the use of a sufficient number of exits for expeditious evacuation; and

b) a ready escape route from each of the exits to be used in an emergency.

9.7 Ground handling (Applicable as of 26 November 2026)

Note 1.— *Ground handling can be provided by an aircraft operator, an aerodrome operator or an independent organization. When provided by an aircraft operator or an aerodrome operator, this organization is also considered, as a ground handling service provider (GHSP).*

Note 2*.— A list of ground handling services is provided in the Manual on Ground Handling (Doc 10121), Appendix B.*

9.7.1 Kuwait DGCA/ASD shall regularly assess the impact of ground handling operations on aviation safety.

Note.— *Guidance on the assessment of the impact of ground handling operations on aviation safety is provided in the Manual on Ground Handling (Doc 10121), Chapter 2.*

9.7.2 Kuwait DGCA/ASD should establish criteria for the safety oversight of ground handling as part of their State Safety Programme (SSP).

Note 1.— *Guidance on the establishment of criteria for the safety oversight of ground handling, and approaches for safety oversight are contained in the Manual on Ground Handling (Doc 10121)*

Note 2*.— Provisions on periodically reviewing the need to extend SMS to additional aviation sectors are contained in Annex 19 – Safety Management. Examples of additional aviation sectors can include GHSP.*

9.8 Aerodrome vehicle operations

~~**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 the PANS-Aerodromes (Doc 9981), Part II, Chapter 9*

Note 2. *Guidance on aerodrome vehicle operations is contained in Attachment A, Section 19, and on traffic rules and regulations for vehicles in ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

Note 3*. It is intended that roads located on the movement area be restricted to the exclusive use of aerodrome personnel and other authorized persons, and that access to the public buildings by an unauthorized person will not require use of such roads.*

9.~~7~~8.1 A vehicle shall be operated:

a) on a manoeuvring area only as authorized by the aerodrome control tower; and

b) on an apron only as authorized by the appropriate designated authority.

9.~~7~~8.2 The driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by markings and signs unless otherwise authorized by:

a)the aerodrome control tower when on the manoeuvring area; or

b)the appropriate designated authority when on the apron.

9.~~7~~8.3 The driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by lights.

9.~~7~~8.4 The driver of a vehicle on the movement area shall be appropriately trained for the tasks to be performed and shall comply with the instructions issued by:

a)the aerodrome control tower, when on the manoeuvring area; and

b)the appropriate designated authority, when on the apron.

9.~~7~~8.5 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 designated authority before entering the apron. The driver shall maintain a continuous listening watch on the assigned frequency when on the movement area.

~~9.7 Surface movement guidance and control systems~~

9.9 Surface movement guidance and control systems

Application

9.~~8~~9.1 A surface movement guidance and control system (SMGCS) shall be provided at an aerodrome.

Note.— *Guidance on surface movement guidance and control systems is contained in ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

Characteristics

9.~~8~~9.2 The design of an SMGCS should 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.

9.~~8~~9.3 The visual aid components of an SMGCS, i.e. markings, lights and signs, should be designed to conform with the relevant specifications in 5.2, 5.3 and 5.4, respectively.

9.~~8~~9.4 An SMGCS should be designed to assist in the prevention of inadvertent incursions of aircraft and vehicles onto an active runway.

9.~~8~~9.5 The system should be designed 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 Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

9.~~8~~9.6 Where an SMGCS 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 1.— *See Sections 5.3.17 and 5.3.20 for specifications on taxiway centre line lights and stop bars, respectively.*

Note 2.— *Guidance on installation of stop bars and taxiway centre line lights in SMGCSs is given in Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

9.~~8~~9.7 Surface movement radar for the manoeuvring area should be provided at an aerodrome intended for use in runway visual range conditions less than a value of 350 m.

9.~~8~~9.8 Surface movement radar for the manoeuvring area should be provided at an aerodrome other than that in 9.8.7 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 radar is given in ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and in the Air Traffic Services Planning Manual (Doc 9426).*

9.10 Siting of equipment and installations on operational areas

Note 1*.— Requirements for obstacle limitation surfaces are specified in 4.2.*

Note 2.— *The design of light fixtures and their supporting structures, light units of visual approach slope indicators, signs, and markers, is specified in 5.3.1, 5.3.5, 5.4.1 and 5.5.1, respectively. Guidance on the frangible design of visual and non-visual aids for navigation is given in ICAO Aerodrome Design Manual (Doc 9157), Part 6.*

9.~~9~~10.1 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 Table 3-1, column 11, if it would endanger an aircraft; or

b) on a clearway if it would endanger an aircraft in the air.

9.~~9~~10.2 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:

1) 75 m of the runway centre line where the code number is 3 or 4; or

2) 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 3-1; or

c) on a clearway and which would endanger an aircraft in the air; shall be frangible and mounted as low as possible.

9.~~9~~10.3 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 should be regarded as an obstacle and should be frangible and mounted as low as possible.

Note.— Guidance on the siting of navigation aids is contained in ICAO Aerodrome Design Manual (Doc 9157), Part 6.

9.~~9~~10.4 Unless its function requires it to be there for air navigation or for aircraft safety purposes, 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.

9.~~9~~10.5 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:

1) 60 m of the extended runway centre line where the code number is 3 or 4; or

2) 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.

~~shall be frangible and mounted as low as possible.~~

9.~~9~~10.6 Any equipment or installation required for air navigation or for aircraft safety purposes which is an obstacle of operational significance in accordance with 4.2.4, 4.2.11, 4.2.20 or 4.2.27 should be frangible and mounted as low as possible.

9.11 Fencing

Application

9.~~10~~11.1 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.

9.~~10~~11.2 A fence or other suitable barrier shall be provided on an aerodrome to deter the inadvertent or premeditated access of an unauthorized 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 unauthorized person to runways or taxiways which overpass public roads.*

9.~~10~~11.3 Suitable means of protection shall be provided to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safety of civil aviation located off the aerodrome.

Location

9.~~10~~11.4 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.

9.~~10~~11.5 When greater security is thought necessary, a cleared area should be provided on both sides of the fence or barrier to facilitate the work of patrols and to make trespassing more difficult. Consideration should be given to the provision of a perimeter road inside the aerodrome fencing for the use of both maintenance personnel and security patrols.

9.12 Security lighting

At an aerodrome where it is deemed desirable for security reasons, a fence or other barrier provided for the protection of international civil aviation and its facilities should be illuminated at a minimum essential level. Consideration should be given to locating lights so that the ground area on both sides of the fence or barrier, particularly at access points, is illuminated.

9.13 Autonomous runway incursion warning system

***Note 1**.— The inclusion of detailed specifications for an autonomous runway incursion warning system (ARIWS) in this section is not intended to imply that an ARIWS has to be provided at an aerodrome.*

***Note 2.—** The implementation of an ARIWS is a complex issue deserving careful consideration by aerodrome operators, air traffic services and States, and in coordination with the aircraft operators.*

***Note 3**.— Attachment A, Section 21, provides a description of an ARIWS and information on its use.*

Characteristics

9.~~12~~13.1 Where an ARIWS is installed at an aerodrome:

a) it shall provide autonomous detection of a potential incursion or of the occupancy of an active runway and a direct warning to a flight crew or vehicle operator;

b) it shall function and be controlled independently of any other visual system on the aerodrome;

c) its visual aid components, i.e. lights, shall be designed to conform with the relevant specifications in 5.3; and

d) failure of part or all of it shall not interfere with normal aerodrome operations. To this end, provision shall be made to allow the ATC unit to partially or entirely shut down the system.

***Note 1.—** An ARIWS may be installed in conjunction with enhanced taxiway centre line markings, stop bars or runway guard lights.*

***Note 2.—** It is intended that the system(s) be operational under all weather conditions, including low visibility.*

***Note 3.—** An ARIWS may share common sensory components of an SMGCS or A-SMGCS, however, it operates independently of either system.*

9.~~12~~13.2 Where an ARIWS is installed at an aerodrome, information on its characteristics and status shall be provided to the appropriate aeronautical information services for

~~Chapter 9.~~Chapter 10. AERODROME MAINTENANCE

10.1 General

10.1.1 A maintenance programme, including preventive maintenance where appropriate, shall be established at an aerodrome to maintain facilities in a condition which does not impair the safety, regularity or efficiency of air navigation.

Note 1.— *Preventive maintenance is programmed maintenance work done in order to prevent a failure or degradation of facilities.*

Note 2.— *"Facilities" are intended to include such items as pavements, visual aids, fencing, drainage systems, electrical systems and buildings.*

10.1.2 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 ICAO Human Factors Training Manual (Doc 9683) and in ICAO Airport Services Manual (Doc 9137), Part 8 – Airport Operational Services.*

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

10.2 Pavements

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

Note 1*.— See 2.9.3 for inspections of movement areas.*

Note 2.— *Procedures on carrying out daily inspections of the movement area and control of FOD are given in ICAO PANS-Aerodromes (Doc 9981), ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and 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 ICAO Airport Services Manual (Doc 9137), Part 9.*

Note 4.— *Guidance on precautions to be taken in regard to the surface of shoulders is given in Attachment A, Section 9, and 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 2.6.6 c), particular attention should be given to the integrity of light fittings in the pavement and pavement joints.*

10.2.2 The surface of a runway shall be maintained in a condition such as to prevent formation of harmful irregularities.

Note.— *See Attachment A, Section 5.*

10.2.3 A paved runway shall be maintained in a condition so as to provide surface friction characteristics at or above the minimum friction level specified by the State.

Note.— The State 's runway friction levels can be found in CAP: Pavement Surface Conditions . ~~*Until 3 November 2021, ICAO Airport Services Manual (Doc 9137), Part 2, contains further information on this subject, on improving surface friction characteristics of runways.*~~

CAP: Global Reporting Format for Runway Surface Condition ~~*As of 4 November 2021,*~~ *Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 329) contains further information on this subject.*

10.2.4 Runway surface friction characteristics for maintenance purposes 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.

~~*Note 1.— Until 3 November 2021, Guidance on evaluating the friction characteristics of a runway is provided in Attachment A, Section 7.Additional guidance is included in ICAO Airport Services Manual (Doc 9137), Part 2.Note 1.— As of 4 November 2021, guidance on evaluating the runway surface friction characteristics is provided in Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 329).*~~

Note 1. *Guidance on evaluating the runway surface friction characteristics is provided in CAP: Pavement Surface Conditions Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 355).*

Note 2*.—* ~~*Until 3 November 2021,*~~ *The objective of 10.2.3 to 10.2.*~~*6*~~ *8 is to ensure that the surface friction characteristics for the entire runway remain at or above a minimum friction level specified by the State.*

~~*Note 2.— As of 4 November 2021, the objective of 10.2.3 to 10.2.7 and 10.2.9 is to ensure that the surface friction characteristics for the entire runway remain at or above a minimum friction level specified by the State.*~~

~~*Note 3.— Until 3 November 2021, Guidance for the determination of the required frequency is provided in Attachment A, Section 7 and in ICAO Airport Services Manual (Doc 9137), Part 2, Appendix 5.*~~

10.2.5 ~~As of 5 November 2021, when~~ When runway surface friction measurements are made for maintenance purposes using a self-wetting continuous friction measuring device, the performance of the device shall meet the standard set or agreed by the State.

10.2.6 ~~As of 4 November 2021, personnel~~ Personnel measuring runway surface friction required in 10.2.5 shall be trained to fulfil their duties.

10.2.7 Corrective maintenance action shall be taken to prevent the runway surface friction characteristics for either the entire runway or a portion thereof from falling below a minimum friction level specified by the State.

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

~~10.2.8 Until 3 November 2021, 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.~~

10.2.8 ~~As of 4 November 2021, the~~ The runway surface should be visually assessed, as necessary, under natural or simulated rain conditions for ponding or poor drainage and where required, corrective maintenance action taken.

10.2.9 When a taxiway is used by turbine-engined 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 CAP Pavement Surface Conditions & ICAO Aerodrome Design Manual (Doc 9157), Part 2.

10.3 Removal of contaminants

10.3.1 Snow, slush, ice, 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 minimize accumulation.

~~*Note.— Until 3 November 2021, The above requirement does not imply that winter operations on compacted snow and ice are prohibited. Guidance on snow removal and ice control and removal of other contaminants is given in ICAO Aerodrome Services Manual (Doc 9137), Parts 2 and 9.*~~

Note.— ~~*As of 4 November 2021*~~, ~~*the*~~ *The above requirement does not imply that winter operations on compacted snow and ice are prohibited. Information on snow removal and ice control and removal of other contaminants is given in the PANS-Aerodromes (Doc 9981).*

10.3.2 Taxiways should be kept clear of snow, slush, ice, etc., to the extent necessary to enable aircraft to be taxied to and from an operational runway.

10.3.3 Aprons should be kept clear of snow, slush, ice, etc., to the extent necessary to enable aircraft to manoeuvre safely or, where appropriate, to be towed or pushed.

10.3.4 Whenever the clearance of snow, slush, ice, etc., from the various parts of the movement area cannot be carried out simultaneously, the order of priority after the runway(s) in use should be set in consultation with the affected parties such as rescue and firefighting service and documented in a snow plan.

Note ~~*1*~~*. — See PANS-AIM (Doc 10066),, Appendix 2, Part 3, AD 1.2.2 for information to be promulgated in an AIP concerning a snow plan. ICAO Aeronautical Information Services Manual (Doc 8126), contains guidance on the description of a snow plan including general policy concerning operational priorities established for the clearance of movement areas.*

~~*Note 2. — Until 3 November 2021, ICAO Airport Services Manual (Doc 9137), Part 8, Chapter 6, specifies that an aerodrome snow plan clearly defines, inter alia, the priority of surfaces to be cleared.*~~

10.3.5 Chemicals to remove or to prevent the formation of ice and frost on aerodrome pavements should be used when conditions indicate their use could be effective. Caution should be exercised in the application of the chemicals so as not to create a more slippery condition.

~~*Note. — Until 3 November 2021 Guidance on the use of chemicals for aerodrome pavements is given in ICAO Airport Services Manual (Doc 9137), Part 2.*~~

Note.— ~~*As of 4 November 2021,*~~ ~~*information*~~ *Information on the use of chemicals for aerodrome pavements is given in the PANS-Aerodromes (Doc 9981).*

10.3.6 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.

~~10.3.6 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.~~

10.5 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. Aerodrome operators who have come to expect the melting of ice and snow by this heat signature may wish to evaluate whether or not a modified maintenance schedule is required during such conditions, or evaluate the possible operational value of installing LED fixtures with heating elements.*

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

10.5.1 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 2. For light units where the main beam average intensity is required to be higher than the value specified in the appropriate figure in Appendix 2, a light shall be deemed to be unserviceable when the main beam average intensity value is less than 50 per cent of this higher value and not the value specified in Appendix 2. ~~For light units where the designed main beam average intensity is above the value shown in Appendix 2, the 50 per cent value shall be related to that design value.~~

Note.— *Guidance on maintenance criteria for aeronautical ground lights, on the use of a site standard and on using a higher main beam average intensity is contained in the Aerodrome Design Manual (Doc 9157), Part 4.*

10.5.2 A system of preventive maintenance of visual aids shall be employed to ensure lighting and marking system reliability.

Note.— *Guidance on preventive maintenance of visual aids is given in Aerodorme Maintenance ICAO Airport Services Manual (Doc 9137), Part 9.*

10.5.3 The system of preventive maintenance employed for a precision approach runway category II or III should include at least the following checks:

a) visual inspection and in-field measurement of the intensity, beam spread and orientation of lights included in the approach and runway lighting systems;

b) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and

c) control of the correct functioning of light intensity settings used by air traffic control.

10.5.4 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

visual range conditions less than a value of ~~350~~ 300 m shall have the following objectives:

a) no more than two lights will remain unserviceable; and

b) two adjacent lights will not remain unserviceable unless the light spacing is significantly less than that specified.

10.5.9 The system of preventive maintenance employed for a taxiway intended for use in runway visual range conditions less than a value of ~~350~~ 300 m shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.

10.5.10 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:

a) precision approach category I lighting system;

b) runway threshold lights;

c) runway edge lights; and

d) 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.

10.5.11 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 shall have as its objective that, during any period of operations, all runway lights are serviceable and that in any event:

a) 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

b) 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.

10.5.12 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

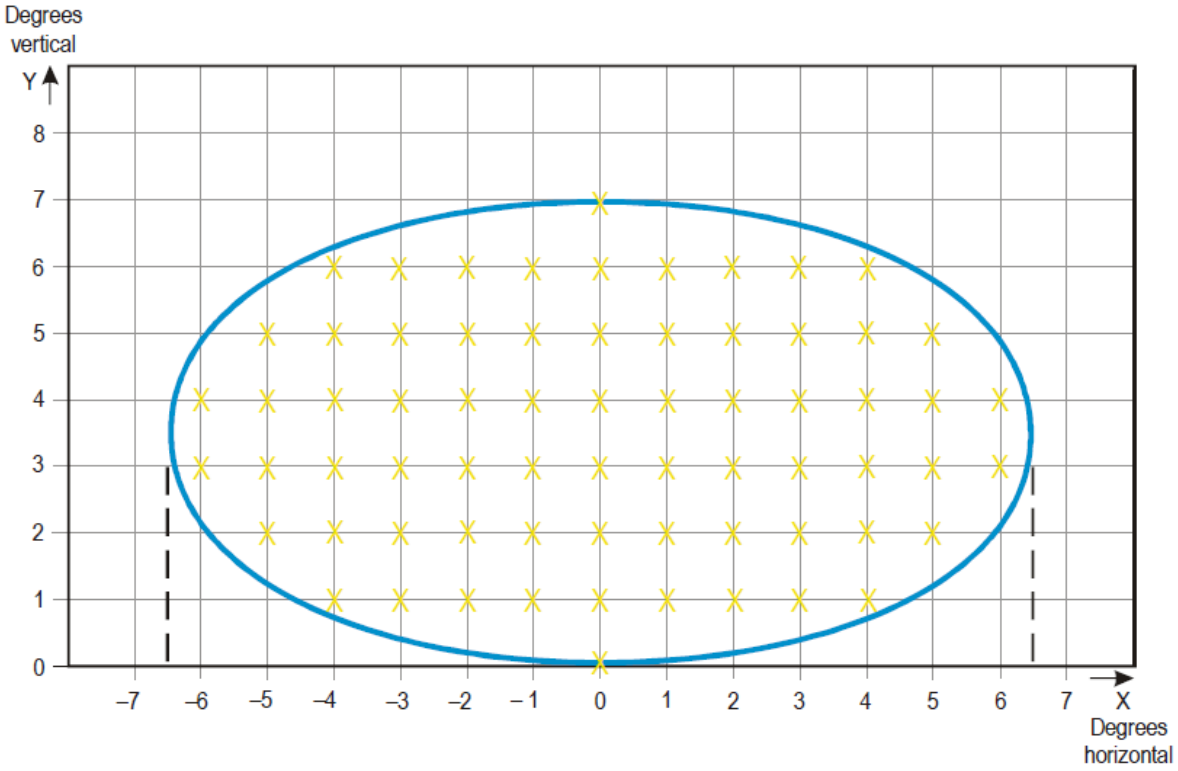


Figure A2-11. Grid points to be used for the calculation of average intensity of approach and runway lights

Collective notes to Figures A2-1 to A2-11 ~~and~~ , A2-26 and A2-27

1. The ellipses in each figure are symmetrical about the common vertical and horizontal axes.

2. Figures A2-1 to A2-10, as well as Figure A2-26, show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-11 and using the intensity value 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. The average intensity within the ellipse defining the main beam of a new light is established as a ratio of the minimum (1.0) average intensity of a new Runway edge light. The ratios also define the maximum allowed main beam average intensity for the lights in the lighting system supporting runway operations. Guidance on

maintenance criteria for aeronautical ground lights and the use of a site standard is contained in the Aerodrome Design Manual (Doc 9157), Part 4.~~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 A2-1 Approach centre line and crossbars 2.0 to 3.0 ~~1.5 to 2.0~~ (white light)

Figure A2-2 Approach side row 0.5 to 1.0 (red light)

Figure A2-3 Threshold 1.0 to 1.5 (green light)

Figure A2-4 Threshold wing bar 1.0 to 1.5 (green light)

Figure A2-5 Touchdown zone0.5 to 1.0 (white light)

Figure A2-6 Runway centre line (longitudinal spacing 30 m) 0.5 to 1.0 (white light)

Figure A2-7 Runway centre line (longitudinal spacing 15 m) 0.5 to 1.0 for CAT III (white light) 0.25 to 0.5 for CAT I, II (white light)

Figure A2-8 Runway end 0.25 to 0.5 (red light)

Figure A2-9 Runway edge (45 m runway width) 1.0 to 1.5 (white light)

Figure A2-10 Runway edge (60 m runway width) 1.0 to 1.5 (white light)

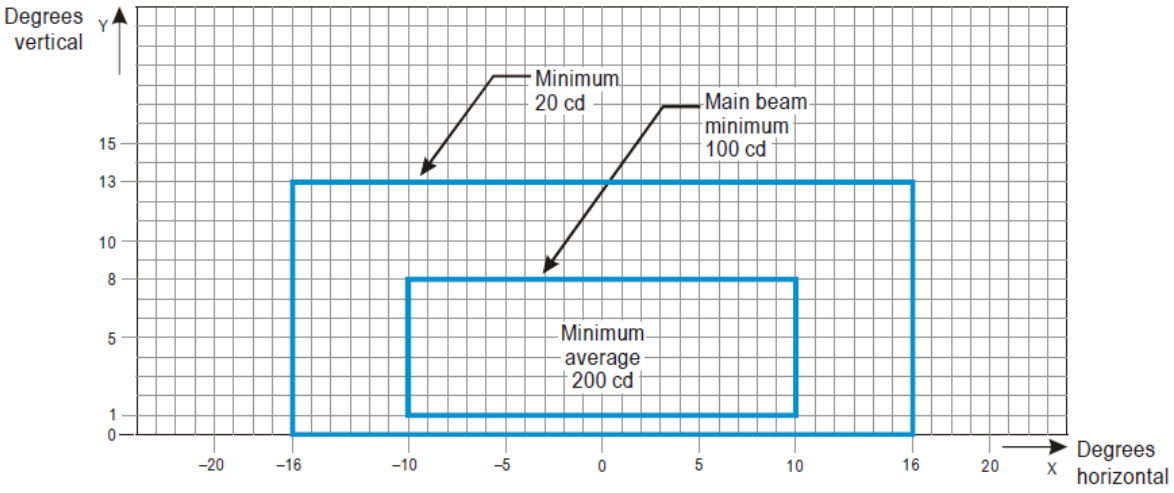
5. The beam coverages in the figures provide the necessary guidance for approaches down to an RVR of the order of 150 m and take-offs down to an RVR of the order of 100 m.

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 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 overemphasized. 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.

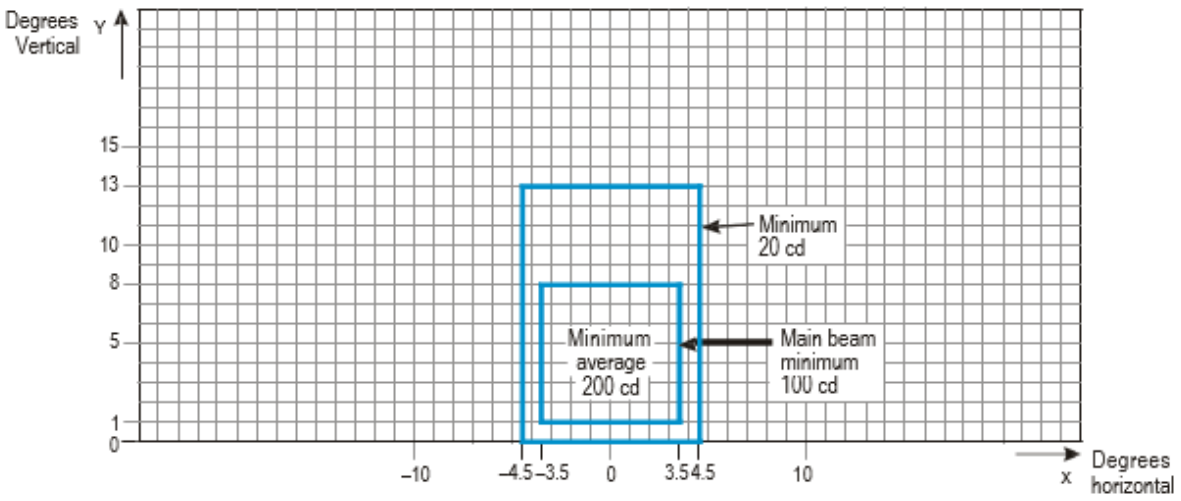


Notes:

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 A2-12 to A2-21.*
3. *Increased intensities for enhanced rapid exit taxiway centre line lights as recommended in 5.3.16.9 are four times the respective intensities in the figure (i.e. 800 cd for minimum average main beam).*

Figure A2-12. 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

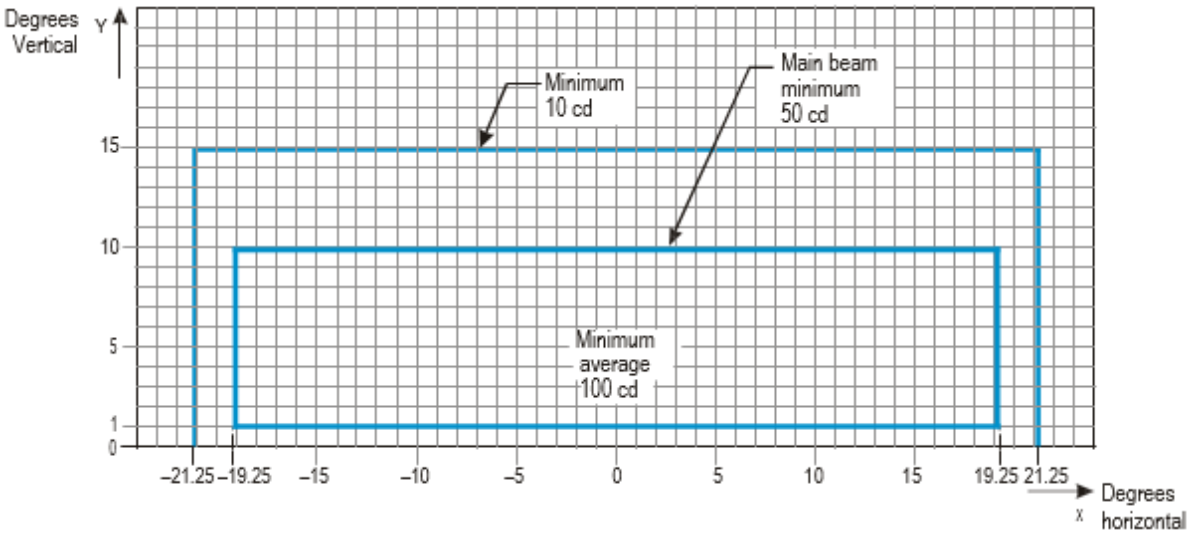
~~in runway visual range conditions of less than a value of 350 m where large offsets can occur and for low-intensity runway guard lights, Configuration B~~



Notes:

1. *These beam coverages 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 A2-12 to A2-21.*

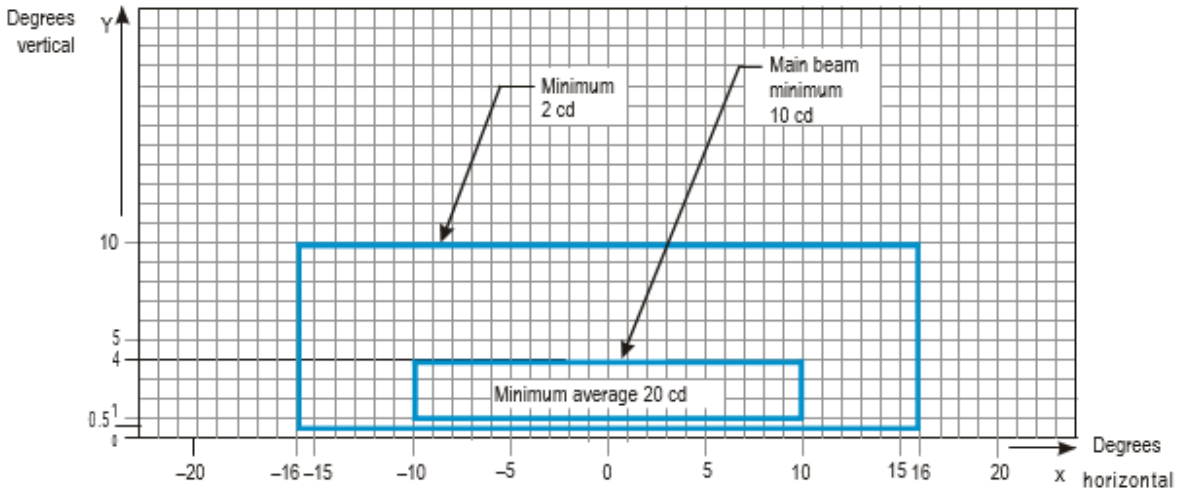
Figure A2-13. Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of ~~350~~ 300 m



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 100 cd and minimum average 200 cd.*
3. *See collective notes for Figures A2-12 to A2-21.*

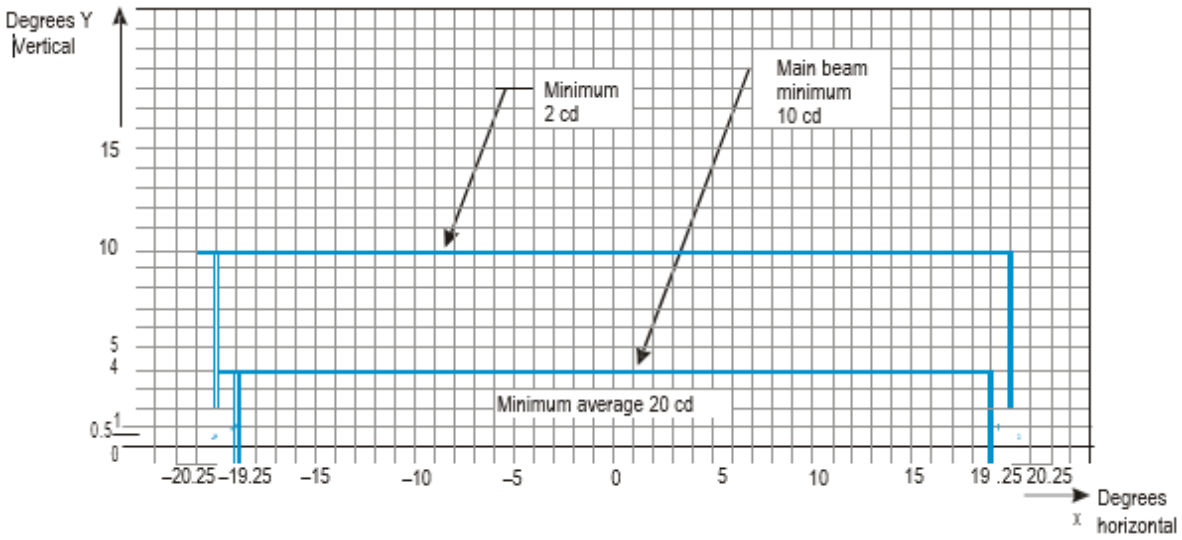
Figure A2-14. Isocandela diagram for taxiway centre line (7.5 m spacing), RELs, no-entry bar and stop bar lights in curved sections intended for use in runway visual range conditions of less than a value of ~~350~~ 300 m.



Notes:

1. *At locations where high background luminance is usual and where deterioration of light output resulting from dust, snow 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 A2-12 to A2-21.*

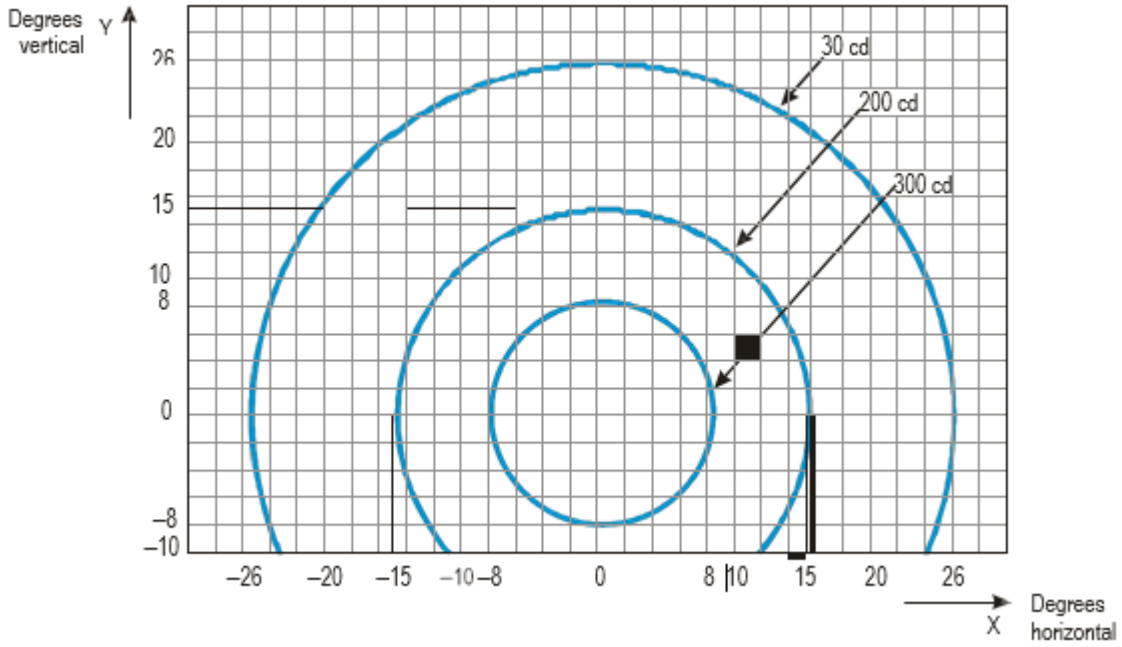
Figure A2-15. Isocandela diagram for taxiway centre line (30 m, 60 m spacing), no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of ~~350~~ 300 m or greater.



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, snow 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 A2-12 to A2-21.*

Figure A2-16. 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 ~~350~~ 300 m or greater.

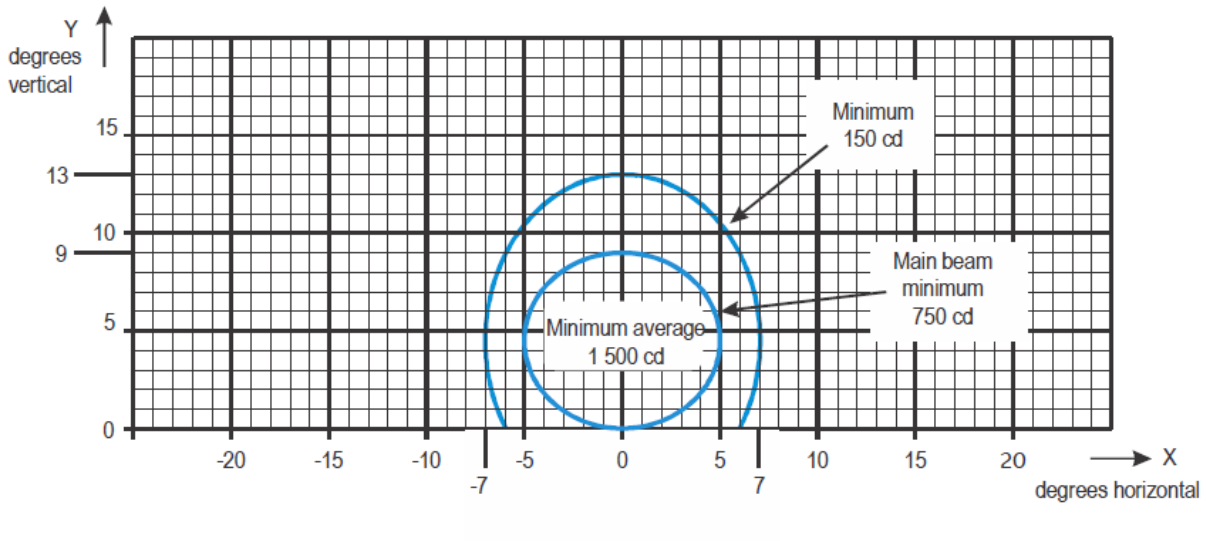


Notes:

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 A2-24. Isocandela diagram for each light in low-intensity runway guard lights, Configuration A and for flashing lights supplementing unserviceability signs



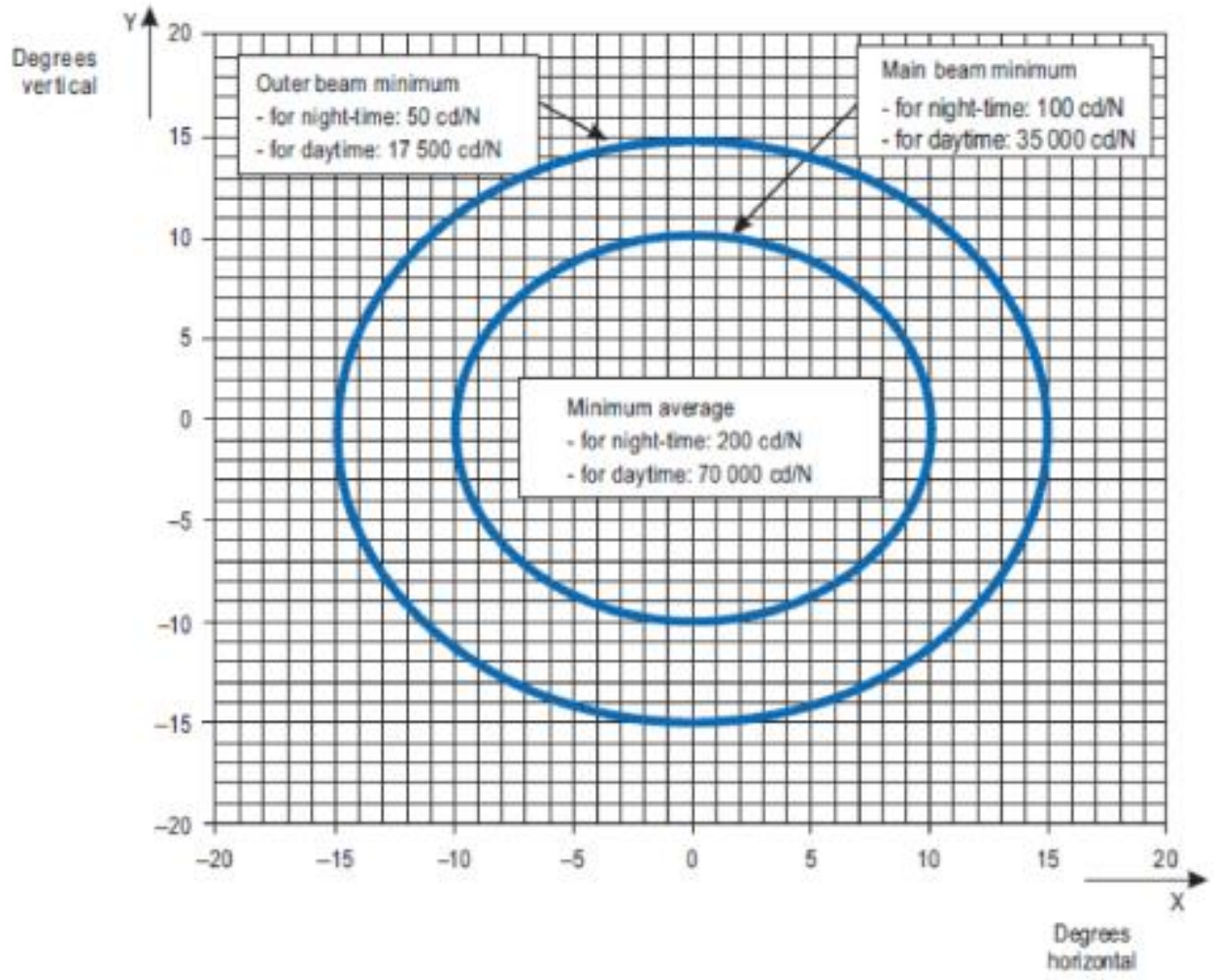
Notes:

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 A2-1 to A2-11 and A2-26.

Figure A2-26. Isocandela diagram for 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	10	15
b	10	15

2. N is the total number of lights of the closed runway lighting.

3. See collective notes for Figures A2-1 to A2-11, A2-26 and A2-27.

Figure A2-27. Isocandela diagram for closed runway lights (white light)

APPENDIX 4. REQUIREMENTS CONCERNING DESIGN OF ~~TAXIING GUIDANCE~~ SIGNS

~~*Note.— See Chapter 5, Section 5.4, for specifications on the application, location and characteristics of signs.*~~

1. Inscription heights shall conform to the following tabulation.

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 (see 5.4.3.22), the character size shall be that specified for mandatory instruction signs.

2. Arrow dimensions shall be as follows:

Legend height	Stroke
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

3. Stroke width for single letter shall be as follows:

Legend height	Stroke
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

4. 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/m2
Yellow	150 cd/m2
White	300 cd/m2

b) Where operations are conducted in accordance with 5.4.1.7 b) and c) and 5.4.1.8, average sign luminance shall be at least:

Red	10 cd/m2
Yellow	50 cd/m2
White	100 cd/m2

Note.— In runway visual range conditions less than a value of 400 m, there will be some degradation in the performance of signs.

5. The luminance ratio between red and white elements of a mandatory sign shall be between 1:5 and 1:10.

6. The average luminance of the sign is calculated by establishing grid points as shown in Figure A4-1 and using the luminance values measured at all grid points located within the rectangle representing the sign.

7. The average value is the arithmetic average of the luminance values measured at all considered grid points.

Note.— Guidance on measuring the average luminance of a sign is contained in ICAO Aerodrome Design Manual (Doc 9157), Part 4.

8. 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.

9. The forms of characters, i.e. letters, numbers, arrows and symbols for mandatory instruction and information signs, shall conform to those shown in Figure A4-2. The width of characters and the space between individual characters shall be determined as indicated in Table A4-1.

Note.— Guidance on the width of characters and the space between individual characters for RDRS is contained in the Aerodrome Design Manual (Doc 9157), Part 4 — Visual Aids.

10. The face height of signs shall be as follows:

Legend height	Face height (min)
200 mm	300 mm

300 mm	450 mm
400 mm	600 mm

11. The face width of mandatory instruction and information signs shall be determined using Figure A4-4 except that, where a mandatory instruction sign is provided on one side of a taxiway only, 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 Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.*

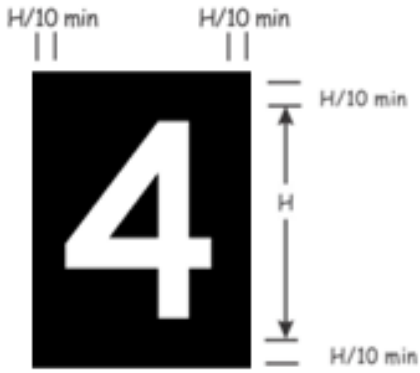
12. The face width of runway distance remaining sign (RDRS) shall be determined using Figure A4-5.

~~12~~13. 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.

~~13~~14. The colours of signs shall be in accordance with the appropriate specifications in Appendix 1.



Explanatory Note to Figure A4-5: "H" stands for the inscription height.

Figure A4-5. Sign dimensions for RDRS

~~6. Assessing the surface friction characteristics of snow-, slush-, ice- and frost-covered paved surfaces (Applicable until 3 November 2021)~~

~~6.1 There is an operational need for reliable and uniform information concerning the surface condition of contaminated runways. Contaminant type, distribution and for loose contaminants, depth are assessed for each third of the runway. An indication of surface friction characteristics is helpful in conducting runway condition assessment. It can be obtained by friction measuring devices; however, there is no international consensus on the ability to correlate the results obtained by such equipment directly with aircraft performance. However, for contaminants such as slush, wet snow and wet ice, contaminant drag on the equipment's measuring wheel, amongst other factors, may cause readings obtained in these conditions to be unreliable.~~

~~6.2 Any friction measuring device intended predict aircraft braking performance according to an agreed local or national procedure should be shown to correlate such performance in a manner acceptable to the State. Information on the practice of one State providing correlation directly with aircraft braking performance can be found in Appendix A of Assessment, Measurement and Reporting of Runway Surface Conditions (ICAO Cir 329).~~

~~6.3 The friction conditions of a runway can be assessed in descriptive terms of "estimated surface friction". The estimated surface friction is categorized as good, medium to good, medium, medium to poor, and poor, and promulgated in PANS-AIM (Doc 10066), Appendix 24, "SNOWTAM format" as well as in PANS-ATM, Chapter 12, 12.3, "ATC phraseologies".6.4 The table below with associated descriptive terms was developed from friction data collected only in compacted snow and ice and should not therefore be taken to be absolute values applicable in all conditions. If the surface is affected by snow or ice and the estimated surface friction is reported as "good", pilots should not expect to find conditions as good as on a clean dry runway (where the available friction may well be greater than that needed in any case). The value "good" is a comparative value and is intended to mean that aeroplanes should not experience directional control or braking difficulties, especially when landing. The figures in the "Measured Coefficient μ" column are given as an indication. At each aerodrome a specific table can be developed according to the measuring device used on the aerodrome and according to the standard and correlation criteria set or agreed by the State. The μ values given will be specific to each friction measuring device as well as to the surface being measured and the speed employed~~

Measured coefficient μ	*Estimated surface friction*	*Code*
0.40 and above	Good	5
0.39 to 0.36	Medium to good	4
0.35 to 0.30	Medium	3
0.29 to 0.26	Medium to poor	2
0.25 and below	Poor	1

~~6.5 Relating braking action to friction measurements has been elusive over the years. The main reason is that the industry to date has not achieved the ability to control the total uncertainty associated with the readings from these devices. Consequently, readings from a friction measuring device should be used only as part of an overall runway condition assessment. A major difference between the decelerometer type of devices and the other types is that when using the decelerometer type the operator is an integrated part of the measuring process. In addition to carrying out the measurement, the operator can feel the behaviour of the vehicle where the decelerometer is installed and by that feel the deceleration process. This gives additional information in the total assessment process.~~

~~6.6 It has been found necessary to provide assessed surface condition information, including estimated surface friction, for each third of a runway. The thirds are called A, B and C. For the purpose of reporting information to aeronautical service units, section A is always the section associated with the lower runway designation number. When giving landing information to a pilot before landing, the sections are however referred to as 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. Assessments are made along two lines parallel to the runway, i.e. along a line on each side of the centre line approximately 3 m, or that distance from the centre line at which most operations take place. The objective of the assessment is to determine the type, depth and coverage of the contaminants and their effect on estimated surface friction, given the prevailing weather conditions for sections A, B and C. In cases where a continuous friction measuring device is used, the mean values are obtained from the friction values recorded for each section. In cases where a spot measuring friction measuring device is used as part of the total assessment of estimated surface friction, each third of the runway should have a minimum of three tests carried out on it where achievable. Information collected and assessed on the state of pavement surface is disseminated using forms prepared by the State for SNOWTAM and NOTAM (see ICAO Airport Services Manual (Doc 9137) Part 2).~~

~~6.7 ICAO Airport Services Manual (Doc 9137), Part 2 provides guidance on the uniform use of test equipment and other information on removal of surface contamination and improvement of friction conditions.~~

6. Runway condition report for reporting runway surface condition ~~(Applicable 4 November 2021)~~

6.1 On a global level, movement areas are exposed to a multitude of climatic conditions and consequently a significant difference in the condition to be reported. The runway condition report (RCR) describes a basic methodology applicable for all these climatic variations and is structured in such a way that States can adjust them to the climatic conditions applicable for that State or region.

6.2 The concept of the RCR is premised on:

a) an agreed set of criteria used in a consistent manner for runway surface condition assessment, aeroplane (performance) certification and operational performance calculation;

b) a unique runway condition code (RWYCC) linking the agreed set of criteria with the aircraft landing and takeoff performance table, and related to the braking action experienced and eventually reported by flight crews;

c) reporting of contaminant type and depth that is relevant to take-off performance;

d) a standardized common terminology and phraseology for the description of runway surface conditions that can be used by aerodrome operator inspection personnel, air traffic controllers, aircraft operators and flight crew; and

e) globally-harmonized procedures for the establishment of the RWYCC with a built-in flexibility to allow for local variations to match the specific weather, infrastructure and other particular conditions.

6.3 These harmonized procedures are reflected in a runway condition assessment matrix (RCAM) which correlates the RWYCC, the agreed set of criteria and the aircraft braking action which the flight crew should expect for each value of the RWYCC.

6.4 Procedures which relate to the use of the RCAM are provided in the PANS-Aerodromes (Doc 9981).

6.5 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).

6.6 This is further amplified by the need for providing the assessed information in the proper format for dissemination, which requires insight into the limitations set by the syntax for dissemination. This in turn restricts the wording of plain text remarks that can be provided.

6.7 It is important to follow standard procedures when providing assessed information on the runway surface conditions to ensure that safety is not compromised when aeroplanes use wet or contaminated runways. Personnel should be trained in the

16. Intensity control of approach and runway lights

16.1 The conspicuity of a light depends on the impression received of contrast between the light and its background. If a light is to be useful to a pilot by day when on approach, it must have an intensity of at least 2 000 or 3 000 cd, and in the case of approach lights an intensity of the order of 20 000 cd is desirable. In conditions of very bright daylight fog it may not be possible to provide lights of sufficient intensity to be effective. On the other hand, in clear weather on a dark night, an intensity of the order of 100 cd for approach lights and 50 cd for the runway edge lights may be found suitable. Even then, owing to the closer range at which they are viewed, pilots have sometimes complained that the runway edge lights seemed unduly bright.

16.2 In fog the amount of light scattered is high. At night this scattered light increases the brightness of the fog over the approach area and runway to the extent that little increase in the visual range of the lights can be obtained by increasing their intensity beyond 2 000 or 3 000 cd. In an endeavour to increase the range at which lights would first be sighted at night, their intensity must not be raised to an extent that a pilot might find excessively dazzling at diminished range.

16.3 From the foregoing will be evident the importance of adjusting the intensity of the lights of an aerodrome lighting system according to the prevailing conditions, so as to obtain the best results without excessive dazzle that would disconcert the pilot. The appropriate intensity setting on any particular occasion will depend both on the conditions of background brightness and the visibility. Detailed guidance material on selecting intensity setting for different conditions is given in Visual Aids ICAO Aerodrome Design Manual (Doc 9157), Part 4.

17. Signal area

signal area need be provided only when it is intended to use visual ground signals to communicate with aircraft in flight. Such signals may be needed when the aerodrome does not have an aerodrome control tower or an aerodrome flight information service unit, or when the aerodrome is used by aeroplanes not equipped with radio. Visual ground signals may also be useful in the case of failure of two-way radio communication with aircraft. It should be recognized, however, that the type of information which may be conveyed by visual ground signals should normally be available in AIPs or NOTAM. The potential need for visual ground signals should therefore be evaluated before deciding to provide a signal area.

~~20. The ACN-PCN method of reporting pavement strength (Applicable until 27 November 2024)~~

20. The ACR-PCR method of reporting pavement strength ~~(Applicable as of 28 November 2024)~~

20.1 Overload operations

20.1.1 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:

a) 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;

b) the annual number of overload movements should not exceed approximately 5 per cent of the total annual movements, excluding light aircraft.

20.1.2 Such overload movements should not normally be permitted on pavements exhibiting signs of distress or failure. Furthermore, overloading should be avoided during any periods of thaw following frost penetration, or when the strength of the pavement or its subgrade could be weakened by water. Where overload operations are conducted, the appropriate authority should review the relevant pavement condition regularly, and should also review the criteria for overload operations periodically since excessive repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of pavement.

20.2 ACRs for several aircraft types

For convenience, a 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 Chapter 2, 2.6.6 b).

21. Autonomous runway incursion warning system (ARIWS)

Note 1.— *These autonomous systems are generally quite complex in design and operation and, as such, deserve careful consideration by all levels of the industry, from the regulating authority to the end user. This guidance is offered to provide a more clear description of the system(s) and offer some suggested actions required in order to properly implement these system(s) at an aerodrome in any State.*

Note 2.— *The Manual on the Prevention of Runway Incursion (Doc 9870) presents different approaches for the prevention of runway incursion.*

21.1 General description

21.1.1 The operation of an ARIWS is based upon a surveillance system which monitors the actual situation on a runway and automatically returns this information to warning lights at the runway (take-off) thresholds and entrances. When an aircraft is departing from a runway (rolling) or arriving at a runway (short final), red warning lights at the entrances will illuminate, indicating that it is unsafe to enter or cross the runway. When an aircraft is aligned on the runway for take-off and another aircraft or vehicle enters or crosses the runway, red warning lights will illuminate at the threshold area, indicating that it is unsafe to start the take-off roll.

21.1.2 In general, an ARIWS consists of an independent surveillance system (primary radar, multilateration, specialized cameras, dedicated radar, etc.) and a warning system in the form of extra airfield lighting systems connected through a processor which generates alerts independent from ATC directly to the flight crews and vehicle operators.

21.1.3 An ARIWS does not require circuit interleaving, secondary power supply or operational connection to other visual aid systems.

21.1.4 In practice, not every entrance or threshold needs to be equipped with warning lights. Each aerodrome will have to assess its needs individually depending on the characteristics of the aerodrome. There are several systems developed offering the same or similar functionality.

21.2 Flight crew actions

23. Runway distance remaining signs (RDRSs)

23.1 Runway distance remaining signs (RDRSs) do not have to be provided at all aerodromes. An aerodrome considering the installation of such signs may wish to assess their need individually, depending on factors such as runway length, aerodrome elevation, aerodrome geometry, traffic levels, lack of runway end safety area, lack of runway friction and climate.

23.2 RDRSs are placed along the full length of the runway at longitudinal spacing of 300 m (±30 m), parallel and equidistant from the runway centre line as in Configurations A, B or C, illustrated in Figure A-10. RDRSs are arranged by any of three different configurations as shown in Figure A-10.

23.3 In Configuration A, the RDRSs consist of double-faced signs and are located on both sides of the runway. Where the runway length is not an exact multiple of 300 m, the signs are placed at locations where the runway total length is divided equally.

23.4 In Configuration B, the RDRSs consist of double-faced signs and are located on both sides of the runway. Where the runway length is not an exact multiple of 300 m, one-half of the excess distance is added to the distance of each sign from each runway extremity. To illustrate the case where the distance between the end of the runway and the sign is the maximum, for a runway length of 1 950 m, the excess distance is 150 m and the location of the last sign on each runway end is 300 m plus one-half of 150 m, or 375 m. This configuration allows a maximum of 375 m at the end of the runway, but the other signs are exactly 300 m apart. The signs may be omitted on one side of the runway because of clearance conflict or by design.

> ***Note.—*** *For Configurations A and B, the signs may be omitted on one side of the runway because of clearance conflict or by design.*

23.5 In Configuration C, the RDRSs consist of single-faced signs and are located on one side of each runway, viewed in the direction of take-off or landing. The advantage of Configuration C is that the runway distance remaining is more accurately reflected for a runway length that is not an exact multiple of 300 m.

23.6 An RDRS may be omitted if the sign cannot be placed within the tolerance of ±30 m.

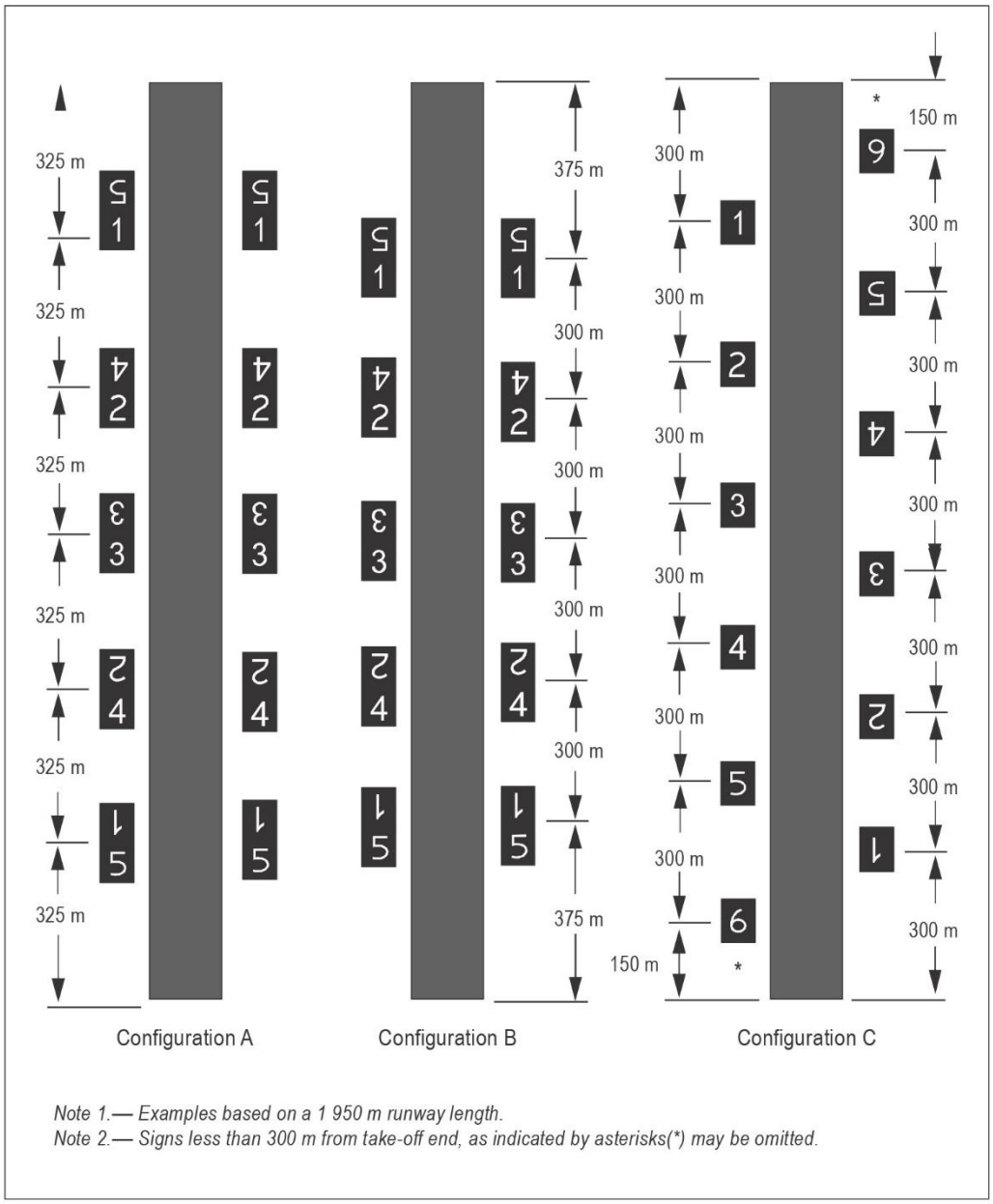


Figure A-10. Runway distance remaining sign configurations

~~23~~24. Aerodrome mapping data

~~23~~24.1 Introduction

Chapter 2, 2.1.2 and 2.1.3, relate to the provision of aerodrome mapping data. The aerodrome mapping data features are collected and made available to the aeronautical information services for aerodromes designated by States with consideration of the intended applications. These applications are closely tied to an identified need and operational use where the application of the data would provide a safety benefit or could be used as mitigation of a safety concern.

~~23~~24.2 Applications

~~23~~24.2.1 Aerodrome mapping data include aerodrome geographic information that supports applications which improve the user's situational awareness or supplement surface navigation, thereby increasing safety margins and operational efficiency. With appropriate data element accuracy, these data sets support collaborative decision-making, common situational awareness and aerodrome guidance applications. The data sets are intended to be used in the following air navigation applications:

a) on-board positioning and route awareness including moving maps with own aircraft position, surface guidance and navigation;

b) traffic awareness including surveillance and runway incursion detection and alerting (such as, respectively, in A-SMGCS levels 1 and 2);

c) ground positioning and route awareness including situational displays with aircraft and vehicles position and taxi route, surface guidance and navigation (such as A-SMGCS levels 3 and 4);

d) facilitation of aerodrome-related aeronautical information, including NOTAMs;

e) resource and aerodrome facility management; and

f) aeronautical chart production.

~~23~~24.2.2 The data may also be used in other applications such as training/flight simulators and on-board or ground enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

Determination of aerodromes to be considered for collection of aerodrome mapping data features