GUYANA

REGULATIONS

Made Under

CIVIL AVIATION ACT
(Cap. 53:01)

IN EXERCISE OF THE POWERS CONFERRED UPON ME BY SECTION 37 OF THE CIVIL AVIATION ACT, I MAKE THE FOLLOWING REGULATIONS:-

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Citation.

1. These Regulations may be cited as the Civil Aviation (Licensing and Certification of Aerodromes- Part XII) Regulations 2016.

Interpretation.

2. In these Regulations unless the context otherwise requires –

“Act” means the Civil Aviation Act;

“aerodrome” means a defined area on land or water including any buildings, installations, and equipment used for the arrival, departure and surface movement of aircraft licensed or certificated under these Regulations;

“aerodrome beacon” means an aeronautical beacon used to indicate the location of an aerodrome from the air;

“aerodrome certificate” means a certificate issued by the Authority under these Regulations for the operation of an aerodrome;

“aerodrome elevation” means the elevation of the highest point of the landing area;

“aerodrome facilities and equipment” means facilities and equipment, inside or outside the boundaries of an aerodrome that are constructed or installed and maintained for the arrival, departure and surface movement of aircraft;

“aerodrome manual” means the manual that forms part of the application for a licence or a certificate under these Regulations, including any amendments to the manual, approved by the Authority;

“aerodrome reference code” means a code used for planning purposes to classify an aerodrome with respect to the critical aircraft characteristics for which the aerodrome is intended;
“aerodrome reference point” means the designated geographical location of an aerodrome;

“aerodrome traffic zone” means the airspace extending from aerodrome level to a height of two thousand feet over the area comprising the aerodrome and the surrounding land or water within a distance of two thousand yards of its boundaries;

“aeronautical beacon” means 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” means any light provided as an aid to air navigation, other than a light displayed on an aircraft;

“Aeronautical Information Circular” means a notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the Aeronautical Information Publication, but which relates to flight safety, air navigation, technical, administrative or legislative matters;

“Aeronautical Information Publication” means an aeronautical information publication of a lasting character essential to air navigation, issued by the Authority;

“air traffic service” means a flight information service, alerting service, air traffic advisory service, or air traffic control service;

“air traffic service unit” is a generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office;

“Aircraft Classification Number” means a number expressing the relative effect of an aircraft on a pavement for a specified sub grade category;

“aircraft stand” means a designated area on an apron
intended to be used for parking an aircraft;

“apron” means a defined area, on an aerodrome, intended to accommodate aircraft for purposes of loading or unloading of passengers, mail or cargo, fuelling, parking or maintenance;

“apron management service” means a service provided to regulate the activities and the movement of aircraft and vehicles on an apron;

“Authority” means the Civil Aviation Authority;

"authorized person” means any person authorized by the Authority either generally or in relation to a particular case or class of cases and reference to an authorized person includes references to the holder for the time being of an office designated by the Authority;

“balked landing” means a landing manoeuvre that is unexpectedly discontinued at any point below the obstacle clearance altitude/ height (OAC/H);

“certificate” means the certificate to operate an aerodrome issued by the Authority under Part IV;

“clearway” means a defined rectangular area on the ground or water under the control of the appropriate authority selected or prepared as a suitable area over which an aircraft may make a portion of its initial climb to a specified height;

“controlled aerodrome” means an aerodrome where air traffic services are provided;

“critical aircraft” means the most demanding aircraft in terms of its size and maximum take-off weight that is proposed to use an aerodrome facility;

“dangerous goods” means articles or substances which are capable of posing a risk to health, safety, property or the environment.

“declared distance” means –
(a) accelerate-stop distance available which is the length of the take-off run available plus the length of the stopway, if provided;

(b) landing distance available which is the length of the runway which is declared available and suitable for the ground run of an aircraft landing;

(c) take-off distance available which is the length of the take-off run available plus the length of the clearway, if provided;

(d) take-off run available which is the length of runway declared available and suitable for the ground run of an aircraft taking off;

“displaced threshold” means a threshold not located at the extremity of a runway;

“geoid” means the equipotential surface in the gravity field of the earth which coincides with the undisturbed Mean Sea Level extended continuously through the continents;

“hazard beacon” means an aeronautical beacon used to designate a danger to air navigation;

“holding bay” means a defined area where aircraft can be held, or bypassed, to facilitate efficient surface movement of aircraft;

“human factors principles” means principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance;

“human performance” means human capabilities and limitations, which have an impact on the safety and efficiency of aeronautical operations;

“identification beacon” means an aeronautical beacon emitting a coded signal by means of which a
particular point of reference can be identified;

“incident” means an occurrence other than an accident associated with the operation of an aircraft, which affect or may affect the safety of operation of aircraft;

“instrument runway” means any of the following types of runways intended for the operation of aircraft using instrument approach procedures-

(a) non-precision approach runway which means an instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach;

(b) precision approach runway, category I, which means an instrument runway served by instrument landing system and microwave landing system and visual aids intended for operation with a decision height not lower than 60m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550m;

(c) precision approach runway, category II, which means an instrument runway served by Instrument Landing System and Microwave Landing System and visual aids intended for operation with a decision height lower than 60m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m;

(d) Precision approach runway, category III which means an instrument runway served by Instrument Landing System and/or Microwave Landing System to and along the surface of the runway and –

(i) intended for operations with a decision height lower than 30 m (100 ft.), or no decision height and a runway visual range not less than 200 m.
(ii) intended for operations with a decision height lower than 15 m (50 ft.), or no decision height and a runway visual range less than 200 m but not less than 50 m.

(iii) intended for operations with no decision height and no runway visual range limitations;

“integrity (aeronautical data)” means a degree of assurance that an aeronautical data and its value has not been lost nor altered since the data origination or authorised amendment;

“intermediate holding position” means a designated position intended for traffic control at which taxiing aircraft and vehicles stop and hold until they are cleared to proceed, when so instructed by the aerodrome control tower;

“landing area” means that part of a movement area intended for the landing or take-off of aircraft;

"licence" means a licence to operate an aerodrome issued by the Authority under Part III;

“lighting system reliability” means the probability that the complete installation operates within the specified tolerances and that the system is operationally usable;

“manoeuvring area” means that part of an aerodrome to be used for the take-off, landing and taxiing of an aircraft, excluding aprons;

“Manual of Aerodrome Standards” means the Manual of Aerodrome Standards developed by the Authority and contained in Schedule 1;

“marker” means an object displayed above ground level in order to indicate an obstacle or delineate a boundary;

“marking” means a symbol or group of symbols displayed on the surface of the movement area in order to
convey aeronautical information;

“Minister” means the Minister assigned responsibility for civil aviation;

“movement area” means that part of the aerodrome to be used for take-off, landing and taxiing of an aircraft, consisting of the manoeuvring area and apron;

“notify” means shown in Aeronautical Information Publications, Aeronautical Information Circulars, NOTAM, civil aviation publications or any other official publication issued for the purpose of enabling any of the provisions of these Regulations to be complied with;

“non-instrument runway” means a runway intended for the operation of an aircraft using visual approach procedures;

“obstacle” means any fixed (whether temporary or permanent) and mobile object, or part thereof, that:

(a) is located on an area intended for the surface movement of aircraft;

(b) extends above a defined surface intended to protect aircraft in flight; or

(c) stands outside those defined surfaces and that has been assessed as being a hazard to air navigation.

“obstacle free zone” means the airspace above the inner approach surface, inner transitional surfaces, the 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;

“obstacle limitation surfaces” means 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 aircraft operations to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome;

“operator” means a person operating an aerodrome licensed or certificated under these Regulations;

“Pavement Classification Number” means a number expressing the bearing strength of a pavement for unrestricted operations;

“precision approach runway” (see instrument runway);

“primary runway” means a runway used in preference to others whenever conditions permit;

“recommended practice” means any specification for the physical characteristics configuration, material, performance or procedure, the uniform application of which is recognised as desirable in the interest of safety, regularity or efficiency of international air navigation;

“relevant authority” means any authority other than the Civil Aviation Authority whose action may be necessary or complimentary for the implementation of these Regulations;

“road” means an established surface route on the movement area meant for the exclusive use of vehicles;

“road holding position” means a designated position at which vehicles may be required to hold;

“runway” means a defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft;

“runway end safety area” means an area symmetrical about the extended runway centreline and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aircraft undershooting or
overrunning the runway;

“runway-holding position” means a designated position intended to protect a runway, an obstacle limitation surface or an Instrument Landing System or Microwave Landing System critical or sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower;

“runway strip” means a defined area including the runway and stopway, if provided, intended –

(a) to reduce the risk of damage to aircraft running off a runway; and

(b) to protect aircraft flying over it during take-off or landing operations;

“runway visual range” means the range over which a pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line;

“safety” means a state in which the risk of harm to persons or of property damage is reduced to, and maintained at or below an acceptable level through a continuing process or hazard identification and risk management;

“safety management system” means a systematic approach to managing safety including the necessary organizational structure, accountabilities, policies and procedures;

“shoulder” means an area adjacent to the edge of a pavement, prepared to provide a transition between the pavement and the adjacent surface;

“standard” means any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognised as necessary for the safety of air navigation;
“stop-way” means a defined rectangular area on the ground at the end of the take-off run available, prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off;

“taxiway” means a defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including-

(a) an aircraft stand taxi lane which is a portion of an apron designated as a taxiway and intended to provide access to aircraft stands only;

(b) an apron taxiway which is a portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron;

(c) rapid exit taxiway which is a taxiway connected to a runway at an acute angle and designed to allow landing aircraft to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times;

“taxiway strip” means an area including a taxiway intended to protect aircraft operating on a taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway;

“threshold” means the beginning of that portion of the runway usable for landing;

“touchdown zone” means the portion of a runway beyond the threshold, intended for landing an aircraft on first contact with the runway;

“unserviceable area” means a part of the movement area that is unfit and unavailable for use by aircraft;

“vicinity” means a defined airspace around an aerodrome for control of obstacles that may infringe the obstacle limitation surfaces around the aerodrome, contained
within a radius of twelve and half kilometres from the aerodrome reference point up to a height of one thousand five hundred feet above ground level;

“visual traffic pattern” means the aerodrome traffic zone of the aerodrome;

“wildlife” means feral birds and animals, including domestic animals out of the control of their owners;

“wildlife hazard” means a potential for a damaging aircraft collision with wildlife on or near an aerodrome.

(2) For the purposes of these Regulations an aerodrome shall be deemed to be an aerodrome for public use if it is used as a place of take-off and landing of aircraft engaged in flights for the purpose of the public transport of passengers or for the purpose of instruction in flying.

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

(2) **Vertical Reference System** - Mean sea level (MSL) datum, which gives the relationship of gravity-related height (elevation) to a surface known as the geoid, shall be used as the vertical reference system.

(3) **Temporal reference system** - The Gregorian calendar and Coordinated Universal Time (UTC) shall be used as the temporal reference system.
(4) When a different temporal reference system is used, this shall be indicated in GEN 2.1.2 of the Aeronautical Information Publication (AIP).

4. In these Regulations aerodromes shall be categorized as follows-

(a) category A comprising aerodromes available for use by both international and domestic air traffic;

(b) category B comprising aerodromes available for use by domestic air traffic including aircraft of maximum certificated take-off mass above five thousand seven hundred kilogrammes;

(c) category C comprising aerodromes available for use by domestic air traffic of maximum certificated take-off mass not exceeding five thousand seven hundred kilogrammes;

(d) category D comprising aerodromes available for use by helicopters only.

PART II
CONSTRUCTION OF AERODROMES

5. This Part applies to all categories of aerodromes except where otherwise specified.

6. (1) A person shall not construct an aerodrome unless that person has a valid aerodrome construction permit.

(2) An application for an aerodrome construction permit shall be considered for approval, where-
(a) the applicant holds a valid authorization from the Minister to use the place as an aerodrome; and

(b) the application is approved by the authority responsible for national environment management;

(c) the applicant receives security clearance from the relevant authority.

(3) The Minister shall assess the suitability of the place proposed for construction taking into consideration –

(a) the proximity of the place to other aerodromes and landing areas including military aerodromes;

(b) obstacles, terrain and existing airspace restrictions;

(c) that it is not against public interest that the place where the aerodrome is to be constructed should be used as such; and

(d) the critical aircraft type expected to use the runway.

7. The Minister may issue an aerodrome construction permit to an applicant where the application meets the requirements provided in regulation 6 and any other requirements as may be specified by any relevant authority.

8. (1) The owner of a construction permit shall ensure that the design and construction of the aerodrome is undertaken by a person or organisation registered by the relevant professional body.
(2) The Ministry shall inspect the site of an aerodrome during construction to ascertain compliance with the standards specified by the Authority and the terms of the aerodrome construction permit.

9. (1) An aerodrome design shall–

(a) indicate the physical characteristics as determined by the Authority;

(b) indicate the obstacle limitation surfaces;

(c) integrate security measures in accordance with the Civil Aviation (Security) Regulations and requirements in force;

(d) indicate visual aids for navigation obstacles and restricted areas; and

(e) indicate the appropriate equipment and installations;

(2) The physical characteristics, obstacle limitation surfaces, visual aids and equipment and installations, required under subregulation (1) shall –

(a) be appropriate to the critical aircraft characteristics for which the aerodrome intends to serve;

(b) be at the lowest meteorological minima for each runway;

(c) provide ambient light conditions during the operations of aircraft; and

(d) comply with the appropriate aerodrome design standards specified by the Authority.
10. (1) An aerodrome reference code comprising a code number and a code letter shall be used for aerodrome planning purposes.

(2) The Authority shall determine the aerodrome reference code in accordance with the critical aircraft characteristics for which the aerodrome facility is intended.

(3) The aerodrome reference code numbers and code letters required under subregulation (1) shall be determined in accordance with specifications in the Manual of Aerodromes Standards in Schedule 1.

PART III
LICENSING OF AERODROMES

11. This Part applies to aerodromes in categories B, C and D except where otherwise specified.

12. An application for a licence shall be made in a format that may be determined by the Authority and shall be accompanied by –

(a) a site plan for the aerodrome;

(b) an environmental clearance from the Environmental Protection Agency;

(c) an approval from the relevant land use authority;

(d) Security clearance from the relevant authority,

(e) particulars of any non-compliance or deviations from the appropriate aerodrome design, operation or equipment standards; and
(f) charges as may be determined by the Authority.

13. (1) A licence may be issued subject to any conditions that may be determined by the Authority.

(2) The Authority shall endorse on a licence the conditions for use of an aerodrome and any other details as may be deemed necessary by the Authority.

(3) Subject to subregulation (4), where an applicant requests or the Authority considers that an aerodrome should be available for public use, a licence may be granted subject to a condition that the aerodrome shall at all times be available to all persons on equal terms and conditions.

(4) An aerodrome operator may refuse an aircraft from using the aerodrome except in an emergency situation.

14. (1) A person shall not operate an aerodrome without a licence issued by the Authority.

(2) The Authority shall issue a licence in form 1 in Schedule 2, where-

(a) an applicant is found to be competent to operate an aerodrome on consideration of the previous conduct and experience of the applicant, the equipment, organisation, staffing, maintenance and other arrangements of the applicant;

(b) the physical characteristics of the aerodrome and its surroundings are safe for use by aircraft; and

(c) an applicant for a licence complies with the
Civil Aviation (Security) Regulations and requirements where applicable.

(3) The issuance of a licence shall be subject to compliance with these Regulations and such standards specified by the Authority and any other condition as may be specified or notified by the Authority in accordance with safety audits and inspections.

(4) The Authority may refuse to grant a licence to an applicant, and where the Authority so refuses, it shall notify the applicant in writing of the reasons for the refusal, not later than fourteen days after making that decision.

15. (1) The breach of any condition subject to which a licence is issued including any approval, permission or exemption shall render the licence invalid.

(2) The Authority shall impose operating restrictions or sanctions at a licensed aerodrome in the event of non-conformance with the licensing requirements or any unresolved safety concerns.

16. (1) A licence shall specify –

(a) the category of the Aerodrome and the reference code;

(b) the restrictions, if any, relating to non-compliance with or deviations from the appropriate aerodrome design, operation or equipment standards;

(c) the period of validity of the licence.

(2) A licence issued under these Regulations shall not be transferable.
17. (1) A licence issued under these Regulations shall be valid for a period of one year and shall remain in force until it expires, or is suspended or cancelled by the Authority in accordance with regulation 20.

(2) A holder of an aerodrome licence which is suspended or cancelled shall within thirty days of the suspension or cancellation, surrender the licence to the Authority.

(3) Notwithstanding subregulation (2), where an aerodrome licence is suspended for a period of less than thirty days, a holder of the licence shall surrender the licence immediately.

18. (1) An application for the renewal of a licence shall be made to the Authority in a format that may be determined by the Authority and shall be accompanied by –

(a) particulars of deviations, if any, from the appropriate design, operation or equipment standards; and

(b) the appropriate charges as may be determined by the Authority.

(2) An application for renewal shall be submitted sixty days before the expiry of the licence.

(3) The renewal of a licence shall be subject to compliance with these Regulations, standards specified by the Authority and any other conditions as may be specified or notified by the Authority as determined by safety inspections and audit procedures by the Authority, before the renewal of the licence.
19. (1) An application for amendment of a licence shall be submitted in a format that may be determined by the Authority.

(2) The Authority may request that the application be accompanied by any or all of the following –

(a) a site plan for the aerodrome;
(b) approval from the Environmental Protection Agency;
(c) approval from the relevant land use authority;
(d) security clearance for the relevant authority;
(e) approval from any other relevant authority;
(f) particulars of any non-compliance or deviations from the appropriate aerodrome design, operation or equipment standards; and
(g) the charges determined by the Authority.

(3) The Authority may where necessary, provided the requirements of regulations 14 are met, amend a licence –

(a) for a change in the use or operation of the aerodrome;
(b) for a change in the boundaries of the aerodrome;
(c) if the holder of the licence requests an amendment; or
(d) if the Authority deems it necessary.

20. (1) The Authority may suspend an aerodrome licence where –
(a) following a safety inspection or audit, it is evident that the holder of the licence has not complied with the requirements of these Regulations and failed to remedy the non-compliance within a period of thirty days after the inspection;

(b) the holder of the licence prevents the Authority from carrying out a safety inspection or audit in accordance with these Regulations;

(c) it is deemed necessary in the interest of aviation safety.

(2) The Authority may, on giving reasons to the holder of a licence, suspend the licence for a period not exceeding sixty days.

(3) A holder of a licence who is notified of a suspension in subregulation (2) may submit a response in writing within a period not exceeding fourteen days.

(4) Notwithstanding subregulation (3), the Authority may suspend any or all of the operations at an aerodrome pending receipt of a response from the holder.

(5) A holder of a licence who is aggrieved by the suspension of a licence may appeal against the suspension to the Director General within thirty days of the suspension.

(6) Where an appeal is made under subregulation (5), the holder of a licence shall state in writing the reasons why in his or her opinion, the suspension should be varied or set aside.

(7) The Minister may vary or set aside the
suspension made under subregulation (2) on the basis of the reasons given in the appeal under subregulation (5).

(8) Where a holder of a licence does not appeal against the suspension in accordance with subregulation (5), the Authority may cancel the licence, on giving reasons to the holder of a licence.

21. (1) Subject to subregulation (2), a holder of a licence may surrender the licence to the Authority at any time.

(2) A holder of a licence who wishes to surrender the licence shall give the Authority not less than thirty days’ notice in writing, before the date on which the licence is to be surrendered.

(3) The Authority shall cancel the licence upon the expiry of the period of notice in subregulation (2).

(4) Where, after the expiry of the period in subregulation (2), an aerodrome is abandoned or is not maintained in accordance with the conditions of the licence, the holder of the licence shall remove, obliterate or modify the markings referred to in regulation 50 (f).

22. (1) A holder of a licence shall set charges for the use of the aerodrome or of any facilities provided at the aerodrome for the safety, security, efficiency or regularity of air navigation.

(2) Where required by the Authority, a holder of a licence shall, furnish particulars of the charges levied for the use of an aerodrome or the performance of services at the aerodrome.

(3) Notwithstanding subregulation (1), the
Authority may where necessary, determine the maximum charges which may be levied for the use of an aerodrome or the performance of services at the aerodrome, for a specified period.

(4) A holder of a licence of the aerodrome for which the Authority determines charges under subregulation (3) shall not cause or permit any charges to be made in contravention of that subregulation.

(5) A holder of a licence of an aerodrome for which the Authority determines charges shall cause the determined charges to be posted in a conspicuous place at the aerodrome.

23. (1) The Authority shall maintain a register of all licences issued in accordance with these Regulations.

(2) The register shall contain –

(a) the full name of the holder of an aerodrome licence;

(b) the postal, telephone, facsimile and e-mail addresses of the holder of the licence;

(c) the name and location of the aerodrome for which the licence is issued;

(d) the number of the licence;

(e) the date on which the licence was issued; and

(f) any other relevant information.

24. An aerodrome operator shall –

(a) in the case of a licence for public use, cause
Civil Aviation

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29. (1) This Part applies to aerodromes in category A.

25. (1) This Part applies to aerodromes in category A.

26. An application for a certificate shall be submitted in a format that may be determined by the Authority and shall be accompanied by–

(a) two copies of the aerodrome manual;
(b) a plan for the aerodrome;
(c) an environmental impact assessment report;
(d) approval from the land use authority;
(e) security clearance from the relevant authority;
(f) approval from any other relevant authority;
(g) proof of financial capability;
(h) particulars of any non-compliance or deviations from the appropriate aerodrome design, operation or equipment standards;
and

(i) the charges determined by the Authority.

27. (1) A certificate may be issued subject to any conditions that may be specified by the Authority.

(2) The Authority shall endorse on a certificate the conditions for use of an aerodrome and any other details as may be deemed necessary by the Authority.

28. (1) The breach of any condition subject to which a certificate is issued including any approval, permission or exemption shall render the certificate invalid.

(2) The Authority shall impose operating restrictions or sanctions at certified aerodromes in the event of non-conformance with the certification requirements or any unresolved safety concerns.

29. (1) The Authority shall issue a certificate in form 2 in Schedule 2 where the Authority is satisfied that-

(a) the applicant and the personnel of the applicant are adequate in number and have the necessary competency and experience to operate and maintain an aerodrome;

(b) the aerodrome manual prepared for the aerodrome and submitted with the application contains all the relevant information;

(c) the aerodrome facilities, services and equipment are established in accordance with approved standards and recommended practices;

(d) the aerodrome operating procedures make satisfactory provision for the safety of
31. (1) An application for the renewal of a certificate shall be made to the Authority in a format that may be determined by the Authority and shall be accompanied by –

(a) the aerodrome manual if significant
changes have been made following the initial certification;

(b) particulars of deviations, if any, from the appropriate design, operation or equipment standards; and

(c) the appropriate charges as determined by the Authority.

(2) An application for renewal shall be submitted sixty days before the expiry of the certificate.

(3) The renewal of a certificate shall be subject to compliance with these Regulations, standards specified by the Authority and any other conditions as may be specified or notified by the Authority as determined by safety inspections and audit procedures by the Authority, before the renewal of the certificate.

32. (1) An application for amendment of a certificate shall be submitted in a format that may be determined by the Authority.

(2) The Authority may request that the application be accompanied by any or all of the following-

(a) two copies of the aerodrome manual;

(b) a site plan for the aerodrome;

(c) an environmental impact assessment report;

(d) approval from any other relevant authority;

(e) proof of financial capability;

(f) particulars of any non-compliance or deviations from the appropriate aerodrome design, operation or equipment standards;
and

(g) the charges determined by the Authority.

(3) The Authority may, provided the requirements of regulations 29, are met, where necessary, amend an aerodrome certificate –

(a) for a change in the use or operation of the aerodrome;

(b) for a change in the boundaries of the aerodrome;

(c) if the holder of the aerodrome certificate requests an amendment; or

(d) if the Authority deems it necessary.

33. (1) The Authority may suspend a certificate where –

(a) following a safety inspection or audit, it is evident that the holder of the certificate has not complied with the requirements in these Regulations and failed to remedy the non-compliance within a period of thirty days after the inspection;

(b) the holder of the certificate prevents the Authority from carrying out a safety inspection or audit in accordance with these Regulations;

(c) the holder of the certificate is under receivership, liquidation or bankruptcy proceedings;

(d) it is deemed necessary in the interest of
aviation safety.

(2) The Authority may, on giving reasons to the holder of a certificate, suspend the certificate for a period not exceeding sixty days.

(3) A holder of a certificate who is notified of a suspension in subregulation (2) may submit a response in writing within a period not exceeding fourteen days.

(4) Notwithstanding subregulation (3), the Authority may suspend any or all of the operations at an aerodrome pending receipt of a response from the holder.

(5) A holder of a certificate who is aggrieved by the suspension of a certificate may appeal against the suspension to the Minister, within thirty days of the suspension.

(6) Where an appeal is made under subregulation (5), the holder of a certificate shall state in writing the reasons why in his or her opinion, the suspension should be varied or set aside.

(7) The Minister may vary or set aside the suspension made under subregulation (2) on the basis of the reasons given in the appeal under subregulation (5).

(8) Where a holder of a certificate does not appeal against the suspension in accordance with subregulation (5), the Authority may cancel the certificate, on giving reasons to the holder of a certificate.

34. (1) Subject to subregulation (2), a holder of a certificate may surrender the certificate to the Authority at any time.
(2) A holder of a certificate who wishes to surrender the certificate shall give the Authority not less than sixty days’ notice in writing, before the date on which the certificate is to be surrendered.

(3) The Authority shall cancel the certificate upon the expiry of the period of notice in subregulation (2).

(4) Where, after the expiry of the period in subregulation (2), an aerodrome is abandoned or is not maintained in accordance with the conditions of the certificate, the holder of the certificate shall remove, obliterate or modify the markings referred to in regulation 50 (f).

35. (1) A holder of a certificate shall set charges for the use of the aerodrome or of any facilities provided at the aerodrome for the safety, security, efficiency or regularity of air navigation.

(2) Where required by the Authority, a holder of a certificate shall, furnish particulars of the charges levied for the use of an aerodrome or the performance of services at the aerodrome.

(3) Notwithstanding subregulation (1), the Authority may where necessary, specify the maximum charges which may be levied for the use of an aerodrome or the performance of services at the aerodrome, for a specified period.

(4) A holder of a certificate of the aerodrome for which the Authority determines charges under subregulation (3) shall not cause or permit any charges to be made in contravention of that subregulation.

(5) A holder of a certificate of an aerodrome for which the Authority determines charges shall cause the determined charges to be posted in a conspicuous place at the aerodrome.
36. (1) The Authority shall maintain a register of all certificates issued in accordance with these Regulations.

(2) The register shall contain-

(a) the full name of the holder of an aerodrome certificate;
(b) the postal, telephone, facsimile and e-mail addresses of a holder of a certificate;
(c) the name and location of the aerodrome for which a certificate is issued;
(d) the number of the certificate;
(e) the date on which the certificate was issued; and
(f) any other relevant information.

PART V
OBLIGATIONS OF AERODROME OPERATOR

37. This Part applies to all categories of aerodromes except where otherwise specified.

38. An aerodrome operator shall comply with conditions, if any, endorsed on a licence or certificate.

39. (1) An operator shall ensure that there is an adequate number of qualified and skilled personnel to perform activities for aerodrome operation and
maintenance as specified in the aerodrome manual.

(2) Where the Authority or any other relevant authority requires competence certification for the personnel of an aerodrome, the operator shall employ only those persons with the required certification.

40. (1) Subject to any directives the Authority may issue, an operator shall operate and maintain an aerodrome in accordance with the procedures set out in the aerodrome manual.

(2) The Authority may give written directives to an operator to alter the procedures set out in an aerodrome manual.

(3) An operator shall ensure proper and efficient maintenance of the aerodrome facilities.

(4) Where air traffic services are provided at an aerodrome, the operator shall co-ordinate with the air traffic services, to ensure the safety of aircraft operating in the airspace associated with the aerodrome.

41. (1) An operator of an aerodrome shall have a safety management system that complies with the standards specified in the Manual of Aerodrome Standards.

(2) This regulation shall not apply to aerodromes in categories B, C and D aerodromes.

42. A person shall not store fuel, pyrotechnic materials and other highly inflammable or dangerous goods at an aerodrome except with the permission of the Authority and in accordance with the standards specified by the Authority.

43. (1) A person shall not access a restricted area of an aerodrome unless authorised by the operator and subject to such conditions as the operator may impose.

(2) A person authorised to access a restricted area
under subregulation (1) shall not-

(a) move an aircraft or a vehicle in the restricted area except with the permission and directions issued by the air traffic services personnel;

(b) move an aircraft or vehicle in the restricted area in a manner that endangers the safety of persons and property;

(c) use a portion of the aerodrome for landing or taking off, other than the area designated for that purpose.

44. (1) A person, aircraft or vehicle shall not enter or leave a restricted area of an aerodrome except through points established by the operator for the purpose.

(2) Except in an emergency or at an appropriate point of entry or exit established by an operator for that purpose, a person-

(a) other than a person carried in an aircraft or in a vehicle, shall not enter or leave a restricted area of an aerodrome; or

(b) shall not move an aircraft on the surface of an aerodrome or a vehicle into or from the restricted area.

45. A person shall not test-run an aircraft engine at an aerodrome except at the approved aircraft maintenance facility of the aerodrome or a place designated for that purpose, by the operator.

46. (1) A person shall not, on an aerodrome-
(a) obstruct or interfere with the proper use of the aerodrome;

(b) obstruct any person executing his or her duties at the aerodrome;

(c) remove or deface any notice, writing, document or marking erected or displayed by the aerodrome operator;

(d) throw, leave or drop anything capable of causing injury to any person or damage to any property;

(e) dump any waste matter except at a place approved for the purpose by the aerodrome operator;

(f) dump or spill any substance capable of causing water pollution, whether solid, liquid, vapour or gas or a combination of these, except at a place approved for that purpose by the aerodrome operator.

(2) Except with the permission of the operator, a person shall not-

(a) interfere or tamper with any part of the aerodrome or any equipment associated with the operation of the aerodrome;

(b) climb any wall, fence, barrier, ceiling, gate or post on an aerodrome;

(c) handle any baggage or carry baggage for a passenger at an aerodrome;

(d) bring a vehicle into or drive into an aerodrome; or

(e) obstruct an entrance to or a passage at an aerodrome in a manner that inconvenience other users of the entrance or passage.
47. An operator shall remove from the aerodrome surface any vehicle or other obstruction that is likely to be hazardous to aircraft operations.

48. (1) An operator shall establish and maintain an aerodrome environment management programme for the area within the authority of the operator and for the area where any wildlife presents or is likely to present a hazard to aircraft operations.

(2) An operator shall ensure that the environment management programme established under subregulation (1) minimises the effects of any hazards or potential hazards taking into account the provisions of the laws on environmental management.

(3) This regulation shall not apply to aerodromes in categories B, C and D.

49. An operator shall in consultation with the Authority-

(a) prevent construction of any facilities on the aerodrome, which may adversely affect the operation of any electronic or visual navigation or air traffic service facility on the aerodrome;

(b) as far as it is within the authority of the operator, prevent any interruption of visual or electronic signal of navigation aids.

50. An operator shall-

(a) maintain the aerodrome in a serviceable condition;

(b) keep the aerodrome free of unauthorized
persons, vehicles and animals which are not under proper control or any other obstructions;

(c) mark all obstructions in accordance with the guidelines determined by the Authority;

(d) inform the Authority of any alterations to obstruction or works on the aerodrome;

(e) install approved wind direction indicators to show the surface direction of the wind and ensure that they function satisfactorily;

(f) maintain the prescribed markings in a conspicuous condition and ensure that they are readily visible to aircraft in the air or manoeuvring on the ground;

(g) avail facilities and ensure that they are in serviceable condition and that all apparatus installed function efficiently;

(h) appropriately mark the unserviceable areas on the landing terrain;

(i) inform the Authority where the aerodrome or any portion of the surface of the landing area becomes unserviceable through any cause, to such an extent that the safe operation of aircraft may be endangered;

(j) submit to the Authority reports on the condition of the aerodrome as may be required by the Authority;

(k) ensure that organisations performing activities at the aerodrome comply with safety requirements specified by the operator; and

(l) report all incidents and accidents at the aerodrome to the Authority.

Inspection of

51. (1) Before an aerodrome licence or certificate is
issued or renewed and, subsequently, at any other time, for the purpose of ensuring that safety at the aerodrome is maintained, the Authority shall inspect and carry out audits on the aerodrome facilities, services and equipment, inspect the documents and records of the aerodrome and verify the safety management system of the aerodrome.

(2) For the purpose of facilitating the functions of the Authority specified in subregulation (1), an inspector of the Authority shall have unhindered access to any part of the aerodrome or any aerodrome facility, including equipment, records, documents and personnel.

52. An operator shall notify and report to the Authority, the air traffic control unit and pilots, within the specified time limits, information on –

(a) any inaccuracies in the Aeronautical Information Publication;

(b) any changes to the aerodrome facilities, equipment and level of service planned in advance;

(c) issues that may require immediate notification including obstacles, obstructions and hazards, levels of service, movement areas, and any other condition that affects aviation safety at the aerodrome and against which precautions are warranted.

53. An aerodrome operator shall carry out inspections of the movement area each day at least three times for aerodromes in category A.

54. (1) An operator shall inspect an aerodrome-

(a) as soon as practicable after any accident or
incident;

(b) during any period of construction or repair of the aerodrome facilities or equipment that is critical to the safety of aircraft operation; and

(c) at any other time when there are conditions at the aerodrome that may affect aviation safety.

(2) An operator shall notify and report to the Authority, within the specified time limits, information on any special inspection carried out under subregulation (1).

55. (1) Where a low flying aircraft, at or near an aerodrome, or where a taxing aircraft, is likely to be hazardous to people or vehicles, an operator shall –

(a) post hazard warning notices to that effect, on any public way that is adjacent to the manoeuvring area; or

(b) where the public way is not controlled by the operator, inform the relevant authority of the hazard.

PART VI
AERODROME MANUAL

56. This Part applies to all categories of aerodromes except where otherwise specified.

57. (1) Upon making an application for a certificate the applicant shall submit to the Authority an aerodrome manual for approval.

(2) The applicant shall submit one electronic copy
and one printed copy of the aerodrome manual.

(3) An aerodrome manual shall-

(a) be typewritten or printed;
(b) be signed by the operator;
(c) be in a format that is easy to revise;
(d) have a system for recording the current pages and any amendments, including a page for logging revisions; and
(e) be organized in a manner that facilitates the preparation, review and approval processes.

(4) An operator shall keep at least one approved copy of the aerodrome manual at the aerodrome and one copy at the principal place of business of the operator, where it is different from the aerodrome.

58. (1) An aerodrome manual shall contain all information and instructions necessary to enable the personnel of an aerodrome to perform their duties.

(2) Notwithstanding subregulation (1), and to the extent that the particulars are applicable, a manual for an aerodrome shall include the particulars as required by the Authority.

(3) Where a person is given an exemption in accordance with the relevant regulations, the aerodrome manual shall show the exemption notice number given for the exemption by the Authority, the date the exemption came into effect and any conditions or procedures subject to which the exemption was granted.

59. (1) For the purpose of maintaining the accuracy of the information in an aerodrome manual-
(a) an operator shall whenever necessary, amend the aerodrome manual; or

(b) the Authority may issue a written directive requiring the operator to alter or amend the aerodrome manual.

(2) Notwithstanding subregulation (1), an operator shall submit the proposed amendment to the Authority for approval before the aerodrome manual is amended.

(3) The Authority shall approve the amendment made to an aerodrome manual where the amendment meets the requirements of these Regulations.

PART VII
WILDLIFE HAZARD MANAGEMENT

60. In this Part, regulation 62 applies to all categories of aerodromes and regulations 63 and 64 apply to aerodromes in category A.

61. (1) A person shall not bring, permit or graze an animal in the restricted area of an aerodrome or cause any animal to graze or feed in the restricted area of an aerodrome.

(2) Subject to subregulation (1), a person who brings, permits or grazes an animal in the restricted area of an aerodrome or who causes an animal to graze or feed in a restricted area of an aerodrome or who receives an animal in the restricted area of the aerodrome, shall ensure that the animal is at all times under proper control while in the restricted area.

(3) In this regulation, “animal” means a domesticated animal and bird.

62. (1) An operator shall, in consultation with the
authority responsible for wildlife, take necessary action to control wildlife hazards at the aerodrome.

(2) An operator shall ensure that procedures to deal with the danger posed to aircraft operations by the presence of wildlife in the aerodrome flight pattern or movement area are in place.

(3) The wildlife management plan of an aerodrome shall be approved by the Authority and shall form part of the aerodrome manual.

63. (1) An operator shall, in consultation with the authority responsible for wildlife, take all reasonable steps to minimize the risks associated with wildlife strike hazards.

(2) An operator shall take practical measures to control the wildlife habitat at or around the aerodrome and to disperse birds, which are a potential hazard to aircraft operations.

(3) A 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, airport personnel, and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations.; and

(c) an on-going evaluation of the wildlife hazard by competent personnel.

(4) The operator shall collect and forward wildlife strike reports to the Authority for submission to
ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

(5) An operator shall take action to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

(6) An operator shall consult with the relevant authorities to take action to eliminate or to prevent the establishment of garbage disposal dumps, landfills, 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.

(7) Subject to subregulation (6), garbage disposal dumps and landfills shall be located no closer than 13km from an aerodrome facility and where located in the vicinity of an approach and take-off path of an aerodrome, shall be subject to an aeronautical study.

(8) Where the elimination of existing sites is not possible, the operator and the relevant authorities shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

(9) An operator shall establish a wildlife hazard control unit to control and manage the wildlife hazard.

(10) The operator shall cause records of all aspects of wildlife hazard control to be kept and shall report all wildlife strikes to the Authority.

(11) An operator shall monitor the local environment including any activities that may attract wildlife and in designing the wildlife hazard management programme, shall consider that environment and the activities that may attract wildlife.

**PART VIII**

**OBSTACLE RESTRICTIONS AND REMOVAL**
64. This Part applies to all categories of aerodromes.

65. (1) A person shall not cause or permit the erection or growth of an obstacle at or in the vicinity of an aerodrome, where the obstacle may prevent an aircraft operation from being conducted safely or the aerodrome from being usable.

(2) A person shall not cause or permit any object, to penetrate the obstacle limitation surface, without the written permission of the Authority, where the object may cause an increase in an obstacle clearance altitude or in the height for an instrument approach procedure or of any associated visual circling procedure.

(3) The object referred to in subregulation (2) includes a new object or an extension of an existing object above the obstacle limitation surface.

(4) The obstacle clearance altitude and height applicable to obstacle limitation surface, and the obstacle limitation requirements shall comply with the specifications determined by the Authority.

66. (1) Notwithstanding regulation 9, an operator shall ensure that obstacle limitation surfaces are established for the aerodrome in accordance with the standards specified by the Authority.

(2) An operator shall monitor the established obstacle limitation surfaces around the aerodrome for infringement by objects, buildings or other structures.

67. (1) A person shall not construct a building or a structure within the vicinity of an aerodrome unless the Authority issue a no objection for such a construction.
(2) Where the Authority is consulted regarding a proposed construction in subregulation (1), the Authority shall cause an aeronautical study of the effect of the construction on operation of aircraft, to be carried out.

68. (1) A person shall remove any obstacle in the vicinity of aerodrome, except where, after an aeronautical study, the Authority determines that the obstacle does not adversely affect the safety or significantly affect the regularity of operations of aircraft.

(2) The Authority may direct the removal of any obstacle which, in the opinion of the Authority, constitutes a hazard to aircraft operations to the relevant land use authority.

69. (1) An operator shall ensure that an obstacle is marked and where a runway is used at night and is associated with the obstacle, that obstacle shall be lighted.

(2) The markings and lights referred to in subregulation (1) shall be in accordance with guidelines determined by the Authority.

(3) An operator shall, where practicable, ensure that all fixed obstacles to be marked in accordance with subregulation (1) are coloured as determined by the Authority.

(4) Where the conditions required in subregulation (3) are not practicable, markers or flags shall be displayed on or above the fixed obstacles, except the obstacles that are sufficiently conspicuous by their shape, size or colour, which may not be marked.

(5) An operator shall ensure that a mobile obstacle is coloured as determined by the Authority or has displayed on it or above it, a flag.

(6) An obstacle lighted in accordance with
subregulation (1) shall be indicated as low-intensity, medium-intensity or high-intensity light obstacle or a combination of these lights and shall be displayed in accordance with guidelines determined by the Authority.

**PART IX**

**AERONAUTICAL GROUND LIGHTING**

70. This Part applies to aerodromes in category A.

71. (1) An operator shall establish and maintain aeronautical ground lights and any other lights as may be appropriate for the safe operation of aircraft and for runways, taxiways, aprons, thresholds and stopways.

(2) Where an aerodrome is used at night or during conditions of poor visibility, an operator shall ensure that aeronautical ground lights and any other lights are installed on the aerodrome.

(3) Without prejudice to the generality of subregulation (1), the location, characteristics, intensity control and settings of aeronautical ground lights shall be in accordance with specifications determined by the Authority.

(4) A non-aeronautical ground light, which, by reason of its intensity, configuration or colour, may prevent or cause confusion in the clear interpretation of aeronautical ground lights, shall be extinguished, screened or modified to eliminate such a possibility.

(5) Except with the permission of the Authority, a person shall not establish, maintain or alter the character of—

(a) an aeronautical beacon within Guyana except an aeronautical beacon which is or may be visible from the waters;

(b) any aeronautical ground light, other than an aeronautical beacon, at an aerodrome,
or any aeronautical ground light which forms part of the lighting system for use by aircraft taking off from or landing at the aerodrome.

(6) A person shall not –

(a) intentionally or negligently damage an aeronautical ground light; or

(b) interfere with an aeronautical ground light without the permission of the operator.

(7) The Authority shall not grant permission under this regulation except with the consent of the lighthouse authority of the area where the aerodrome is situated.

72. An operator shall not operate or maintain an aerodrome provided with runway lighting, without a secondary power supply.

73. (1) An operator shall provide, where necessary, at each aerodrome intended for use at night, an aerodrome beacon, where –

(a) aircraft navigate predominantly by visual means;

(b) reduced visibility is frequent; or

(c) it is difficult to locate the aerodrome from the air due to a surrounding light or terrain.

(2) An identification beacon shall be provided at an aerodrome, which is intended for use at night and which is not easily identifiable from the air by other means.

(3) The location and characteristics of an aerodrome and identification beacon described in subregulations (1) and (2) shall be in accordance with
specifications determined by the Authority.

**PART X**

**AERODROME VISUAL AIDS**

**Application of this Part.**

**74.** This Part applies to all categories of aerodromes.

**Wind direction indicators.**

**75.** (1) An operator shall provide and maintain at least one wind direction indicator for an aerodrome.

(2) The wind direction indicator required under subregulation (1) shall be located so as to be visible to an 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.

(3) The characteristics of the wind direction indicator, the methods and procedures for installation and maintenance shall be in accordance with the methods and procedures determined by the Authority.

**Signalling lamp.**

**76.** (1) An operator shall ensure that a signalling lamp is provided at a controlled aerodrome in the aerodrome control tower.

(2) The characteristics and operating procedure of a signalling lamp shall be in accordance with specifications determined by the Authority.

**Signal panel and signalling area.**

**77.** (1) The Authority may where it deems necessary, require a signalling panel and a signalling area to be provided at an aerodrome for safe operation of aircraft.

(2) Where provided, the location and the
characteristics of the signal area shall be in accordance with specifications determined by the Authority.

**Markings.**

78. (1) An operator shall provide markings for paved runway centreline, paved runway edge, paved runway threshold, paved runway touchdown zone, paved runway holding position, aiming point, paved runway side stripe, paved runway turn pad, and intermediate holding positions at an aerodrome, in accordance with specifications determined by the Authority.

(2) Runway markings shall be white in colour.

(3) Taxiway markings, runway turn pad markings and aircraft stand markings shall be yellow in colour.

(4) Apron safety-lines shall be of a conspicuous colour, which shall contrast with that used for aircraft stand markings.

(5) The application, location and the characteristics of markers for unpaved runway edge markers, stopway edge markers, taxiway edge markers, taxiway centreline markers and boundary markers shall be in accordance with the specifications determined by the Authority.

79. (1) An operator shall ensure that where a Voice over Radar (VOR) aerodrome checkpoint is established at an aerodrome, it is indicated by a VOR aerodrome checkpoint sign.

(2) The VOR aerodrome checkpoint location and characteristics shall be in accordance with specifications determined by the Authority.

80. An operator shall provide aircraft stand markings for designated parking positions on a paved apron in accordance with specifications determined by the Authority.
81. An operator shall provide apron safety lines on a paved apron as required by the parking configuration and ground facilities and in accordance with specifications determined by the Authority.

82. (1) An operator shall provide road-holding position markings at all road entrances to a runway.

(2) The road-holding position markings provided under subregulation (1) shall be located across the road at all the holding positions.

(3) The road-holding position marking shall be as specified by the Authority.

83. (1) An operator shall provide a mandatory instruction marking and a sign to identify a location beyond which a taxiing aircraft or vehicle shall not proceed, unless authorized by the aerodrome control tower.

(2) Where it is impracticable to install a mandatory instruction marking and a sign in accordance with subregulation (1), a mandatory instruction marking or sign shall be provided on the surface of the pavement.

(3) The location and characteristics of the mandatory instruction marking or sign shall be in accordance with specifications determined by the Authority.

(4) An operator shall provide signs to convey mandatory instructions and information on a specific location or destination on a movement area, or to provide surface movement guidance and control.
(5) The location and characteristics of the signs referred to in subregulation (4) shall be in accordance with the specifications determined by the Authority.

84. An operator shall install information marking, in accordance with specifications determined by the Authority, where an information sign is required but is physically impossible to install.

85. An operator shall ensure that the visual aids for denoting obstacles are frangible and that those located near a runway or taxiway are sufficiently low to preserve clearance for propellers and for engine pods of jet aircraft.

86. An operator shall ensure that all fixed obstacles that extend above take-off climb surfaces are marked and that where the runway is used at night, the obstacles are lighted in accordance with the specifications determined by the Authority.

87. (1) An operator shall ensure that restricted areas are marked in a manner that is visible to aircraft operating on the ground and in the air.

(2) Without prejudice to the generality of subregulation (1), markings denoting restricted areas such as closed runways and taxiways, non-load-bearing surfaces, pre-threshold areas and unserviceable areas shall be done in accordance with the specifications determined by the Authority.

PART XI
AERODROME OPERATIONAL SERVICES, EQUIPMENT, INSTALLATIONS AND FACILITIES
88. This Part applies to all categories of aerodromes except where otherwise specified.

89. The Authority may, in consultation with the authorities responsible for immigration, customs and excise, notify of any aerodrome which is introduced as, or ceases to be a place for landing or departure of aircraft for purposes of the laws relating to immigration, customs and excise.

90. (1) An operator shall establish an aerodrome emergency plan at the aerodrome, which shall-

(a) be commensurate with the aircraft operations and activities conducted at the aerodrome; and

(b) provide for the coordination of the actions to be taken in the event of an emergency occurring at the aerodrome or in its vicinity.

(2) The emergency plan shall provide for the coordination with the rescue coordination centre and for the response and participation of all agencies whose assistance is required in the event of an emergency, including –

(a) at an aerodrome-

(i) air traffic control unit;

(ii) rescue and firefighting services;

(iii) aerodrome administration;

(iv) medical and ambulance services;

(v) aircraft operators;

(vi) security services;
(vii) airport police unit;

(b) outside the aerodromes-

(i) fire departments;

(ii) Police force;

(iii) medical and ambulance services;

(iv) hospitals and public health services;

(v) military forces;

(vi) harbour patrol or coast guard.

(3) The emergency plan shall include-

(a) the types of emergencies planned for;

(b) agencies to be involved in the plan;

(c) the responsibility and role of each agency, the emergency operation centre and the command post for each type of emergency;

(d) names and contacts of offices or people to be contacted in the case of a particular emergency; and

(e) a grid map of the aerodrome and its immediate vicinity.

(4) In developing an aerodrome emergency plan, the operator shall take into consideration the human factor principles to ensure optimum response by all existing agencies participating in the emergency operations.

(5) This regulation applies to aerodromes in category A.

91. (1) An operator shall form an emergency planning committee to discuss, determine and implement emergency planning arrangements commensurate with the size and type of aircraft that use the aerodrome.
(2) This regulation applies to aerodromes in category A.

92.(1) An emergency plan established under regulation 90 shall contain procedures for periodic testing of the adequacy of the plan and for reviewing of the results in order to improve its effectiveness.

(2) Without prejudice to the generality of subregulation (1), the plan shall be tested by conducting-

(a) full scale emergency exercises every two years;

(b) partial emergency exercises every year, to ensure that any deficiencies found during the full scale aerodrome emergency exercise are corrected and reviewed, or after an actual emergency, to correct any deficiency found;

(c) table top emergency exercises at least once a year; and

(d) contingency plan exercises in accordance with the civil aviation security regulations.

93.(1) An operator of an aerodrome shall ensure that a fixed emergency operations centre and a mobile command post are available for use during an emergency.

(2) This regulation shall apply to aerodromes in category A.

94. (1) Where an aerodrome is located close to water or a swampy area and where a significant portion of
approach or departure operations takes place over the area, the emergency plan established under regulation 90 shall include the ready availability of and co-ordination with appropriate specialist rescue services.

(2) At an aerodrome located close to a water body, a swampy area, or difficult terrain, the aerodrome emergency plan shall include the establishment, testing and assessment at regular intervals of a pre-determined response for the specialist rescue services.

(3) This regulation applies to aerodromes in category A.

95. (1) An operator shall put in place rescue and firefighting facilities commensurate with the category of the aerodrome as specified by the Authority.

(2) Where an aerodrome is located close to a water body, a swampy area or difficult terrain and where a significant portion of approach or departure operations takes place over such an area, specialist rescue services and firefighting equipment appropriate to the hazard and risk shall be made available.

(3) The level of protection provided at an aerodrome for rescue and firefighting shall be appropriate to the aerodrome category which shall be determined using the principles in subregulations (4) and (5) 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.

(4) For purposes of aerodrome rescue and firefighting services, the aerodrome category shall be determined as specified by the Authority and shall be based on the longest aircraft that normally uses the aerodrome, and its fuselage width.
(5) Where after selecting the aerodrome category appropriate to the overall length of the longest aircraft, the fuselage of that aircraft is found to be greater than the maximum width provided for that category, the category for that aircraft shall be the next category or as specified by the Authority.

(6) The amounts of water for foam production and the complementary agents to be provided on the rescue and fire fighting vehicles shall be in accordance with the aerodrome category determined under subregulations (3) and (4).

(7) The amounts of water for foam production may be replaced as follows –

(a) for aerodrome categories one and two, up to one hundred per cent of water may be replaced by a complementary agent;

(b) for aerodrome categories three to ten, where a foam meeting performance level A is used, up to thirty per cent of the water may be replaced by a complementary agent.

(8) The quantities of water are based on the average overall length of an aircraft in a given category and where operations of the aircraft larger than the average size are expected, the quantities of water shall be recalculated.

(9) The complementary agents shall comply with the appropriate specifications of the International Organization for Standardisation (ISO).

(10) The operational objective of a 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.

(11) Any vehicles, other than the first responding vehicle(s), required to deliver the amounts of extinguishing agents shall ensure continuous agent application and shall arrive no more than four minutes from the initial call.
(12) All rescue and firefighting personnel shall be properly trained, including training in human performance and team coordination and shall participate in live fire drills commensurate with the types of aircraft and rescue and firefighting equipment in use at the aerodrome, including pressure-fed fuel fires.

(13) The minimum number of rescue and firefighting vehicle provided at an aerodrome shall be as required for the aerodrome category for rescue and firefighting and shall correspond to the foam meeting performance.

(14) The Authority may specify alternative means of compliance with this regulation for aerodromes in categories B, C and D.

96. (1) An operator shall have in place a plan for the removal of disabled aircraft from the movement area or adjacent to it.

(2) The plan for the removal of disabled aircraft shall be based on the characteristics of the type of aircraft operations and shall include:

(a) a list of equipment and personnel available for the purpose;

(b) arrangement for the rapid receipt of aircraft recovery equipment kits from other aerodromes, where applicable; and

(c) the name of the co-ordinator designated to implement the plan.

(3) The plan under this regulation shall include particulars of the procedures for removing a disabled aircraft on the movement area or adjacent to it.

(4) This regulation shall not apply to aerodromes in categories B, C and D unless otherwise specified by the Authority.

97. (1) An operator shall provide an apron
management service at an aerodrome where air traffic service is provided at that aerodrome.

(2) The apron management service provided under subregulation (1) shall be provided by an operator, an aerodrome air traffic service unit, or a combination of these, as may be specified for each aerodrome category by the Authority.

(3) Subject to subregulation (2), where the aerodrome control tower does not participate in the apron management service, procedures shall be established to facilitate the orderly transition of aircraft between the apron management unit and the aerodrome control tower.

(4) An operator shall ensure that, where an apron management service is established, radio communication facilities are provided.

(5) Where low visibility procedures are in effect, persons and vehicles operating in the apron shall be restricted to the essential minimum.

(6) An emergency vehicle responding to an emergency shall have priority over all other surface movement traffic and any vehicle operating on an apron shall give way to an emergency vehicle or to an aircraft about to taxi, or which is being pushed or towed.

(7) An aircraft stand at an apron where apron management service is provided shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand.

(8) This regulation does not apply to aerodromes in categories B, C and D unless otherwise specified by the Authority.

98. (1) An operator shall ensure that fire extinguishing equipment, suitable for at least the initial intervention in the event of a fuel fire, is readily available.
during the ground servicing of an aircraft, and that there is means of quickly summoning the rescue and firefighting service in the event of a fire or major fuel spill.

(2) An operator shall ensure that, when aircraft refuelling operations take place while passengers are on board, embarking or disembarking, ground equipment are positioned in a manner that allows-

(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.

99. (1) A person shall not operate a vehicle on the manoeuvring area at an aerodrome where air traffic service is provided, except where authorized by the aerodrome control tower.

(2) A person shall not operate a vehicle on an apron of an aerodrome except where authorized by the operator.

(3) A vehicle operating on the movement area shall have a rotating beacon.

(4) A driver of the vehicle on the movement area shall comply with all mandatory instructions conveyed by markings and signs, where the vehicle is on the manoeuvring area, except where the driver is authorized by the aerodrome control tower.

(5) A driver of the vehicle on the movement area shall comply with all mandatory instructions conveyed by markings and signs, where the vehicle is on an apron, except where the driver is authorized by the aerodrome operator.

(6) A driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by lights and instructions issued by the aerodrome control
tower where the vehicle is on the manoeuvring area or by the appropriate designated authority, where the vehicle is on an apron.

(7) A driver of a vehicle on the movement area shall be appropriately trained for the tasks to be performed and shall be issued with a permit by the operator.

(8) A 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, and shall maintain a continuous listening watch on the assigned frequency while on the movement area.

(9) This regulation shall not apply to aerodromes in categories B, C and D unless otherwise specified by the Authority.

100. (1) Except for the purpose of air navigation, a person shall not construct or install equipment or any installation on a runway strip, a runway end safety area, a taxiway strip, a clearway or within any distances determined by the Authority, where the construction or the equipment may endanger the safety of an aircraft.

(2) Where any equipment or installation required for air navigation purposes is to be located on a portion of a runway strip or on a runway end safety area, a taxiway strip or within any distances determined by the Authority, the equipment or installation shall be located in accordance with the standards specified by the Authority.

101. (1) An operator of an aerodrome shall provide a fence or a suitable barrier on the aerodrome-

(a) to prevent the entrance into the movement area, of any animals likely to be a hazard to aircraft; and

(b) to deter the inadvertent or premeditated
access of an unauthorized person onto a non-public area of the aerodrome.

(2) An operator shall provide suitable means of protection for an aerodrome to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safe operation of aircraft.

(3) The fence or barrier required under subregulation (1) shall be located so as to separate the movement area and other facilities or zones on the aerodrome which are vital to the safe operation of aircraft from areas open to public use.

(4) Where greater security is needed, a cleared area shall be provided on both sides of the fence or barrier to facilitate the work of patrols and to make trespassing more difficult and provision for a perimeter road along the aerodrome fencing for the use of both maintenance personnel and security patrols may be made.

(5) Where the Authority deems it necessary for security reasons, the fence or barrier provided under subregulation (1) shall be illuminated at a minimum essential level and the security lighting shall be located so that the ground area on both sides of the fence or barrier, particularly at access points, is illuminated.

(6) This regulation shall not apply to aerodromes in categories B, C and D unless otherwise specified by the Authority.

102. (1) An operator shall establish and maintain a safety inspection programme for the aerodrome.

(2) The safety inspection programme shall-

(a) provide procedures to ensure that competent aerodrome personnel execute the programme effectively; and

(b) provide a reporting system to ensure
prompt correction of unsafe aerodrome conditions noted during any inspection.

PART XII
AERODROME MAINTENANCE

103. This part shall apply only to aerodromes in categories A.

104. (1) An operator shall establish at the aerodrome, a maintenance programme, including preventive maintenance to maintain a facility in a condition that does not impair the safety, regularity and efficiency of air navigation.

(2) In this regulation, “facility” includes a pavement, visual aid, fencing, drainage system and building; “preventive maintenance” means programmed maintenance work done to prevent failure or degradation of a facility.

105. (1) An operator shall at all times ensure that-

(a) the surfaces of all movement areas including pavements (runways, taxiways, and aprons) and adjacent areas are inspected and their conditions monitored regularly as part of an aerodrome preventive and corrective maintenance programme with the objective of avoiding and eliminating any loose objects or debris that might cause damage to aircraft or impair the operation of aircraft systems;

(b) the surface of the runway is maintained in a condition that precludes formation of harmful irregularities such as water pools
and rough surfaces;

(c) measurements of the friction characteristics of the runway are made periodically with a continuous friction measuring device using self-wetting features;

(d) corrective maintenance action is taken whenever the friction characteristics for the entire runway or portion of it are below the prescribed minimum friction level or minimum maintenance planning level;

(e) when there is reason to believe that the drainage characteristics of a runway or portions of the runway, are poor due to slopes or depressions, then the runway friction characteristics are assessed under natural or simulated conditions that are representative of local rain and corrective maintenance action is taken where necessary;

(f) where a taxiway is used by turbine-engine aircraft, the surface of the taxiway shoulders is maintained so as to be free of any loose stones or other objects that may be ingested by the aircraft engines;

(g) the surfaces of the paved runways, taxiways and aprons, are maintained in a condition that provides good friction characteristics and low rolling resistance;

(h) any standing water, mud, dust, oil, rubber deposits and other contaminants is removed to minimize accumulation, with priority given to runways, taxiways, aprons, holding bays and other areas, in that order.
(2) An operator shall ensure that the overlaying of runway pavements is done in accordance with standards specified by the Authority so that aircraft operations do not experience down ramp.

106. (1) An operator shall not operate an aerodrome unless a system of preventive maintenance of visual aids is employed at the aerodrome.

(2) The system of preventive maintenance required under subregulation (1) shall, if employed for instrument precision approach runways categories I and II include-

(a) visual inspections 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 the light intensity settings used by air traffic control unit.

(3) The in-field measurements of intensity, beam spread and orientation of lights applicable to instrument precision approach runways categories I and II shall be undertaken by measuring all lights, as far as practicable to ensure conformity with prescribed specifications using a mobile measuring unit of sufficient accuracy to analyse the characteristics of individual lights.

(4) The frequency of measurement of lights shall be at least twice a year for instrument precision approach runways categories I and II and at least once a year for
other lights.

(5) An operator who is required to employ a system of preventive maintenance under subregulation (1), for instrument precision approach runways categories I and II operations and for operations under runway visual range conditions shall comply with specifications specified by the Authority.

107. An operator shall ensure that any construction or maintenance activity is not undertaken in the proximity of aerodrome electrical systems at any time during periods of low visibility operations.

108. (1) An operator shall establish procedures and precautions to ensure that any works carried out at an aerodrome do not endanger the safety of any aircraft operations.

(2) The procedures and precautions in subregulation (1) shall comply with standards specified by the Authority.

PART XIII
ELECTRICAL SYSTEMS

109. (1) This Part shall apply to aerodromes in category A.

(2) This Part may apply to aerodromes in categories B, C, and D where deemed necessary by the Authority.
110. (1) An operator shall not operate an aerodrome unless adequate primary power supply systems are made available for the safe functioning of air navigation services and facilities.

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

(3) Where secondary power is required for air navigation services and facilities, the operator shall arrange the electric power supply connections so as to ensure that the facilities are automatically connected to the secondary power supply upon failure of the primary power supply.

(4) Subregulation (3) applies for non-instrument runways except that a secondary power supply for visual aids may not be provided where an emergency lighting system is provided and is capable of being deployed within fifteen minutes.

(5) At an aerodrome where the primary runway is an instrument non-precision approach runway, a secondary power supply capable of fulfilling the requirements of subregulation (3) shall be provided, except that a secondary power supply for visual aids need not be provided for more than one instrument non-precision approach runway.

(6) An operator shall provide the following aerodrome facilities with secondary power supply capable of supplying power where 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;

(b) all obstacle lights which, in the opinion of the Authority are essential to ensure the safe operation of aircraft;

(c) approach, runway and taxiway lighting;

(d) meteorological equipment;

(e) essential security lighting, if provided;

(f) essential equipment and facilities for the aerodrome emergency agencies;

(g) floodlighting on a designated isolated aircraft packing position if provided; and

(h) illumination of apron areas over which passengers may walk.

(7) The maximum switch-over time between failure of the primary source of power and the secondary source of power for the services required by subregulation (6) shall be specified by the Authority.

(8) For the purpose of this regulation, “switch-over time” means the time required for the actual intensity of a light measured in a given direction to fall from fifty percent and recover to fifty percent during a power supply changeover, when the light is being operated at intensities of twenty-five percent or more.

PART XIV
INFORMATION TO BE REPORTED TO AERONAUTICAL INFORMATION SERVICES
111. This Part shall apply to all categories of aerodromes.

112. (1) An operator shall ensure that information relating to the aerodrome and its facilities, which is significant for the conduct of flights to and from the aerodrome, is available to the users of the aerodrome.

(2) An operator shall be responsible for notifying the Aeronautical Information Services of any errors and omissions in the aeronautical information of operational significance, published in the Aeronautical Information Publication or Aeronautical Information Circular or in the NOTAM, and of any pending changes in the aerodrome or its facilities which are likely to affect this information.

(3) An operator shall provide information on the following for the guidance of pilots and other operators:

(a) status of licensing/certification of the aerodrome;
(b) construction or maintenance work on or immediately adjacent to the manoeuvring area;
(c) unserviceable portions of any part of the manoeuvring area;
(d) the runway surface conditions when affected by water, damp, wet, water patches or flooded, as appropriate;
(e) parked aircraft or other objects on, or immediately adjacent to the taxiways;
(f) the presence of other temporary hazards;
(g) failure or irregular operation of any part of the aerodrome lighting system, or of the
(a) changes in the availability of the manoeuvring area and changes in the runway declared distance; except that increases in declared distances may only be made with the approval of the Authority;

(b) significant changes in aerodrome lighting and other visual aids;

(c) presence or removal of temporary obstructions to aircraft operation in the manoeuvring area;

(d) presence of airborne hazards to air navigation;

(e) interruption, return to service, or major changes to rescue facilities and aerodrome main and secondary power supplies;

(h) failure, irregular operation and changes in the operational status of any electronic approach or navigation aid, or aeronautical communication facility;

(i) failures and changes in the runway visual range observer system; and

(j) any other information of operational significance.

113. (1) Where any of the following conditions occur or are anticipated, an operator shall take immediate action to amend the information contained in the Aeronautical Information Circular and where necessary, promulgate the change by NOTAM through the Aeronautical Information Services using the Aeronautical Information Services address notified in the Aeronautical Information Circular –

(a) changes in the availability of the manoeuvring area and changes in the runway declared distance; except that increases in declared distances may only be made with the approval of the Authority;

(b) significant changes in aerodrome lighting and other visual aids;

(c) presence or removal of temporary obstructions to aircraft operation in the manoeuvring area;

(d) presence of airborne hazards to air navigation;

(e) interruption, return to service, or major changes to rescue facilities and
firefighting services in terms of the new category of the rescue and firefighting service available at the aerodrome; except that permanent changes to the promulgated rescue firefighting category may only be made with the approval of the Authority;

(f) failure of or return to operation of hazard beacons and obstruction lights on or in the vicinity of the aerodrome;

(g) erection or removal of obstructions to air navigation, and erection or removal of significant obstacles in take-off, climb or approach areas;

(h) air displays, air races, parachute jumping, or any unusual aviation activity; and

(i) any other information of operational significance.

(2) Where any of the conditions in subregulation (1) arises at short notice, an operator shall notify the Aeronautical Information Services for promulgation of a NOTAM.

(3) Where any of the conditions in subregulation (1) is intended, the operator shall make a written request to the Aeronautical Information Services, for the amendment of the Aeronautical Information Publication and Aeronautical Information Circular or for supplementary action.

114. (1) An operator or a person in charge of a navigation facility shall initiate NOTAM action-

(a) for the establishment or withdrawal of electronic aids to air navigation; and
Civil Aviation

Civil Aviation Regulations- Part XII- Licensing and Certification of Aerodromes-

(b) for changes in the regularity or reliability of operation of any electronic aid to air navigation or aeronautical communication facility.

(2) An operator or a person in charge of a navigation facility shall request for the NOTAM action, or an amendment or a supplement of Aeronautical Information Publication or Aeronautical Information Circular directly from the Aeronautical Information Services or through channels established by the Authority.

115. (1) An operator shall provide to the Authority for promulgation, accurate aeronautical data as specified by the Authority.

(2) An operator shall ensure that aerodrome related aeronautical data is adequate and accurate and that the integrity of the data is maintained and protected throughout the data process from survey or origin up to the next intended user.

(3) An operator shall determine and report aerodrome related aeronautical data in accordance with provided accuracy and integrity requirements while taking into account the established quality system procedures.

(4) Accuracy requirements for aeronautical data shall be based upon a ninety five percent confidence level and in that respect, three types of positional data, namely; surveyed points, calculated points and declared points shall be identified.

(5) Without prejudice to the generality of subregulations (1), (2), (3) and (4), the determination and reporting of aerodrome aeronautical data shall be in accordance with the accuracy and integrity levels specified by the Authority or a person in charge of a navigation facility.
(6) Subject to subregulation (5), the following classification and data integrity levels shall apply-

(a) critical data, integrity level $1 \times 10^{-8}$: where there is a high probability, when using corrupted critical data that the continued safe flight and landing of an aircraft may be severely at risk with the potential for catastrophe;

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

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

PART XV
GENERAL PROVISIONS

116. This Part shall apply to all categories of aerodromes except where otherwise specified.

117. (1) A person shall not-

(a) use a licence, certificate, approval, permission, exemption or any other document issued or required by or under these Regulations which is forged, altered, revoked, or suspended, or which
the person is not entitled to use;

(b) forge or alter a licence, certificate, approval, permission, exemption or any other document issued under or required by these Regulations;

c) lend a licence, certificate, approval, permission, exemption or any other document issued under or required by these Regulations to any other person; or

d) make any false representation for the purpose of procuring for himself, herself or any other person the issue, renewal or variation of a licence, certificate, approval, permission or exemption or other document.

(2) A person shall not, during the period for which it is required under these Regulations to be preserved –

(a) mutilate, alter, render illegible or destroy a licence, certificate or any entry made in any record;

(b) knowingly make, procure or assist in the making of any false entry in a licence, certificate or record, or

(c) wilfully omit to make a material entry in an licence, certificate or record.

(3) A record required to be maintained under these Regulations shall be recorded in a permanent and indelible material.

(4) A person shall not purport to issue a licence, certificate or exemption for the purpose of these Regulations unless that person is authorised to do so.

(5) The Authority may suspend or cancel a licence or certificate of an operator who contravenes any provision of these Regulations.
**Replacement of documents.**

118. A holder of a licence or certificate who requires a replacement of the licence or certificate may apply to the Authority in **a format that may be determined by the Authority.**

**Aeronautical user charges.**

119. (1) The Authority shall publish fees to be charged in connection with-

(a) the issue, validation, renewal, extension or variation of any licence, certificate or any other document, including a copy of any of these;

(b) the undertaking of any examination, test, inspection or investigation;

(c) the grant of any permission or approval required for the purpose of these Regulations.

(2) Where an application for which any fee is chargeable under subregulation (1) is made, the applicant shall, before the application is processed, pay the required fee.

(3) The Authority shall not refund the fees where an application is withdrawn after payment of fees is made or where the application ceases to have effect or is refused.

**Conditions for operating an aerodrome.**

120. A person shall not operate an aerodrome licensed or certificated under these Regulations unless the facilities and characteristics of the aerodrome are effectively related and match the needs of the aircraft for which the aerodrome is intended.

**Standards for physical characteristics.**

121. A person shall not operate an aerodrome unless the physical characteristics of the aerodrome comply with
the standards specified by the Authority and any publications as may be published or approved by the Authority.

122. (1) A person shall not exhibit a light in the vicinity of an aerodrome which, by its glare, endangers the safety of aircraft arriving or departing from the aerodrome.

(2) Where a light appears to the Authority to be capable of endangering the safety of aircraft as described in subregulation (1), the Authority may direct the owner of the place where the light is exhibited or the person having charge of light to extinguish and to prevent in the future, the exhibition of the light within the period specified.

(3) Where a light is or may be visible from any waters within the area of a general lighthouse authority, the power of the Authority under this regulation shall not be exercised except with the consent of that lighthouse authority.

123. (1) An owner or a person in charge of an en-route obstacle shall ensure that the en-route obstacle is fitted with medium intensity steady red light-

(a) positioned as close as possible to the top of the obstacle; and

(b) spaced as far as practicable, equally between the top lights and ground level with an interval not exceeding thirty three metres, at the intermediate levels.

(2) Where any light which is required by this regulation to be displayed fails, an owner or a person in charge of an en-route obstacle shall repair or replace the light as soon as is reasonably practicable but in any case not later than twenty-four hours after the failure of the light.
(3) Subject to subregulation (2), an owner or a person in charge of an en-route obstacle shall ensure that the lights required to be fitted by this regulation are displayed.

(4) An owner or a person in charge of an en-route obstacle shall ensure that sufficient light is fitted and arranged at each level of an obstacle where lights are required to be fitted, so as to show, when displayed, in all directions.

(5) The Authority may direct that an en-route obstacle is fitted with additional lights which shall be displayed in positions and times as the Authority may specify.

(6) For the purpose of this regulation-

(a) “en-route obstacle” means any building, structure or erection, which is one hundred metres or more, above ground level, except a building, structure or erection, which is in the vicinity of an aerodrome;

(b) “medium intensity steady light” means a light, which complies with the characteristics described for a medium intensity type C light as specified in the Manual of Aerodrome Standards in Schedule 1.

Schedule 1.

124. All land use practices and activities in the vicinity of an aerodrome shall conform to the guidelines determined by the Authority.

125. Where an aerodrome does not meet the requirements of standards specified by the Authority, the
Authority may determine, after carrying out aeronautical studies, the conditions and procedures that are necessary to ensure a level of safety equivalent to that established by the relevant specified standard.

126. Any deviation from a specified standard or procedure in these Regulations shall be set out in an endorsement on the aerodrome manual.

127. The Authority shall-

(a) carry out such safety inspections and audits as may be necessary for the purpose of verifying the validity of an application for construction and operation of an aerodrome;

(b) carry out safety inspections and audits of any document and records of an operator, which may be necessary to determine compliance with the appropriate requirements in these Regulations.

PART XVI
SAVINGS AND TRANSITION

128. A licence, certificate or any other document issued to an operator prior to the commencement of these Regulations shall continue in force as if it was issued under these Regulations until it expires or is cancelled by the Authority.
SCHEDULE 1

MANUAL OF AERODROME STANDARDS

First Edition
February, 2016

FOREWORD

These Standards are setup under the authority of the responsible Ministry for the aerodrome certification and licensing. The Aerodrome Standards are based on the standards and recommended practices stipulated in Volume I of Annex 14 to the Chicago Convention on International Civil Aviation Organization (ICAO).
Where necessary, the Director of Aviation Safety Regulation may wish to supplement the aero
drome standards and requirements in the form of directives, Notices, Circulars and/or Publications as and when published by the Authority. Such publications or directives may be incorporated into this Manual by making necessary periodical amendments.

Users and other interested parties should forward advice and suggestions for improvement to:

Director General,
Guyana Civil Aviation Authority,
73 High Street Kingston
Guyana

Director Aviation Safety Regulation
Guyana Civil Aviation Authority

RECORDS OF AMENDMENTS

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ABBREVIATIONS AND SYMBOLS

**Abbreviations**

- **ACN**: Aircraft Classification Number
- **AGL**: Aerodrome Ground Lighting
- **AIP**: Aeronautical Information Publication
- **AIS**: Aeronautical Information Services
- **AOC**: Air Operator’s Committee
- **Aprx**: Approximately
- **ASDA**: Accelerate-Stop Distance Available
- **ATC**: Air Traffic Control
ATS - Air Traffic Services
cd - Candela
cm - Centimetre
C - Degree Celsius
Cat. - Category
DGCA - Director-General of Civil Aviation
DME - Distance Measuring Equipment
DSR - Director of Safety Regulation
DANS - Director Air Navigation Services
ft - Foot
ICAO - International Civil Aviation Organisation
ILS - Instrument Landing System
IMC - Instrument Meteorological Conditions
kg - Kilogram
km - Kilometre
km/h - Kilometre per Hour
kt - Knot
K - Degree Kelvin
L - Litre
LDA - Landing Distance Available
m - Metre
max - Maximum
mm - Millimetre
mm - Minimum
MLS - Microwave Landing System
MN - Mega Newton
MOT - Ministry of Transport
MPa - Mega Pascal
NM - Nautical Mile
OCA/H - Obstacle Clearance Altitude/Height
OFZ - Obstacle Free Zone
PAPI - Precision Approach Path Indicator
PCN - Pavement Classification Number
RESA - Runway End Safety Area
RFFS - Rescue and Fire Fighting Services
RVR - Runway Visual Range
SARPS - ICAO Standards and Recommended Practices
SMGCS - Surface Movement Guidance and Control System
SMR - Surface Movement Radar
SMS - Safety Management System
TODA - Take-Off Distance Available
TORA - Take-Off Run Available
VMC - Visual Meteorological Conditions
Vol. - Volume
VOR - Very High Frequency Omni-directional Radio Range

Symbols
° Degree
= Equals
‘ Minute of Arc
μ Friction Coefficient
> Greater than
< Less than
% Percentage
± Plus or Minus
“ Second of Arc

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CHAPTER 1 – INTRODUCTION

1.1.0 General

Background and Scope

1.1.0.1 Aerodrome safety is a vital link in aviation safety. Aerodrome safety is achieved by providing appropriate aerodrome services, facilities and equipment and maintaining them and the aerodrome environment to a level safe for aircraft operations. By complying with the prescribed standards and procedures, and by taking a proactive safety management approach in the operation of their aerodrome. Aerodrome operators can demonstrate that they have discharged their safety obligations to the travelling public.

1.1.0.2 This Manual of Aerodrome Standards contains aerodrome standards recommended practices and guidance materials pertaining to the planning, operation and maintenance of aerodrome services, facilities and equipment to be complied with by aerodrome operators. The manual contains standards and recommended practices that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces.

1.1.0.3 This document sets forth the minimum aerodrome specifications for aircraft which have the characteristics of those which are currently operating or for similar aircraft that are planned for introduction. Accordingly, any additional safeguards that might be considered appropriate to provide for more demanding aircraft are not taken into account. Such matters are left to appropriate authorities to evaluate and take into account as necessary for each particular aerodrome. Provisions for the accommodation of more demanding aircraft at existing aerodromes can be found in the PANS-AERODROMES (Doc 9981). Guidance on some possible effects of future aircraft on these specifications is given in the Aerodrome Design Manual (Doc 9157), Part 2.

1.1.0.4 The scope of this Manual is confined to the safety, regularity and efficiency aspects of aerodrome facilities, equipment and operational procedures. It does not cover such aspects as those
related to aeronautical meteorology, the administration of aerodrome finances and the servicing of passengers and cargo. It also excludes air traffic services and aeronautical information services, although their coordination with the aerodrome operator, which forms an integral part of an aerodrome’s operations, has been incorporated.

1.1.1 Aerodrome safety regulation
1.1.1.1 Paragraph 1.4.1 of ICAO Annex 14 Vol. I states that States shall certify aerodromes used for international operations in accordance with the specifications contained in the Annex as well as other relevant ICAO specifications through an appropriate regulatory framework. Paragraph 1.4.3 of the Annex further states that the regulatory framework shall include the establishment of criteria and procedures for the certification of aerodromes.
1.1.1.2 Reserved.
1.1.1.3 Reserved

1.1.1.4 The Authority shall grant a certificate in respect of an aerodrome in Guyana subject to the provision of the Guyana Aviation Requirements 2007.

a) the applicant is competent, having regard to his/her previous conduct and experience, his/her facilities and equipment, organisation, staffing, maintenance and other arrangements, to ensure that the aerodrome and the airspace within which its visual traffic is contained is safe for use by aircraft;

b) the aerodrome manual prepared for the applicant’s aerodrome and submitted with the application for the aerodrome licence or certificate contains accurate information and complies with the requirements specified by the Authority;

c) the applicant’s aerodrome facilities, equipment and services comply with the standards specified by the Authority;

d) the applicant’s aerodrome operating procedures make satisfactory provision for the safety of aircraft;

e) an acceptable safety management system is in place in respect of certified aerodromes; and subject to such conditions as the Authority may deem necessary.
1.1.2 Aerodrome security regulation
1.1.2.1 The regulations on aviation security as they pertain to aerodromes are contained in the Civil Aviation (Security) Regulations, and are outside the scope of this Manual except those areas for preventing unlawful interference at the aerodrome and for preventing unauthorized entry of persons, vehicles, equipment, animals and anything considered undesirable into the movement area. Aerodrome operators shall adhere to the Civil Aviation (Security) Regulations in order to implement aerodrome security measures (such as control of access to the aircraft movement areas, aerodrome fencing and security lighting) in accordance with the standards and recommended practices stipulated in ICAO Annex 17.

1.1.3 Aircraft accident investigation
1.1.3.1 The responsibility for investigation of aircraft accidents and incidents in Guyana is vested on the agency designated by the Minister Aircraft Accident Investigation Unit. The Guyana Civil Aviation Authority may however conduct its own internal investigations to determine if any breach of aerodrome safety regulations and requirements could have contributed to an accident or incident.

1.1.4 Regulatory Framework for Aerodromes Oversight
1.1.5 Responsibilities of the Authority

1.1.5.1 The safety regulatory roles and responsibilities with regard to aerodromes include:

- a) Ensuring that aerodromes in Guyana offer a safe operating environment in accordance with the Convention on International Civil Aviation;
- b) Reviewing ICAO State letters on the subject of aerodromes, preparing response thereto and taking action thereon;
- c) Notifying ICAO of differences between Guyana’s national aerodrome regulations and practices concerning the Standards and Recommended Practices contained in ICAO Annex 14.
- d) Carrying out aerodrome licensing/certification in accordance with the Civil Aviation regulations and the procedures set out in the Aerodrome Certification Manual;
- e) Developing and reviewing national safety standards and recommended practices relating to aerodromes;
- f) Monitoring and ensuring adherence to aerodrome standards and recommended practices through regular safety audits and providing measures for enforcing compliance;
g) Conducting regular reviews of aerodrome regulations and practices, and developing and issuing aerodrome safety directives, notices, circulars and/or publications containing guidance material relating to aerodrome standards and recommended practices to promote the improvement of aerodrome safety;

h) Reviewing aerodrome-related accident and incident investigation reports and performing investigations, where necessary, to determine if there is any violation of safety regulations and requirements by aerodrome operators;

i) Notification of Aeronautical Information regarding the licensed or certified status and particulars of aerodromes through promulgation in the Aeronautical Information Publications;

j) Maintaining a technical library containing files for each licensed or certified aerodrome; records of the organisation; documents issued by ICAO relating to the design, operations and maintenance of aerodrome facilities and equipment; national aerodrome standards, recommended practices, guidance material and where necessary, other relevant reference materials; and

1.1.5.2 Notwithstanding that the Authority sets and maintains aerodrome standards and recommended practices, licenses or certifies aerodrome operators and conducts aerodrome safety oversight audit, the responsibility for the safety of aerodrome operations rests with the aerodrome operators. A certified aerodrome operator with a Safety Management System in place is required to maintain its own safety audit and inspection program with the Authority taking an interest in what the internal safety audit program is achieving and how the aerodrome operator organisation is performing from a safety perspective.

1.1.5.3 The Authority shall monitor the safety performance through conducting regular safety audits, reviewing the findings, identifying preventive and corrective actions needed, examining safety occurrences at the aerodromes and evaluating concerns expressed by the public or other industry participants.

1.1.6 Relevant legislation and documents

1.1.6.1 Reserved.
1.1.6.2 Reserved
1.1.6.3 Reserved
1.1.6.4 The Manual of Aerodrome Standards contains the requirements published by the Director General Civil Aviation (DGCA). These requirements are based on the SARP’s contained in ICAO Annex 14 Vol.1 and other related ICAO guidance material. The DGCA may also adopt suitable standards and /or recommended practices from other States into this Manual. Aerodrome operators shall document their internal action in their Aerodrome Manuals to demonstrate their continued compliance with requirements in this Manual.

1.1.6.5 Aerodrome Safety Directives and /or Aerodrome Safety Publications, where published, are intended to supplement the standards and recommended practices contained in the Manual of Aerodrome Standards, or to provide recommended practices and additional materials for education. These documents illustrate a means, but not necessarily the only means, of complying with the Regulations. These Directives or Publications may explain certain regulatory requirements by providing interpretive and explanatory materials. It is expected that aerodrome operators will provide adequate practices and /or document internal actions in their own Aerodrome Manuals to address the subject matter contained in these Directives or Publications.

1.1.7 Publication of differences in AIP
1.1.7.1 Differences between the Standards prescribed in this Manual and those contained in ICAO Annex 14, if any, shall be promulgated in the Guyana Aeronautical Information Publications (AIP) and notified to ICAO.

1.1.7.2 Aerodrome operators shall notify any differences between the provisions at their aerodromes and the Standards prescribed in this Manual through the Aerodrome (AD) section of the AIP. Such differences shall be subject to approval by the Authority.

1.1.8 Document change management
1.1.8.1 The power and rights to issue and amend this Manual rests with the Director General of Guyana Civil Aviation Authority.

1.1.8.2 Requests for any change, review or amendment in content of this Manual may be directed as follows:
   Director General
1.1.8.3 The need to amend this Manual may be generated by a number of causes, including but not be limited to:

a) promotion of safety;
b) response to changed requirements;
c) response to ICAO prescription; or
d) accommodation of new initiatives or technologies.

1.1.9 Related reference documents
1.1.9.1 This Manual should be read in conjunction with the list of reference documents shown in Appendix 8 to this Manual.

1.2.0 Definitions

When the following terms are used in this Manual, they have the following meanings:

Accident: Any occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which;

1) any person suffers death or seriously injured as a result of
   a) being in the aircraft, or
   b) direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
   c) direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted, or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or
2) the aircraft sustains damage or structural failure which:
   a) adversely affects the structural strength, performance or flight characteristics of the aircraft; and
   b) would normally require major repair or replacement of the affected component, except for engine failure or damage,
when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tyres, brakes, fairings, small dents or puncture holes in the aircraft skin; or

3) the aircraft is missing or is completely inaccessible.

Note 1 – an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury.

Note 2 – an aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

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

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

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

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

Aerodrome Certificate: A certificate issued by the Authority under the Civil Aviation (Aerodromes) Regulations, for the operation of an aerodrome.

Aerodrome elevation: The elevation of the highest point of the landing area

Aerodrome facilities and equipment: Any facility or equipment, inside or outside the boundaries of an aerodrome that is constructed, or installed, and maintained for the arrival, departure and surface movement of aircraft

Aerodrome identification sign: A sign placed on an aerodrome to aid in identifying the aerodrome from the air.

Aerodrome incident: An incident involving an aircraft operation and

a) an obstruction either on the aerodrome operational area or protruding into the aerodrome obstacle limitation surfaces; or

b) a defective visual aid; or

c) a defective surface of a manoeuvring area; or

d) any other hazardous or potentially hazardous situation.

Aerodrome License: A license granted by the Authority to an aerodrome operator to operate an aerodrome, and for the purpose of this Manual, includes an aerodrome certificate.
**Aerodrome Manual:** The manual forming part of the application for an Aerodrome Certificate under the Aerodrome regulations and includes any amendments thereto made in accordance with the regulations.

**Aerodrome mapping data (AMD).** Data collected for the purpose of compiling aerodrome mapping information for aeronautical uses. Note. — Aerodrome mapping data are collected for purposes that include the improvement of the user’s situational awareness, surface navigation operations, training, charting and planning.

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

**Aerodrome operator:** means the holder of an Aerodrome Certificate or licence.

**Aerodrome reference point:** The designated geographical location of an aerodrome.

**Aerodrome Safety Directives, Notices, Circulars and Publications:** Refers to directives, notices, circulars and publications published by and issued by the Authority intended to supplement the standards, recommended practices and guidance material contained in the Manual of Aerodrome Standards, or to provide recommended practices and additional materials for education.

**Aerodrome Safety Regulation Division:** A unit or units within the Guyana Civil Aviation Authority responsible for aerodrome safety standards regulation.

**Aerodrome traffic density**

a) **Light.** Where the number of movements in the mean busy hour is not greater than 15 per runway or typically less than 20 total aerodrome movements.

b) **Medium.** Where the number of movements in the mean busy hour is of the order of 16 to 25 per runway or typically between 20 to 35 total aerodrome movements.

c) **Heavy.** Where the number of movements in the mean busy hour is of the order of 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 landing constitutes a movement.
**Aeronautical beacon:** An aeronautical ground light visible at all azimuths, either continuously or intermittently, to designate a particular point on the surface of the earth.

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

**Aeronautical Information Circular:** A notice containing information, which relates to flight safety, air navigation, technical, administrative or legislative matters.

**Aeronautical Information Publication:** A publication issued by and with the authority of the Aeronautical Information Services and containing aeronautical information of a lasting character essential to air navigation.

**Aeronautical Information Services:** The services established within the defined area of coverage responsible for the provision of aeronautical information and data necessary for the safety, regularity and efficiency of air navigation and, where appropriate, includes the personnel and facilities employed to provide information pertaining to the availability of air navigation services and their associated procedures necessary for the safety, regularity and efficiency of air navigation.

**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 – Attachment A, Section 2 of Annex 14 provides information on the concept of balanced field length and the ICAO Airworthiness Technical Manual (Doc9051) contains detailed guidance on matters related to take-off distance.*

**AIP amendment:** Permanent changes to the information contained in the Aeronautical Information Publication.

**AIP supplement:** Temporary changes, published by means of special pages, to the information contained in the Aeronautical Information Publication.

**Aircraft Classification Number (ACN):** A number expressing the relative effect of an aircraft on a pavement for a specified standard sub-grade 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 aft most CG position appropriate to the maximum gross apron (ramp)*
mass is used to calculate the CAN. 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.

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

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

**Authority:** The Guyana Civil Aviation Authority established under Section 3 of the Civil Aviation Act.

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

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

**Bird incident:** An incident where;
  a) there is a collision between an aircraft and one or more birds;
  b) where one or more birds pass sufficiently close to an aircraft in flight to cause alarm to the pilot.

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

**Capacitor discharge lights:** A lamp in which high-intensity flashes of extremely short duration are produced by the discharge of electricity at high voltage through a gas enclosed in a tube.

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

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

**Controlled aerodrome:** An aerodrome provided with air traffic control services

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

**Data quality:** A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution and integrity.
Datum: Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities.

Declared distances

a) Take-off run available (TORA). The length of runway declared available and suitable for the ground run of an aeroplane taking off.
b) Take-off distance (TODA). The length of the take-off run available plus the length of the clearway, if provided
c) Accelerate-stop distance available (ASDA). The length of the take-off run available plus the length of the stopway, if provided
d) Landing distance available (LDA). The length of runway, which is declared available and suitable for the ground, run of an aeroplane landing

Dependent parallel approaches: Simultaneous approaches to parallel or near parallel instrument runways where radar separation minimum between aircraft on adjacent extended runway centre lines are prescribed

Director-General: The Director-General of the Guyana Civil Aviation Authority

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

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

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

Fatal injury: Means any injury, which results in death within 30 days of the accident.

Facility malfunction incident: Means an incident that involves an unserviceability of a visual/non-visual aid, electrical system, aeronautical telecommunications facility and/or other equipment needed for aircraft operation.

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

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

**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.

*Note. – In the Gregorian calendar, common years have 365 days and leap years, 366 days divided into 12 sequential months.*

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

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

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

**Holdover time**: The estimated time the anti-icing fluid (treatment) will prevent the formation of ice and frost and the accumulation of snow on the protected (treated) surfaces of an aeroplane.

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

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

**Human performance**: Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.
**Identification beacon:** An aeronautical beacon emitting a coded signal by means of which a particular point of reference can be identified.

**Incident:** An occurrence, other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operation.

**Independent parallel approaches:** Simultaneous approaches to parallel or near-parallel instrument runways where radar separation minima between aircraft on adjacent extended runway centre lines are not prescribed.

**Independent parallel departures:** Simultaneous departures from parallel or near parallel instrument runways

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

a) **Non-precision approach runway.** An instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach.

b) **Precision approach runway, category I.** An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height not lower than 60m (200ft) and either a visibility not less than 800m or a runway visual range not less than 550m.

c) **Precision approach runway, category II.** An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height lower than 60m (200 ft) but not lower than 30m (100 ft) and a runway visual range not less than 300m.

d) **Precision approach runway, category III.** An instrument runway served by ILS and/or MLS to and along the surface of the runway and:

A - intended for operations with a decision height lower than 30m (100ft), or no decision height and a runway visual range not less than 175m.

B - intended for operations with a decision height lower than 15m (50 ft), or no decision height and a runway visual range less than 175m but not less than 50m.

C - intended for operations with no decision height and no runway visual range limitations.

**Note 1.** – See ICAO Annex 10, Volume 1, and Part 1, for related ILS and/or MLS specifications.

**Note 2 –** Visual aids need not necessarily be matched to the scale of non-visual aids provided. The criterion for the selection of visual...
aids is the conditions in which operations are intended to be conducted.

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

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

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

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

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

**Intermediate holding position:** A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower.

**Investigation:** A process conducted for the purpose of accident prevention, which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes, and, when appropriate, the making of safety recommendations.

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

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

**Laser-beam critical flight zone (LCFZ):** Airspace in the immediate proximity of an aerodrome but beyond the LFFZ where the irradiance is restricted to a level unlikely to cause glare effects.

**Laser-beam free flight zone (LFFZ):** Airspace in the immediate proximity of the aerodrome where the irradiance is restricted to a level unlikely to cause any visual disruption.
Laser-beam sensitive flight zone (LSFZ): Airspace outside and not necessarily contiguous with, the LFFZ and LCFZ where the irradiance is restricted to a level unlikely to cause flash-blindness or after-image effects.

Licensed aerodrome: An aerodrome whose operator has been granted an Aerodrome licence and for the purpose of this manual includes certified aerodromes.

Lighting system reliability: The probability that the complete installation operates within the specified tolerances and that the system is operationally usable.

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

Manual of Aerodrome Standards: The document published by the Authority containing the standards, recommended practices and guidance material on aerodromes as may be determined to be applicable in Guyana.

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

Marking: A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information

Minister: The Minister for the time being responsible for civil aviation.

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

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

Non-instrument runway: A runway intended for the operation of aircraft using visual approach procedures.

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

NOTAM or Notice to Airmen: Means a notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

Obstacle: Any fixed (whether temporary or permanent) and mobile objects, or part thereof, that:

   a) are located on an area intended for the surface movement of aircraft; or
b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

**Obstacle free zone:** The airspace above the inner approach surface, inner transitional 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 frangible mounted one required for air navigation purposes.

**Obstacle limitation surfaces:** Means 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 aircraft operations to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome.

**Occurrence:** Means an accident or incident.

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

**Pavement classification number (PCN):** A number expressing the bearing strength of a pavement for unrestricted operations.

**Precision approach runway:** See ‘Instrument runway’.

**Pre-flight information bulletin:** Means a presentation of current NOTAM information of operational significance, prepared prior to flight.

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

**Promulgated information incident:** Means an incident that involves significantly incorrect, inadequate, or misleading information promulgated in any aeronautical information publication, map or chart.

**Protected flight zones:** Airspace specifically designated to mitigate the hazardous effects of laser radiation.

**Road:** An established surface route on the movement area meant for the exclusive use of vehicles.

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

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

**Runway end safety area (RESA):** An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.
Runway guard lights: A light system intended to caution pilots or vehicle drivers that they are about to enter an active runway.

Runway-holding position: A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

Note. – In radio telephony phraseologies, the expression “holding point” is used to designate the runway-holding position.

Runway strip: A defined area, including the runway and stopway if provided, that is intended:

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

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

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

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

Security incident: An incident that involves unlawful interference.

Segregated parallel operations: Simultaneous operations on parallel or near parallel instrument runways in which one runway is used exclusively for approaches and the other runway is used exclusively for departures.

Serious incident: An incident involving circumstances indicating that an accident nearly occurred.

Serious injury: Any injury that is sustained by a person in an accident and that

a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
b) results in a fracture of any bone, except simple fractures of fingers, toes or nose; or
c) involves lacerations which cause severe haemorrhage, nerve, muscle, or tendon damage; or
d) involves any injury to any internal organ; or
e) involves second or third degree burns, or any burns affecting more than 5% of the body surface; or
f) involves verified exposure to infectious substances or injurious radiation.

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

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

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

**State safety programme:** An integrated set of regulations and activities aimed at improving safety.

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

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

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

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

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

   a) *Aircraft stand taxi lane.* A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

   b) *Apron taxiway.* A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

   c) *Rapid exit taxiway.* A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

**Taxiway intersection:** A junction of two or more taxiways
**Taxiway strip:** An area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway.

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

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

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

*Note* - *Cross wind component means the surface wind component at right angles to the runway centre line*

**Unserviceable area:** A part of the movement area that is unfit and unavailable for use by aircraft.

**Work area:** A part of an aerodrome in which maintenance or construction works are in progress.

*Note.* – *Terms and definitions that are shown in singular above shall also take on the same meaning when they are expressed in plural form in this Manual and vice versa.*

### 1.3.0 Applicability

1.3.1 The interpretation of some of the specifications in this Manual expressly requires the exercising of discretion, the taking of a decision or the performance of a function by the Authority. In other specifications, the expression appropriate authority does not actually appear although its inclusion is implied. In both cases, the responsibility for whatever determination or action is necessary shall rest with the State having jurisdiction over the aerodrome.

1.3.2 The specifications, unless otherwise indicated in a particular context, shall apply to all aerodromes open to public use in accordance with the requirements of the Civil Aviation Act and the Civil Aviation (Aerodromes) Regulations. The specifications of Chapter 3 shall apply only to land aerodromes. The specifications in this Manual shall apply, where appropriate, to heliports.

1.3.3 Wherever a colour is referred to in this Manual, the specifications for that colour given in Appendix 1 shall apply.

### 1.4.0 Common reference system

1.4.1 **Horizontal Reference System**

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

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

1.4.2 **Vertical Reference System**

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

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

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

1.4.3 **Temporal reference system**

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

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

1.5.0 **Certification of aerodromes**

1.5.1 **Introduction**

The intent of these specifications is to ensure the establishment of a regulatory regime so that compliance with the specifications in this document can be effectively enforced. It is recognized that the methods of ownership, operation and surveillance of aerodromes differ among States. The most effective and transparent means of ensuring compliance with applicable specifications is the availability of a separate safety oversight entity and a well-defined safety oversight mechanism with support of appropriate legislation to be able to carry out the function of safety regulation of aerodromes. When an aerodrome is granted a certificate, it signifies to aircraft operators and other organisations 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 Authority, 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 will be provided to the Aeronautical Information Services for promulgation in the Aeronautical Information Publication (AIP).

1.5.2 Reserved.

Note. — Specific procedures on the stages of certifying an aerodrome are given in the PANS-AERODROMES (Doc 9981). Further guidance on aerodrome certification can be found in the Manual on Certification of Aerodromes (Doc 9774).

1.5.3 The Authority shall where deemed necessary, certify any aerodromes open to public use in accordance with the specifications stipulated in this document as well as specifications prescribed in other related guidance Materials.

1.5.4 The regulatory framework shall include the establishment of criteria and procedures for the certification of aerodromes.

Note: The criteria and procedures for certification of aerodromes in Guyana is described in the GCAA Inspector’s Handbook and the GCAA Aerodrome Certification Manual.

1.5.5 As part of the certification process, the Authority 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 aerodrome certificate, are available in the 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. Annex 19 — Safety Management contains the safety management provisions applicable to certified aerodrome. Guidance on an aerodrome harmonized safety management system is given in the Safety Management Manual (SMM) (Doc 9859) and in the 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 and continuous monitoring to enforce compliance with applicable specifications so that identified risks are mitigated can be found in the PANS-AERODROMES (Doc 9981).

1.6.0 Safety management

1.6.1 The Authority shall establish a state safety programme in order to achieve an acceptable level of safety in civil aviation.

Note. – The framework for the implementation and maintenance of a state safety programme is contained in Attachment D of this Manual and guidance on a State safety programme is contained in the ICAO Safety Management Manual (SMM) (Doc 9859)

1.6.2 The acceptable level of safety to be achieved shall be established by the Authority in the established State safety programme.

Note. – Guidance on defining an acceptable level of safety is contained in the ICAO Safety Management Manual (SMM) (Doc 9859).

1.6.3 As part of the safety programme, a certified aerodrome operator shall implement a safety management system acceptable to the Authority and that, as a minimum:

a) identifies safety hazards;

b) ensures the implementation of remedial action necessary to maintain agreed safety performance;

c) provides for continuous monitoring and regular assessment of the safety performance; and

d) aims at a continuous improvement of the overall performance of the safety management system.


1.6.4 A safety management system shall clearly define lines of safety accountability throughout a certified aerodrome, including a direct accountability for safety on the part of senior management.

Note. – the framework for the implementation and maintenance of a safety management system is contained in Appendix 7 of this Manual. Guidance on safety management systems is contained in the ICAO Safety Management Manual (SMM) (Doc 9859), and in the Manual on Certification of Aerodromes (Doc 9774) and in Chapter 11 of this Manual.

1.7.0 Airport design

1.7.1 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 are contained in the ICAO Airport Planning Manual (Doc 9184), Part 1.

1.7.2 The design of aerodromes shall take into account, where appropriate, land-use and environmental control measures. 

Note. – Guidance on land-use planning and environmental control measures is contained in the ICAO Airport Planning Manual (Doc 9184), Part 2. Also see Attachment B, Para 1.1.3 b).

1.8.0 Reference code

1.8.1 Introduction

The intent of the reference code is to provide a simple method for inter-relating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for the aeroplanes that are intended to operate at the aerodrome. The code is not intended to be used for determining runway length or pavement strength requirements. The code is composed of two elements which are related to the aeroplane performance characteristics and dimensions. Element 1 is a number based on the aeroplane reference field length and element 2 is a letter based on the aeroplane wing span and outer main gear wheel span. A particular specification is related to the more appropriate of the two elements of the code or to an appropriate combination of the two code elements. The code letter or number within an element selected for design purposes is related to the critical aeroplane characteristics for which the facility is provided. When applying the provisions of this Manual, the aeroplanes which the aerodrome is intended to serve are first identified and then the two elements of the code.

1.8.2 An aerodrome reference code — code number and letter — which is selected for aerodrome planning purposes shall be determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended.

1.8.3 The aerodrome reference code numbers and letters shall have the meanings assigned to them in Table 1-1.

1.8.4 The code number for element 1 shall be determined from Table 1-1, column 1, selecting the code number corresponding to the highest
The value of the aeroplane reference field lengths of the aeroplanes for which the runway is intended.

*Note. – The determination of the aeroplane reference field length is solely for the selection of a code number and is not intended to influence the actual runway length provided.*

**1.8.5** The code letter for element 2 shall be determined from Table 1-1, column 3, by selecting the code letter which corresponds to the greatest wing span, or the greatest outer main gear wheel span, whichever gives the more demanding code letter of the aeroplanes for which the facility is intended.

*Note. – Guidance to assist the appropriate authority in determining the aerodrome reference code is given in the Aerodrome Design Manual (Doc 9157), Parts 1 and 2.*

### Table 1-1. Aerodrome reference code (see 1.8.2 to 1.8.4)

<table>
<thead>
<tr>
<th>Code number (1)</th>
<th>Aeroplane reference field length (2)</th>
<th>Code letters (3)</th>
<th>Wing span (4)</th>
<th>Outer main gear wheel span (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 800m</td>
<td>A</td>
<td>Up to but not including 15m</td>
<td>A up to but not including 4.5m</td>
</tr>
<tr>
<td>2</td>
<td>800m up to but not including 1200m</td>
<td>B</td>
<td>15 m up to but not including 24 m</td>
<td>4.5 m up to but not including 6 m</td>
</tr>
<tr>
<td>3</td>
<td>1200m up to but not including 1800m</td>
<td>C</td>
<td>24 m up to but not including 36 m</td>
<td>6 m up to but not including 9 m</td>
</tr>
<tr>
<td>4</td>
<td>1800m and over</td>
<td>D</td>
<td>36 m up to but not including 52 m</td>
<td>9 m up to but not including 14 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>52 m up to but not including 65 m</td>
<td>9 m up to but not including 14 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>65 m up to but not including 80 m</td>
<td>14 m up to but not including 16 m</td>
</tr>
</tbody>
</table>

### CHAPTER 2 – AERODROME DATA

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

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

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

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

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

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

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

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

2.2.0 Information to be reported to the AIS

2.2.1 Aeronautical data

2.2.1.1 Determination and reporting of aerodrome-related aeronautical data shall be in accordance with the accuracy and integrity requirements set forth in tables A5-1 to A5-5 contained in Appendix 5 while taking into account the established quality systems procedures. Accuracy requirements for aeronautical data are based
upon a 95% confidence level in and in that respect, three types of positional data shall be identified: surveyed points (e.g. runway threshold), calculated points (mathematical calculations from known surveyed points of points in space, fixes) and declared points (e.g. flight information region boundary points).

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

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

Note. — Aerodrome mapping databases related provisions are contained in Annex 15, Chapter 11.

2.2.1.3 Where made available in accordance with 2.2.1.2, the selection of the aerodrome mapping data features to be collected shall be made with consideration of the intended applications.

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

2.2.1.4 Where made available in accordance with 2.2.1.2, aerodrome mapping data shall comply with the accuracy and integrity requirements in Appendix 5.

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

2.2.1.5 Integrity of aeronautical data shall be maintained throughout the data process from survey/origin to the next intended user. Based on the applicable integrity classification, the validation and verification procedures shall:

a) for routine data: avoid corruption throughout the processing of the data;

b) for essential data: assure corruption does not occur at any stage of the entire process and may include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level; and

c) for critical data: assure corruption does not occur at any stage of the entire process and include additional integrity
assurance procedures to fully mitigate the effects of faults identified by thorough analysis of the overall system architecture as potential data integrity risks.

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

2.2.1.6 Protection of electronic aeronautical data while stored or in transit shall be totally monitored by the cyclic redundancy check (CRC). To achieve protection of the integrity level of critical and essential aeronautical data as classified in 2.1.5, a 32- or 24-bit CRC algorithm shall apply, respectively.

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

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

2.2.1.8 Geographical coordinates indicating latitude and longitude shall be determined and reported to the aeronautical information services authority in terms of the World Geodetic System — 1984 (WGS-84) geodetic reference datum, identifying those geographical coordinates which have been transformed into WGS-84 coordinates by mathematical means and whose accuracy of original field work does not meet the requirements in Appendix 5, Table A5-1.

2.2.1.9 The order of accuracy of the field work shall be such that the resulting operational navigation data for the phases of flight will be within the maximum deviations, with respect to an appropriate reference frame, as indicated in the tables contained in Appendix 5.

2.2.1.10 In addition to the elevation (referenced to mean sea level) of the specific surveyed ground positions at aerodromes, geoid undulation (referenced to the WGS-84 ellipsoid) for those positions as indicated in Appendix 5 shall be determined and reported to the aeronautical information services authority.
Note 1.— An appropriate reference frame is that which enables WGS-84 to be realized on a given aerodrome and with respect to which all coordinate data are related.

Note 2.— Specifications governing the publication of WGS-84 coordinates are given in Annex 4, Chapter 2 and Annex 15, Chapter 1.

2.2.2 Aerodrome reference point
2.2.2.1 An aerodrome reference point shall be established for an aerodrome.
2.2.2.2 The aerodrome reference point shall be located near the initial or planned geometric centre of the aerodrome and shall normally remain where first established.
2.2.2.3 The position of the aerodrome reference point shall be measured and reported to the Aeronautical Information Services in degrees, minutes and seconds.

2.2.3 Aerodrome and runway elevations
2.2.3.1 The aerodrome elevation and geoid undulation at the aerodrome elevation points shall be measured to the accuracy of one-half metre and reported to the Aeronautical Information Services.
2.2.3.2 For an aerodrome used by international civil aviation for non-precision approaches, the elevation and geoid undulation of each threshold, the elevation of the runway end and any significant high and low intermediate points along the runway shall be measured to the accuracy of one-half metre and reported to the Aeronautical Information Services.
2.2.3.3 For precision approach runways, the elevation and geoid undulation of the threshold, the elevation of the runway end and the highest elevation of the touchdown zone shall be measured to the accuracy of one quarter metre and reported to the Aeronautical Information Services.

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

2.2.4 Aerodrome reference temperature
2.2.4.1 An aerodrome reference temperature shall be determined for an aerodrome in degrees Celsius.
2.2.4.2 The aerodrome reference temperature shall 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 shall be averaged over a period of years.

2.2.5 Aerodrome dimensions and related information

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

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

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

c) taxiway – designation, width, surface type;

d) apron – surface type, aircraft stands;

e) the boundaries of the air traffic control service;

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

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

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

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

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

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

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

2.2.5.5 The geographical coordinates of 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 1. – See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in Areas 2 and 3.

Note 2. – Appendix 5 provides requirements for obstacle data determination in Areas 2 and 3.

Note 3. – Implementation of Annex 15, provision 10.6.1.2, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data.

2.2.6 Strength of pavements

2.2.6.1 The bearing strength of a pavement shall be determined.

2.2.6.2 The bearing strength of a pavement intended for aircraft of apron (ramp) mass greater than 5 700 kg shall be made available using the aircraft classification number – pavement classification number (ACN-PCN) method by reporting all of the following information:
   a) the pavement classification number (PCN);
   b) pavement type of ACN-PCN determination;
   c) sub-grade strength category;
   d) maximum allowable tire pressure category or maximum allowable tire pressure value; and
   e) evaluation method.

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

2.2.6.3 The pavement classification number (PCN) reported shall indicate that an aircraft with an aircraft classification number (ACN) equal to or less than the reported PCN can operate on the pavement subject to any limitation on the tire pressure, or aircraft all-up mass for specified aircraft type(s).
Note – Different PCNs may be reported if the strength of the pavement is subject to significant seasonal variation.

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

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

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

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

a) **Pavement type for ACN-PCN determination:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Rigid pavement</td>
</tr>
<tr>
<td>F</td>
<td>Flexible pavement</td>
</tr>
</tbody>
</table>

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

b) **Sub-grade strength category:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>High strength: characterized by $K = 150 \text{ MN/m}^3$ and representing all $K$ values above 120 MN/m$^3$ for rigid pavements, and by CBR $= 15$ and representing all CBR values above 13 for flexible pavements.</td>
</tr>
<tr>
<td>B</td>
<td>Medium strength: characterized by $K = 80 \text{ MN/m}^3$ and representing a range in $K$ of 20 to 120 MN/m$^3$ for rigid pavements, and by CBR $= 10$ and representing a range in CBR of 8 to 13 for flexible pavements.</td>
</tr>
<tr>
<td>C</td>
<td>Low strength: characterized by $K = 40 \text{ MN/m}^3$ and representing a range in $K$ of 25 to 20 MN/m$^3$ for rigid pavements, and by CBR $= 2$ and representing a range in CBR of 4 to 8 for flexible pavements.</td>
</tr>
</tbody>
</table>
Ultra low strength: characterized by $K = 20$ MN/m³ and $D$ representing all $K$ values below 25 MN/m³ for rigid pavements, and by $CBR = 3$ and representing all $CBR$ values below 4 for flexible pavements.

c) **Maximum allowable tire pressure category:**

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

*Note.* — See Note 5 to 10.2.1 where the pavement is used by aircraft with tire pressures in the upper categories.

d) **Evaluation method:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Technical evaluation: representing a specific study of the pavement characteristics and application of pavement behaviour technology.</td>
</tr>
<tr>
<td>U</td>
<td>Using aircraft experience: representing a knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use.</td>
</tr>
</tbody>
</table>

*Note.* — The following examples illustrate how pavement strength data are reported under the ACN-PCN method.

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

PCN 80/ R / B / W / T

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

PCN 50/ F / A / Y / U
Example 3 – If the bearing strength of a flexible pavement, resting on a medium strength sub-grade, has been assessed by technical evaluation to be PCN 40 and the maximum allowable tire pressure is 0.80 MPa, then the reported information would be:
PCN 40 / F / B / 0.80 MPa / T

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

2.2.6.7 Criteria for allowing the use of a pavement by an aircraft with an ACN higher than the PCN reported for that pavement in accordance with paragraphs 2.2.6.2 and 2.2.6.3 shall follow the guidance specified in this manual Attachment B, Section 20 Overload Operations.

2.2.6.8 The bearing strength of a pavement intended for aircraft of apron (ramp) mass equal to or less than 5 700 kg shall be made available by reporting the following information:
   a) maximum allowable aircraft mass; and
   b) maximum allowable tire pressure.
   Example: 4 000 kg/0.50 MPa.

2.2.7 Pre-flight altimeter check location

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

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

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

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

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

*Note – Guidance on calculation of declared distances is given in this Manual, Attachment B, Section 3.*

2.2.9 Condition of the movement area and related facilities

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

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

a) construction or maintenance work;
b) rough or broken surfaces on a runway, taxiway or an apron;
c) water on a runway, a taxiway or an apron;
d) other temporary hazards, including parked aircraft;
e) failure or irregular operation of part of all of the aerodrome visual aids; and
f) failure of the normal or secondary power supply.

*Note 1. — Other contaminants may include mud, dust, sand, volcanic ash, oil and rubber. Annex 6, Part I, Attachment C provides guidance on the description of runway surface conditions. Additional guidance is included in the Airport Services Manual (Doc 9137), Part 2.*

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

2.2.9.4 Personnel assessing and reporting runway surface conditions required in 2.9.2 and 2.9.8 shall be trained and competent to meet criteria set by the State.

Note. — Guidance on criteria is included in the Airport Services Manual (Doc 9137), Part 8, Chapter 7.

Water on a runway

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

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

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

WATER PATCHES – significant patches of standing water are visible.

FLOODED – extensive standing water is visible.

2.2.9.6 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 the Airport Services Manual (Doc 9137), Part 2.

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

Note – Guidance on determining and expressing the minimum friction level is provided in his Manual, Attachment B, Section 7.

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

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

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

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

2.2.10.2 Information concerning the capability to remove an aircraft disabled on or adjacent to the movement area shall be made available.
Note – The capability to remove a disabled aircraft may be expressed in terms of the largest type of aircraft which the aerodrome is equipped to remove.

2.2.11 Rescue and firefighting services
Note – See 9.3 of this Manual for information on rescue and firefighting services.

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

2.2.11.2 The level of protection normally available at the aerodrome shall be expressed in terms of the category of the rescue and firefighting services as described in section 9.2 of this Manual and in accordance with the types and amounts of extinguishing agents normally available at the aerodrome.

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

Note – 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.
2.2.11.4 A change shall be expressed in terms of the new category of the rescue and firefighting service available at the aerodrome.

2.2.12. Visual approach slope indicator systems

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

    a) associated runway designation number;

    b) type of system according to paragraph 5.3.5.2 of this Manual. For an AT-VASIS, PAPI or APAPI installation, the side of the runway on which the lights are installed, i.e. left or right, shall be given;

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

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

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

2.2.13 Coordination between the aerodrome operator and the Aeronautical Information Services

2.2.13.1 To ensure that the Aeronautical Information Services obtain information to enable them to provide up-to-date pre-flight information and to meet the need for in-flight information, the aerodrome operator shall establish arrangements with the Aeronautical Information Services to report, with a minimum of delay:
a) information on the status of certification of aerodromes and aerodrome conditions (reference sections 2.2.9, 2.2.10, 2.2.11, 2.2.12 above);

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

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

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

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

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

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

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

Note 3 – The schedule of the predetermined internationally agreed AIRAC common effective dates at intervals of 28 days, including 19 November 2009 and guidance for the AIRAC use are contained in the ICAO Aeronautical Information Services Manual (ICAO Doc 8126, Chapter 2).
CHAPTER 3 – PHYSICAL CHARACTERISTICS

3.1.0 Runways

3.1.1.1 Number and orientation of runways

Many factors affect the determination of the orientation, siting and number of runways. One important factor is the usability factor, as determined by the wind distribution, which is specified hereunder. Another important factor is the alignment of the runway to facilitate the provision of approaches conforming to the approach surface specifications of Chapter 4 of this Manual. In Attachment B, Section 1, information is given concerning these and other factors. When a new instrument runway is being located, particular attention needs to be given to areas over which aeroplanes will be required to fly when following instrument approach and missed approach procedures, so as to ensure that obstacles in these areas or other factors will not restrict the operation of the aeroplanes for which the runway is intended.

3.1.1.2 The number and orientation of runways at an aerodrome shall be such that the usability factor of the aerodrome is not less than 95 per cent for the aeroplanes that the aerodrome is intended to serve.

3.1.1.3 The siting and orientation of runways at an aerodrome shall, where possible, be such that the arrival and departure tracks minimize interference with areas approved for residential use and other noise-sensitive areas close to the aerodrome in order to avoid future noise problems.

Note. – Guidance on how to address noise problems is provided in the ICAO Airport Planning Manual (Doc 9184), Part 2, and in ICAO Guidance on the Balanced Approach to Aircraft Noise Management (Doc 9829).
3.1.2 Choice of maximum permissible cross-wind components (international aerodromes)

3.1.2.1 In the application of 3.1.1 it shall be assumed that landing or take-off of aeroplanes is, in normal circumstances, precluded when the crosswind component exceeds:

— 37 km/h (20 kt) in the case of aeroplanes whose reference field length is 1 500 m or over, except that when poor runway braking action owing to an insufficient longitudinal coefficient of friction is experienced with some frequency, a crosswind component not exceeding 24 km/h (13 kt) shall be assumed;

— 24 km/h (13 kt) in the case of aeroplanes whose reference field length is 1 200 m or up to but not including 1 500 m; and

— 19 km/h (10 kt) in the case of aeroplanes whose reference field length is less than 1 200 m.

Note. — In Attachment B, Section 1, guidance is given on factors affecting the calculation of the estimate of the usability factor and allowances which may have to be made to take account of the effect of unusual circumstances.

3.1.3 Data to be used (international aerodromes)

3.1.3.1 The selection of data to be used for the calculation of the usability factor shall be based on reliable wind distribution statistics that extend over as long a period as possible, preferably of not less than five years. The observations used shall be made at least eight times daily and spaced at equal intervals of time.

Note — These winds are mean winds. Reference to the need for some allowance for gusty conditions is made in Attachment B, Section 1.

3.1.4 Location of threshold

3.1.4.1 A threshold shall normally be located at the extremity of a runway unless operational considerations justify the choice of another location.

Note — Guidance on the siting of the threshold is given in Attachment B, Section 10.

3.1.4.2 When it is necessary to displace a threshold, either permanently or temporarily, from its normal location, account shall be taken of the various factors which may have a bearing on the location of the threshold. Where this displacement is due to an unserviceable
runway condition, a cleared and graded area of at least 60 m in length shall be available between the unserviceable area and the displaced threshold. Additional distance shall also be provided to meet the requirements of the runway end safety area as appropriate. 

Note — Guidance on factors which may be considered in the determination of the location of a displaced threshold is given in Attachment B, Section 11.

Actual length of runways

3.1.5 Primary runway

3.1.5.1 Except as provided in paragraph 3.1.7 of this Manual, the actual runway length to be provided for a primary runway shall be adequate to meet the operational requirements of the aeroplanes for which the runway is intended and shall be not less than the longest length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant aeroplanes.

Note 1 — This specification does not necessarily mean providing for operations by the critical aeroplane at its maximum mass.

Note 2 — Both take-off and landing requirements need to be considered when determining the length of runway to be provided and the need for operations to be conducted in both directions of the runway.

Note 3 — Local conditions that may need to be considered include elevation, temperature, runway slope, humidity and the runway surface characteristics.

Note 4 — When performance data on aeroplanes for which the runway is intended are not known, guidance on the determination of the actual length of a primary runway by application of general correction factors is given in the ICAO Aerodrome Design Manual, Part 1.

3.1.6 Secondary runway

3.1.6.1 The length of a secondary runway shall be determined similarly to primary runways except that it needs only to be adequate for those aeroplanes which require to use that secondary runway in addition to the other runway or runways in order to obtain a usability factor of at least 95 per cent.
3.1.7 Runways with stop-ways or clearways

3.1.7.1 Where a runway is associated with a stop-way or clearway, an actual runway length less than that resulting from application of paragraphs 3.1.5 or 3.1.6, as appropriate, may be considered satisfactory, but in such a case any combination of runway, stop-way and clearway provided shall permit compliance with the operational requirements for take-off and landing of the aeroplanes the runway is intended to serve.

*Note* — *Guidance on use of stop-ways and clearways is given in Attachment B, Section 2.*

Width of runways (Existing aerodromes with code 1A or 1B are licensed with a 15 m width. Those established after the approval of this regulations would comply with 18m width.)

3.1.7.2 The width of a runway shall not be less than the appropriate dimension specified in the following tabulation:

<table>
<thead>
<tr>
<th>Code Number/Letter</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18m</td>
<td>18m</td>
<td>23m</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23m</td>
<td>23m</td>
<td>30m</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>30m</td>
<td>30m</td>
<td>30m</td>
<td>45m</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>45m</td>
<td>45m</td>
<td>45m</td>
<td>60m</td>
</tr>
</tbody>
</table>

a. The width of a precision approach runway shall be not less than 30 m where the code number is 1 or 2.

*Note 1* — *The combinations of code numbers and letters for which widths are specified have been developed for typical aeroplane characteristics.*

*Note 2* — *Factors affecting runway width are given in the ICAO Aerodrome Design Manual, Part 1.*

3.1.8 Minimum distance between parallel runways

3.1.8.1 Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their centre lines shall be:

– 210 m where the higher code number is 3 or 4;
– 150 m where the higher code number is 2; and
– 120 m where the higher code number is 1.
Note — Procedures for wake turbulence categorization of aircraft and wake turbulence separation minima are contained in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM), Doc 4444, Chapter 4, paragraph 4.9 and Chapter 5, paragraph 5.8 respectively.

3.1.8.2 Where parallel instrument runways are intended for simultaneous use subject to conditions specified in the PANS-ATM (Doc 4444) and the PANS-OPS (Doc 8168), Volume I, the minimum distance between their centre lines shall be:
- 1 035 m for independent parallel approaches;
- 915 m for dependent parallel approaches;
- 760 m for independent parallel departures;
- 760 m for segregated parallel operations;
except that:

a) for segregated parallel operations the specified minimum distance:
   1) may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and
   2) shall be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft;

b) for independent parallel approaches, combinations of minimum distances and associated conditions other than those specified in the PANS-ATM (Doc 4444) may be applied when it is determined that such combinations would not adversely affect the safety of aircraft operations.

Note — Procedures and facilities requirements for simultaneous operations on parallel or near-parallel instrument runways are contained in the PANS-ATM (Doc 4444), Chapter 6 and the PANS-OPS (Doc 8168), Volume I, Part III, Section 2, and Volume II, Part I, Section I; and Part III, Section 3, and relevant guidance is contained in the ICAO Manual of Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR)(Doc 9643).

Slopes on runways

3.1.9 Longitudinal slopes

3.1.9.1 The slope computed by dividing the difference between the maximum and minimum elevation along the runway centre line by the runway length shall not exceed:

a) 1 per cent where the code number is 3 or 4; and
b) 2 per cent where the code number is 1 or 2.

3.1.9.2 The longitudinal slope along any portion of the runway shall not exceed:

a) 1.25 per cent where the code number is 4, except that for the first and last quarter of the length of the runway the longitudinal slope shall not exceed 0.8 per cent;

b) 1.5 per cent where the code number is 3, except that for the first and last quarter of the length of a precision approach runway category II or III the longitudinal slope shall not exceed 0.8 per cent; and

c) 2 per cent where the code number is 1 or 2.

Longitudinal slope changes

3.1.9.3 Where slope changes cannot be avoided, a slope change between two consecutive slopes shall not exceed:

- 1.5 per cent where the code number is 3 or 4; and
- 2 per cent where the code number is 1 or 2.

Note — Guidance on slope changes before a runway is given in Attachment B, Section 4.

3.1.9.4 The transition from one slope to another shall be accomplished by a curved surface with a rate of change not exceeding:

- 0.1 per cent per 30 m (minimum radius of curvature of 30 000 m) where the code number is 4;
- 0.2 per cent per 30 m (minimum radius of curvature of 15 000 m) where the code number is 3; and
- 0.4 per cent per 30 m (minimum radius of curvature of 7 500 m) where the code number is 1 or 2.

3.1.10 Sight distance

3.1.10.1 Where slope changes cannot be avoided, they shall be such that there will be an unobstructed line of sight from:

- any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where the code letter is C, D, E or F;
- any point 2 m above a runway to all other points 2 m above the runway within a distance of at least half the length of the runway where the code letter is B; and
- any point 1.5 m above a runway to all other points 1.5 m above the runway within a distance of at least half the length of the runway where the code letter is A.

Note — Consideration will have to be given to providing an unobstructed line of sight over the entire length of a single runway where a full-length parallel taxiway is not available. Where an aerodrome has intersecting runways, additional criteria on the line of sight of the intersection area would need to be considered for operational safety. See the ICAO Aerodrome Design Manual (Doc 9157), Part 1

3.1.11 Distance between slope changes

3.1.11.1 Undulations or appreciable changes in slopes located close together along a runway shall be avoided. The distance between the points of intersection of two successive curves shall not be less than:

a) the sum of the absolute numerical values of the corresponding slope changes multiplied by the appropriate value as follows:
   – 30 000 m where the code number is 4;
   – 15 000 m where the code number is 3; and
   – 5 000 m where the code number is 1 or 2; or

b) 45 m;

whichever is greater.

Note — Guidance on implementing this specification is given in Attachment B, Section 4.

3.1.12 Transverse slopes

3.1.12.1 To promote the most rapid drainage of water, the runway surface shall, if practicable, be cambered except where a single cross fall from high to low in the direction of the wind most frequently associated with rain would ensure rapid drainage. The transverse slope shall ideally be:
   – 1.5 per cent when the code letter is C, D, E or F; and
   – 2 per cent when the code letter is A or B;

but in any event shall not exceed 1.5 per cent or 2 per cent, as applicable, nor be less than 1 per cent except at runway or taxiway intersections where flatter slopes may be necessary.

For a cambered surface the transverse slope on each side of the centre line shall be symmetrical.
Note — On wet runways with cross-wind conditions the problem of aquaplaning from poor drainage is apt to be accentuated. Attachment B, Section 7, information is given concerning this problem and other relevant factors.

3.1.12.2 The transverse slope shall be substantially the same throughout the length of a runway except at an intersection with another runway or a taxiway where an even transition shall be provided taking account of the need for adequate drainage.

Note — Guidance on transverse slope is given in the ICAO Aerodrome Design Manual (Doc 9157), Part3.

3.1.13 Strength of runways
3.1.13.1 A runway shall be capable of withstanding the traffic of aeroplanes the runway is intended to serve.

3.1.14 Surface of runways
3.1.14.1 The surface of a runway shall be constructed without irregularities that would result in loss in friction characteristics or otherwise adversely affect the take-off or landing of an aeroplane.

Note 1 — Surface irregularities may adversely affect the take-off or landing of an aeroplane by causing excessive bouncing, pitching, vibration, or other difficulties in the control of an aeroplane.

Note 2 — Guidance on design tolerances and other information is given in Attachment B, Section 5. Additional guidance is included in the ICAO Aerodrome Design Manual, Part 3.

3.1.14.2 The surface of a paved runway shall be so constructed or resurfaced as to provide good friction characteristics when the runway is wet.

3.1.14.3 Measurements of the friction characteristics of a new or resurfaced runway shall be made with a continuous friction measuring device using self–wetting features in order to assure that the design objectives with respect to its friction characteristics have been achieved.

Note — Guidance on friction characteristics of new runway surfaces is given in Attachment B, Section 7. Additional guidance is included in the ICAO Airport Services Manual (9137), Part 2.

3.1.14.4 The average surface texture depth of a new surface shall be not less than 1.0mm.
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 the Airport Services Manual (Doc 9137), Part 2.


3.1.14.5 When the surface is grooved or scored, the grooves or scorings shall be either perpendicular to the runway centre line or parallel to non-perpendicular transverse joints, where applicable.

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

3.2.0 Runway shoulders


3.2.1 Runway shoulders shall be provided for a runway where the code letter is D or E, and the runway width is less than 60 m.

3.2.2 Runway shoulders shall be provided for a runway where the code letter is F.

Width of runway shoulders

3.2.3 The runway shoulders shall extend symmetrically on each side of the runway so that the overall width of the runway and its shoulders is not less than:

- 60 m where the code letter is D or E; and
- 75 m where the code letter is F.

Slopes on runway shoulders

3.2.4 The surface of the shoulder that abuts the runway shall be flush with the surface of the runway and its transverse slope shall not exceed 2.5 per cent.

Strength of runway shoulders

3.2.5 A runway shoulder shall be prepared or constructed so as to be capable, in the event of an aeroplane running off the runway, of supporting the aeroplane without inducing structural damage to the aeroplane and of supporting ground vehicles which may operate on the shoulder.
Note.— Guidance on strength of runway shoulders is given in the Aerodrome Design Manual (Doc 9157), Part 1.

3.3.0 Runway turn pads
3.3.1 Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the code letter is D, E or F, a runway turn pad shall be provided to facilitate 180 degree turn of aeroplanes. (See figure 3-1)

3.3.2 Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the code letter is A, B, C, a runway turn pad shall be provided to facilitate a 180-degree turn of aeroplanes.

Note 1.— Such areas may also be useful if provided along a runway to reduce taxiing time and distance for aeroplanes which may not require the full length of the runway.

Note 2.— Guidance on the design of the runway turn pads is available in the Aerodrome Design Manual (Doc 9157), Part 1. Guidance on taxiway turnaround as an alternate facility is available in the Aerodrome Design Manual (Doc 9157), Part 2.

![Figure 3-1. Typical turn pad layout](image)

3.3.3 The runway turn pad may be located on either the left or right side of the runway and adjoining the runway pavement at both ends of the runway and at some intermediate locations where deemed necessary.
Note. — The initiation of the turn would be facilitated by locating the turn pad on the left side of the runway, since the left seat is the normal position of the pilot-in-command.

3.3.4 The intersection angle of the runway turn pad with the runway shall not exceed 30 degrees.

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

3.3.6 The design of a runway turn pad shall be such that, where the cockpit of the aeroplane for which the turn pad is intended over the turn pad marking, the clearance distance between any wheels of the aeroplane landing gears and the edge of the turn pad shall not be less than that given by the following tabulation:

<table>
<thead>
<tr>
<th>Code letter</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.5 m</td>
</tr>
<tr>
<td>B</td>
<td>2.25 m</td>
</tr>
<tr>
<td>C</td>
<td>3 m if the turn pad is intended to be used by aeroplane with a wheel base less than 18 m; 4.5 m if the turn pad is intended to be used by aeroplanes with a wheelbase equal to or greater than 18 m;</td>
</tr>
<tr>
<td>D</td>
<td>4.5 m</td>
</tr>
<tr>
<td>E</td>
<td>4.5 m</td>
</tr>
<tr>
<td>F</td>
<td>4.5 m</td>
</tr>
</tbody>
</table>

Note. — Wheelbase means the distance from the nose gear to the geometric centre of the main gear.

3.3.7 Where severe weather conditions and resultant lowering of surface friction characteristics prevail, a larger wheel-to-edge clearance of 6 m shall be provided where the code letter is E or F.

**Slopes on runway turn pads**

3.3.8 The longitudinal and transverse slopes on a runway turn pad shall be sufficient to prevent the accumulation of water on the surface and facilitate rapid drainage of surface water. The slopes shall be the same as those on the adjacent runway pavement surface.

**Strength of runway turn pads**

3.3.9 The strength of a runway turn pad shall be at least equal to that of the adjoining runway which it serves, due consideration being given to the fact that the turn pad will be subjected to slow-moving
traffic making hard turns and consequent higher stresses on the pavement.

Note. — Where a runway turn pad is provided with flexible pavement, the surface would need to be capable of withstanding the horizontal shear forces exerted by the main landing gear tires during turning manoeuvres.

**Surface of runway turn pads**

3.3.10 The surface of a runway turn pad shall not have surface irregularities that may cause damage to an aeroplane using the turn pad.

3.3.11 The surface of a runway turn pad shall be so constructed or resurfaced as to provide good friction characteristics for aeroplanes using the facility when the surface is wet.

**Shoulders for runway turn pads**

3.3.12 The runway turn pads shall be provided with shoulders of such width as is necessary to prevent surface erosion by the jet blast of the most demanding aeroplane for which the turn pad is intended, and any possible foreign object damage to the aeroplane engines.

Note. — As a minimum, the width of the shoulders would need to cover the outer engine of the most demanding aeroplane and thus may be wider than the associated runway shoulders.

3.3.13 The strength of runway turn pad shoulders shall be capable of withstanding the occasional passage of the aeroplane it is designed to serve without inducing structural damage to the aeroplane and to the supporting ground vehicles that may operate on the shoulder.

**Runway strips**

3.4.1 A runway and any associated stop-ways shall be included in a strip.

**Length of runway strips**

3.4.2 A strip shall extend before the threshold and beyond the end of the runway or stop-way 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 extend laterally to a distance of at least:
— 150 m where the code number is 3 or 4; and
— 75 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 shall extend laterally to a distance of at least:
— 150 m where the code number is 3 or 4; and
— 75 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.

**Objects on runway strips**

Note — See paragraph 9.10 of this Manual for information regarding siting and construction of equipment and installations on runway strips.

3.4.5 An object situated on a runway strip, which may endanger aeroplanes shall be regarded as an obstacle and shall be removed.

3.4.6 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 fragility requirement in Para 9.10 of this Manual, shall be permitted on a runway strip:

a) within 77.5 m of the runway centre line of a precision approach runway category I or II where the code number is 4 and the code letter is F; or

b) within 60 m of the runway centre line of a precision approach runway category I or II where the code number is 3 or 4; or

c) within 45 m of the runway centre line of a precision approach runway category I where the code number is 1 or 2.

No mobile object shall be permitted on this part of the runway strip during the use of the runway for landing or take-off.

**Grading of runway strips**

3.4.7 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 shall 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 B, Section 8.

3.4.8 The surface of that portion of a strip that abuts a runway, shoulder or Stop-way shall be flush with the surface of the runway, shoulder or Stop-way.

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

3.4.10 Where the areas in 3.4.11 have paved surfaces, they shall be able to withstand the occasional passage of the critical aeroplane for runway pavement design.

Note.— The area adjacent to the end of a runway may be referred to as a blast pad.

Slopes on runway strips

3.4.11 Longitudinal slopes
3.4.11.1 A longitudinal slope along that portion of a strip to be graded shall not exceed:
   — 1.5 per cent where the code number is 4;
   — 1.75 per cent where the code number is 3; and
   — 2 per cent where the code number is 1 or 2.

Longitudinal slope changes

3.4.12 Slope changes on that portion of a strip to be graded shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.

Transverse slopes

3.4.13 Transverse slopes on that portion of a strip to be graded shall be adequate to prevent the accumulation of water on the surface but shall not exceed:
   — 2.5 per cent where the code number is 3 or 4; and
   — 3 per cent where the code number is 1 or 2;
   except that to facilitate drainage the slope for the first 3 m outward from the runway, shoulder or stop-way edge shall be negative as measured in the direction away from the runway and may be as great as 5 per cent.
3.4.14 The transverse slopes of any portion of a strip beyond that to be graded shall not exceed an upward slope of 5 per cent as measured in the direction away from the runway.

**Strength of runway strips**

3.4.15 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 shall 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 the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

3.5 **Runway end safety areas**

**General**

3.5.1 A runway end safety area shall be provided at each end of a runway strip where:
- the code number is 3 or 4; and
- the code number is 1 or 2 and the runway is an instrument one.

*Note — Guidance on runway end safety areas is given in Attachment B, Section 10.*

**Dimensions of runway end safety areas**

3.5.2 A runway end safety area shall extend from the end of a runway strip to a distance of at least 90 m.
- the code number is 3 or 4; and
- the code number is 1 or 2 and the runway is an instrument one.

If an arresting system is installed, the above length may be reduced, based on the design specification of the system, subject to acceptance by the State.

*Note. — Guidance on arresting systems is given in Attachment B, Section 10.*

3.5.3 The width of a runway end safety area shall be at least twice that of the associated runway.

3.5.4 The width of a runway end safety area shall be equal to that of the graded portion of the associated runway strip.

**Objects on runway end safety areas**
Note — See paragraph 9.10 of this Manual for information regarding siting and construction of equipment and installations on runway end safety areas.

3.5.5 An object situated on a runway end safety area, which may endanger aeroplanes shall be regarded as an obstacle and shall, as far as practicable be removed.

Clearing and grading of runway end safety areas

3.5.6 A runway end safety area shall provide a cleared and graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane undershooting or overrunning the runway.

Note: — The surface of the ground in the runway end safety area does not need to be prepared to the same quality as the runway strip. See, paragraph 3.5.11 of this Manual.

Slopes on runway end safety areas

3.5.7 General
The slopes of a runway end safety area shall be such that no part of the runway end safety area penetrates the approach or take-off climb surface.

3.5.8 Longitudinal slopes
The longitudinal slopes of a runway end safety area shall not exceed a downward slope of 5 per cent. Longitudinal slope changes shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.

3.5.9 Transverse slopes
The transverse slopes of a runway end safety area shall not exceed an upward or downward slope of 5 per cent. Transitions between differing slopes be as gradual as practicable.

Strength of runway end safety areas

3.5.10 A runway end safety area shall be so prepared or constructed as to reduce the risk of damage to an aeroplane undershooting or overrunning the runway, enhance aeroplane deceleration and
facilitate the movement of rescue and fire fighting vehicles as required in paragraphs 9.3.34 to 9.3.36 of this Manual.

*Note — Guidance on strength of a runway end safety area is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 1.*

### 3.6.0 Clearways

*Note — The inclusion of detailed specifications for clearways in this section is not intended to imply that a clearway has to be provided. Attachment B, Section 2 provides information on the use of clearways.*

#### Location of clearways

3.6.1 The origin of a clearway shall be at the end of the take-off run available.

#### Length of clearways

3.6.2 The length of a clearway shall not exceed half the length of the take-off run available.

#### Width of clearways

3.6.3 A clearway shall extend laterally to a distance of at least 75 m on each side of the extended centre line of the runway.

#### Slopes on clearways

3.6.4 The ground in a clearway shall not project above a plane having an upward slope of 1.25 per cent, the lower limit of this plane being a horizontal line which:

a) is perpendicular to the vertical plane containing the runway centre line; and

b) passes through a point located on the runway centre line at the end of the take-off run available.

*Note — Because of transverse or longitudinal slopes on a runway, shoulder or strip, in certain cases the lower limit of the clearway plane specified above may be below the corresponding elevation of the runway, shoulder or strip. It is not intended that these surfaces be graded to conform with the lower limit of the clearway plane nor is it intended that terrain or objects which are above the clearway plane beyond the end of the strip but below the level of the strip be removed unless it is considered they may endanger aeroplanes.*

3.6.5 Abrupt upward changes in slope shall be avoided when the slope on the ground in a clearway is relatively small or when the mean slope is upward. In such situations, in that portion of the clearway within a distance of 22.5 m or half the runway width whichever is
greater on each side of the extended centre line, the slopes, slope changes and the transition from runway to clearway shall conform with those of the runway with which the clearway is associated.

**Objects on clearways**

*Note — See paragraph 9.10 of this Manual for information regarding siting and construction of equipment and installations on clearways.*

3.6.6 An object situated on a clear-way, which may endanger aeroplanes in the air shall be regarded as an obstacle and shall as far as practicable be removed.

### Stop-ways

*Note — The inclusion of detailed specifications for stop-ways in this section is not intended to imply that a stop-way has to be provided. Attachment B, Section 2 provides information on the use of stop-ways.*

**Width of stop-ways**

3.7.1 A stop-way shall have the same width as the runway with which it is associated.

**Slopes on stop-ways**

3.7.2 Slopes and changes in slope on a stop-way, and the transition from a runway to a stop-way, shall comply with the specifications of paragraphs 3.1.13 to 3.1.19 of this Manual for the runway with which the stop-way is associated except that:

a) the limitation in paragraph 3.1.14 of this Manual of a 0.8 per cent slope for the first and last quarter of the length of a runway need not be applied to the stop-way; and

b) at the junction of the stop-way and runway and along the stop-way the maximum rate of slope change may be 0.3 per cent per 30 m (minimum radius of curvature of 10,000 m) for a runway where the code number is 3 or 4.

**Strength of stop-ways**

3.7.3 A stop-way shall be prepared or constructed so as to be capable, in the event of an abandoned take-off, of supporting the aeroplane which the stop-way is intended to serve without inducing structural damage to the aeroplane.

*Note — Attachment B, Section 2 presents guidance relative to the support capability of a stop-way.*

**Surface of stop-ways**
3.7.4 The surface of a paved stop-way shall be so constructed as to provide a good coefficient of friction to be compatible with that of the associated runway when the stop-way is wet.

3.7.5 The friction characteristics of an unpaved stop-way shall not be substantially less than that of the runway with which the stop-way is associated.

3.8.0 Radio altimeter operating area

General

3.8.1 A radio altimeter operating area shall be established in the pre-threshold area of a precision approach runway.

Length of the area

3.8.2 A radio altimeter operating area shall extend before the threshold for a distance of at least 300m.

Width of the area

3.8.3 A radio altimeter operating area shall extend laterally, on each side of the extended centre line of the runway, to a distance of 60 m, except that, when special circumstances so warrant, the distance may be reduced to no less than 30 m if an aeronautical study indicates that such reduction would not affect the safety of operations of aircraft.

Longitudinal slope changes

3.8.4 On a radio altimeter operating area, slope changes shall be avoided or kept to a minimum. Where slope changes cannot be avoided, the slope changes shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided. The rate of change between two consecutive slopes shall not exceed 2 per cent per 30 m.

Note — Guidance on radio altimeter operating area is given in Attachment B, Section 4.3 and in the ICAO Manual of All-Weather Operations, (Doc 9365), Section 5.2. Guidance on the use of radio altimeter is given in the PANS-OPS, Volume II, Part II, Section I.

3.9.0 Taxiways
Note: Unless otherwise indicated the requirements in this section are applicable to all types of taxiways.

General

3.9.1 Taxiways shall be provided to permit the safe and expeditious surface movement of aircraft.

Note — Guidance on layout of taxiways is given in the ICAO Aerodrome Design Manual, Part 2.

3.9.2 Sufficient entrance and exit taxiways for a runway shall be provided to expedite the movement of aeroplanes to and from the runway and provision of rapid exit taxiways considered when traffic volumes are high.

3.9.3 As of 20 November 2008, the design of a taxiway shall be such that, when the cockpit of the aeroplane for which the taxiway is intended remains over the taxiway centre line markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway shall be not less than that given by the following tabulation:

<table>
<thead>
<tr>
<th>Code letter</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.5 m</td>
</tr>
<tr>
<td>B</td>
<td>2.25 m</td>
</tr>
<tr>
<td>C</td>
<td>3 m if the taxiway is intended to be used by aeroplanes with a wheel base less than 18 m; 4.5 m if the taxiway is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.</td>
</tr>
<tr>
<td>D</td>
<td>4.5 m</td>
</tr>
<tr>
<td>E</td>
<td>4.5 m</td>
</tr>
<tr>
<td>F</td>
<td>4.5 m</td>
</tr>
</tbody>
</table>

Note 1.— Wheel base means the distance from the nose gear to the geometric centre of the main gear.

Note 2.— Where the code letter is F and the traffic density is high, a wheel-to-edge clearance greater than 4.5 m may be provided to permit higher taxiing speeds.

Note 3.— This provision applies to taxiways first put into service on or after 20 November 2008.

Width of taxiways
3.9.4  A straight portion of a taxi-way shall have a width of not less than that given by the following tabulation:

<table>
<thead>
<tr>
<th>Code letter</th>
<th>Taxiway Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.5 m</td>
</tr>
<tr>
<td>B</td>
<td>10.5 m</td>
</tr>
<tr>
<td>C</td>
<td>15 m if the taxiway is intended to be used by aeroplanes with a wheel base less than 18 m; 18 m if the taxiway is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m;</td>
</tr>
<tr>
<td>D</td>
<td>18 m if the taxiway is intended to be used by aeroplanes with an outer main gear wheel span of less than 9 m; 23 m if the taxiway is intended to be used by aeroplanes with an outer main gear wheel span equal to or greater than 9 m.</td>
</tr>
<tr>
<td>E</td>
<td>23 m</td>
</tr>
<tr>
<td>F</td>
<td>25 m</td>
</tr>
</tbody>
</table>

Note — Guidance on width of taxiways is given in the ICAO Aerodrome Design Manual (DOC 9157), Part 2.

3.9.5  Changes in direction of taxiways shall be as few and small as possible. The radii of the curves shall be compatible with the manoeuvring capability and normal taxiing speeds of the aeroplanes for which the taxiway is intended. The design of the curve shall be such that, when the cockpit of the aeroplane remains over the taxiway centre line markings, the clearance distance between the outer main wheels of the aeroplane and the edge of the taxiway shall not be less than those specified in 3.9.3.of this Manual. 

Note 1 — An example of widening taxiways to achieve the wheel clearance specified is illustrated in Figure 3-2. Guidance on the values of suitable dimensions is given in the ICAO Aerodrome Design Manual, Part 2.

Note 2 — The location of taxiway centre line markings and lights is specified in paragraphs 5.2.8.4 and 5.4.17.12 of this Manual.

Note 3 — Compound curves may reduce or eliminate the need for extra taxiway width.
Junctions and intersections

3.9.6 To facilitate the movement of aeroplanes, fillets shall be provided at junctions and intersections of taxiways with runways, aprons and other taxiways. The design of the fillets shall ensure that the minimum wheel clearances specified in 3.9.3 of this Manual are maintained when aeroplanes are manoeuvring through the junctions or intersections.

Note — Consideration will have to be given to the aeroplane datum length when designing fillets. Guidance on the design of fillets and the definition of the term aeroplane datum length are given in the ICAO Aerodrome Design Manual, Part 2.

Taxiway minimum separation distances

3.9.7 The separation distance between the centre line of a taxiway and the centre line of a runway, the centre line of a parallel taxiway or an object shall not be less than the appropriate dimension specified in Table 3-1 of this chapter, except that it may be permissible to operate with lower separation distances at an existing aerodrome if an aeronautical study indicates that such lower separation distances
would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

Note 1 — Guidance on factors, which may be considered in the aeronautical study, is given in the ICAO Aerodrome Design Manual (DOC 9157), Part 2.

Note 2 — ILS and MLS installations may also influence the location of taxiways due to interferences to ILS and MLS signals by a taxiing or stopped aircraft. Information on critical and sensitive areas surrounding ILS and MLS installations is contained in ICAO Annex 10, Volume I, Attachments C and G (respectively).

Note 3 — The separation distances of Table 3-1, column 10, do not necessarily provide the capability of making a normal turn from one taxiway to another parallel taxiway. Guidance for this condition is given in the ICAO Aerodrome Design Manual (DOC 9157), Part 2.

Note 4 — The separation distance between the centre line of an aircraft stand taxi lane and an object shown in Table 3-1, column 12, may need to be increased when jet exhaust wake velocity may cause hazardous conditions for ground servicing.

Slopes on taxiways

3.9.8 Longitudinal slopes
The longitudinal slope of a taxiway shall not exceed:
— 1.5 per cent where the code letter is C, D, E or F; and
— 3 per cent where the code letter is A or B.

3.9.9 Longitudinal slope changes
Where slope changes on a taxiway cannot be avoided, the transition from one slope to another slope shall be accomplished by a curved surface with a rate of change not exceeding:
— 1 per cent per 30 m (minimum radius of curvature of 3 000 m) where the code letter is C, D, E or F; and
— 1 per cent per 25 m (minimum radius of curvature of 2 500 m) where the code letter is A or B.
### Table 3-1 – Taxiway minimum separation distances

<table>
<thead>
<tr>
<th>Code Letter</th>
<th>Instrument runways Code number</th>
<th>Non-Instrument runways Code number</th>
<th>Taxiway centre line to taxiway centre line (m)</th>
<th>Taxiway other than aircraft stand taxilane, centre line to object (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>A</td>
<td>82.5</td>
<td>82.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>87</td>
<td>87</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
<td>168</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
<td>176</td>
<td>176</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>182.5</td>
</tr>
<tr>
<td>F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>190</td>
</tr>
</tbody>
</table>

**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.

### 3.9.10 Sight distance

Where a change in slope on a taxiway cannot be avoided, the change shall be such that, from any point:

a) 3 m above the taxiway, it will be possible to see the whole surface of the taxiway for distance of at least 300 m from that point, where the code letter is C, D, E or F;

b) 2 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 200 m from that point, where the code letter is B; and

c) 1.5 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 150 m from that point, where the code letter is A.
Transverse slopes

3.9.11 The transverse slopes of a taxiway shall be sufficient to prevent the accumulation of water on the surface of the taxiway but shall not exceed:
— 1.5 per cent where the code letter is C, D, E or F; and
— 2 per cent where the code letter is A or B.

Note — See paragraph 3.13.4 of this Manual regarding transverse slopes on an aircraft stand taxi lane.

Strength of taxiways

3.9.12 The strength of a taxiway shall be at least equal to that of the runway it serves, due consideration being given to the fact that a taxiway will be subjected to a greater density of traffic and, as a result of slow moving and stationary aeroplanes, to higher stresses than the runway it serves.

Note — Guidance on the relation of the strength of taxiways to the strength of runways is given in the ICAO Aerodrome Design Manual (DOC 9157, Part 3).

Surface of taxiways

3.9.13 The surface of a taxiway shall not have irregularities that cause damage to aeroplane structures.

3.9.14 The surface of a paved taxiway shall be so constructed as to provide good friction characteristics when the taxiway is wet.

Rapid exit taxiways

Note — The following specifications detail requirements particular to rapid exit taxiways. See Figure 3-3. General requirements for taxiways also apply to this type of taxiway. Guidance on the provision, location and design of rapid exit taxiways is included in the ICAO Aerodrome Design Manual (DOC 9157, Part 2).
3.9.15 A rapid exit taxiway shall be designed with a radius of turn-off curve of at least:
- 550 m where the code number is 3 or 4; and
- 275 m where the code number is 1 or 2;
to enable exit speeds under wet conditions of:
- 93 km/h where the code number is 3 or 4; and
- 65 km/h where the code number is 1 or 2.

*Note — The locations of rapid exit taxiways along a runway are based on several criteria described in the ICAO Aerodrome Design Manual (DOC 9157, Part 2, in addition to different speed criteria.*

3.9.16 The radius of the fillet on the inside of the curve at a rapid exit taxiway shall be sufficient to provide a widened taxiway throat in order to facilitate early recognition of the entrance and turn-off onto the taxiway.

3.9.17 A rapid exit taxiway shall include a straight distance after the turn-off curve sufficient for an exiting aircraft to come to a full stop clear of any intersecting taxiway.

3.9.18 The intersection angle of a rapid exit taxiway with the runway shall not be greater than 45° nor less than 25° and preferably be 30°.

**Taxiways on bridges**

3.9.19 The width of that portion of a taxiway bridge capable of supporting aeroplanes, as measured perpendicularly to the taxiway centre line, shall not be less than the width of the graded area of the strip provided for that taxiway, unless a proven method of lateral
restraint is provided which shall not be hazardous for aeroplanes for which the taxiway is intended.

3.9.20 Access shall be provided to allow rescue and fire fighting vehicles to intervene in both directions within the specified response time to the largest aeroplane for which the taxiway bridge is intended. *Note — If aeroplane engines overhang the bridge structure, protection of adjacent areas below the bridge from engine blast may be required.*

3.9.21 A bridge shall be constructed on a straight section of the taxiway with a straight section on both ends of the bridge to facilitate the alignment of aeroplanes approaching the bridge.

3.10.0 Taxiway shoulders

*Note — Guidance on characteristics of taxiway shoulders and on shoulder treatment is given in the ICAO Aerodrome Design Manual (DOC 9157, Part 2).*

3.10.1 Straight portions of a taxiway where the code letter is C, D, E or F shall be provided with shoulders, which extend symmetrically on each side of the taxiway so that the overall width of the taxiway and its shoulders on straight portions is not less than:

- 60 m where the code letter is F;
- 44 m where the code letter is E;
- 38 m where the code letter is D; and
- 25 m where the code letter is C.

On taxiway curves and on junctions or intersections where increased pavement is provided, the shoulder width shall be not less than that on the adjacent straight portions of the taxiway.

3.10.2 When a taxiway is intended to be used by turbine-engine aeroplanes, the surface of the taxiway shoulder shall be so prepared as to resist erosion and the ingestion of the surface material by aeroplane engines.

3.11.0 Taxiway strips

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

**General**

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

**Width of taxiway strips**
3.11.2 A taxiway strip shall extend symmetrically on each side of the centre line of the taxiway throughout the length of the taxiway to at least the distance from the centre line given in Table 3-1, column 11 of this Manual.

**Objects on taxiway strips**

*Note — See paragraph 9.9 of this Manual for information regarding siting and construction of equipment and installations on taxiway strips.*

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

*Note — Consideration will have to be given to the location and design of drains on a taxiway strip to prevent damage to an aeroplane accidentally running off a taxiway. Suitably designed drain covers may be required.*

**Grading of taxiway strips**

3.11.4 The centre portion of a taxiway strip shall provide a graded area to a distance from the centre line of the taxiway of at least:
- 11 m where the code letter is A;
- 12.5 m where the code letter is B or C;
- 19 m where the code letter is D;
- 22 m where the code letter is E; and
- 30 m where the code letter is F.

**Slopes on taxiway strips**

3.11.5 The surface of the strip shall be flush at the edge of the taxiway or shoulder, if provided, and the graded portion shall not have an upward transverse slope exceeding:
- 2.5 per cent for strips where the code letter is C, D, E or F; and
- 3 per cent for strips of taxiways where the code letter is A or B; the upward slope being measured with reference to the transverse slope of the adjacent taxiway surface and not the horizontal. The downward transverse slope shall not exceed 5 per cent measured with reference to the horizontal.

3.11.6 The transverse slopes on any portion of a taxiway strip beyond that to be graded shall not exceed an upward or downward slope of 5 per cent as measured in the direction away from the taxiway.

3.12.0 **Holding bays, runway-holding positions, intermediate holding positions and road holding positions**

**General**
3.12.1 Holding bay(s) shall be provided when the traffic density is medium or heavy.

3.12.2 A runway-holding position or positions shall be established:
   a) on the taxiway, at the intersection of a taxiway and a runway; and
   b) at an intersection of a runway with another runway when the former runway is part of a standard taxi-route.

3.12.3 A runway-holding position shall be established on a taxiway if the location or alignment of the taxiway is such that a taxying aircraft or vehicle can infringe an obstacle limitation surface or interfere with the operation of radio navigation aids.

3.12.4 An intermediate holding position shall be established on a taxiway at any point other than a runway-holding position where it is desirable to define a specific holding limit.

3.12.5 A road-holding position shall be established at an intersection of a road with a runway.

Location

3.12.6 The distance between a holding bay, runway-holding position established at a taxiway/runway intersection or road-holding position and the centre line of a runway shall be in accordance with Table 3-2 of this Manual of this chapter and, in the case of a precision approach runway, such that a holding aircraft or vehicle will not interfere with the operation of radio navigation aids.

3.12.7 At elevations greater than 700 m (2300 ft) the distance of 90 m specified in Table 3-2 of this chapter for precision approach runway code 4 shall be increased as follows:
   a) up to an elevation of 2000 m (6600 ft); 1 m for every 100 m (330 ft) in excess of 700 m (2300 ft);
   b) elevation in excess of 2000 m (6600 ft) and up to 4000 m (13320 ft); 13 m plus 1.5 m for every 100 m (330 ft) in excess of 2000 m (6600 ft); and
   c) elevation in excess of 4000 m plus 2 m for every 100 m (330 ft) in excess of 4000 m (13320 ft); 43 m plus 2 m for every 100 m (330 ft) in excess of 4000 m (13320 ft).

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 of 90 m or 107.5 m, as appropriate, specified in Table 3-2 of this chapter shall be
further increased 5 m for every metre the bay or position is higher than the threshold.

3.12.9 The location of a runway-holding position established in accordance with paragraph 3.12.3 of this Manual 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.

<table>
<thead>
<tr>
<th>Type of Runway</th>
<th>Code Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Non-instrument</td>
<td>30 m</td>
</tr>
<tr>
<td>Non-precision Approach</td>
<td>40 m</td>
</tr>
<tr>
<td>Precision Approach Cat. I</td>
<td>60 m&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Precision Approach Cat. II and III</td>
<td>-</td>
</tr>
<tr>
<td>Take-off Runway</td>
<td>30 m</td>
</tr>
</tbody>
</table>

a) If a holding bay, runway-holding position or road-holding position is at a lower elevation compared to the threshold, the distance may be decreased 5 m for every metre the bay or holding position is lower than the threshold, contingent upon not infringing the inner transitional surface.

b) This distance may need to be increased to avoid interference with radio navigation aids, particularly the glide path and localizer facilities. Information on critical and sensitive areas of ILS and MLS is contained in ICAO Annex 10, Volume I, Attachments C and G to Part I, respectively (See also paragraph 3.13.6 of this Manual).
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.

c) Where the code letter is F this distance shall be 107.5 m

Note. — The distance of 107.5 m for code number 4 where the code letter is F 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.

3.13.0 Aprons

General

3.13.1 Aprons shall be provided where necessary to permit the on- and off-loading of passengers, cargo or mail as well as the servicing of aircraft without interfering with the aerodrome traffic.

Size of aprons

3.13.2 The total apron area shall be adequate to permit expeditious handling of the aerodrome traffic at its maximum anticipated density.

Strength of aprons

3.13.3 Each part of an apron shall be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that some portions of the apron will be subjected to a higher density of traffic and, as result of slow moving or stationary aircraft, to higher stresses than a runway.

Slopes on aprons

3.13.4 Slopes on an apron, including those on an aircraft stand taxi lane, shall be sufficient to prevent accumulation of water on the surface of the apron but shall be kept as level as drainage requirements permit.

3.13.5 On an aircraft stand the maximum slope shall not exceed 1 per cent.

Clearance distances on aircraft stands
3.13.6 An aircraft stand shall provide the following minimum clearances between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects:

<table>
<thead>
<tr>
<th>Code letter</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3 m</td>
</tr>
<tr>
<td>B</td>
<td>3 m</td>
</tr>
<tr>
<td>C</td>
<td>4.5 m</td>
</tr>
<tr>
<td>D</td>
<td>7.5 m</td>
</tr>
<tr>
<td>E</td>
<td>7.5 m</td>
</tr>
<tr>
<td>F</td>
<td>7.5 m</td>
</tr>
</tbody>
</table>

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 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 the ICAO Aerodrome Design Manual, Part 2, for guidance on storage of ground equipment).

3.14.0 Isolated aircraft parking position

3.14.1 An isolated aircraft parking position shall be designated or the aerodrome control tower shall be advised of an area or areas suitable for the parking of an aircraft which is known or believed to be the subject of unlawful interference, or which for other reasons needs isolation from normal aerodrome activities.

3.14.2 The isolated aircraft parking position shall be located at the maximum distance practicable and in any case never less than 100 m from other parking positions, buildings or public areas, etc. Care shall be taken to ensure that the position is not located over underground utilities such as gas and aviation fuel and, to the extent feasible, electrical or communication cables.
CHAPTER 4 - OBSTACLE RESTRICTION AND REMOVAL

4.1 Introduction

4.1.0 Introduction

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.

4.1.1 The shielding principles to be used for assessing whether an existing obstacle shields another one or a new one is explained in section 4.3.

4.1.2 An aerodrome operator shall establish a systematic means of surveying and monitoring any object that penetrates these surfaces and report any penetration immediately to the Authority’s Safety Directorate and to promulgate them through the Aeronautical Information Services and air traffic services unit so that aeroplane operations can be conducted safely at all times.

4.1.3 When requested, an aerodrome operator shall also work jointly with the Authority’s Safety Directorate to plan and determine the allowable height limits for new developments in the vicinity of and outside its aerodrome and the type of instrument or visual flight operations that may be permitted taking the obstacle survey plan into account.

Note 1.— 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 the Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168).

Note 2.— The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in Chapter 5.

4.2 Obstacle limitation surfaces

Note: See Figure 4.1.

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

Conical surface

4.2.1 Description – Conical surface: A surface sloping upwards and outwards from the periphery of the inner horizontal surface.

4.2.2 Characteristics – The limits of the conical surface shall comprise:

a) a lower edge coincident with the periphery of the inner horizontal surface; and
b) an upper edge located at a specified height above the inner horizontal surface.

4.2.3 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**

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

4.2.5 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 to be circular. Guidance on determining the extent of the inner horizontal surface is contained in the ICAO Airport Services Manual (Doc 9137), Part 6.

4.2.6 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 the ICAO Airport Services Manual (Doc 9137), Part 6.

**Approach surface**

4.2.7 Description – Approach surface: An inclined plane or combination of planes preceding the threshold.

4.2.8 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; and

c) an outer edge parallel to the inner edge.

d) the above surfaces shall be varied when lateral offset, offset or curved approaches are utilized, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the lateral offset, offset or curved ground track.

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

4.2.10 The slope(s) of the approach surface shall be measured in the vertical plane containing the centre line of the runway.

*Note.* – See Figure 4-2
4.2.11 Description – Inner approach surface: A rectangular portion of the approach surface immediately preceding the threshold.

4.2.12 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.

**Transitional surface**
4.2.13 Description – Transitional surface. A complex surface along the side of the strip and part of the side of the approach surface, the slopes upwards and outwards to the inner horizontal surface.

4.2.14 Characteristics – The limits of the 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 in the inner horizontal surface.

4.2.15 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.

4.2.16 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 be penetrated except for frangible objects. The transitional surface described in paragraph 4.2.13 of this Manual is intended to remain as the controlling obstacle limitation surface for buildings, etc.

4.2.17 Description – Inner transitional surface: A surface similar to the transitional surface but closer to the runway.

4.2.18 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.

4.2.19 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 a straight line depending on the runway profile.

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

**Balked landing surface**

4.2.21 Description – Balked landing surface: An inclined plane located at a specified distance after the threshold, extending between the inner transitional surface.

4.2.22 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 location 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;
   c) an outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

4.2.23 The elevation of the inner edge shall be equal to the elevation of the runway centre line at the location of the inner edge.

4.2.24 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**
4.2.25 Description – Take-off climb surface. An inclined plane or other specified surface beyond the end of a runway or clearway.

4.2.26 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 takeoff track.

4.2.27 The elevation of the inner edge shall be equal to the highest point on the 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.

4.2.28 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.

4.2.29 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 normal to its centre line, and the slope of the centre line shall be the same as that for a straight takeoff flight path.

4.3.0 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 case 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
4.3.1 The following obstacle limitation surfaces shall be established for a non-instrument runway.
   — conical surface;
   — inner horizontal surface;
   — approach surface; and
   — transitional surfaces.

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

4.3.3 New objects or extensions of existing objects shall not be permitted above an approach or transitional surface except when the new object or extension would be shielded by an existing immovable object.

*Note – Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137) (Doc 9137), Part 6.*

4.3.4 New objects or extensions of existing objects shall not be permitted above the conical surface or inner horizontal surface except when 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 of aeroplane operations.

4.3.5 Existing objects above any of the surfaces required by paragraph 4.3.1 of this Manual shall as far as practicable be removed except when, in the opinion of the 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.*

4.3.6 In considering proposed construction, account shall be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.
Table 4-1 – Dimensions and slopes of obstacle limitation surfaces

### APPROACH RUNWAYS

<table>
<thead>
<tr>
<th>Surface and Dimensions</th>
<th>Non-instrument code number</th>
<th>Non-precision approach code number</th>
<th>Precision approach category code number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>CONICAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope %</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Height (m)</td>
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<td>55</td>
<td>75</td>
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<td></td>
<td></td>
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<tr>
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<td>45</td>
<td>45</td>
</tr>
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<td>Radius (m)</td>
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<td>2500</td>
<td>4000</td>
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<td>INNER APPROACH</td>
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<td></td>
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</tr>
<tr>
<td>Width (m)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Distance from threshold (m)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Length (m)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Slope %</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>APPROACH</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length of inner edge (m)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Distance from threshold (m)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Divergence (each side) %</td>
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<td>10</td>
<td>10</td>
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<td>First section</td>
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</tr>
<tr>
<td>Length (m)</td>
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<td>2500</td>
<td>3000</td>
</tr>
<tr>
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<td>3.33</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length (m)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Slope %</td>
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<td>2.5</td>
<td>3</td>
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<td>Horizontal section</td>
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<tr>
<td>Length (m)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total length (m)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRANSITIONAL</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>INNER TRANSITIONAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BALKED LANDING SURFACE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length of inner edge (m)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Distance from threshold (m)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Divergence (each side) %</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Slope %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**a.** All dimensions are measured horizontally unless specified otherwise.

**b.** Variable length (See paragraph 4.3.9 or 4.3.17 of this Manual).

**c.** Distance to the end of strip.
Non-precision approach runway

4.3.7 The following obstacle limitation surfaces shall be established for a non precision approach runway:
— conical surface;
— inner horizontal surface;
— approach surface; and
— transitional surfaces.

4.3.8 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 of this Manual, except in the case of the horizontal section of the approach surface as per section 4.3.9 of this Manual).

4.3.9 The approach surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:
(a) a horizontal plane 150m 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.

4.3.10 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 the new object or extension would be shielded by an existing immovable object.

Note – Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137) (Doc 9137) (Doc 9137), Part 6.

4.3.11 New objects or extensions of existing objects shall not be permitted above the approach surface beyond 3 000m from the inner edge, the conical surface or inner horizontal surface except when 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 of aeroplane operations.

Note – Because of the 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 paragraph 9.10 for information regarding siting and construction of equipment and installations on operational areas.

*Note 2* – Guidance on obstacle limitation surfaces for precision approach runways is given in the ICAO Airport Services Manual (Doc 9137) (Doc 9137), Part 6.

4.3.12 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.

4.3.13 The following obstacle limitation surfaces shall be established for a precision approach runway category I:
- inner approach surface;
- inner transitional surfaces; and
- balked landing surface.

4.3.14 The following obstacle limitation surfaces shall be established for a precision approach runway category II.
- conical surface;
- inner horizontal surface;
- approach surface and inner approach surface;
- transitional surfaces;
- inner transitional surfaces; and
- balked landing surface.

4.3.15 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 of this Manual, except in the case of the horizontal section of the approach surface as per section 4.3.17 below).

4.3.16 The approach surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:
   a) a horizontal plane 150m 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.

4.3.17 Fixed objects shall not be permitted above the inner approach surface, 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.

4.3.18 New objects or extensions of existing objects shall not be permitted above an approach surface or a transitional surface except when, in the opinion of the Authority’s Safety Directorate, the new object or extension would be shielded by an existing immovable object.

Note – Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137) (Doc 9137), Part 6.

4.3.19 New objects or extensions of existing objects shall not be permitted above the conical surface and the inner horizontal surface except when 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 of aeroplane operations.

4.3.20 Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface shall as far as practicable be removed except when 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 of aeroplane operations.

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 that may endanger aeroplanes.

Runways meant for take-off

4.3.21 The following obstacle limitation surface shall be established for a runway meant for take-off:
– take-off climb surface.

4.3.22 The dimension of the surface shall be not less than the dimensions specified in Table 4-2 of this Manual, except that a lesser length may be adopted or the take-off climb surface where such lesser length would be consistent with procedural measures adopted to govern the outward flight of aeroplanes.
4.3.23 The operational characteristics of aeroplanes for which the runway is intended shall be examined to see if it is desirable to reduce the slope specified in Table 4-2 of this Manual when critical operating conditions are to be catered to. If the specified slope is reduced, corresponding adjustment in the length of take-off climb surface shall be made so as to provide protection to a height of 300m.

Note – When local conditions differ widely from sea level standard atmospheric conditions, it may be advisable for the slope specified in Table 4-2 of this Manual 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.

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

<table>
<thead>
<tr>
<th>RUNWAYS MEANT FOR TAKE-OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Number</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>TAKE-OFF CLIMB</td>
</tr>
<tr>
<td>Length of inner edge (m)</td>
</tr>
<tr>
<td>Distance from runway end b (m)</td>
</tr>
<tr>
<td>Divergence (each side) %</td>
</tr>
<tr>
<td>Final width (m)</td>
</tr>
<tr>
<td>Length (m)</td>
</tr>
<tr>
<td>Slope %</td>
</tr>
</tbody>
</table>

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 intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d) See paragraphs 4.3.24 and 4.3.26 of this Manual.

4.3.24 New objects or extensions of existing objects shall not be permitted above a take-off climb surface except when, in the opinion of the Authority, the new object or extension would be shielded by an existing immovable object.

Note – Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137) (Doc 9137), Part 6.
4.3.25 If no object reaches the 2 per cent (1:50) take-off climb surface, new objects shall be limited to preserve the existing obstacle free surface or a surface down to a slope of 1.6 per cent (1:62.5).

4.3.26 Existing objects that extend above a take-off climb surface shall as far as practicable be removed except when, in the opinion of the Authority, an object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety 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 it is intended that terrain or objects, which are above the take-off, climb surface beyond the end of the strip of clearway, but below the level of the strip or clearway, be removed unless it is considered that they endanger aeroplanes. Similar considerations apply at the junction of a clearway and strip where differences in transverse slopes exist.

4.4.0 Objects outside the obstacle limitation surfaces

4.4.1 The Authority shall be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established in paragraph 4.4.2, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

4.4.2 In areas beyond the limits of the obstacle limitation surfaces, at least those objects that extend to a height of 150 m or more above ground elevation shall be regarded as obstacles, unless a special aeronautical study indicate that they do not constitute a hazard to operations of aeroplanes.

Note – The study may have regard to the nature of operations concerned and may distinguish between day and night operations.

4.5.0 Other objects

4.5.1 Objects which do not project through the approach surface but which would nevertheless adversely affect the optimum siting or performance of visual or nonvisual aids shall, as far as practicable, be removed.
4.5.2 Anything which may, after aeronautical study, endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces shall be regarded as an obstacle and shall be removed in so far as practicable.

*Note* – In certain circumstances, objects that do not project above any of the surfaces enumerated in paragraph 4.2 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.

4.6 **Shielding of obstacles**

4.6.1 **General**

4.6.1.1 The principle of shielding as applied to obstacles to air navigation may reduce the necessity for removing obstacles or prohibiting the construction of new constructions.

4.6.1.2 Shielding principles are employed when some object, an existing building or natural terrain already penetrates above one of the obstacle limitation surfaces described in this Manual.

4.6.2 **The principles of Shielding**

4.6.2.1 If it is considered that the nature of an object is such that its presence may be described as permanent, the additional objects within a specified area around it may be permitted to penetrate the surface without being considered as obstacles. The original obstacle is considered as dominating or shielding the surrounding area.

4.6.2.2 The formula for shielding shall be based on a horizontal plane projected from the top of each obstacle away from the runway and a plane with a negative slope of 10% towards the runway. Any object which is below either of the two planes would be considered shielded. The permission to allow objects to penetrate an obstacle limitation surface under the shielding principle shall however be qualified by reference to the need for an aeronautical study in all cases.

4.6.2.3 The shielding effect of immovable obstacles laterally in approach and take-off climb shall be more critically considered. It is important to preserve existing unobstructed cross section areas particularly when the obstacle is close to the runway. This would guard against future changes in either approach or take-off climb area specifications or the adoption of a turned take-off procedure.
4.6.2.4 An object shall be considered as permanent and immovable obstacle only if, when taking the longest view possible, there is no prospect of removal being practicable, possible or justifiable, regardless of how the pattern, type or density of air operations might change. Generally, an aeronautical study will need to be carried out to determine the exact effect the construction of a new object will have on air operations.

4.6.2.5 Alternative methods for assessing Obstacles in critical areas
The Authority may assess and determine whether an obstacle is shielded. In assessing whether an existing obstacle shields other obstacles, the Authority may be guided by the following shielding practices employed by other States:

**Obstacles in the Take-off climb and Approach Surfaces**

4.6.2.6 An obstacle may be assessed as not imposing additional restrictions if:

(i) when located between the inner edge end and the critical obstacle, the obstacle being assessed is below a plane sloping downwards at 10% from the top of the critical obstacle toward the inner edge;

(ii) when located beyond the critical obstacle from the inner edge end, the obstacle being assessed is not higher than the height of the permanent obstacle; and

(iii) where there is more than one critical obstacle within the approach and take-off climb area, and the obstacle being assessed is located between two critical obstacles, the height of the obstacle being assessed is not above a plane sloping downwards at 10% from the top of the next critical obstacle.

**Obstacle in the Transitional Surfaces**

4.6.2.7 An obstacle may be assessed as not imposing additional restrictions if it does not exceed the height of an existing obstacle which is closer to the runway strip and the obstacle being assessed is located perpendicularly behind the existing obstacle relative to the runway centre line.

**Obstacle in the Horizontal and Conical Surfaces**

4.6.2.8 An obstacle may be assessed as not imposing additional restrictions if it is in the vicinity of an existing obstacle, and does not penetrate a 10% downward sloping conical shaped surface from the top of the
existing obstacle, i.e. the obstacle is shielded radially by the existing obstacle.

**Figure 4-3 – Shielding of obstacles penetrating the approach and take-off climb surfaces**
CHAPTER 5 - VISUAL AIDS FOR NAVIGATION

5.1.0 Introduction
This chapter details the specifications for aerodrome indicators and signalling devices, markings, lights, signs and markers to be provided at an aerodrome.

5.2.0 Indicators and signalling devices
5.2.1 Wind direction indicator

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

Location
5.2.1.2 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
5.2.1.3 The wind direction indicator shall be in the form of a truncated cone made of fabric and shall 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 shall 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 shall 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, shall be used. Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they shall preferably be orange and white, red and white, or black and white, and shall be arranged in five alternate bands, the first and last bands being the darker colour.

5.2.1.4 The location of at least one wind direction indicator shall be marked by a circular band 15 m in diameter and 1.2 m wide. The band shall be centred about the wind direction indicator support and shall be in a colour chosen to give adequate conspicuity, preferably white.

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

5.2.2 Landing direction indicator
Location
5.2.2.1 Where provided, a landing direction indicator shall be located in a conspicuous place on the aerodrome.

Characteristics
5.2.2.2 The landing direction indicator shall be in the form of a “T”.
5.2.2.3 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.

![Diagram of Landing Direction Indicator](image)

Figure 5-1. Landing direction indicator

5.2.3 Signalling lamp (Controlled aerodrome)

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

Characteristics
5.2.3.2 A signalling lamp shall 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
5.2.3.3 The beam spread shall be not less than 1° or 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 shall be not less than 6 000 cd.

5.2.4 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. This Manual Attachment B, Section 15 provides guidance on the need to provide ground signals. ICAO Annex 2 Appendix 1 specifies the shape, colour and use of visual ground signals. The ICAO Aerodrome Design Manual, Part 4 provides guidance on their design.

Location of signal area

5.2.4.1 The signal area shall 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

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

5.2.4.3 The colour of the signal area shall be chosen to contrast with the colours of the signal panels used, and it shall be surrounded by a white border not less than 0.3 m wide.

5.3 Markings

5.3.1 General

Interruption of runway markings

5.3.1.1 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.

5.3.1.2 The order of importance of runways for the display of runway markings shall be as follows:

– 1st— precision approach runway;
– 2nd— non-precision approach runway; and
– 3rd— non-instrument runway.

5.3.1.3 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 paragraph 5.3.8.5 regarding the manner of connecting runway and taxiway centre line markings.

**Colour and conspicuity**

5.3.1.4 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.*

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

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

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

*Note — Guidance on reflective materials is given in the ICAO Aerodrome Design Manual (Doc 9157) Part 4.*

**5.3.2 Runway designation marking**

**Application**

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

**Location**

5.3.2.2 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

5.3.2.3 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.

![Figure 5-2. Runway designation, centre line and threshold markings](image)

5.3.2.4 In the case of parallel runways, each runway designation number shall be supplemented by a letter as follows, in the order shown from left to right when viewed from the direction of approach:

- for two parallel runways: “L” “R”;
- for three parallel runways: “L” “C” “R”;
- for four parallel runways: “L” “R” “L” “R”;
- for five parallel runways: “L” “C” “R” “L” “R” or “L” “R” “L” “C” “R”; and

5.3.2.5 The numbers and letters shall be in the form and proportion shown in Figure 5-3. The dimensions shall be not less than those shown in Figure 5-3, but where the numbers are incorporated in the threshold marking, larger dimensions shall be used in order to fill adequately the gap between the stripes of the threshold marking.

5.3.3 Runway centre line marking

Application

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

Location

5.3.3.2 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 paragraph 5.3.1.1 of this Manual.

Characteristics

5.3.3.3 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.

5.3.3.4 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.
5.3.4 Threshold marking

Application

5.3.4.1 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.

5.3.4.2 A threshold marking shall 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.

Note: — The ICAO Aerodrome Design Manual, Part 4, shows a form of marking which has been found satisfactory for the marking of downward slopes immediately before the threshold.

Location

5.3.4.3 The stripes of the threshold marking shall commence 6 m from the threshold.

Characteristics

5.3.4.4 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:

<table>
<thead>
<tr>
<th>Runway width</th>
<th>Number of stripes</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 m</td>
<td>4</td>
</tr>
<tr>
<td>23 m</td>
<td>6</td>
</tr>
<tr>
<td>30 m</td>
<td>8</td>
</tr>
<tr>
<td>45 m</td>
<td>12</td>
</tr>
<tr>
<td>60 m</td>
<td>16</td>
</tr>
</tbody>
</table>

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).

5.3.4.5 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 spacing 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 22.5m.

Transverse stripe
5.3.4.6 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 this Manual, Figure 5-4 (B) shall be added to the threshold marking.

5.3.4.7 A transverse stripe shall be not less than 1.80 m wide.

Arrows

5.3.4.8 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.

5.3.4.9 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.

Note 1 — In the case where a threshold is temporarily displaced for only a short period of time, it has been found satisfactory to use markers in the form and colour of a displaced threshold marking rather than attempting to paint this marking on the runway.

Note 2 — when the runway before a displaced threshold is unfit for the surface movement of aircraft, closed markings, as described in paragraph 7.2.1.4 of this Manual, are required to be provided.
5.3.5 Aiming point marking

Application

5.3.5.1 The provisions of Sections 5.3.5 and 5.3.6 of this Manual shall not require the replacement of existing markings before 1 January 2009.

5.3.5.2 An aiming point marking shall be provided at each approach end of a paved instrument runway where the code number is 2, 3 or 4.

5.3.5.3 An aiming point marking shall be provided at each approach end of:
   a) a paved non-instrument runway where the code number is 3 or 4,
   b) a paved instrument runway where the code number is 1, when additional conspicuity of the aiming point is desirable.

Location

5.3.5.4 The aiming point marking shall commence no closer to the threshold than the distance indicated in the appropriate column of Table 5-1 except that, on a runway equipped with a visual approach...
slope indicator system, the beginning of the marking shall be coincident with the visual approach slope origin.

5.3.5.5 An aiming point marking shall consist of two conspicuous stripes. The dimensions of the stripes and the lateral spacing between their inner sides shall be in accordance with the provisions of the appropriate column of Table 5-1 of this Manual. Where a touchdown zone marking is provided, the lateral spacing between the markings shall be the same as that of the touch-down zone marking.

Table 5-1 – Location and dimensions of aiming point marking

<table>
<thead>
<tr>
<th>Location and Dimensions</th>
<th>Landing distance available</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 800 m</td>
</tr>
<tr>
<td>(1) Distance from threshold to the beginning of marking (m)</td>
<td>(2)</td>
</tr>
<tr>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>Length of stripe a</td>
<td>30-45</td>
</tr>
<tr>
<td>Width of stripe</td>
<td>4</td>
</tr>
<tr>
<td>Lateral spacing between inner sides of stripe</td>
<td>6 c</td>
</tr>
</tbody>
</table>

a. The greater dimensions of the specified ranges are intended to be used where increased conspicuity is required.
b. The lateral spacing may be varied within these limits to minimize the contamination of the marking by rubber deposits.
c. These figures were deduced by reference to the outer main gear wheel span which is element 2 of the aerodrome reference code at Chapter 1, Table 1-1

5.3.6 Touchdown zone marking

Application
5.3.6.1 A touchdown zone marking shall be provided in the touchdown zone of a paved precision approach runway where the code number is 2, 3 or 4.

5.3.6.2 A touchdown zone marking shall be provided in the touchdown zone of a paved non-precision approach or non-instrument runway where the code number is 3 or 4 and additional conspicuity of the touchdown zone is desirable.

**Location and characteristics**

5.3.6.3 A touchdown zone marking shall consist of pairs of rectangular markings symmetrically disposed about the runway centre line with the number of such pairs related to the landing distance available and, where the marking is to be displayed at both the approach directions of a runway, the distance between the thresholds, as follows:

<table>
<thead>
<tr>
<th>Landing distance available or the distance between thresholds</th>
<th>Pair(s) of markings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 900 m</td>
<td>1</td>
</tr>
<tr>
<td>900 m up to but not including 1 200 m</td>
<td>2</td>
</tr>
<tr>
<td>1 200 m up to but not including 1 500 m</td>
<td>3</td>
</tr>
<tr>
<td>1 500 m up to but not including 2 400 m</td>
<td>4</td>
</tr>
<tr>
<td>2 400 m or more</td>
<td>6</td>
</tr>
</tbody>
</table>

5.3.6.4 A touchdown zone marking shall conform to either of the two patterns shown in Figure 5-5. For the pattern shown in Figure 5-5 (A), the markings shall be not less than 22.5 m long and 3 m wide. For the pattern shown in Figure 5-5(B), each stripe of each marking shall be not less than 22.5 m long and 1.8 m wide with spacing of 1.5 m between adjacent stripes. The lateral spacing between the inner sides of the rectangles shall be equal to that of the aiming point marking where provided. Where an aiming point marking is not provided, the lateral spacing between the inner sides of the rectangles shall correspond to the lateral spacing specified for the aiming point marking in Table 5-1 of this Manual (columns 2, 3, 4 or 5, as appropriate). The pairs of markings shall be provided at
longitudinal spacings of 150 m beginning from the threshold except that pairs of touchdown zone markings coincident with or located within 50 m of an aiming point marking shall be deleted from the pattern.

5.3.6.5 On a non-precision approach runway where the code number is 2, an additional pair of touchdown zone marking stripes shall be provided 150 m beyond the beginning of the aiming point marking.
Figure 5-5. Aiming point and touchdown zone markings
(illustrated for a runway with a length of 2,400 m or more)
5.3.7 Runway side stripe marking

Application

5.3.7.1 A runway side stripe marking shall be provided between the thresholds of a paved runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain.

5.3.7.2 A runway side stripe marking shall be provided on a precision approach runway irrespective of the contrast between the runway edges and the shoulders or the surrounding terrain.

Location

5.3.7.3 A runway side stripe marking shall consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway, except that, where the runway is greater than 60 m in width, the stripes shall be located 30 m from the runway centre line.

5.3.7.4 Where a runway turn pad is provided, the runway side stripe marking shall be continued between the runway and the runway turn pad.

Characteristics

5.3.7.5 A runway side stripe shall have an overall width of at least 0.9 m on runways 30 m or more in width and at least 0.45 m on narrower runways.

5.3.8 Taxiway centre line marking

Application

5.3.8.1 Taxiway centre line marking shall be provided on a paved taxiway and apron where the code number is 3 or 4 in such a way as to provide continuous guidance between the runway centre line and aircraft stands.

5.3.8.2 Taxiway centre line marking shall be provided on a paved taxiway and apron where the code number is 1 or 2 in such a way as to provide continuous guidance between the runway centre line and aircraft stands.

5.3.8.3 Taxiway centre line marking shall be provided on a paved runway when the runway is part of a standard taxi-route and:

a) there is no runway centre line marking; or

b) where the taxiway centre line is not coincident with the runway centre line.
5.3.8.4 Where it is necessary to denote the proximity of a runway holding position, enhanced taxiway centre line marking shall be provided.
*Note.* The provision of enhanced taxiway may form part of runway incursion prevention measures.

5.3.8.5 Where provided, enhanced taxiway centre line marking shall be installed at all taxiway/runway intersections at that aerodrome.

**Location**

5.3.8.6 On a straight section of a taxiway the taxiway centre line marking shall be located along the taxiway centre line. On a taxiway curve the marking shall continue from the straight portion of the taxiway at a constant distance from the outside edge of the curve.
*Note* — See paragraph 3.2.9.5 and Figure 3-2.

5.3.8.7 At an intersection of a taxi-way with a runway where the taxiway serves as an exit from the runway, the taxiway centre line marking shall be curved into the runway centre line marking as shown in Figures 5-6 and 5-26. The taxiway centre line marking shall be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2.

5.3.8.8 Where taxiway centre line marking is provided on a runway in accordance with paragraph 5.3.8.3 of this Manual, the marking shall be located on the centre line of the designated taxiway.

5.3.8.9 Where provided:

a) An enhanced taxiway centre line marking shall extend from the runway-holding position Pattern A (as defined in Figure 5-6, Taxiway markings) to a distance of up to 47 m in the direction of travel away from the runway. See Figure 5-7 (a).

b) If the enhanced taxiway centre line marking intersects another runway-holding position marking, such as for a precision approach category II or III runway, that is located within 47 m of the first runway-holding position marking, the enhanced taxiway centre line marking shall be interrupted 0.9 m prior to and after the intersected runway-holding position marking. The enhanced taxiway centre line marking shall continue beyond the intersected runway-
holding position marking for at least three dashed line segments or 47 m from start to finish, whichever is greater. See Figure 5-7 (b).

c) If the enhanced taxiway centre line marking continues through a taxiway/taxiway intersection that is located within 47 m of the runway-holding position marking, the enhanced taxiway centre line marking shall be interrupted 1.5 m prior to and after the point where the intersected taxiway centre line crosses the enhanced taxiway centre line. The enhanced taxiway centre line marking shall continue beyond the taxiway/taxiway intersection for at least three dashed line segments or 47 m from start to finish, whichever is greater. See Figure 5-7 (c).

d) Where two taxiway centre lines converge at or before the runway-holding position marking, the inner dashed line shall not be less than 3 m in length. See Figure 5-7 (d).

e) Where there are two opposing runway-holding position markings and the distance between the markings is less than 94 m, the enhanced taxiway centre line markings shall extend over this entire distance. The enhanced taxiway centre line markings shall not extend beyond either runway-holding position marking. See Figure 5-7 (e).

**Characteristics**

**5.3.8.10** A taxiway centre line marking shall be at least 15cm in width and continuous in length except where it intersects with a runway-holding position marking or an intermediate holding position marking as shown in Figure 5-6.

**5.3.8.11** Enhanced taxiway centre line marking shall be as shown in Figure 5-7.
Figure 5-6. Taxiway markings

(Shown with basic runway markings)
Figure 5-7. Enhanced taxiway centre line marking

(a) Dimensions

- A: 7.5 – 15 cm (Note 1)
- B: 15 cm
- C: 15 – 30 cm (Note 2)
- D: 15 cm

Note 1: Black background for contrast on light-coloured pavements.
Note 2: Continuous yellow centre line.
5.3.9  Runway turn pad marking

Application

5.3.9.1 Where a runway turn pad is provided, a runway turn pad marking shall be provided for continuous guidance to enable an aeroplane complete a 180–degree turn and align with runway centre line.

Location

5.3.9.2 The runway turn pad marking shall be curved from the runway centre line into the turn pad. The radius of the curve shall be compatible with the manoeuvring capability and normal taxiing speeds of the aeroplanes for which the runway turn pad is intended. The intersection angle of the runway turn pad marking with the runway centre line shall not be greater than 30 degrees.

5.3.9.3 The runway turn pad marking shall be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2.

5.3.9.4 A runway turn pad marking shall guide the aeroplane in such a way as to allow a straight portion of taxiing before the point where a 180-degree turn is to be made. The straight portion of the runway turn pad marking shall be parallel to the outer edge of the runway turn pad.

5.3.9.5 The design of the curve allowing the aeroplane to negotiate a 180-degree turn shall be based on a nose wheel steering angle not exceeding 45 degrees.

5.3.9.6 The design of the turn pad marking shall be such that, when the cockpit of the aeroplane remains over the runway turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the runway turn pad shall be not less than those specified in 3.3.6

Characteristics

5.3.9.7 A runway turn pad marking shall be at least 15 cm in width and continuous in length.

Note. — For ease of manoeuvring, consideration may be given to providing a larger wheel-to-edge clearance for codes E and F aeroplanes.

5.3.10 Runway-holding position marking

Application and location
5.3.10.1 A runway-holding position marking shall be displayed along a runway-holding position.

Note — See Para 5.5.2 concerning the provision of signs at runway-holding positions.

Characteristics

5.3.10.2 At an intersection of a taxiway and a non-instrument, non-precision approach or take-off runway, the runway-holding position marking shall be as shown in Figure 5-6, pattern A.

5.3.10.3 Where a single runway-holding position is provided at an intersection of a taxiway and a precision approach category I, II runway, the runway-holding position marking shall be as shown in Figure 5-6, pattern A. Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closer (closest) to the runway shall be as shown in Figure 5-6, pattern A and the markings farther from the runway shall be as shown in Figure 5-6, pattern B.

5.3.10.4 The runway-holding position marking displayed at a runway-holding position established in accordance with paragraph 3.12.3 of this Manual shall be as shown in Figure 5-6, pattern A.

5.3.10.5 Where increased conspicuity of the runway-holding position is required, the runway-holding position marking shall be as shown in Figure 5-8, pattern A or pattern B, as appropriate.

5.3.10.6 Where a pattern B runway-holding position marking is located on an area where it would exceed 60 m in length, the term “CAT II” or “CAT III” as appropriate shall be marked on the surface at the ends of the runway-holding position marking and at equal intervals of 45 m maximum between successive marks. The letters shall be not less than 1.8 m high and shall be placed not more than 0.5 m beyond the holding position marking.

5.3.10.7 The runway-holding position marking displayed at a runway/runway intersection shall be perpendicular to the centre line of the runway forming part of the standard taxi-route. The pattern of the marking shall be as shown in Figure 5-8, pattern A.
5.3.11 Intermediate holding position marking

Application and location

5.3.11.1 An intermediate holding position marking shall be displayed along an intermediate holding position.

5.3.11.2 Where an intermediate holding position marking is displayed at an intersection of two paved taxiways, it shall be located across the taxiway at sufficient distance from the near edge of the intersecting taxiway to ensure safe clearance between taxiing aircraft. It shall be coincident with a stop bar or intermediate holding position lights, where provided.

5.3.11.3 The distance between an intermediate holding position marking at the exit boundary of a remote de-icing/anti-icing facility and the centre line of the adjoining taxiway shall not be less than the dimension specified in Table 3-1, column 11.

Characteristics

5.3.11.4 An intermediate holding position marking shall consist of a single broken line as shown in Figure 5-6.
5.3.12 **VOR aerodrome check-point marking**

**Application**

5.3.12.1 When a VOR aerodrome check-point is established, it shall be indicated by a VOR aerodrome check-point marking and sign.

*Note* — See figure 5-31 of ICAO Annex 14 Volume 1 Para 5.4.4 for VOR aerodrome check-point sign.

5.3.12.2 **Site selection**

*Note* — Guidance on the selection of sites for VOR aerodrome checkpoints is given in ICAO Annex 10, Volume I, Attachment E to Part I.

**Location**

5.3.12.3 A VOR aerodrome check-point marking shall be centred on the spot at which an aircraft is to be parked to receive the correct VOR signal.

**Characteristics**

5.3.12.4 A VOR aerodrome check-point marking shall consist of a circle 6 m in diameter and have a line width of 15 cm (See Figure 5-9 (A)).

![Figure 5-9. VOR aerodrome checkpoint marking](image)

5.3.12.5 When it is preferable for an aircraft to be aligned in a specific direction, a line shall be provided that passes through the centre of the circle on the desired azimuth. The line shall extend 6 m outside the circle in the desired direction of heading and terminate in an arrowhead. The width of the line shall be 15 cm (see Figure 5-9 (B)).
5.3.12.6 A VOR aerodrome check-point marking shall preferably be white in colour but shall differ from the colour used for the taxiway markings.

*Note — To provide contrast, markings may be bordered with black.*

5.3.13 Road-holding position marking

**Application**

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

**Location**

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

**Characteristics**

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

5.3.14 Mandatory instruction marking

*Note — Guidance on mandatory instruction marking is given in the ICAO Aerodrome Design Manual, Part 4.*

**Application**

5.3.14.1 Where it is impracticable to install a mandatory instruction sign in accordance with paragraph 5.5.2 of this Manual, a mandatory instruction marking shall be provided on the surface of the pavement.

5.3.14.2 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 shall be supplemented by a mandatory instruction marking.

**Location**

5.3.14.3 The mandatory instruction marking on taxiways where the code letter is A, B, C or D shall be located across the taxiway equally placed about the taxiway centre line and on the holding side of the runway –holding position marking as shown in figure 5-10 (A). The distance between the nearest edge of the marking and the runway-holding position marking or the runway centre line marking shall be not less than 1m.
5.3.14.4 The mandatory instruction marking on taxiways where the code letter is E or F shall be located on both sides of the taxiway centre line marking and on the holding side of the runway-holding position marking as shown in Figure 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.

5.3.14.5 Except where operationally required, a mandatory instruction marking shall not be located on a runway.

![Figure 5-10 Mandatory instruction marking](image)

**Characteristics**

5.3.14.6 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.

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

5.3.14.8 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.
5.3.14.9 The character height shall be 4 m for inscriptions where the code letter is C, D, E or F, and 2 m where the code letter is A or B. The inscriptions shall be in the form and proportions shown in Appendix 3.

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

5.3.15 Information marking


Application

5.3.15.1 Where an information sign would normally be installed and it is physically impossible to install a sign, information marking shall be displayed on the surface of the pavement.

5.3.15.2 Where operationally required an information sign shall be supplemented by an information marking.

5.3.15.3 An information (location/direction) marking shall 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.

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

Location

5.3.15.5 The information marking shall be displayed across the surface of the taxiway or apron where necessary and positioned so as to be legible from the cockpit of an approaching aircraft.

Characteristics

5.3.15.6 An information marking shall consist of:
   a) an inscription in yellow, when it replaces or supplements a location sign; and
   b) an inscription in black, when it replaces or supplements a direction or destination sign.

5.3.15.7 Where there is insufficient contrast between the marking and the pavement surface, the marking shall include:
   a) a black background where the inscriptions are in yellow; and
   b) a yellow background where the inscriptions are in black.
5.3.15.8 The character height shall be 4 m. The inscriptions shall be in the form and proportions shown in Appendix 3.

5.4.0 Lights

5.4.1 General

Lights which may endanger the safety of aircraft

5.4.1.1 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

5.4.1.2 To protect the safety of aircraft against the hazardous effects of laser emitters, the following protected zones shall be established around aerodromes:
- a laser-beam free flight zone (LFFZ),
- a laser-beam critical flights zone (LCFZ), and
- a laser-beam sensitive flight zone.

Note: 1 — Figures 5-10, 5-11 and 5-12 may be used to determine the exposure levels and distances that adequately protects flights operations.
Note 2 — The restrictions in 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 air space, the irradiance level of any laser beam, visible or invisible, is expected to be less than or equal to the maximum permissible exposure (MPE).
Note 3 — The protected flight zones are established in order to mitigate the risks of operating laser emitters in the vicinity of aerodromes.
Note 4 — Further guidance on how to protect flight operations from the hazardous effects of laser emitters is contained in the ICAO Manual on Laser Emitters and Flights Safety (ICAO Doc 5815).
Note 5 — See also ICAO Annex 11 – Air Traffic Services, Chapter 2.
Figure 5-11. Protected flight zones

Figure 5-12. Multiple runway laser-beam free zone

PROTECTED FLIGHT ZONES
Elevation
5.4.1.3 A non-aeronautical ground light which, by reason of its intensity, configuration or colour, might prevent, or cause confusion in, the clear interpretation of aeronautical ground lights shall be extinguished, screened or otherwise modified so as to eliminate such a possibility. In particular, attention shall be directed to a non-aeronautical ground light visible from the air within the areas described hereunder:

a) Instrument runway — code number 4:
   Within the areas before the threshold and beyond the end of the runway extending at least 4 500 m in length from the threshold and runway end and 750m either side of the extended runway centre line in width.

b) Instrument runway — code number 2 or 3:
   As in a), except that the length shall be at least 3 000 m.

c) Instrument runway — code number 1; and non-instrument runway: Within the approach area.

Aeronautical ground lights, which may cause confusion to mariners

Figure 5-13. Protected flight zones with indication of maximum irradiance levels for visible laser Beams
Note — In the case of aeronautical ground lights near navigable waters, consideration needs to be given to ensuring that the lights do not cause confusion to mariners.

**Light fixtures and supporting structures**

*Note — See Para 9.10 of this Manual for information regarding siting and construction of equipment and installations on operational areas, and the ICAO Aerodrome Design Manual, Part 6 for guidance on frangibility of light fixtures and supporting structures.*

**Elevated approach lights**

5.4.1.4 Elevated approach lights and their supporting structures shall be frangible except that, in that portion of the approach lighting system beyond 300 m from the threshold:

a) where the height of a supporting structure exceeds 12 m, the frangibility requirement shall apply to the top 12 m only; and

b) where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding objects shall be frangible.

5.4.1.5 The provisions of paragraph 5.4.1.3 above shall not require the replacement of existing installations before 1 January 2005.

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

**Elevated lights**

5.4.1.7 Elevated runway, stop-way 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**

5.4.1.8 Light fixtures inset in the surface of runways, stop-ways, 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.

5.4.1.9 The temperature produced by conduction or radiation at the interface between an installed inset light and an aircraft tire shall not exceed 160°C during a 10-minute period of exposure.

*Note — Guidance on measuring the temperature of inset lights is given in the ICAO Aerodrome Design Manual, 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 13, and the ICAO Aerodrome Design Manual, Part 4.)

5.4.1.10 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.

5.4.1.11 Where a high-intensity lighting system is provided, a suitable intensity control shall be incorporated to allow for adjustment of the light intensity to meet the prevailing conditions. Separate intensity controls or other suitable methods shall be provided to ensure that the following systems, when installed, can be operated at compatible intensities:

— approach lighting system;
— runway edge lights;
— runway threshold lights;
— runway end lights;
— runway centre line lights;
— runway touchdown zone lights; and
— taxiway centre line lights.

5.4.1.12 On the perimeter of and within the ellipse defining the main beam in ICAO Annex 14 Vol. I, Appendix 2, Figures 2.1 to 2.10, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with this manual. Appendix 2, collective notes for Figures 2.1 to 2.11, Note 2.

5.4.1.13 On the perimeter of and within the rectangle defining the main beam in ICAO Annex 14 Vol. I, Appendix 2, Figures 2.12 to 2.20,
the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with this manual. Appendix 2, collective notes for Figures 2.12 to 2.21, Note 2.

5.4.2 Emergency lighting

Application

5.4.2.1 At an aerodrome provided with runway lighting and without a secondary power supply, sufficient emergency lights shall be conveniently available for installation on at least the primary runway in the event of failure of the normal lighting system.

Note — Emergency lighting may also be useful to mark obstacles or delineate taxiways and apron areas.

Location

5.4.2.2 When installed on a runway the emergency lights shall, as a minimum, conform to the configuration required for a non-instrument runway.

Characteristics

5.4.2.3 The colour of the emergency lights shall conform to the colour requirements for runway lighting, except that, where the provision of coloured lights at the threshold and the runway end is not practicable, all lights may be variable white or as close to variable white as practicable.

5.4.3 Aeronautical beacons

Application

5.4.3.1 Where operationally necessary an aerodrome beacon or an identification beacon shall be provided at each aerodrome intended for use at night.

5.4.3.2 The operational requirement shall be determined having regard to the requirements of the air traffic using the aerodrome, the conspicuity of the aerodrome features in relation to its surroundings and the installation of other visual and non-visual aids useful in locating the aerodrome.

Aerodrome beacon

5.4.3.3 An aerodrome beacon shall be provided at an aerodrome intended for use at night if one or more of the following conditions exist:

a) aircraft navigate predominantly by visual means;

b) reduced visibilities are frequent; or
c) it is difficult to locate the aerodrome from the air due to surrounding lights or terrain.

**Location**

5.4.3.4 The aerodrome beacon shall be located on or adjacent to the aerodrome in an area of low ambient back-ground lighting.

5.4.3.5 The location of the beacon shall be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.

**Characteristics**

5.4.3.6 The aerodrome beacon shall show either coloured flashes alternating with white flashes, or white flashes only. The frequency of total flashes shall be from 20 to 30 per minute. Where used, the coloured flashes emitted by beacons at land aerodromes shall be green and coloured flashes emitted by beacons at water aerodromes shall be yellow. In the case of a combined water and land aerodrome, coloured flashes, if used, shall have the colour characteristics of whichever section of the aerodrome is designated as the principal facility.

5.4.3.7 The light from the beacon shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the Aerodrome Standards and Safety Unit to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used and the effective intensity of the flash shall be not less than 2 000 cd.

*Note — At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.*

**Identification beacon**

**Application**

5.4.3.8 An identification beacon shall be provided at an aerodrome which is intended for use at night and cannot be easily identified from the air by other means.

**Location**

5.4.3.9 The identification beacon shall be located on the aerodrome in an area of low ambient background lighting.

5.4.3.10 The location of the beacon shall be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.
Characteristics

5.4.3.11 An identification beacon at a land aerodrome shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the Aerodrome Standards and Safety Unit to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used and the effective intensity of the flash shall be not less than 2 000 cd.

Note — At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.

5.4.3.12 An identification beacon shall show flashing-green at a land aerodrome and flashing-yellow at a water aerodrome.

5.4.3.13 The identification characters shall be transmitted in the International Morse Code.

5.4.3.14 The speed of transmission shall be between six and eight words per minute, the corresponding range of duration of the Morse dots being from 0.15 to 0.2 seconds per dot.

5.4.4 Approach lighting systems

Note — It is intended that existing lighting systems not conforming to the specifications in paragraphs 5.4.4.21, 5.4.4.39, 5.4.5.10, 5.4.10.10, 5.4.10.11, 5.4.11.5, 5.4.12.8, 5.4.13.6 and 5.4.16.8 of this Manual be replaced not later than 1 January 2005.

Application

5.4.4.1 Application

A — Non-instrument runway
Where physically practicable, a simple approach lighting system as specified in paragraphs 5.4.4.2 to 5.4.4.9 of this Manual shall be provided to serve a non-instrument runway where the code number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility, and sufficient guidance is provided by other visual aids.

Note — A simple approach lighting system can also provide visual guidance by day.

B — Non-precision approach runway
Where physically practicable, a simple approach lighting system as specified in paragraphs 5.4.4.2 to 5.4.4.9 of this Manual shall be provided to serve a non-precision approach runway, except when
the runway is used only in conditions of good visibility or sufficient
guidance is provided by other visual aids.

*Note — It is advisable to give consideration to the installation of a precision
approach category I lighting system or to the addition of a runway lead-in
lighting system.*

C — Precision approach runway category I
Where physically practicable, a precision approach category I
lighting system as specified in paragraphs 5.4.4.10 to 5.4.4.21 of this
Manual shall be provided to serve a precision approach runway
category I.

D — Precision approach runway categories II and III
A precision approach category II lighting system as specified in
paragraphs 5.4.4.22 to 5.4.4.39 of this Manual shall be provided to
serve a precision approach runway category II or III

**Simple approach lighting system**

**Location**

*5.4.4.2* A simple approach lighting system shall consist of a row of lights
on the extended centre line of the runway extending, whenever
possible, over a distance of not less than 420 m from the threshold
with a row of lights forming a crossbar 18 m or 30 m in length at a
distance of 300 m from the threshold.

*5.4.4.3* The lights forming the crossbar shall be as nearly as practicable in a
horizontal straight line at right angles to, and bisected by, the line of
the centre line lights. The lights of the crossbar shall be spaced so as
to produce a linear effect, except that, when a crossbar of 30 m is
used, gaps may be left on each side of the centre line. These gaps
shall be kept to a minimum to meet local requirements and each
shall not exceed 6 m.

*Note 1 —* Spacings for the crossbar lights between 1 m and 4 m are in use.
Gaps on each side of the centre line may improve directional guidance when
approaches are made with a lateral error, and facilitate the movement of
rescue and fire fighting vehicles.

*Note 2 —* See Attachment B, Section 10 for guidance on installation
tolerances

*5.4.4.4* The lights forming the centre line shall be placed at longitudinal
intervals of 60 m, except that, when it is desired to improve the
guidance, an interval of 30 m may be used. The innermost light shall
be located either 60 m or 30 m from the threshold, depending on the
longitudinal interval selected for the centre line lights.
5.4.4.5 If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it shall be extended to 300 m so as to include the crossbar. If this is not possible, the centre line lights shall be extended as far as practicable, and each centre line light shall then consist of a barrette at least 3 m in length. Subject to the approach system having a crossbar at 300 m from the threshold, an additional crossbar may be provided at 150 m from the threshold.

5.4.4.6 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and

b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.4.4.7 The lights of a simple approach lighting system shall be fixed lights and the colour of the lights shall be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present. Each centre line light shall consist of either:

a) a single source; or

b) a barrette at least 3 m in length.

Note 1 — When the barrette as in b) is composed of lights approximating to point sources, a spacing of 1.5 m between adjacent lights in the barrette has been found satisfactory.

Note 2 — It may be advisable to use barrettes 4 m in length if it is anticipated that the simple approach lighting system will be developed into a precision approach lighting system.

Note 3 — At locations where identification of the simple approach lighting system is difficult at night due to surrounding lights, sequence flashing lights installed in the outer portion of the system may resolve this problem.

5.4.4.8 Where provided for a non-instrument runway, the lights shall show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights shall be adequate for all
conditions of visibility and ambient light for which the system has been provided.

5.4.4.9 Where provided for a non-precision approach runway, the lights shall show at all angles in azimuth necessary to the pilot of an aircraft which on final approach does not deviate by an abnormal amount from the path defined by the non-visual aid. The lights shall be designed to provide guidance during both day and night in the most adverse conditions of visibility and ambient light for which it is intended that the system shall remain usable.

**Precision approach category I lighting system**

**Location**

5.4.4.10 A precision approach category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, wherever possible, over a distance of 900 m from the runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold.

*Note — The installation of an approach lighting system of less than 900 m in length may result in operational limitations on the use of the runway. See ICAO Annex 14 Vol. I, Attachment A, Section 11.*

5.4.4.11 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

*Note 1 — Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles.*

*Note 2 — See Attachment B, Section 10 for guidance on installation tolerances.*

5.4.4.12 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold.

5.4.4.13 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.4.4.14 The centre line and crossbar lights of a precision approach category I lighting system shall be fixed lights showing variable white. Each centre line light position shall consist of either:
   a) a single light source in the innermost 300 m of the centre line, two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line to provide distance information; or
   b) a barrette.

5.4.4.15 Where the serviceability level of the approach lights specified as a maintenance objective in 10.5.10 can be demonstrated, each centre line light position may consist of either:
   a) a single light source; or
   b) a barrette.

5.4.4.16 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

5.4.4.17 If the centre line consists of barrettes as described in paragraph 5.4.4.14 b) or 5.4.4.15 b), each barrette shall be supplemented by a capacitor discharge light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

5.4.4.18 Each capacitor discharge light as described in paragraph 5.4.4.17 of this Manual shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

5.4.4.19 If the centre line consists of lights as described in paragraph 5.4.4.14 a) or 5.4.4.15 a), additional crossbars of lights to the
crossbar provided at 300 m from the threshold shall be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note — See ICAO Attachment A, Section 11 for detailed configuration.

5.4.4.20 Where the additional crossbars described in paragraph 5.4.4.19 of this Manual are incorporated in the system, the outer ends of the crossbars shall lie on two straight lines that either are parallel to the line of the centre line lights or converge to meet the runway centre line 300 m from threshold.

5.4.4.21 The lights shall be in accordance with the specifications of Appendix 2, Figure A2-1.

Note — The flight path envelopes used in the design of these lights are given in Attachment B, Figure A4.

Precision approach category II and III lighting system

Location

5.4.4.22 The approach lighting system shall consist of a row of lights on the extended centre line of the runway, extending, wherever possible, over a distance of 900 m from the runway threshold. In addition, the system shall have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-14. Where the serviceability level of the approach lights specified as maintenance objectives in paragraph 10.4.7 can be demonstrated, the system may have two side rows of lights, extending 240 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-15.

Note — The length of 900 m is based on providing guidance for operations under category I, and II conditions. Reduced lengths may support category II operations but may impose limitations on category I operations. See Attachment B, Section 12.

5.4.4.23 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold.
5.4.4.24 The lights forming the side rows shall be placed on each side of the centre line, at a longitudinal spacing equal to that of the centre line lights and with the first light located 30 m from the threshold. Where the serviceability level of the approach lights specified as maintenance objectives in paragraph 10.5.7 of this Manual can be demonstrated, lights forming the side rows may be placed on each side of the centre line, at a longitudinal spacing of 60 m with the first light located 60 m from the threshold. The lateral spacing (or gauge) between the innermost lights of the side rows shall be not less than 18 m nor more than 22.5 m, and preferably 18 m, but in any event shall be equal to that of the touchdown zone lights.

5.4.4.25 The crossbar provided at 150 m from the threshold shall fill in the gaps between the centre line and side row lights.

5.4.4.26 The crossbar provided at 300 m from the threshold shall extend on both sides of the centre line lights to a distance of 15 m from the centre line.

5.4.4.27 If the centre line beyond a distance of 300 m from the threshold consists of lights as described in paragraph 5.4.4.31 b) or 5.4.4.32 b) of this Manual, additional crossbars of lights shall be provided at 450 m, 600 m and 750 m from the threshold.

5.4.4.28 Where the additional crossbars described in paragraph 5.4.4.27 of this Manual are incorporated in the system, the outer ends of these crossbars shall lie on two straight lines that either are parallel to the centre line or converge to meet the runway centre line 300 m from the threshold.
Figure 5-14. Inner 300m approach and runway lighting for precision approach runways, categories II and III
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.

5.4.4.29 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.4.4.30 The centre line of a precision approach category II and III lighting system for the first 300 m from the threshold shall consist of barrettes showing variable white, except that, where the threshold is displaced 300 m or more, the centre line may consist of single light sources showing variable white. Where the serviceability level of the approach lights specified as maintenance objectives in paragraph 10.5.7 of this Manual can be demonstrated, the centre line of a precision approach category II and III lighting system for the first 300 m from the threshold may consist of either:

a) barrettes, where the centre line beyond 300 m from the threshold consists of barrettes as described in paragraph 5.4.4.32 a); or
b) alternate single light sources and barrettes, where the centre line beyond 300 m from the threshold consists of single light sources as described in paragraph 5.4.4.32 b), with the innermost single light source located 30 m and the innermost barrette located 60 m from the threshold; or
c) single light sources where the threshold is displaced 300 m or more; all of which shall show variable white.

5.4.4.31 Beyond 300 m from the threshold each centre line light position shall consist of either:

a) a barrette as used on the inner 300 m; or
b) two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line; all of which shall show variable white.

5.4.4.32 Where the serviceability level of the approach lights specified as maintenance objectives in paragraph 10.5.8 of this Manual can be demonstrated, beyond 300 m from the threshold each centre line light position may consist of either:
a) a barrette; or
b) a single light source;
all of which shall show variable white.

5.4.4.33 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

5.4.4.34 Each capacitor discharge light shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

5.4.4.35 The side row shall consist of barrettes showing red. The length of a side row barrette and the spacing of its lights shall be equal to those of the touchdown zone light barrettes.

5.4.4.36 The lights forming the crossbars shall be fixed lights showing variable white. The lights shall be uniformly spaced at intervals of not more than 2.7 m.

5.4.4.37 The intensity of the red lights shall be compatible with the intensity of the white lights.

5.4.4.38 The lights shall be in accordance with the specifications of Appendix 2, Figures 2.1 and Figures 2.2.

Note — The flight path envelopes used in the design of these lights are given in Attachment B, Figure A -6.

5.4.5 Visual approach slope indicator systems

Application

5.4.5.1 A visual approach slope indicator system shall be provided to serve the approach to a runway whether or not the runway is served by other visual approach aids or by non-visual aids, where one or more of the following conditions exist:

a) the runway is used by turbojet or other aeroplanes with similar approach guidance requirements;

b) the pilot of any type of aeroplane may have difficulty in judging the approach due to:
i) inadequate visual guidance such as is experienced during an approach over water or featureless terrain by day or in the absence of sufficient extraneous lights in the approach area by night, or

ii) misleading information such as is produced by deceptive surrounding terrain or runway slopes;

c) the presence of objects in the approach area may involve serious hazard if an aeroplane descends below the normal approach path, particularly if there are no non-visual or other visual aids to give warning of such objects;

d) physical conditions at either end of the runway present a serious hazard in the event of an aeroplane undershooting or overrunning the runway; and

e) terrain or prevalent meteorological conditions are such that the aeroplane may be subjected to unusual turbulence during approach.

Note — Guidance on the priority of installation of visual approach slope indicator systems is contained in Attachment A, Section 13.

5.4.5.2 The standard visual approach slope indicator systems shall consist of the following:

a) T-VASIS and AT-VASIS conforming to the specifications contained in 5.4.5.6 to 5.4.5.22 inclusive;

b) PAPI and APAPI systems conforming to the specifications contained in 5.4.5.23 to 5.4.5.40 inclusive; as shown in Figure 5-16.

5.4.5.3 PAPI, T-VASIS or AT-VASIS shall be provided where the code number is 3 or 4 when one or more of the conditions specified in paragraph 5.4.5.1 of this Manual exist.
5.4.5.4 PAPI or APAPI shall be provided where the code number is 1 or 2 when one or more of the conditions specified in paragraph 5.4.5.1 of this Manual exist.

**T-VASIS and AT-VASIS**

**Description**

5.4.5.5 The T-VASIS shall consist of twenty light units symmetrically disposed about the runway centre line in the form of two wing bars of four light units each, with bisecting longitudinal lines of six lights, as shown in Figure 5-17.

5.4.5.6 The AT-VASIS shall consist of ten light units arranged on one side of the runway in the form of a single wing bar of four light units with a bisecting longitudinal line of six lights.

5.4.5.7 The light units shall be constructed and arranged in such a manner that the pilot of an aeroplane during an approach will:

a) when above the approach slope, see the wing bar(s) white, and one, two or three fly-down lights, the more fly-down lights being visible the higher the pilot is above the approach slope;

b) when on the approach slope, see the wing bar(s) white; and

c) when below the approach slope, see the wing bar(s) and one, two or three fly-up lights white, the more fly-up lights being...
visible the lower the pilot is below the approach slope; and when well below the approach slope, see the wing bar(s) and the three fly-up lights red.

When on or above the approach slope, no light shall be visible from the fly-up light units; when on or below the approach slope, no light shall be visible from the fly-down light units.

**Siting**

5.4.5.8 The light units shall be located as shown in Figure 5-17, subject to the installation tolerances given therein. 

*Note — The siting of T-VASIS will provide, for a 3° slope and a nominal eye height over the threshold of 15 m (See paragraphs 5.4.5.6 and 5.4.5.19), a pilot’s eye height over threshold of 13m to 17 m when only the wing bar lights are visible. If increased eye height at the threshold is required (to provide adequate wheel clearance), then the approaches may be flown with one or more fly-down lights visible. The pilot’s eye height over the threshold is then of the following order:*

- Wing bar lights and one fly-down light visible 17 m to 22 m
- Wing bar lights and two fly-down lights visible 22 m to 28 m
- Wing bar lights and three fly-down lights visible 28 m to 54 m

**Characteristics of the light units**

5.4.5.9 The systems shall be suitable for both day and night operations.

5.4.5.10 The light distribution of the beam of each light unit shall be of fan shape showing over a wide arc in azimuth in the approach direction. The wing bar light units shall produce a beam of white light from 1°54’ vertical angle up to 6° vertical angle and a beam of red light from 0° to 1°54’ vertical angle. The fly-down light units shall produce a white beam extending from an elevation of 6° down to approximately the approach slope, where it shall have a sharp cut-off. The fly-up light units shall produce a white beam from approximately the approach slope down to 1°54’ vertical angle and a red beam below a 1°54’ vertical angle. The angle of the top of the red beam in the wing bar units and fly-up units may be increased to comply with paragraph 5.4.5.21 of this Manual.

5.4.5.11 The light intensity distribution of the fly-down, wing bar and fly-up light units shall be as shown in Appendix 2, Figure A2-22.

5.4.5.12 The colour transition from red to white in the vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur over a vertical angle of not more than 15’.
5.4.5.13 At full intensity the red light shall have a Y coordinate not exceeding 0.320.

5.4.5.14 A suitable intensity control shall be provided to allow adjustments to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

Figure 5-17. Siting of light units for T-VASIS
5.4.5.15 The light units forming the wing bars, or the light units forming a fly-down or a fly-up matched pair, shall be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.

5.4.5.16 The light units shall be so designed that deposits of condensation, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall in no way affect the elevation of the beams or the contrast between the red and white signals. The construction of the light units shall be such as to minimize the probability of the slots being wholly or partially blocked by snow or ice where these conditions are likely to be encountered.

**Approach slope and elevation setting of light beams**

5.4.5.17 The approach slope shall be appropriate for use by the aeroplanes using the approach.

5.4.5.18 When the runway on which a T-VASIS is provided is equipped with an ILS and/or MLS, the siting and elevations of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

5.4.5.19 The elevation of the beams of the wing bar light units on both sides of the runway shall be the same. The elevation of the top of the beam of the fly-up light unit nearest to each wing bar, and that of the bottom of the beam of the fly-down light unit nearest to each wing bar, shall be equal and shall correspond to the approach slope. The cut-off angle of the top of the beams of successive fly-up light units shall decrease by 5’ of arc in angle of elevation at each successive unit away from the wing bar. The cut-in angle of the bottom of the beam of the fly-down light units shall increase by 7’ of arc at each successive unit away from the wing bar (See Figure 5-18).
Figure 5-18. Light beams and elevation settings of T-VASIS and AT-VASIS

5.4.5.20 The elevation setting of the top of the red light beams of the wing bar and fly-up light units shall be such that, during an approach, the pilot of an aeroplane to whom the wing bar and three fly-up light units are visible would clear all objects in the approach area by a safe margin if any such light did not appear red.

5.4.5.21 The azimuth spread of the light beam shall be suitably restricted where an object located outside the obstacle protection surface of the system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

Note — See paragraphs 5.4.5.41 to 5.4.5.45 concerning the related obstacle Protection surface.

PAPI and APAPI Description

5.4.5.22 The PAPI system shall consist of a wing bar of four sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically impracticable to do so.

Note — Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.

5.4.5.23 The APAPI system shall consist of a wing bar of two sharp transition multi-lamp (or paired single lamp) units. The system
shall be located on the left side of the runway unless it is physically impracticable to do so.

Note — Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.

5.4.5.24 The wing bar of a PAPI shall be constructed and arranged in such a manner that a pilot making an approach will:

a) when on or close to the approach slope, see the two units nearest the runway as red and the two units farthest from the runway as white;

b) when above the approach slope, see the one unit nearest the runway as red and the three units farthest from the runway as white; and when further above the approach slope, see all the units as white; and

c) when below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red.

5.4.5.25 The wing bar of an APAPI shall be constructed and arranged in such a manner that a pilot making an approach will:

a) when on or close to the approach slope, see the unit nearer the runway as red and the unit farther from the runway as white;

b) when above the approach slope, see both the units as white; and

c) when below the approach slope, see both the units as red.

Siting

5.4.5.26 The light units shall be located as in the basic configuration illustrated in Figure 5-19, subject to the installation tolerances given therein. The units forming a wing bar shall be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.
Figure 5-19. Sitting of PAPI and APAPI

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 5-19, 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 (8) of Table 5-2.

Note.— See Section 5.2.3 for specifications on aiming point marking. Guidance on the harmonization of PAPI, ILS and/or MLS signals is contained in the Aerodrome Design Manual, Part A.

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 $D_1$ 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 traverse 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 ($\pm 1$ m) between PAPI units should be used on code numbers 1 and 2. In such an event, the inner PAPI unit shall be located not less than 10 m ($\pm 1$ m) from the runway edge.

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

g) The lateral spacing between APAPI units may be increased to 9 m ($\pm 1$ m) if greater range is required or later conversion to a full PAPI is anticipated. In the latter case, the inner APAPI unit shall be located 15 m ($\pm 1$ m) from the runway edge.
Figure 5-20. Light beams and angle of elevation setting of PAPI and APAPI
Characteristics of the light units

5.4.5.27 The system shall be suitable for both day and night operations.

5.4.5.28 The colour transition from red to white in the vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3’. 

5.4.5.29 At full intensity the red light shall have a Y coordinate not exceeding 0.320.

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

*Note* — See para 8.3 of ICAO Aerodrome Design Manual, Part 4 for additional guidance on the characteristics of light units.

5.4.5.31 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.

5.4.5.32 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.

5.4.5.33 The light units shall be so designed that deposits of condensation, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall not affect the contrast between the red and white signals and the elevation of the transition sector.
Approach slope and elevation setting of light units

5.4.5.34 The approach slope as defined in Figure 5-20 shall be appropriate for use by the aeroplanes using the approach.

5.4.5.35 When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

5.4.5.36 The angle of elevation settings of the light units in a PAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing a signal of one white and three reds will clear all objects in the approach area by a safe margin. (See Table 5-2)

5.4.5.37 The angle of elevation settings of the light units in an APAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing the lowest on slope signal, i.e. one white and one red, will clear all objects in the approach area by a safe margin. (See Table 5-2)

5.4.5.38 The azimuth spread of the light beam shall be suitably restricted where an object located outside the obstacle protection surface of the PAPI or APAPI system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

Note — See paragraphs 5.4.5.41 to 5.4.5.45 concerning the related obstacle protection surface.

5.4.5.39 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.

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

5.4.5.41 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.
Table 5-3 – Dimensions and slopes of the obstacles protection surface

<table>
<thead>
<tr>
<th>Surface dimensions</th>
<th>Runway Type /Code Number</th>
<th>Non-instrument Code number</th>
<th>Instrument Code number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Length of inner edge (m)</td>
<td></td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Distance from threshold (m)</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Divergence (each side) %</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total Length (m)</td>
<td></td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Slope</td>
<td></td>
<td>-c</td>
<td>1.9</td>
</tr>
<tr>
<td>a) T-VASIS and AT-VASIS (°)</td>
<td></td>
<td>-</td>
<td>A-0.57</td>
</tr>
<tr>
<td>b) PAPId</td>
<td></td>
<td>A-0.9</td>
<td>-</td>
</tr>
<tr>
<td>c) APAPId</td>
<td></td>
<td>-</td>
<td>A-0.9</td>
</tr>
</tbody>
</table>

5.4.5.42 New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when, in the opinion of the Aerodrome Standards and Safety Unit, 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 Para 2.9 of ICAO Airport Services Manual, Part 6.

5.4.5.43 Existing objects above an obstacle protection surface shall be removed except when, in the opinion of the Aerodrome Standards and Safety Unit, 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.

5.4.5.44 Where an aeronautical study indicates that an existing object extending above an obstacle protection surface could adversely affect the safety of operations of aeroplanes one or more of the following measures shall be taken:

a) suitably raise the approach slope of the system;
b) reduce the azimuth spread of the system so that the object is outside the confines of the beam;
c) displace the axis of the system and its associated obstacle protection surface by no more than 5\(^\circ\);
d) suitably displace the threshold; and
e) where d) is found to be impracticable, suitably displace the system upwind of the threshold to provide an increase in threshold crossing height equal to the height of the object penetration.


Figure 5-21. Obstacle protection surface for visual approach slope indicator systems
5.4.6 Runway threshold identification lights

Application

5.4.6.1 Runway threshold identification lights shall be installed:
   a) at the threshold of a non-precision approach runway when additional threshold conspicuity is necessary or where it is not practicable to provide other approach lighting aids; and
   b) where a runway threshold is permanently displaced from the runway extremity or temporarily displaced from the normal position and additional threshold conspicuity is necessary.

Location

5.4.6.2 Runway threshold identification lights shall be located symmetrically about the runway centre line, in line with the threshold and approximately 10 m outside each line of runway edge lights.

Characteristics

5.4.6.3 Runway threshold identification lights shall be flashing white lights with a flash frequency between 60 and 120 per minute.

5.4.6.4 The lights shall be visible only in the direction of approach to the runway.

5.4.7 Runway edge lights

Application

5.4.7.1 Runway edge lights shall be provided for a runway intended for use at night or for a precision approach runway intended for use by day or night.

5.4.7.2 Runway edge lights shall be provided on a runway intended for take-off with an operating minimum below an RVR of the order of 800 m by day.

Location

5.4.7.3 Runway edge lights shall be placed along the full length of the runway and shall be in two parallel rows equidistant from the centre line.

5.4.7.4 Runway edge lights shall be placed along the edges of the area declared for use as the runway or outside the edges of the area at a distance of not more than 3 m.

5.4.7.5 Where the width of the area which could be declared as runway exceeds 60 m, the distance between the rows of lights shall be
determined taking into account the nature of the operations, the light distribution characteristics of the runway edge lights, and other visual aids serving the runway.

5.4.7.6 The lights shall be uniformly spaced in rows at intervals of not more than 60 m for an instrument runway, and at intervals of not more than 100 m for a non-instrument runway. The lights on opposite sides of the runway axis shall be on lines at right angles to that axis. At intersections of runways, lights may be spaced irregularly or omitted, provided that adequate guidance remains available to the pilot.

Characteristics

5.4.7.7 Runway edge lights shall be fixed lights showing variable white, except that:
a) in the case of a displaced threshold, the lights between the beginning of the runway and the displaced threshold shall show red in the approach direction; and
b) a section of the lights 600 m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-off run is started, may show yellow.

5.4.7.8 The runway edge lights shall show at all angles in azimuth necessary to provide guidance to a pilot landing or taking off in either direction. When the runway edge lights are intended to provide circling guidance, they shall show at all angles in azimuth (See paragraph 5.4.6.1 of this Manual).

5.4.7.9 In all angles of azimuth required in paragraph 5.4.9.8 of this Manual, runway edge lights shall show at angles up to 15° above the horizontal with an intensity adequate for the conditions of visibility and ambient light in which use of the runway for take-off or landing is intended. In any case, the intensity shall be at least 50 cd except that at an aerodrome without extraneous lighting the intensity of the lights may be reduced to not less than 25 cd to avoid dazzling the pilot.

5.4.7.10 Runway edge lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure 2-9 or 2-10.

5.4.8 Runway threshold and wing bar lights
Application of runway threshold lights

5.4.8.1 Runway threshold lights shall be provided for a runway equipped with runway edge lights except on a non-instrument or non-precision approach runway where the threshold is displaced and wing bar lights are provided.

Figure 5-22. Arrangement of runway threshold and runway end lights

Location of runway threshold lights

5.4.8.2 When a threshold is at the extremity of a runway, the threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.

5.4.8.3 When a threshold is displaced from the extremity of a runway, threshold lights shall be placed in a row at right angles to the runway axis at the displaced threshold.

5.4.8.4 Threshold lighting shall consist of:

a) on a non-instrument or non-precision approach runway, at least six lights;
b) on a precision approach runway category I, at least the number of lights that would be required if the lights were uniformly spaced at intervals of 3m between the rows of runway edge lights; and

c) on a precision approach runway category II or III, lights uniformly spaced between the rows of runway edge lights at intervals of not more than 3 m.

5.4.8.5 The lights prescribed in paragraph 5.4.10.4 a) and b) shall be either:

a) equally spaced between the rows of runway edge lights, or

b) symmetrically disposed about the runway centre line in two groups, with the lights uniformly spaced in each group and with a gap between the groups equal to the gauge of the touchdown zone marking or lighting, where such is provided, or otherwise not more than half the distance between the rows of runway edge lights.

**Application of wing bar lights**

5.4.8.6 Wing bar lights shall be provided on a precision approach runway when additional conspicuity is considered desirable.

5.4.8.7 Wing bar lights shall be provided on a non-instrument or non-precision approach runway where the threshold is displaced and runway threshold lights are required, but are not provided.

**Location of wing bar lights**

5.4.8.8 Wing bar lights shall be symmetrically disposed about the runway centre line at the threshold in two groups, i.e. wing bars. Each wing bar shall be formed by at least five lights extending at least 10 m outward from, and at right angles to, the line of the runway edge lights, with the innermost light of each wing bar in the line of the runway edge lights.

**Characteristics of runway threshold and wing bar lights**

5.4.8.9 Runway threshold and wing bar lights shall be fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

5.4.8.10 Runway threshold lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-3.
5.4.8.11 Threshold wing bar lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-4.

5.4.9 Runway end lights
(See Figure 5-22)

Application

5.4.9.1 Runway end lights shall be provided for a runway equipped with runway edge lights.

*Note: When the threshold is at the runway extremity, fittings serving as threshold lights may be used as runway end lights.*

Location

5.4.9.2 Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end.

5.4.9.3 Runway end lighting shall consist of at least six lights. The lights shall be either:

a) equally spaced between the rows of runway edge lights, or

b) symmetrically disposed about the runway centre line in two groups with the lights uniformly spaced in each group and with a gap between the groups of not more than half the distance between the rows of runway edge lights.

For a precision approach runway category III, the spacing between runway end lights, except between the two innermost lights if a gap is used, shall not exceed 6 m.

Characteristics

5.4.9.4 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.

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

5.4.10 Runway centre line lights

Application

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

5.4.10.3 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.

5.4.10.4 Runway centre line lights shall be provided on a runway intended to be used for take-off with an operating minimum of an RVR of 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**

5.4.10.5 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 paragraph 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 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.*

**Characteristics**

5.4.10.6 Runway centre line lights shall be fixed lights showing variable white from the threshold to the point 900 m from the runway end; alternate red and variable white from 900 m to 300 m from the runway end; and red from 300 m to the runway end, except that for runways less than 1 800 m in length, the alternate red and variable white lights shall extend from the mid-point of the runway usable for landing to 300 m from the runway end.

*Note — Care is required in the design of the electrical system to ensure that failure of part of the electrical system will not result in a false indication of the runway distance remaining.*

5.4.10.7 Runway centre line lights shall be in accordance with the specifications of Appendix 2, Figure A2 - 6 or A2 - 7.
5.4.11 Runway touchdown zone lights

Application

5.4.11.1 Touchdown zone lights shall be provided in the touchdown zone of a precision approach runway category II or III.

Location

5.4.11.2 Touchdown zone lights shall extend from the threshold for a longitudinal distance of 900 m, except that, on runways less than 1 800 m in length, the system shall be shortened so that it does not extend beyond the midpoint of the runway. The pattern shall be formed by pairs of barrettes symmetrically located about the runway centre line. The lateral spacing between the innermost lights of a pair of barrettes shall be equal to the lateral spacing selected for the touchdown zone marking. The longitudinal spacing between pairs of barrettes shall be either 30 m or 60 m.

Note — To allow for operations at lower visibility minima, it may be advisable to use a 30 m longitudinal spacing between barrettes.

Characteristics

5.4.11.3 A barrette shall be composed of at least three lights with a spacing between the lights of not more than 1.5m.

5.4.11.4 A barrette shall be not less than 3 m nor more than 4.5 m in length.

5.4.11.5 Touchdown zone lights shall be fixed uni-directional lights showing variable white.

5.4.11.6 Touchdown zone lights shall be in accordance with the specifications of Appendix 2, Figure A2 - 5.
5.4.11.7 Simple touchdown zone lights

Note. — The purpose of simple touchdown zone lights is to provide pilots with enhanced situational awareness in all visibility conditions and to help enable pilots to decide whether to commence a go-around if the aircraft has not landed by a certain point on the runway. It is essential that pilots operating at aerodromes with simple touchdown zone lights be familiar with the purpose of these lights.

Application
5.4.11.8 Except where TDZ lights are provided in accordance with paragraph 5.4.13, at an aerodrome where the approach angle is greater than 3.5 degrees and/or the Landing Distance Available combined with other factors increases the risk of an overrun, simple touchdown zone lights shall be provided.

Location

5.4.11.9 Simple touchdown zone lights shall be a pair of lights located on each side of the runway centreline 0.3 m beyond the upwind edge of the final touchdown zone marking. The lateral spacing between the inner lights of the two pairs of lights shall be equal to the lateral spacing selected for the touchdown zone marking. The spacing between the lights of the same pair shall not be more than 1.5 m or half the width of the touchdown zone marking, whichever is greater. (See Figure 5-24.)

5.4.11.10 Where provided on a runway without TDZ markings, simple touchdown zone lights shall be installed in such a position that provides the equivalent TDZ information.

Characteristics

5.4.11.11 Simple touchdown zone lights shall be fixed unidirectional lights showing variable white, aligned so as to be visible to the pilot of a landing aeroplane in the direction of approach to the runway.

5.4.11.12 Simple touchdown zone lights shall be in accordance with the specifications in Appendix 2, Figure A2-5.

Note. — As a good operating practice, simple touchdown zone lights are supplied with power on a separate circuit to other runway lighting so that they may be used when other lighting is switched off.
5.4.12 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 breaking action for more efficient roll-out and runway exit speeds. It is essential that pilots operating at aerodromes with runway(s) displaying runway exit taxiway indicator light be familiar with the purpose of these lights.

Application

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

Note. See Attachment B, Section 14.

5.4.12.2 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.

Location

5.4.12.3 A set of rapid exit taxiway indicator lights shall be located on the runway on the same side of the runway centre line as the associated rapid exit taxiway, in the configuration as shown in figure 5– 25 of this manual. In each set, the light shall be located 2
m apart and light nearest to the runway centre line shall be displaced 2 m from the runway centre line

5.4.12.4 Where more than one rapid exit taxiway exits on a runway, the set of rapid exit taxiway indicator light for each exit shall not overlap when displayed.

**Characteristics**

5.4.12.5 Rapid exit taxiway indicator lights shall be fixed unidirectional yellow lights, aligned so as to be visible to the pilot of a landing aeroplane in the directional of approach to the runway.

![Figure 5-24. Rapid exit taxiway indicator lights (RETILS)](image)

5.4.12.6 Rapid exit taxiway indicator lights shall be in accordance with the specification in Appendix 2, Figure A2 – 6 or A2 – 7 as appropriate.

5.4.12.7 Rapid exit taxiway indicator lights shall be supplied with power on a separate circuit to other runway lighting so that they may be used when other lighting is switched off.

5.4.13 **Stop-way lights**

**Application**

5.4.13.1 Stop-way lights shall be provided for a stop-way intended for use at night.

**Location**
5.4.13.2 Stop-way lights shall be placed along the full length of the stop-way and shall be in two parallel rows that are equidistant from the centre line and coincident with the rows of the runway edge lights. Stop-way lights shall also be provided across the end of a stop-way on a line at right angles to the stop-way axis as near to the end of the stop-way as possible and, in any case, not more than 3 m outside the end.

Characteristics

5.4.13.3 Stop-way lights shall be fixed unidirectional lights showing red in the direction of the runway.

5.4.14 Taxiway centre line lights

Application

5.4.14.1 Taxiway centre line lights shall be provided on an exit taxiway and apron intended for use in runway visual range conditions less than a value of 350 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.

5.4.14.2 Taxiway centre line lights shall be provided on a taxiway intended for use at night in runway visual range conditions of 350 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.

5.4.14.3 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 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 paragraph 8.3.3 for provisions concerning the interlocking of runway and taxiway lighting systems.

Characteristics
5.4.14.4 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.

5.4.14.5 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 (See Figure 5-26). The light nearest to the perimeter shall always show yellow. Where aircraft may follow the same centre line in both directions, all the centre line lights shall show green to aircraft approaching the runway.
Figure 5-26. Taxiway Lighting

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 ICAO Annex 10, Volume I. Attachments C and G to Part I.

Note 4 — See paragraph 5.5.3 for specifications on runway vacated signs.

5.4.14.6 Taxiway centre line lights shall be in accordance with the specifications of:
   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 m; and
   b) Appendix 2, Figure A2-15 or A2-16 for other taxiways.

Location

5.4.14.7 Taxiway centre line lights shall normally be located on the taxiway centre line marking, except that they may be offset by not more than 30cm where it is not practicable to locate them on the marking.

Taxiway centre line lights on taxiways

Location

5.4.14.8 Taxiway centre line lights on a straight section of a taxiway shall be spaced at longitudinal intervals of not more than 30 m, except that:
   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 shall be provided on short straight sections; and
   c) on a taxiway intended for use in RVR conditions of less than a value of 350 m, the longitudinal spacing shall not exceed 15 m.

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

5.4.14.10 On a taxiway intended for use in RVR conditions of less than a value of 350 m, the lights on a curve shall not exceed a spacing of 15 m and on a curve of less than 400 m radius the lights shall be spaced at intervals of not greater than 7.5 m. This spacing shall extend for 60 m before and after the curve.
Note 1 — Spacings on curves that have been found suitable for a taxiway intended for use in RVR conditions of 350 m or greater are:

<table>
<thead>
<tr>
<th>Curve radius</th>
<th>Light spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 400 m</td>
<td>7.5 m</td>
</tr>
<tr>
<td>401 m to 899 m</td>
<td>15 m</td>
</tr>
<tr>
<td>900 m or greater</td>
<td>30 m</td>
</tr>
</tbody>
</table>

Note 2 — See paragraph 3.2.9.5 and Figure 3–2.

Taxiway centre line lights on rapid exit taxiways

Location

5.4.14.11 Taxiway centre line lights on a rapid exit taxiway shall commence at a point at least 60m 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 shall always be at least 60 cm from any row of runway centre line lights, as shown in Figure 5-27.

5.4.14.12 The lights shall 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

5.4.14.13 Taxiway centre line lights on exit taxiways other than rapid exit taxiways shall commence at the point where the taxiway centre line marking begins to curve from the runway centre line, and follow the curved taxiway centre line marking at least to the point where the marking leaves the runway. The first light shall be at least 60 cm from any row of runway centre line lights, as shown in Figure 5-26.

5.4.14.14 The lights shall be spaced at longitudinal intervals of not more than 7.5 m.
5.4.15 Taxiway edge lights

**Application**

5.4.15.1 Taxiway edge lights shall be provided at the edges of a holding bay, apron, etc. intended for use at night and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations, adequate guidance can be achieved by surface illumination or other means.

*Note — See paragraph 5.6.5 for taxiway edge markers.*

5.4.15.2 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 paragraph 8.3.3 for provisions concerning the inter-locking of runway and taxiway lighting systems.*

**Location**

5.4.15.3 Taxiway edge lights on a straight section of a taxiway and on a runway forming part of a standard taxi-route shall be spaced at uniform longitudinal intervals of not more than 60 m. The lights on a curve shall be spaced at intervals less than 60 m so that a clear indication of the curve is provided.
Note. — Guidance on the spacing of taxiway edge lights on curves is given in the Aerodrome Design Manual (Doc 9157), Part 4.

5.4.15.4 Taxiway edge lights on a holding bay, apron, etc. shall be spaced at uniform longitudinal intervals of not more than 60 m.

5.4.15.5 Taxiway edge lights on a runway turn pad shall be spaced at uniform longitudinal interval of not more than 30m.

5.4.15.6 The lights shall be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, apron or runway, etc. or outside the edges at a distance of not more than 3 m.

Characteristics

5.4.15.7 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.

5.4.15.8 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°.

5.4.16 Runway turn pad lights

Application

5.4.16.1 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 350 m, to enable an aeroplane to complete a 180-degree turn and align with the runway centre line.

5.4.16.2 Runway turn pad lights shall be provided on a runway turn pad intended for use at night.

Location

5.4.16.3 Runway turn pad lights shall 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.

5.4.16.4 Runway turn pad lights on a straight section of the runway turn pad marking shall be spaced at longitudinal intervals of not more than 15 m.

5.4.16.5 Runway turn pad lights on a curved section of the runway turn pad marking shall not exceed a spacing of 7.5 m.
Characteristics

5.4.16.6 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.

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

5.4.17 Stop bars

Application

Note 1. — The provision of stop bars requires their control either manually or automatically by air traffic control unit.

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.

5.4.17.1 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 m, except where:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles 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.

5.4.17.2 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 of values between 350 m and 550 m, except where:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles onto the runway; or

b) operational procedures exist to limit, in runway visual range conditions
   1) aircraft on the manoeuvring area to one at a time; and
2) vehicles on the manoeuvring area to the essential minimum.

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

**Location**

5.4.17.4 Stop bars shall be located across the taxiway at the point where it is desired that traffic stop. Where the additional lights specified in 5.4.20.7 are provided, these lights shall be located not less than 3 m from the taxiway edge.

**Characteristics**

5.4.17.5 Stop bars shall consist of lights spaced at intervals of 3 m across the taxiway, showing red in the intended direction(s) of approach to the intersection or runway-holding position.

*Note.* Where necessary to enhance conspicuity of an existing stop bar, extra lights are installed uniformly.

5.4.17.6 Stop bars installed at a runway-holding position shall be unidirectional and shall show red in the direction of approach to the runway.

5.4.17.7 Where the additional lights specified in 5.3.20.7 are provided, these lights shall have the same characteristics as the lights in the stop bar, but shall be visible to approaching aircraft up to the stop bar position.

5.4.17.8 The intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications in Appendix 2, Figures A2-12 through A2-16, as appropriate.

5.4.17.9 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 the Aerodrome Design Manual (Doc 9157), Part 5.

5.4.18 Intermediate holding position lights

Note.—See paragraph 5.3.11 for specifications on intermediate holding position marking.

Application

5.4.18.1 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.

Location

5.4.18.2 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

5.4.18.3 Intermediate holding position lights shall consist of three fixed unidirectional lights showing yellow in the direction of approach to the intermediate holding position with a light distribution similar to taxiway centre line lights if provided. The lights shall be disposed symmetrically about and at right angle to the taxiway centre line, with individual lights spaced 1.5 m apart.

5.4.19 Runway guard lights

Note.—The purpose of runway guard lights is to warn pilots, and drivers of vehicles when they are operating on taxiways, that they are about to enter an active runway. There are two standard configurations of runway guard lights as illustrated in Figure 5-27.
5.4.19.1 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.

5.4.19.2 Runway guard lights, Configuration A, shall be located at each side of the taxiway at a distance from the runway centre line not less than that specified for a take-off runway in Table 3-2 of this Manual.

5.4.19.3 Runway guard lights, Configuration B, shall be located across the taxiway at a distance from the runway centre line not less than that specified for a take-off runway in Table 3-2.

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

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

5.4.19.6 The light beam shall be unidirectional and aligned so as to be visible to the pilot of an aeroplane taxiing to the holding position.

5.4.19.7 The lights in each unit of Configuration A shall be illuminated alternately.
5.4.19.8 For Configuration B, adjacent lights shall be alternately illuminated and alternative lights shall be illuminated in unison.

5.4.19.9 The lights shall be illuminated between 30 and 60 cycles per minute and the light suppression and illumination periods shall be equal and opposite in each light.

Note — The optimum flash rate is dependent on the rise and fall times of the lamps used. Runway guard lights, Configuration A, installed on 6.6 ampere series circuits have been found to look best when operated at 45 to 50 flashes per minute per lamp. Runway guard lights, Configuration B, installed on 6.6 ampere series circuits have been found to look best when operated at 30 to 32 flashes per minute per lamp.

5.4.20 Apron floodlighting
(See also paragraphs 5.4.16.1 and 5.4.17.1)

Application

5.4.20.1 Apron floodlighting shall be provided on an apron and on a designated isolated aircraft parking position intended to be used at night.

Note 1 — (Intentionally left blank)

Note 2: The designation of an isolated aircraft parking position is specified in paragraph 3.14 of this Manual.


Location

5.4.20.2 Apron floodlights shall be located so as to provide adequate illumination on all apron service areas, with a minimum of glare to pilots of aircraft in flight and on the ground, aerodrome and apron controllers, and personnel on the apron. The arrangement and aiming of floodlights shall be such that an aircraft stand receives light from two or more directions to minimize shadows.

Characteristics

5.4.20.3 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.

5.4.21 Visual docking guidance system
Application

5.4.21.1 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 bridges, etc. See Para 12.3 of ICAO Aerodrome Design Manual, Part 4 — Visual Aids for guidance on the selection of suitable visual docking guidance systems.

Characteristics

5.4.21.2 The system shall provide both azimuth and stopping guidance.

5.4.21.3 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.

5.4.21.4 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.

5.4.21.5 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.

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

5.4.21.7 The system should be usable by all types of aircraft for which the aircraft stand is intended, preferably without selective operation.
5.4.21.8 If selective operation is required to prepare the system for use by a particular type of aircraft, then the system shall provide an identification of the selected aircraft type to both the pilot and the system operator as a means of ensuring that the system has been set properly.

Azimuth guidance unit

Location

5.4.21.9 The azimuth guidance unit shall be located on or close to the extension of the stand centre line ahead of the aircraft so that its signals are visible from the cockpit of an aircraft throughout the docking manoeuvre and aligned for use at least by the pilot occupying the left seat.

Characteristics

5.4.21.10 The azimuth guidance unit shall provide unambiguous left/right guidance which enables the pilot to acquire and maintain the lead-in line without over controlling.

5.4.21.11 When azimuth guidance is indicated by colour change, green shall be used to identify the centre line and red for deviations from the centre line.

Stopping position indicator

Location

5.4.21.12 The stopping position indicator shall be located in conjunction with, or sufficiently close to, the azimuth guidance unit so that a pilot can observe both the azimuth and stop signals without turning the head.

5.4.21.13 The stopping position indicator shall be usable at least by the pilot occupying the left seat.

Characteristics

5.4.21.14 The stopping position information provided by the indicator for a particular aircraft type shall account for the anticipated range of variations in pilot eye height and/or viewing angle.

5.4.21.15 The stopping position indicator shall show the stopping position for the aircraft for which guidance is being provided, and shall provide closing rate information to enable the pilot to gradually decelerate the aircraft to a full stop at the intended stopping position.

5.4.21.16 When stopping guidance is indicated by colour change, green shall be used to show that the aircraft can proceed and red to show that the stop point has been reached except that for a short
distance prior to the stop point a third colour may be used to warn that the stopping point is close.

5.4.22 **Advanced visual docking guidance system**

**Application**

Note 1.— Advanced visual docking guidance systems (A-VDGS) include those systems that, in addition to basic and passive azimuth and stop position information, provide pilots with active (usually sensor-based) guidance information, such as aircraft type indication (in accordance with Doc 8643 — Aircraft Type Designators), distance-to-go information and closing speed. Docking guidance information is usually provided on a single display unit.

Note 2.— An A-VDGS may provide docking guidance information in three stages: the acquisition of the aircraft by the system, the azimuth alignment of the aircraft, and the stopping position information.

5.4.22.1 An A-VDGS should be provided where it is operationally desirable to confirm the correct aircraft type for which guidance is being provided and/or to indicate the stand centre line in use, where more than one is provided for.

5.4.22.2 The A-VDGS shall be suitable for use by all types of aircraft for which the aircraft stand is intended.

5.4.22.3 The A-VDGS shall be used only in conditions in which its operational performance is specified.

Note 1.— The use of the A-VDGS in conditions such as weather, visibility and background lighting, both by day and night, would need to be specified.

Note 2.— Care is required in both the design and on-site installation of the system to ensure that glare, reflection of sunlight, or other light in the vicinity, does not degrade the clarity and conspicuity of the visual cues provided by the system.

5.4.22.4 The docking guidance information provided by an A-VDGS shall not conflict with that provided by a conventional visual docking guidance system on an aircraft stand if both types are provided and are in operational use. A method of indicating that the A-VDGS is not in operational use or is unserviceable shall be provided.

**Location**

5.4.22.5 The A-VDGS shall be located such that unobstructed and unambiguous guidance is provided to the person responsible for,
and persons assisting, the docking of the aircraft throughout the docking manoeuvre.

Note. — Usually the pilot-in-command is responsible for the docking of the aircraft. However, in some circumstances, another person could be responsible and this person may be the driver of a vehicle that is towing the aircraft.

**Characteristics**

5.4.22.6 The A-VDGS shall provide, at minimum, the following guidance information at the appropriate stage of the docking manoeuvre:

a) an emergency stop indication;

b) the aircraft type and model for which the guidance is provided;

c) an indication of the lateral displacement of the aircraft relative to the stand centre line;

d) the direction of azimuth correction needed to correct a displacement from the stand centre line;

e) an indication of the distance to the stop position;

f) an indication when the aircraft has reached the correct stopping position; and

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

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

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

5.4.22.8 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.

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

5.4.22.10 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.

<table>
<thead>
<tr>
<th>Guidance information</th>
<th>Maximum deviation at stop position (stop area)</th>
<th>Maximum deviation at 9 m from stop position</th>
<th>Maximum deviation at 15 m from stop position</th>
<th>Maximum deviation at 25 m from stop position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azimuth</td>
<td>±250 mm</td>
<td>±340 mm</td>
<td>±400 mm</td>
<td>±500 mm</td>
</tr>
<tr>
<td>Distance</td>
<td>±500 mm</td>
<td>±1 000 mm</td>
<td>±1 300 mm</td>
<td>Not specified</td>
</tr>
</tbody>
</table>

Table 5-4. A-VDGS Displacement accuracy

5.4.22.11 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.*

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

5.4.22.13 Throughout the docking manoeuvre, an appropriate means shall be provided on the A-VDGS to indicate the need to bring the aircraft to an immediate halt. In such an event, which includes a failure of the A-VDGS, no other information shall be displayed.

5.4.22.14 Provision to initiate an immediate halt to the docking procedure shall be made available to personnel responsible for the operational safety of the stand.

5.4.23 Road-holding position light

**Application**

5.4.23.1 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 m.

5.4.23.2 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 of values between 350 m and 550 m.

**Location**

5.4.23.3 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 paragraph 9.9 for the mass and height limitations and fragility requirements of navigation aids located on runway strips.*

**Characteristics**

5.4.23.4 The road-holding position light shall comprise:

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

b) a flashing-red light.

*Note — It is intended that the lights specified in sub-paragraph a) be controlled by the air traffic control unit.*

5.4.23.5 The road-holding position light beam shall be unidirectional and aligned so as to be visible to the driver of a vehicle approaching the holding position.

5.4.23.6 The intensity of the light beam shall be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended, but shall not dazzle the driver.

*Note — The commonly used traffic lights are likely to meet the requirements in paragraphs 5.4.27.5 and 5.4.27.6.*

5.4.23.7 The flash frequency of the flashing-red light shall be between 30 and 60 per minute.

5.5.0 **Signs**

5.5.1 **General**

*Note — Signs shall be either fixed message signs or variable message signs. Guidance on signs is contained in chapter 11 of ICAO Aerodrome Design Manual, Part 4.*

**Application**

5.5.1.1 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 paragraph 9.8.1.

*Note — See paragraph 5.3.17 of this Manual for specifications on information marking.*

**Characteristics**
5.5.1.2 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 5-4 of this Manual.

5.5.1.3 Signs shall be rectangular, as shown in Figures 5-28 and 5-29 with the longer side horizontal.

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

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

5.5.1.6 Signs shall be illuminated in accordance with the provisions of Appendix 4 when intended for use:
   a) in runway visual range conditions less than a value of 800 m; or
   b) at night in association with instrument runways; or
   c) at night in association with non-instrument runways where the code number is 3 or 4.

Table 5-4 – Location distances for taxiing guidance signs including runway exit Signs

<table>
<thead>
<tr>
<th>Code number</th>
<th>Legend</th>
<th>Face (min)</th>
<th>Installed (max)</th>
<th>Perpendicular distance from defined taxiway pavement edge to near side of sign (m)</th>
<th>Perpendicular distance from defined runway pavement edge to near side of sign (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 2</td>
<td>200</td>
<td>400</td>
<td>700</td>
<td>5-11</td>
<td>3-10</td>
</tr>
<tr>
<td>1 or 2</td>
<td>300</td>
<td>600</td>
<td>900</td>
<td>5-11</td>
<td>3-10</td>
</tr>
<tr>
<td>3 or 4</td>
<td>300</td>
<td>600</td>
<td>900</td>
<td>11-21</td>
<td>8-15</td>
</tr>
<tr>
<td>3 or 4</td>
<td>400</td>
<td>800</td>
<td>1100</td>
<td>11-21</td>
<td>8-15</td>
</tr>
</tbody>
</table>

5.5.1.7 Signs shall be retro-reflective and/or illuminated in accordance with the provisions of Appendix 4 when intended for use at night in association with non-instrument runways where the code number is 1 or 2.

5.5.1.8 A variable message sign shall show a blank face when not in use.
5.5.1.9 In case of failure, a variable message sign shall not provide information that could lead to unsafe action from a pilot or a vehicle driver.

Figure 5-28. Mandatory instruction signs
5.5.2 **Mandatory instruction signs**

*Note* — See Figure 5-28 for pictorial representation of mandatory instruction signs and Figure 5-29 for examples of locating signs at taxiway/runway intersections

**Application**

5.5.2.1 A mandatory instruction sign shall be provided to identify a location beyond which an aircraft taxiing or vehicle shall not proceed unless authorized by the aerodrome control tower.
5.5.2.2 Mandatory instruction signs shall include runway designation signs, category I, II or III holding position signs, runway-holding position signs, road-holding position signs and NO ENTRY signs. 

*Note — See paragraph 5.5.7 for specifications on road-holding position signs.*

5.5.2.3 A pattern “A” runway-holding position marking shall be supplemented at a taxiway/runway intersection or a runway/runway intersection with a runway designation sign.

5.5.2.4 A pattern “B” runway-holding position marking shall be supplemented with a category I, II or III holding position sign.

5.5.2.5 A pattern “A” runway-holding position marking at a runway-holding position established in accordance with paragraph 3.12.3 shall be supplemented with a runway-holding position sign.

*Note — See paragraph 5.3.10 for specifications on runway-holding position marking.*

5.5.2.6 A runway designation sign at a taxiway/runway intersection shall be supplemented with a location sign in the outboard (farthest from the taxiway) position, as appropriate.

*Note — See paragraph 5.5.3 for characteristics of location signs.*

5.5.2.7 A NO ENTRY sign shall be provided when entry into an area is prohibited.

**Location**

5.5.2.8 A runway designation sign at a taxiway/runway intersection or a runway/runway intersection shall be located on each side of the runway-holding position marking facing the direction of approach to the runway.

5.5.2.9 A category I, II or III holding position sign shall be located on each side of the runway-holding position marking facing the direction of the approach to the critical area.

5.5.2.10 A NO ENTRY sign shall be located at the beginning of the area to which entrance is prohibited on each side of the taxiway as viewed by the pilot.

5.5.2.11 A runway-holding position sign shall be located on each side of the runway-holding position established in accordance with 3.12.3, facing the approach to the obstacle limitation surface or ILS/MLS critical/sensitive area, as appropriate.
Note. Distance X is established in accordance with Table 3-2. Distance Y is established at the edge of the ILS/MLS critical/sensitive area.

**Figure 5-30. Examples of sign positions at taxiway/runway intersections**

**Characteristics**

5.5.2.12 A mandatory instruction sign shall consist of an inscription in white on a red background.

5.5.2.13 Where, owing to environmental or other factors, the conspicuity of the inscription on a mandatory instruction sign needs to be enhanced, the outside edge of the white inscription shall be supplemented by a black outline measuring 10mm in width for runway code numbers 1 and 2, and 20 mm in width for runway code numbers 3 and 4.

5.5.2.14 The inscription on a runway designation sign shall consist of the runway designations of the intersecting runway properly oriented
with respect to the viewing position of the sign, except that a runway designation sign installed in the vicinity of a runway extremity may show the runway designation of the concerned runway extremity only.

5.5.2.15 The inscription on a category I, II or III or joint II/III holding position sign shall consist of the runway designator followed by CAT I, CAT II, CAT III or CAT II/III as appropriate.

5.5.2.16 The inscription on a NO ENTRY sign shall be in accordance with Figure 5-28.

5.5.2.17 The inscription on a runway-holding position sign at a runway holding position established in accordance with paragraph 3.12.3 of this Manual shall consist of the taxiway designation and a number.

5.5.2.18 Where appropriate, the following inscriptions/symbol shall be used:

<table>
<thead>
<tr>
<th>Inscription/Symbol</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runway designation of a runway extremity Or</td>
<td>To indicate a runway-holding position at a runway extremity</td>
</tr>
<tr>
<td>Runway designation of both extremities of a runway</td>
<td>To indicate a runway-holding position located at other taxiway/runway intersections or runway/runway intersections</td>
</tr>
<tr>
<td>25 CAT I (Example)</td>
<td>To indicate a category I runway-holding position at the threshold of runway 25</td>
</tr>
<tr>
<td>25 CAT II (Example)</td>
<td>To indicate a category II runway-holding position at the threshold of runway 25</td>
</tr>
<tr>
<td>25 CAT III (Example)</td>
<td>To indicate a category III runway-holding position at the threshold of runway 25</td>
</tr>
<tr>
<td>25 CAT II/III (Example)</td>
<td>To indicate a joint category II/III runway-holding position at the threshold of runway 25</td>
</tr>
<tr>
<td>NO ENTRY symbol</td>
<td>To indicate that entry to an area is prohibited</td>
</tr>
<tr>
<td>B2 (Example)</td>
<td>To indicate a runway-holding position established in accordance with 3.12.3</td>
</tr>
</tbody>
</table>

5.5.3 Information signs

*Note — See Figure 5-29 for pictorial representations of information signs.*

**Application**

5.5.3.1 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.
5.5.3.2 Information signs shall include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs and intersection take-off signs.

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

5.5.3.4 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 paragraph 5.4.16 for specifications on colour coding taxiway centreline lights.

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

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

5.5.3.7 A combined location and direction sign shall be provided when it is intended to indicate routing information prior to a taxiway intersection.

5.5.3.8 A direction sign shall be provided when there is an operational need to identify the designation and direction of taxiways at an intersection.

5.5.3.9 A location sign shall be provided at an intermediate holding position.

5.5.3.10 A location sign shall be provided in conjunction with a runway designation sign except at a runway/runway intersection.

5.5.3.11 A location sign shall be provided in conjunction with a direction sign, except that it may be omitted where an aeronautical study indicates that it is not needed.

5.5.3.12 Where necessary, a location sign shall be provided to identify taxiways exiting an apron or taxiways beyond an intersection.

5.5.3.13 Where a taxiway ends at an intersection such as a “T” and it is necessary to identify this, a barricade, direction sign and/or other appropriate visual aid shall be used.

Location
5.5.3.14 Except as specified in paragraphs 5.5.3.16 and 5.5.3.24 of this Manual information signs shall, wherever practicable, be located on the left-hand side of the taxiway in accordance with Table 5-4.

5.5.3.15 At a taxiway intersection, information signs shall be located prior to the intersection and in line with the taxiway intersection marking. Where there is no taxiway intersection marking, the signs shall be installed at least 60 m from the centre line of the intersecting taxiway where the code number is 3 or 4 and at least 40 m where the code number is 1 or 2.

*Note — A location sign installed beyond a taxiway intersection may be installed on either side of a taxiway.*

5.5.3.16 A runway exit sign shall be located on the same side of the runway as the exit is located (i.e. left or right) and positioned in accordance with Table 5-4.

5.5.3.17 A runway exit sign shall be located prior to the runway exit point in line with a position at least 60 m prior to the point of tangency where the code number is 3 or 4, and at least 30 m where the code number is 1 or 2.

5.5.3.18 A runway vacated sign shall be located at least on one side of the taxiway. The distance between the sign and the centre line of a runway shall be not less than the greater of the following:

a) the distance between the centre line of the runway and the perimeter of the ILS/MLS critical/sensitive area; or

b) the distance between the centre line of the runway and the lower edge of the inner transitional surface.

5.5.3.19 Where provided in conjunction with a runway vacated sign, the taxiway location sign shall be positioned outboard of the runway vacated sign.

5.5.3.20 An intersection take-off sign shall be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway shall be not less than 60 m where the code number is 3 or 4 and not less than 45 m where the code number is 1 or 2.

5.5.3.21 A taxiway location sign installed in conjunction with a runway designation sign shall be positioned outboard of the runway designation sign.

5.5.3.22 A destination sign shall not normally be collocated with a location or direction sign.
5.5.3.23 An information sign other than a location sign shall not be collocated with a mandatory instruction sign.

5.5.3.24 A direction sign, barricade and/or other appropriate visual aid used to identify a “T” intersection shall be located on the opposite side of the intersection facing the taxiway.

**Characteristics**

5.5.3.25 An information sign other than a location sign shall consist of an inscription in black on a yellow background.

5.5.3.26 A location sign shall consist of an inscription in yellow on a black background and where it is a stand-alone sign shall have a yellow border.

5.5.3.27 The inscription on a runway exit sign shall consist of the designator of the exit taxiway and an arrow indicating the direction to follow.

5.5.3.28 The inscription on a runway vacated sign shall depict the pattern A runway-holding position marking as shown in Figure 5-29.

5.5.3.29 The inscription on an intersection take-off sign shall consist of a numerical message indicating the remaining take-off run available in metres plus an arrow, appropriately located and oriented, indicating the direction of the take-off as shown in Figure 5-29.

5.5.3.30 The inscription on a destination sign shall comprise an alpha, alphanumerical or numerical message identifying the destination plus an arrow indicating the direction to proceed as shown in Figure 5-29.

5.5.3.31 The inscription on a direction sign shall comprise an alpha or alphanumerical message identifying the taxiway(s) plus an arrow or arrows appropriately oriented as shown in Figure 5-29.

5.5.3.32 The inscription on a location sign shall comprise the designation of the location taxiway, runway or other pavement the aircraft is on or is entering and shall not contain arrows.

5.5.3.33 Where it is necessary to identify each of a series of intermediate holding positions on the same taxiway, the location sign shall consist of the taxiway designation and a number.

5.5.3.34 Where a location sign and direction signs are used in combination:

a) all direction signs related to left turns shall be placed on the left side of the location sign and all direction signs related to right turns shall be placed on the right side of the location sign, except that where the junction consists of one
intersecting taxiway, the location sign may alternatively be placed on the left hand side;
b) the direction signs shall be placed such that the direction of the arrows departs increasingly from the vertical with increasing deviation of the corresponding taxiway;
c) an appropriate direction sign shall be placed next to the location sign where the direction of the location taxiway changes significantly beyond the intersection; and
d) adjacent direction signs shall be delineated by a vertical black line as shown in Figure 5-29.

5.5.3.35 A taxiway shall be identified by a designator comprising a letter, letters or a combination of a letter or letters followed by a number.

5.5.3.36 When designating taxiways, the use of the letters I, O or X and the use of words such as inner and outer shall be avoided wherever possible to avoid confusion with the numerals 1, 0 and closed marking.

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

5.5.4 VOR aerodrome check-point sign

Application

5.5.4.1 When a VOR aerodrome check-point is established, it shall be indicated by a VOR aerodrome check-point marking and sign.

Note — See paragraph 5.2.2.12 for VOR aerodrome check-point marking.

Location

5.5.4.2 A VOR aerodrome check-point sign shall be located as near as possible to the check-point and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome check-point marking.

Characteristics

5.5.4.3 A VOR aerodrome check-point sign shall consist of an inscription in black on a yellow background.

5.5.4.4 The inscriptions on a VOR check-point sign shall be in accordance with one of the alternatives shown in Figure 5-31 in which:
- VOR is an abbreviation identifying this as a VOR check-point;
- 116.3 is an example of the radio frequency of the VOR concerned;
- 147° is an example of VOR bearing, to the nearest degree, which shall be indicated at VOR; and
- 4.3NM is an example of distance in nautical miles to a DME.
collocated in VOR concerned.

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

Figure 5-31. VOR aerodrome check-point sign

5.5.5 Road-holding position sign

5.5.5.1 A road-holding position sign shall be provided at all road entrances to a runway.

Location

5.5.5.2 The road-holding position sign shall be located 1.5 m from one edge of the road (left or right as appropriate to the local traffic regulations) at the holding position.

Characteristics

5.5.5.3 A road-holding position sign shall consist of an inscription in white on a red background.

5.5.5.4 The inscription on a road-holding position sign shall be in the English language, be in conformity with the local traffic regulations and include the following:
   a) a requirement to stop; and
   b) where appropriate:
      1) a requirement to obtain ATC clearance; and
      2) location designator.
Note — Examples of road-holding position signs are contained in chapter 10 of ICAO Aerodrome Design Manual, Part 4.

5.5.5 A road-holding position sign intended for night use shall be retro-reflective or illuminated.

5.6.0 Markers

5.6.1 General

Markers shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

Note 1 — Anchors or chains, to prevent markers which have broken from their mounting from blowing away, are sometimes used.

Note 2 — Guidance on frangibility of markers is given in chapter 4 and 5 of ICAO Aerodrome Design Manual, Part 6 (in preparation).

5.7.0 Boundary markers

5.7.1 Application

Boundary markers shall be provided at an aerodrome where the landing area has no runway.

5.7.2 Location

Boundary markers shall be spaced along the boundary of the landing area at intervals of not more than 200m, if the type shown in Figure 5-32 is used, or approximately 50 m, if the conical type is used with a marker at any corner.

5.7.3 Characteristics

Boundary markers shall be of a form similar to that shown in Figure 5-32, or in the form of a cone not less than 50 cm high and not less than 75cm in diameter at the base. The markers shall be coloured to contrast with the background against which they will be seen. A single colour, orange or red, or two contrasting colours, orange and white or alternatively red and white, shall be used, except where such colours merge with the background.
Figure 5-32. Boundary markers
CHAPTER 6 – VISUAL AIDS FOR DENOTING OBSTACLES

6.1.0 Objects to be marked and/or lighted

*Note.*—The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.

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 taxi-lane shall be marked and, if the taxiway, apron taxiway or aircraft stand taxi-lane is used at night, lighted.

6.1.1.4 A fixed obstacle that extends above a take-off climb surface within 3 000m of the inner edge of the take-off climb surface shall be marked and, if the runway is used at night, lighted, except that:

a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;

b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;

c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.
6.1.1.5 A fixed object, other than an obstacle, adjacent to a take-off climb surface shall be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when:
   a) the object is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m; or
   b) the object is lighted by high-intensity obstacle lights by day.

6.1.1.6 A fixed obstacle that extends above an approach surface within 3000 m of the inner edge or above a transitional surface shall be marked and, if the runway is used at night, lighted, except that:
   a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;
   b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;
   c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and
   d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

6.1.1.7 A fixed obstacle that extends above a horizontal surface shall be marked and, if the aerodrome is used at night, lighted, except that:
   a) such marking and lighting may be omitted when:
      1) the obstacle is shielded by another fixed obstacle; or
      2) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or
      3) an aeronautical study shows the obstacle not to be of operational significance;
   b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;
   c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and
d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

6.1.1.8 A fixed object that extends above an obstacle protection surface shall be marked and, if the runway is used at night, lighted.  
Note.—See 5.3.5 for information on the obstacle protection surface.

6.1.1.9 Other objects inside the obstacle limitation surfaces shall be marked and/or lighted if an aeronautical study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway or highway).  
Note.—See note accompanying 4.4.2.

6.1.1.10 Overhead wires, cables, etc., crossing a river, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an aeronautical study indicates that the wires or cables could constitute a hazard to aircraft.

6.1.2 Objects outside the lateral boundaries of the obstacle limitation surfaces

6.1.2.1 Obstacles in accordance with 4.4.2 shall be marked and lighted, except that the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day.

6.1.2.2 Other objects outside the obstacle limitation surfaces shall be marked and/or lighted if an aeronautical study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway, highway).

6.1.2.3 Overhead wires, cables, etc., crossing a river, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an aeronautical study indicates that the wires or cables could constitute a hazard to aircraft.

6.2.0 Marking and/or lighting of object

6.2.1 General

6.2.1.1 The presence of objects which must be lighted, as specified in 6.1, shall be indicated by low-, medium- or high-intensity obstacle lights, or a combination of such lights.

6.2.1.2 Low-intensity obstacle lights, Types A, B, C and D, medium-intensity obstacle lights, Types A, B and C, high-intensity obstacle lights Type A and B, shall be in accordance with the specifications in Table 6-1 and Appendix 1.
6.2.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

6.2.2 Mobile objects

Marking

6.2.2.1 All mobile objects to be marked shall be coloured or display flags.

Marking by colour

6.2.2.2 When mobile objects are marked by colour, a single conspicuous colour, preferably red or yellowish green for emergency vehicles and yellow for service vehicles, shall be used.

Marking by flags

6.2.2.3 Flags used to mark mobile objects shall be displayed around, on top of, or around the highest edge of the object. Flags shall not increase the hazard presented by the object they mark.

6.2.2.4 Flags used to mark mobile objects shall not be less than 0.9 m on each side and shall consist of a chequered pattern, each square having sides of not less than 0.3 m. The colours of the pattern shall contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white shall be used, except where such colours merge with the background.

Table 6-1. Characteristics of obstacle lights

<table>
<thead>
<tr>
<th>Light Type</th>
<th>Colour</th>
<th>Signal type (flash rate)</th>
<th>Peak intensity (cd) at given Background luminance (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-intensity Type A (Fixed obstacle)</td>
<td>Red</td>
<td>Fixed</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 6-2
<table>
<thead>
<tr>
<th>Low-intensity Type B (Fixed obstacle)</th>
<th>Red</th>
<th>Fixed</th>
<th>N/A</th>
<th>N/A</th>
<th>32</th>
<th>Table 6-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-intensity Type C (mobile obstacle)</td>
<td>Yellow/Blue (a)</td>
<td>Flashing (60-90 fpm)</td>
<td>N/A</td>
<td>40</td>
<td>40</td>
<td>Table 6-2</td>
</tr>
<tr>
<td>Low-intensity Type D (follow-me obstacle)</td>
<td>Yellow</td>
<td>Flashing (60-90 fpm)</td>
<td>N/A</td>
<td>200</td>
<td>200</td>
<td>Table 6-2</td>
</tr>
<tr>
<td>Medium-intensity, Type A</td>
<td>White</td>
<td>Flashing (20-60fpm)</td>
<td>20000</td>
<td>20000</td>
<td>2000</td>
<td>Table 6-3</td>
</tr>
<tr>
<td>Medium-intensity, Type B</td>
<td>Red</td>
<td>Flashing (20-60fpm)</td>
<td>N/A</td>
<td>N/A</td>
<td>2000</td>
<td>Table 6-3</td>
</tr>
<tr>
<td>Medium-intensity, Type C</td>
<td>Red</td>
<td>Fixed</td>
<td>N/A</td>
<td>N/A</td>
<td>2000</td>
<td>Table 6-3</td>
</tr>
<tr>
<td>High-intensity, Type A</td>
<td>White</td>
<td>Flashing (40-60fpm)</td>
<td>200000</td>
<td>20000</td>
<td>2000</td>
<td>Table 6-3</td>
</tr>
<tr>
<td>High-intensity, Type B</td>
<td>White</td>
<td>Flashing (40-60fpm)</td>
<td>100000</td>
<td>20000</td>
<td>2000</td>
<td>Table 6-3</td>
</tr>
</tbody>
</table>

a) See 6.2.2.6
b) For flashing lights, effective intensity as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4

Table 6-2. Light distribution for low-intensity obstacle lights

<table>
<thead>
<tr>
<th>Minimum intensity (a)</th>
<th>Maximum intensity (a)</th>
<th>Vertical beam spread (f)</th>
<th>Minimum beam spread (°)</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>10 cd (b)</td>
<td>N/A</td>
<td>10</td>
<td>5 cd</td>
</tr>
<tr>
<td>Type B</td>
<td>32 cd (b)</td>
<td>N/A</td>
<td>10</td>
<td>16 cd</td>
</tr>
<tr>
<td>Type C</td>
<td>40 cd (b)</td>
<td>400 cd</td>
<td>12 (d)</td>
<td>20 cd</td>
</tr>
<tr>
<td>Type D</td>
<td>200 cd (c)</td>
<td>400 cd</td>
<td>12 (e)</td>
<td>N/A</td>
</tr>
</tbody>
</table>
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. For flashing lights, the intensity is read into effective intensity, as determined in accordance with 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 shall be located at approximately 2.5° vertical.

e) Peak intensity shall 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

<table>
<thead>
<tr>
<th>Benchmark intensity</th>
<th>Minimum requirements</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical elevation angle (b)</td>
<td>Vertical beam spread (c)</td>
</tr>
<tr>
<td></td>
<td>0°</td>
<td>-1°</td>
</tr>
<tr>
<td></td>
<td>Intensity (a)</td>
<td>Min. beam spread</td>
</tr>
<tr>
<td>200000</td>
<td>200000</td>
<td>150000</td>
</tr>
<tr>
<td>100000</td>
<td>100000</td>
<td>75000</td>
</tr>
<tr>
<td>20000</td>
<td>20000</td>
<td>15000</td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>1500</td>
</tr>
</tbody>
</table>

Note. — This table does not include recommended horizontal beam spreads. 6.2.1.3 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.
a) 360° horizontal. All intensities are expressed in Candela. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the 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 Annex 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 aerobridges 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 shall 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 shall 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 shall contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white shall be used, except where such colours merge with the background. (See Figure 6-1.)

6.2.3.3 An object shall 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. The bands shall be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less. The colours of the bands shall contrast with the background against which they will be seen. Orange and white shall be used, except where such colours are not conspicuous when viewed against the background. The bands on the extremities of the object shall be of the darker colour. (See Figures 6-1 and 6-2.)

Note. — Table 6-4 shows a formula for determining band widths and for having an odd number of bands, thus permitting both the top and bottom bands to be of the darker colour.
6.2.3.4 An object shall be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red shall be used, except where such colours merge with the background. Note.— Against some backgrounds it may be found necessary to use a different colour from orange or red to obtain sufficient contrast.
Marking by flags

6.2.3.5 Flags used to mark fixed objects shall be displayed around, on top of, or around the highest edge of, the object. When flags are used to mark extensive objects or groups of closely spaced objects, they shall be displayed at least every 15 m. Flags shall not increase the hazard presented by the object they mark.

6.2.3.6 Flags used to mark fixed objects shall not be less than 0.6 m on each side
Figure 6-2 Examples of marking and lighting of tall structures

6.2.3.7 Flags used to mark fixed objects shall be orange in colour or a combination of two triangular sections, one orange and the other white, or one red and the other white, except that where such
colours merge with the background, other conspicuous colours shall be used.

**Marking by markers**

6.2.3.8 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented by the object they mark is not increased.

6.2.3.9 A marker shall be of one colour. When installed, white and red, or white and orange markers shall be displayed alternately. The colour selected shall contrast with the background against which it will be seen.

**Lighting**

6.2.3.10 In the case of an object to be lighted, one or more low-, medium- or high-intensity obstacle lights shall be located as close as practicable to the top of the object.  
*Note.* Recommendations on how a combination of low-, medium- and/or high-intensity lights on obstacles shall be displayed are given in Appendix 6.

6.2.3.11 In the case of chimney or other structure of like function, the top lights shall be placed sufficiently below the top so as to minimize contamination by smoke, etc. (See Figure 6-2).

6.2.3.12 In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance, such as a rod or an antenna, greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light shall be located at the highest practicable point and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.

6.2.3.13 In the case of an extensive object or of a group of closely spaced objects to be lighted that are:

a) penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights shall be so arranged as to at least 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 shall 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, shall 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 Aerodrome Design

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 shall be provided. This system shall be composed of high-
intensity obstacle lights, Type A, or medium-intensity obstacle
lights, Type A, as appropriate, for daytime and twilight use and
medium-intensity obstacle lights, Type B or C, for night-time use.

Lighting of objects with a height less than 45 m
above ground level

6.2.3.19 Low-intensity obstacle lights, Type A or B, shall be used where the object is a less extensive one and its height above the surrounding ground is less than 45 m.

6.2.3.20 Where the use of low-intensity obstacle lights, Type A or B, would be inadequate or an early special warning is required, then medium- or high-intensity obstacle lights shall be used.

6.2.3.21 Low-intensity obstacle lights, Type B, shall be used either alone or in combination with medium-intensity obstacle lights, Type B, in accordance with 6.2.3.22.

6.2.3.22 Medium-intensity obstacle lights, Type A, B or C, shall be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, shall be used alone, whereas medium-intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

Note.— A group of buildings is regarded as an extensive object.

Lighting of objects with a height 45 m to a height less than 150 m above ground level

6.2.3.23 Medium-intensity obstacle lights, Type A, B or C, shall be used. Medium-intensity obstacle lights, Types A and C, shall be used alone, whereas medium intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

6.2.3.24 Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.
6.2.3.25 Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.26 Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.27 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 6.2.3.10, except that where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

Lighting of objects with a height 150 m or more above ground level

6.2.3.28 High-intensity obstacle lights, Type A, shall be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and an aeronautical study indicates such lights to be essential for the recognition of the object by day.

6.2.3.29 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 6.2.3.10, except that where an object to be marked is surrounded by buildings, the
elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

6.2.3.30 Where, in the opinion of the appropriate authority, the use of high-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, medium-intensity obstacle lights, Type C, shall be used alone, whereas medium-intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

6.2.3.31 Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

6.2.3.32 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.33 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.4 Wind turbines

Markings

6.2.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note. — see 4.3.1 and 4.3.2

Lighting

6.2.4.2 When lighting is deemed necessary, medium-intensity obstacle lights shall be used. In the case of a wind farm, i.e. a group of two
or more wind turbines, it shall be regarded as an extensive object and the lights shall be installed:

a) to identify the perimeter of the wind farm;
b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;
c) so that, where flashing lights are used, they flash simultaneously; and

d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.

6.2.5 Overhead wires, cables, etc., and supporting towers

Marking

6.2.5.1 The wires, cables, etc., to be marked shall be equipped with markers; the supporting tower shall be coloured.

Marking by colours

6.2.5.2 The supporting towers of overhead wires, cables, etc., that require marking shall be marked in accordance with 6.2.3.1 to 6.2.3.4, except that the marking of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.

Marking by markers

6.2.5.3 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented by the object they mark is not increased.

6.2.5.4 A marker displayed on an overhead wire, cable, etc., shall be spherical and have a diameter of not less than 60 cm.

6.2.5.5 The spacing between two consecutive markers or between a marker and a supporting tower shall be appropriate to the diameter of the marker, but in no case shall the spacing exceed:
a) 30 m where the marker diameter is 60 cm progressively increasing with the diameter of the marker to
b) 35 m where the marker diameter is 80 cm and further progressively increasing to a maximum of
c) 40 m where the marker diameter is of at least 130 cm.
Where multiple wires, cables, etc., are involved, a marker shall be located not lower than the level of the highest wire at the point marked.

6.2.5.6 A marker shall be of one colour. When installed, white and red, or white and orange markers shall be displayed alternately. The colour selected shall contrast with the background against which it will be seen.

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, shall be provided on their supporting towers.

**Lighting**

6.2.5.8 High-intensity obstacle lights, Type B, shall 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., shall flash sequentially; first the middle light, second the top light and last, the bottom light. The intervals between flashes of the lights shall approximate the following ratios:

<table>
<thead>
<tr>
<th>Flash interval between</th>
<th>Ratio of cycle time</th>
</tr>
</thead>
<tbody>
<tr>
<td>middle and top light</td>
<td>1/13</td>
</tr>
<tr>
<td>top and bottom light</td>
<td>2/13</td>
</tr>
<tr>
<td>bottom and middle light</td>
<td>10/13</td>
</tr>
</tbody>
</table>
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 Aerodrome Design Manual (Doc 9157), Part 4.

6.2.5.11 Where, in the opinion of the appropriate authority, the use of high-intensity obstacle lights, Type B, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system shall be provided. This system shall be composed of high-intensity obstacle lights, Type B, for daytime and twilight use and medium-intensity obstacle lights, Type B, for night time use. Where medium-intensity lights are used they shall be installed at the same level as the high-intensity obstacle light Type B.

6.2.5.12 The installation setting angles for high-intensity obstacle lights, Type B, shall be in accordance with Table 6-5.

Table 6-5. Installation setting angles for high-intensity obstacle lights

<table>
<thead>
<tr>
<th>Height of light unit above terrain</th>
<th>Angle of the peak of the beam above the horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>greater than 151 m AGL</td>
<td>0°</td>
</tr>
<tr>
<td>122 m to 151 m AGL</td>
<td>1°</td>
</tr>
<tr>
<td>92 m to 122 m AGL</td>
<td>2°</td>
</tr>
<tr>
<td>less than 92 m AGL</td>
<td>3°</td>
</tr>
</tbody>
</table>

CHAPTER 7 - VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS

7.1.0 Closed runways and taxiways, or parts thereof

Application

7.1.1 A closed marking shall be displayed on a runway or taxiway or portion thereof which is permanently closed to the use of all aircraft.

Location
7.1.2 On a runway a closed marking shall be placed at each end of the runway, or portion thereof, declared closed, and additional markings shall be so placed that the maximum interval between markings does not exceed 300 m. On a taxiway a closed marking shall be placed at least at each end of the taxiway or portion thereof closed.

Characteristics

7.1.3 The closed 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. — 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.

7.1.4 When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.

7.1.5 Lighting on a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes.

7.1.6 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 (see7.4.4).
Figure 7-1. Closed runway and taxiway markings

7.2.0 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 shall be placed along the edge of the load bearing pavement, with the outer edge of the marking approximately on the edge of the load-bearing pavement.
Characteristics

7.2.3 A taxi side stripe marking shall consist of a pair of solid lines, each 15 cm wide and spaced 15 cm apart and the same colour as the taxiway centre line marking.

Note.— Guidance on providing additional transverse stripes at an intersection or a small area on the apron is given in the Aerodrome Design Manual (Doc 9157), Part 4.

7.3 Unserviceable areas

Application

7.3.1 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. On a movement area used at night, unserviceability lights shall be used.

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

Location

7.3.2 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

7.3.3 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones or marker boards.

Characteristics of unserviceability lights

7.3.4 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.
Characteristics of unserviceability cones

7.3.5 An unserviceability cone shall 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

7.3.6 An unserviceability flag shall 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

7.3.7 An un-serviceability marker board shall 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 8 – ELECTRICAL SYSTEMS

8.1.0 Electrical power supply systems for air navigation facilities

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

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

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

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

8.1.3 Electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities
are automatically connected to the secondary power supply on failure of the primary source of power.

8.1.4 The time interval between failure of the primary source of power and the complete restoration of the services required by 8.1.10 shall 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 shall apply.

*Note.*—A definition of switch-over time is given in Chapter 1.

8.1.5 The 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**

8.1.6 For 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.

8.1.7 For a runway meant for take-off in runway visual range conditions less than a value of 800 m, a secondary power supply capable of meeting the relevant requirements of Table 8-1 shall be provided.

8.1.8 At 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 shall be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.

8.1.9 At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of 8.1.4 shall 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 shall be provided with a secondary power supply capable of supplying power when there is a failure of the primary power supply:

a) the signalling lamp 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) meteorological equipment;

e) essential security lighting, if provided in accordance with 9.11;

f) essential equipment and facilities for the aerodrome responding emergency agencies;

g) floodlighting on a designated isolated aircraft parking position if provided in accordance with 5.3.24.1; and

h) 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 Annex 10, Volume I, Chapter 2.

8.1.11 Requirements for a secondary power supply shall 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 the Aerodrome Design Manual (Doc 9157), Part 5.
### Table 8-1. Secondary power supply requirements

<table>
<thead>
<tr>
<th>Runway</th>
<th>Lighting aids required power</th>
<th>Maximum switch-over time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-instrument</td>
<td>Visual approach slope indicator (^a)</td>
<td>See 8.1.4 and 8.1.9</td>
</tr>
<tr>
<td></td>
<td>Runway edge (^b)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Runway threshold (^b)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Runway end (^b)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obstacle</td>
<td></td>
</tr>
<tr>
<td>Non-precision approach</td>
<td>Approach lighting system</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Visual approach slope indicators (^a, d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway edge (^d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway threshold (^d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway end</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Obstacle (^a)</td>
<td>15 seconds</td>
</tr>
<tr>
<td>Precision approach category I</td>
<td>Approach lighting system</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Visual approach slope indicators (^a, d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway edge (^d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway threshold (^d)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway end</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Obstacle (^a)</td>
<td>15 seconds</td>
</tr>
<tr>
<td>Precision approach category II/III</td>
<td>Inner 300 m of the approach lighting system</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Other parts of the approach lighting system</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Obstacle (^a)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway edge</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Runway threshold</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Runway end</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Runway centre line</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Runway touchdown zone</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>All stop bars</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Essential taxiway</td>
<td>15 seconds</td>
</tr>
<tr>
<td>Runway meant for take-off in runway visual</td>
<td>Runway edge</td>
<td>15 seconds</td>
</tr>
<tr>
<td>range conditions less than a value of 800 m</td>
<td>Runway end</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Runway centre line</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>All stop bars</td>
<td>1 second</td>
</tr>
<tr>
<td></td>
<td>Essential taxiway (^a)</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td>Obstacle (^a)</td>
<td>15 seconds</td>
</tr>
</tbody>
</table>

\(^a\) Supplied with secondary power when their operation is essential to the safety of flight operation.

\(^b\) See Chapter 5, 5.3.2, regarding the use of emergency lighting.
c. One second where no runway centre line lights are provided.
d. One second where approaches are over hazardous or precipitous terrain.

8.2.0 System design
8.2.1 For a runway meant for use in runway visual range conditions less than a value of 550m, 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 the 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.

8.3.0 Monitoring

Note.— Guidance on this subject is given in the 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.

CHAPTER 9 - AERODROME OPERATIONAL SERVICES, EQUIPMENT AND INSTALLATIONS
9.1.0 Aerodrome emergency planning

General

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 the 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 fire-fighting services, aerodrome administration, medical and ambulance services, aircraft operators, 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.
Note 2.— Public health services include planning to minimize adverse effects to the community from health-related events and deal with population health issues rather than provision of health services to individuals.

9.1.4 The plan shall provide for cooperation and coordination with the rescue coordination centre, as necessary.

9.1.5 The aerodrome emergency plan document shall include at least the following:

a) types of emergencies planned for;

b) agencies involved in the plan;

c) responsibility and role of each agency, the emergency operations centre and the command post, for each type of emergency;

d) information on names and telephone numbers of offices or people to be contacted in the case of a particular emergency; and

e) a grid map of the aerodrome and its immediate vicinity.

9.1.6 The plan shall observe Human Factors principles to ensure optimum response by all existing agencies participating in emergency operations.

Note.— Guidance material on Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

Emergency operations centre and command post

9.1.7 A fixed emergency operations centre and a mobile command post shall be available for use during an emergency. Requirement)

9.1.8 The emergency operations centre shall be a part of the aerodrome facilities and shall be responsible for the overall coordination and general direction of the response to an emergency. Requirement)

9.1.9 The command post shall be a facility capable of being moved rapidly to the site of an emergency, when required, and shall undertake the local coordination of those agencies responding to the emergency. Requirement)

9.1.10 A person shall be assigned to assume control of the emergency operations centre and, when appropriate, another person the command post. Requirement)

Communication system

9.1.11 Adequate communication systems linking the command post and the emergency operations centre with each other and with the
participating agencies shall be provided in accordance with the plan and consistent with the particular requirements of the aerodrome.

**Aerodrome emergency exercise**

9.1.12 The plan shall contain procedures for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness.  
*Note.* The plan includes all participating agencies and associated equipment.

9.1.13 The plan shall be tested by conducting:  

a) a full-scale aerodrome emergency exercise at intervals not exceeding two years and partial emergency exercises in the intervening year to ensure that any deficiencies found during the full-scale aerodrome emergency exercise have been corrected; or

b) a series of modular tests commencing in the first year and concluding in a full-scale aerodrome emergency exercise at intervals not exceeding three years; and reviewed thereafter, or after an actual emergency, so as to correct any deficiency found during such exercises or actual emergency.

*Note 1.* The purpose of a full-scale exercise is to ensure the adequacy of the plan to cope with different types of emergencies. The purpose of a partial exercise is to ensure the adequacy of the response to individual participating agencies and components of the plan, such as the communications system. The purpose of modular tests is to enable concentrated effort on specific components of established emergency plans.

*Note 2.* Guidance material on airport emergency planning is available in the Airport Services Manual (Doc 9137), Part 7.

**Emergencies in difficult environments**

9.1.14 The plan shall include the ready availability of, and coordination with, appropriate specialist rescue services to be able to respond to emergencies where an aerodrome is located close to water and/or swampy areas and where a significant portion of approach or departure operations takes place over these areas.

*Note.* Guidance material on assessing approach and departure areas within 1 000 m of runway thresholds can be found in Chapter 13 of the Airport Services Manual (Doc 9137), Part 1.

9.2.0 **Rescue and firefighting**

**General**
Note.—The principal objective of a rescue and firefighting service is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome. The rescue and firefighting service is provided to create and maintain survivable conditions, to provide egress routes for occupants and to initiate the rescue of those occupants unable to make their escape without direct aid. The rescue may require the use of equipment and personnel other than those assessed primarily for rescue and firefighting purposes. The most important factors bearing on effective rescue in a survivable aircraft accident are: the training received, the effectiveness of the equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can be put into use. Requirements to combat building and fuel farm fires, or to deal with foaming of runways, are not taken into account.

Application

9.2.1 Rescue and firefighting equipment and services shall be provided at an aerodrome.

Note.—Public or private organizations, suitably located and equipped, may be designated to provide the rescue and firefighting service. It is intended that the fire station housing these organizations be normally located on the aerodrome, although an off-aerodrome location is not precluded provided the response time can be met.

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 Chapter 13 of the 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 shall 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 the Airport Services Manual (Doc 9137), Part 1, for categorizing aerodromes, including those for all-cargo aircraft operations, for rescue and firefighting purposes.

Note 2. — Guidance on 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 the Airport Services Manual (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>
<thead>
<tr>
<th>Aerodrome category (1)</th>
<th>Aeroplane overall length (2)</th>
<th>Max. fuselage width (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 m up to but not including 9 m</td>
<td>2 m</td>
</tr>
<tr>
<td>2</td>
<td>9 m up to but not including 12 m</td>
<td>2 m</td>
</tr>
<tr>
<td>3</td>
<td>12 m up to but not including 18 m</td>
<td>3 m</td>
</tr>
<tr>
<td>4</td>
<td>18 m up to but not including 24 m</td>
<td>4 m</td>
</tr>
<tr>
<td>5</td>
<td>24 m up to but not including 28 m</td>
<td>4 m</td>
</tr>
<tr>
<td>6</td>
<td>28 m up to but not including 39 m</td>
<td>5 m</td>
</tr>
<tr>
<td>7</td>
<td>39 m up to but not including 49 m</td>
<td>5 m</td>
</tr>
<tr>
<td>8</td>
<td>49 m up to but not including 61 m</td>
<td>7 m</td>
</tr>
</tbody>
</table>
### Extinguishing agents

**9.2.8** Both principal and complementary agents shall normally be provided at an aerodrome.  
*Note.* — *Descriptions of the agents may be found in the Airport Services Manual (Doc 9137), Part 1.*

**9.2.9** The principal extinguishing agent shall 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 shall 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 the Airport Services Manual (Doc 9137), Part 1.*

**9.2.10** The complementary extinguishing agent shall 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 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 fire fighting 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.

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 Chapter 2 of the Airport Services Manual (Doc 9137), Part 1.

9.2.12 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 Chapter 2 of the Airport Services Manual (Doc 9137), Part 1.

Table 9-2. Minimum usable amounts of extinguishing agents

<table>
<thead>
<tr>
<th>Aerodrome Category</th>
<th>Foam meeting performance level A</th>
<th>Foam meeting performance level B</th>
<th>Foam meeting performance level C</th>
<th>Complementary agents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water (L)</td>
<td>Water (L)</td>
<td>Water (L)</td>
<td>Dry chemical powders (kg)</td>
</tr>
<tr>
<td>Aerodrome Category</td>
<td>Discharge Foam solution /minute (L)</td>
<td>Discharge Foam solution /minute (L)</td>
<td>Discharge Foam solution /minute (L)</td>
<td>Discharge rate (kg/second)</td>
</tr>
<tr>
<td>1</td>
<td>350</td>
<td>350</td>
<td>230</td>
<td>145</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>800</td>
<td>670</td>
<td>190</td>
</tr>
<tr>
<td>3</td>
<td>1800</td>
<td>1300</td>
<td>1200</td>
<td>135</td>
</tr>
</tbody>
</table>
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.

9.2.13 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.

9.2.14 The discharge rate of the foam solution shall not be less than the rates shown in Table 9-2.

9.2.15 The complementary agents shall comply with the appropriate specifications of the International Organization for Standardization (ISO).*

9.2.16 The discharge rate of complementary agents shall be no less than the values shown in Table 9-2.

9.2.17 Dry chemical powders shall only be substituted with an agent that has equivalent or better fire fighting 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 the Airport Services Manual (Doc 9137), Part 1.

9.2.18 Where a major delay in the replenishment of the supplies is anticipated, the amount of reserve supply in shall be increased as determined by a risk assessment.

Note. — See the 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**

9.2.19 Rescue equipment commensurate with the level of aircraft operations shall be provided on the rescue and fire fighting vehicle(s).

Note. — Guidance on the rescue equipment to be provided at an aerodrome is given in the Airport Services Manual (Doc 9137), Part 1.
Response time

9.2.20 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.

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.

9.2.21 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 shall be provided.

Note.—Additional guidance is available in the Airport Services Manual (Doc 9137), Part 1.

9.2.22 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.

Fire stations

9.2.23 The fire station shall be located so that the access for rescue and firefighting vehicles into the runway area is direct and clear, requiring a minimum number of turns.

Communication and alerting systems

9.2.24 A discrete communication system shall be provided linking a fire station with the control tower, any other fire station on the aerodrome and the rescue and firefighting vehicles.

9.2.25 An alerting system for rescue and fire fighting personnel, capable of being operated from that station, shall be provided at a fire station, any other fire station on the aerodrome and the aerodrome control tower.

Number of rescue and firefighting vehicles

9.2.26 The minimum number of rescue and fire fighting vehicles provided at an aerodrome shall be in accordance with the following tabulation:

<table>
<thead>
<tr>
<th>Aerodrome category</th>
<th>Rescue and firefighting vehicles</th>
</tr>
</thead>
</table>
Note.— Guidance on minimum characteristics of rescue and fire fighting vehicles is given in the Airport Services Manual (Doc 9137), Part 1

**Personnel**

9.2.27 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 the 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”.*

9.2.28 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 the Human Factors Training Manual (Doc 9683).*

9.2.29 In determining the minimum number of rescue and firefighting personnel required, a task resource analysis shall 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 the Airport Services Manual (Doc 9137), Part 1.*

9.2.30 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.
9.3.0 Disabled aircraft removal

Note. — Guidance on removal of a disabled aircraft, including recovery equipment, is given in the Airport Services Manual (Doc 9137), Part 5. See also Annex 13 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 shall be established for an aerodrome, and a coordinator designated to implement the plan, when necessary.

9.3.2 The disabled aircraft removal plan shall 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.

9.4.0 Wildlife strike hazard reduction

Note. — The presence of wildlife (birds and 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 procedure by the aerodrome operator for recording and reporting bird strikes to aircraft; and
   b) the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome the aerodrome constituting a potential hazard to aircraft operations.
   c) an ongoing evaluation of the wildlife hazard by competent personnel.

Note. — See Annex 15, Chapter 8.

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 the Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332).
9.4.3 The Aerodrome operator shall take action to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

*Note.* — *Guidance on effective measures for establishing whether or not wildlife, on or near an aerodrome, constitute a potential hazard to aircraft operations, and on methods for discouraging their presence, is given in the Airport Services Manual (Doc 9137), Part 3.*

9.4.4 The Aerodrome Operator 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 Aerodrome Operator shall give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.

9.5.0 **Apron management service**

9.5.1 When warranted by the volume of traffic and operating conditions, an appropriate apron management service shall 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 shall be established to facilitate the orderly transition of aircraft between the apron management unit and the aerodrome control tower.

*Note.* — *Guidance on an apron management service is given in the Airport Services Manual (Doc 9137), Part 8, and in the 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 the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

9.5.5 An emergency vehicle responding to an emergency shall be given priority over all other surface movement traffic.

9.5.6 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.

9.5.7 An aircraft stand shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand.

9.6.0 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 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.

9.7.0 Aerodrome vehicle operations

*Note 1. — Guidance on aerodrome vehicle operations is contained in Attachment A, Section 19, and on traffic rules and regulations for vehicles in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).*

*Note 2. — 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.

9.7.1 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.

9.7.2 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.

9.7.3 The driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by lights.

9.7.4 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.

9.7.5 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.

9.8 Surface movement guidance and control systems

9.8.0 Application

9.8.1 A surface movement guidance and control system (SMGCS) shall be provided at an aerodrome.


Characteristics

9.8.2 The design of an SMGCS shall take into account:
   a) the density of air traffic;
b) the visibility conditions under which operations are intended;  
c) the need for pilot orientation;  
d) the complexity of the aerodrome layout; and  
e) movements of vehicles.

9.8.3 An SMGCS shall be designed to assist in the prevention of inadvertent incursions of aircraft and vehicles onto an active runway.

9.8.4 The system shall 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 the Aerodrome Design Manual (Doc 9157), Part 4.

9.8.5 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 the Aerodrome Design Manual (Doc 9157), Part 4.  

9.9.0 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 the Aerodrome Design Manual (Doc 9157), Part 6.
9.9.1 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.

9.9.2 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.

   Note.— Guidance on the siting of navigation aids is contained in the Aerodrome Design Manual (Doc 9157), Part 6.

9.9.3 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.

9.9.4 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 on that portion of the strip within 77.5 m of the runway centre line where the code number is 4 and the code letter is F; or
   b) 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
penetrates the inner approach surface, the inner transitional surface or the balked landing surface; shall be frangible and mounted as low as possible.

9.10.0 Fencing

Application

9.10.1 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.

9.10.2 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.

9.10.3 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

9.10.4 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.

CHAPTER 10 - AERODROME MAINTENANCE

10.1.0 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.

10.2.0 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 loose objects/debris 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 3.— Additional guidance on sweeping/cleaning of surfaces is contained in the 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 the 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.— GCAA TP 16, New Runway Friction, contains further information on the minimum friction level required in Guyana.

Note.— The Airport Services Manual (Doc 9137), Part 2, contains further information on this subject, on improving surface friction characteristics of runways.

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.** — Guidance on evaluating the friction characteristics of a runway is provided in Attachment A, Section 7. Additional guidance is included in the Airport Services Manual (Doc 9137), Part 2.

**Note 2.** — The objective of 10.2.3 to 10.2.6 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.** — Guidance for the determination of the required frequency is provided in Attachment A, Section 7 and in the Airport Services Manual (Doc 9137), Part 2, Appendix 5.

**10.2.5** 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.*

**10.2.6** 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 shall be assessed under natural or simulated conditions that are representative of local rain, and corrective maintenance action shall be taken as necessary.

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

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

**10.2.8** 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.

**10.3.0** **Removal of contaminants**

**10.3.1** Standing water, mud, dust, sand, oil, rubber deposits and other forms of contaminants shall be removed from the surface of runways in use as rapidly and completely as possible to minimize accumulation.
Note.— 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 the Aerodrome Services Manual (Doc 9137), Parts 2 and 9.

10.3.2 Taxiways shall be kept clear of contaminants, to the extent necessary to enable aircraft to be taxied to and from an operational runway.

10.3.3 Aprons shall be kept clear of contaminants, 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 contaminants, from the various parts of the movement area cannot be carried out simultaneously, the order of priority after the runway(s) in use shall be set in consultation with the affected parties such as rescue and firefighting service and documented in a contamination removal plan.

Note 1.— See Annex 15, Appendix 1, Part 3, AD 1.2.2 for information to be promulgated in an AIP concerning a snow plan. The Aeronautical Information Services Manual (Doc 8126), Chapter 5 contains guidance on the description of a snow plan including general policy concerning operational priorities established for the clearance of movement areas.

10.4.0 Runway pavement overlays

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

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

a) 0.5 to 1.0 per cent for overlays up to and including 5 cm in thickness; and

b) not more than 0.5 per cent for overlays more than 5 cm in thickness.

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

10.4.3 The entire width of the runway shall be overlaid during each work session.
10.4.4 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the specifications in Section 5.2.3 shall be provided. Additionally, the location of any temporary threshold shall be identified by a 3.6 m wide transverse stripe.

10.4.5 The overlay shall be constructed and maintained above the minimum friction level specified in 10.2.3.

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. Annex 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 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.

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

10.5.5 The system of preventive maintenance employed for a precision approach runway category II or III shall have as its objective that, during any period of category II or III operations, all approach and runway lights are serviceable and that, in any event, at least:

a) 95 per cent of the lights are serviceable in each of the following particular significant elements:
   1) precision approach category II and III lighting system, the inner 450 m;
   2) runway centre line lights;
   3) runway threshold lights; and
   4) runway edge lights;

b) 90 per cent of the lights are serviceable in the touchdown zone lights;

c) 85 per cent of the lights are serviceable in the approach lighting system beyond 450 m; and

d) 75 per cent of the lights are serviceable in the runway end lights.

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

Note.—With respect to barrettes, crossbars and runway edge lights, lights are considered to be adjacent if located consecutively and:
   — laterally: in the same barrette or crossbar; or
   — longitudinally: in the same row of edge lights or barrettes.
10.5.6 The system of preventive maintenance employed for a stop bar provided at a runway-holding position used in conjunction with a runway intended for operations in runway visual range conditions less than a value of 350 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.

10.5.7 The system of preventive maintenance employed for a taxiway intended for use in runway visual range conditions less than a value of 350 m shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.

10.5.8 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.

10.5.9 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.
10.5.10 The system of preventive maintenance employed for a runway meant for take-off in runway visual range conditions of a value of 550 m or greater shall have as its objective that, during any period of operations, all runway lights are serviceable and that, in any event, at least 85 per cent of the lights are serviceable in the runway edge lights and runway end lights. In order to provide continuity of guidance, an unserviceable light shall not be permitted adjacent to another unserviceable light.

CHAPTER 11 - AERODROME SAFETY MANAGEMENT SYSTEMS (SMS)

11.1.0 Introduction
11.1.1 Safety management addresses all of the operational activities of the entire organization. The scope of an SMS encompasses most of the activities of the organization, and all operational activities that support delivery of services and contain the potential to generate hazards. The scope of an SMS directly includes operations, maintenance, repair, support services, training and checking and other operational activities. The scope of an SMS indirectly includes, as appropriate and relevant to service delivery, other organizational activities that support operational activities, such as finance, human resources and legal.

11.1.2 An SMS must start with senior management. The management of safety, as a core business function of an organization, requires resources, just like any other core business function. The allocation of resources is eminently a function of senior management, in that senior management has both the authority and the responsibility for resource allocation. If senior management is not apprised of the role and objectives of the organization’s SMS, or involved at an
appropriate level in the organization’s SMS, it will not have an appreciation of the extent of the threat that safety risks represent to the capabilities of the organization. Without such an appreciation, allocation of resources may fall short of real needs.

**11.1.3** An SMS aims to make continuous improvements to the overall level of safety of an organization. In accordance with the nature of safety management as a core business function, an SMS involves non-stop, daily hazard identification, collection and analysis, safety risk estimation, and implementation of mitigation strategies. There is no specific point at which an SMS stops or slows down. An SMS is a constant, never-ending operation that aims at maintaining and, if possible, improving safety levels that are commensurate with the organization’s strategic objectives and supporting core business functions. In this sense, an SMS is profoundly different from the traditional notion of accident investigation, which waited for an accident to occur, then extracted and distributed as many safety lessons as possible learned from the investigation in order to prevent similar accidents. An SMS actively looks for hazards, continuously assesses safety risks, to contain them before they result in an accident.

**11.2.0 Safety management system**

**11.2.1 General**

**11.2.1.1** This chapter covers the principles for Aerodrome Safety Management Systems.

**11.2.1.2** A Safety Management System (SMS) should be established by an aerodrome operator for operations and maintenance of its aerodrome.

**11.2.1.3** Every operator of a certified aerodrome shall establish and implement an operating safety management system at the aerodromes.

**11.2.1.4** The information contained in this Chapter is not intended to be a prescriptive formula but serves to provide basic explanation of the essential components of an SMS. An aerodrome operator should start to develop its own SMS taking into account these guidelines and any other supplementary material that the Authority may publish from time to time.

*Note – Guidance on development and implementation of an aerodrome safety management system is contained in Appendix 7 to this Manual.*
11.2.2 General features of an SMS

11.2.2.1 An SMS is a systematic, proactive and explicit process for the management of safety risks.

11.2.2.2 An SMS is systematic because safety management activities are in accordance with a pre-determined plan and applied in a consistent manner throughout the organization. A long-range plan to keep the safety risks of the consequences of hazards under control is developed, approved, implemented and operated on a non-stop, daily basis. As a consequence of their systematic and strategic nature, SMS activities aim at gradual but constant improvement, as opposed to instant dramatic change. The systematic nature of an SMS also leads to a focus on processes rather than outcomes. Although outcomes (i.e. adverse events) are duly considered to extract conclusions that support the control of safety risks, the main focus of an SMS is the capture of hazards, which are the precursors to outcomes, during the course of the routine operational activities (processes) that the organization engages in during delivery of services.

11.2.2.3 An SMS is proactive because it builds upon an approach that emphasizes hazard identification and safety risk control and mitigation, before events that affect safety occur. It involves strategic planning, seeking to keep safety risks under the constant control of the organization, instead of engaging in repair action when an adverse event is experienced, and then reverting to “sleep mode” until the next adverse event is experienced and repair action is reengaged. In order to sustain effective hazard identification, constant monitoring is conducted of operational activities necessary for the provision of services. This in turn allows for the collection of safety data on hazards, allowing data driven organizational decisions on safety risks and their control, as opposed to formulating decisions on safety risks based on opinion or, even worse, on bias or prejudice.

11.2.2.4 An SMS is explicit because all safety management activities are documented, visible and therefore defensible. Safety management activities and the ensuing safety management know-how of the organization are formally recorded in official documentation that is available for anyone to access. Thus, safety management activities are transparent. In this respect, maintaining a “safety
library” is fundamental in ensuring that safety management activities and know-how are documented in formal organizational structures.

11.2.3 General description of an aerodrome SMS

11.2.3.1 The SMS applies to all activities related to the requirements for aerodrome certification and for ensuring the continuous safe functioning of aerodrome operations. The SMS should permeate throughout the aerodrome operator organization, and be implemented through a continuing safety program based on a coherent policy that leads to well-designed work procedures. The SMS should also extend to include interfaces between the aerodrome operator and its suppliers, sub-contractors, agents, business partners and other relevant external service providers.

11.2.3.2 The SMS should focus principally on the hazards associated with the operation of the aerodrome and their effects upon those activities critical to safety. It should provide for goal setting, planning and measuring performance, and should place emphasis on organizational safety rather than conventional health and safety-at-work concerns. Active monitoring and auditing processes should be applied to validate that the necessary controls identified through the hazard management process are effectively put in place so as to ensure continuing active commitment to safety and to achieve continuous improvement in safety performance.

11.2.3.3 An aerodrome operator’s SMS defines how it intends to manage aerodrome safety as an integral part of its business management activities. The SMS should be woven into the fabric of an aerodrome operator’s organization and become part of its culture – the way people do their jobs.

11.2.4 Aerodrome SMS Framework

The framework for an aerodrome SMS is described in Appendix 7 to this Manual

11.2.5 Safety policy
The SMS should have a clear definition of the philosophy and fundamental approach an aerodrome operator will adopt for the management of safety within its organization. This includes the setting of policies on the process of safety management and how they relate to the operations and maintenance processes at an aerodrome.

11.2.6 Safety roles and responsibilities
The SMS should have a well-defined organization structure, including staffing positions, lines of responsibility and clear assignment of group and individual safety accountabilities at all levels involved in the safety process within the organization. The staff positions responsible for the safety compliance of externally supplied services should also be identified. The dedication and involvement of top management towards safety and safety practices should be clearly visible, including their commitment to provide priority to tackle safety initiatives and setting aside adequate time, financial and human resources necessary to attain the strategic safety objectives established by the organization.

11.2.7 Safety committee(s)
The SMS should include forums for discussing safety-related issues from a cross-functional perspective and for streamlining the implementation of the safety management plan across the aerodrome operator organization. This will provide a means of looking at safety from a broader viewpoint, to review safety achievements and broadcast safety information. Safety committee(s) could take the form of a high-level committee(s) as well as sub-committees with specific areas of responsibility.

11.2.8 Safety standards, goals and strategy
The SMS should have a plan and strategy involving setting of safety performance targets and the establishment of a framework for controlling risks to a level as low as reasonably practicable.

11.2.9 Safety assessment
The SMS should comprise a proactive means to assess safety by seeking out potential safety hazards so as to enable the evaluation and sound management of the associated risks. Hazard
identification is the act of identifying any condition with the potential for causing injury to personnel, damage to equipment, structures or property, loss of material, or reduction of the ability to perform a prescribed function. Risk management involves analysing the risks associated with an identified hazard, making an assessment of its potential severity and likelihood of occurrence, and finally developing and implementing preventive or corrective actions to reduce the risks to an acceptable level. Appropriate tools/techniques for the identification of and action on critical safety areas, which require a higher level of safety management integrity, should also be used in the risk management process, where needed. Hazard identification and risk management should be performed in the following circumstances:

a) through regular reviews;
b) when major operational changes are planned;
c) when the organization is undergoing rapid change, such as expansion or downsizing; introduction of new facilities or procedures; decommissioning of existing facilities or modification of procedures, etc.; and
d) when key personnel change takes place.

The safety assessment should extend to the management of contracts with external service providers. Tender or proposal invitation documents shall be assessed and reviewed to ensure that safety requirements are adequately defined and documented for the performance by the external service providers.

### 11.2.10 Safety monitoring

The SMS should have built-in active safety monitoring techniques for data collection, which should include

a) routine detailed inspections of specific task areas (e.g. using safety checklists);
b) regular reviews of appropriateness and effectiveness of current modes of operation – equipment performance, process, practices and procedures;
c) internal audits of compliance with SMS requirements; and
d) examination of adequacy of SMS setup and of management and line commitment.

Safety performance records should be documented and used as feedback to improve the system.
11.2.11 Safety reporting

Every event is an opportunity to learn valuable safety lessons. The lessons however, will only be understood if the occurrence is analysed so that all staff, including management, are aware of not only what happened but also why it happened. This involves looking beyond the event and investigating the contributing factors, e.g. organizational and human factors within the organization that played a role in the event. The SMS developed and maintained by the aerodrome operator should therefore include procedures for the internal reporting and recording of occurrences, hazards and other safety related issues. The aerodrome operator should make use of appropriate, accurate and timely collected data to identify the root cause and to apply the necessary corrective action to prevent a recurrence of the event. The aerodrome operator should also note the need to satisfy the regulatory requirements for aerodrome occurrence reporting and investigations, as detailed in section 11.3 of this Manual. The safety reporting system should encompass the following fundamental elements:

1) system to allow staff to report hazards, events or safety concerns in a simple, convenient and non-punitive way;
2) procedures for investigating and analysing safety data, safety reports and any other safety related information;
3) methods for the collection, storage and distribution of data;
4) corrective actions and risk reduction strategies;
5) on-going monitoring; and
6) validation of the effectiveness of corrective actions.

11.2.12 Safety information dissemination and awareness

The SMS setup should allow all safety-related information to be disseminated throughout the organization. An aerodrome operator should endeavour to inform all staff as to where safety related information and messages can be found, and provide a means to keep staff notified whenever a potential safety threat is discovered. In this way, the entire organization will become aware of safety issues and understand that the company is actively seeking to address these issues.
11.2.13 Safety improvement
The SMS should encourage and allow opportunities for all staff to proactively participate in the safety process. Staff should have the opportunity to feedback and contribute to the development and implementation of the SMS. Their involvement in the decision making process fosters ownership of the system and helps to promote a positive safety culture that is geared towards continuous improvement of safety performance.

11.2.14 Safety competencies
The SMS should account for staff training and competency, including review and evaluation on the adequacy of training provided to staff on safety related duties and of the certification system for testing their competency. An aerodrome operator should document the training requirements for each area of work within the organization, including those required of external service providers. The training should include initial, recurrent and update training requirements and, where necessary, training specific to the operation of the SMS. It is recommended that a training file be developed for each operational staff, including management, to assist in identifying and tracking staff competence and training requirements.

11.2.15 SMS documentation and records
Up to date information is essential for the aerodrome operator organization to operate in a safe and efficient manner in accordance with current aerodrome safety regulations, standards and exemptions. The SMS developed by the aerodrome operator should have a process for documenting the regulations, standards and exemptions by which it is regulated for the various activities it conducts. Consolidated documentation describing each component of the SMS is essential if the aerodrome operator staff are to understand how the whole safety management system is integrated. The safety management plan should be documented in a SMS Manual, where all components of the system stipulated in this section and their interrelationships/interfaces clearly illustrated. The SMS Manual should be a controlled document, i.e. there should be a systematic process to distribute, keep track and update the SMS
Manual. Safety assessments carried out, audit findings, preventive and corrective action and monitoring of follow-up procedures should be duly recorded to facilitate easy retrieval and auditing.

11.2.16 Safety culture and promotion
The SMS should include measures for safety promotion and publication of relevant educational materials on safety initiatives and accident prevention.

11.3.0 Aerodrome work safety
11.3.1 General
11.3.1.1 An aerodrome operator shall plan and implement works to be carried out at an aerodrome so as not to create any hazard to aircraft operations or confusion to pilots. The Aerodrome Manual submitted by an aerodrome operator shall include details of the procedures for planning and safe carrying out of such work activities at the aerodrome.

11.3.1.2 An aerodrome operator shall, in his Aerodrome Manual, address how aerodrome works are to be carried out so that:
   a) where the works are of a nature that will disrupt operations, these works shall be carried out with proper planning, consultation and coordination with all pertinent parties in advance; and
   b) where the works are of a minor/maintenance nature, these works may be carried out as time-limited works where normal aircraft operations are not disrupted and the movement area can be restored to normal safety standards and any obstacle created by those works removed in not more than 10 minutes. Depending on the nature and extent of each activity, time-limited works may include minor maintenance of markings and lights, grass mowing, sweeping of aircraft pavements, surveys and inspections, etc.

11.3.1.3 At a controlled aerodrome, the air traffic control unit may, at the request of the aerodrome operator, vary the time limits set out in paragraph 11.2.1.2 (b) above for restoring normal safety standards or resuming aerodrome works. A variation under this paragraph is subject to such conditions as the air traffic control unit may impose.
11.3.2 Aerodrome work plans

11.3.2.1 Unless an aerodrome is closed during works in progress, or the work is of an emergency nature, an aerodrome operator shall not carry out aerodrome works, other than time-limited works, without proper planning in advance.

11.3.2.2 A plan shall be established, setting out the arrangements for carrying out those aerodrome works in coordination with all other operational, maintenance and development activities at the aerodrome.

11.3.2.3 When preparing a work plan, an aerodrome operator should consult:
   a) commercial air transport operators using the aerodrome;
   b) the aerodrome’s air traffic control unit; and
   c) if the work plan may affect its operations, the Rescue and Fire Fighting Service unit at the aerodrome so that the scope and impact of work is understood by related aerodrome users and service providers and to ensure the safety of aircraft operations at the aerodrome.

11.3.2.4 The aerodrome operator shall ensure that clear and ample prior notification is provided to the Aeronautical Information Services, the aerodrome air traffic control unit, aircraft operators and other users or service providers of the aerodrome. Such notification shall include timely and accurate promulgation of AIP Supplements or NOTAMs, with clear details of the extent and period of works.

11.3.2.5 An aerodrome operator shall be required to provide an explanation of his work plan, and any alterations or updates thereof, to the Authority upon request.

11.3.2.6 Aerodrome works, for which a work plan is required, shall be carried out in accordance with the arrangements set out in the work plan and any subsequent alterations or updates.

11.3.2.7 The work plan should address details of any special requirements or restrictions arising during or on completion of the works.

11.3.2.8 The work plan should outline details, if any, of special arrangements to be made during works if emergencies or adverse weather conditions occur.
11.3.2.9 A work plan may not be required if the aerodrome operator closes the aerodrome to aircraft operations while aerodrome works are being carried out. The Authority, commercial air transport operators and all organizations and persons likely to be affected by the closure shall be given reasonable notice of intention to close the aerodrome.

11.3.2.10 An aerodrome operator shall not close the aerodrome to aircraft operations due to aerodrome works unless an AIP Supplement or a NOTAM giving notice of the closure has been issued not less than 14 days before the closure takes place.

11.3.2.11 A work plan is not required for emergency aerodrome works carried out to repair damage to part of the manoeuvring area, or to remove an obstacle, or if the works do not require any restrictions to aircraft operations. Where practicable, a NOTAM giving the nature and time and date of the commencement of the urgent repair works should be issued, as early as possible, before the commencement of the works.

11.3.3 Management and control of aerodrome works

11.3.3.1 An aerodrome operator should ensure that aerodrome works are carried out in accordance with the requirements of this Manual.

11.3.3.2 An aerodrome operator should appoint a person responsible for the safe and proper execution of each item of aerodrome works. This person shall be required to

1) ensure the safety of aircraft operations is not affected by the aerodrome work plan;

2) ensure that, where applicable, the aerodrome works are notified by the issue of an AIP Supplement or a NOTAM and that the text of each AIP Supplement or NOTAM pertaining to such notification conveys the information on operational restrictions accurately and clearly to aerodrome users and service providers;

3) supply the air traffic control unit with whatever information necessary to ensure the safety of aircraft operations;

4) discuss with the work organizations involved, on a regular basis, any matters necessary to ensure the safety of aircraft operations;

5) ensure that unserviceable portions of the movement area, temporary obstructions and limits of the work areas are
correctly marked and lit in accordance with the required standards and the work plan;

6) ensure that vehicles, plant and equipment carrying out aerodrome works are properly marked and lit or are properly supervised;

7) ensure that all requirements under the work plan pertaining to vehicles, plant and equipment and materials are complied with;

8) ensure that access routes to work areas are in accordance with that designated in the work plan and are clearly identified and that access is restricted to these routes;

9) ensure that excavation is carried out in accordance with the work plan and relevant requirements, and in particular, that sufficient precautions are taken so as to avoid damage or loss of calibration to any underground power or control cable, utilities or other services associated with a precision approach and landing system, any navigational aid or facility or equipment essential for the safety of aerodrome operations;

10) report immediately to the aerodrome air traffic control unit and the aerodrome operator any incident, or damage to facilities, likely to affect air traffic control services or the safety of aircraft;

11) provide adequate supervisors duty at the work areas while major works are in progress and the aerodrome is open to aircraft operations;

12) ensure that the aerodrome air traffic control unit is kept informed of the radio call signs of vehicles used by the work organizations that are operating in the aircraft movement areas;

13) remove vehicles, plant and personnel from the movement area immediately, where necessary, to ensure the safety of aircraft operations;

14) ensure that the movement area is safe for normal aircraft operations following the removal of vehicles, plant and equipment and personnel from the work areas;

15) in the case of time-limited works, ensure that the work areas are restored to normal safety standards not less than 11
minutes before the time scheduled for opening the work areas to aircraft operations; and

17) ensure that floodlighting or any other lighting required for carrying out aerodrome works is shielded so as not to present a hazard to aircraft operations.

11.3.3.3 The person responsible for the aerodrome works should be satisfied that the work plan is adequately prepared and that sufficient safety measures are put in place on the work site at all times during the execution of the aerodrome works when the aerodrome is open to aircraft operations.

11.3.3.4 An aerodrome operator should take all reasonable measures to ensure that aerodrome works are well-organized and that all work personnel carry out aerodrome works in a manner that will ensure the safety of aircraft operations.

11.3.3.5 Persons, vehicles, plant and equipment required for carrying out aerodrome works must not be permitted to enter the movement area or remain on it except for the purpose of carrying out those works.

11.3.3.6 Procedures for entering the work areas shall be addressed in the work plan.

11.3.4 Markers, markings, signs and lights

11.3.4.1 Aerodrome markers, markings, signs and lights required for, or affected by, aerodrome works shall be adjusted or installed in accordance with the appropriate aerodrome standards.

11.3.4.2 Parts of the movement area that are unserviceable as a result of the aerodrome works being carried out shall be marked and lit in accordance with the appropriate aerodrome standards.

11.3.4.3 All obstacles created as a result of aerodrome works being carried out shall be marked and lit in accordance with the appropriate aerodrome standards.

11.3.4.4 Vehicles and plant used in carrying out aerodrome works shall be marked and lit, where necessary, in accordance with the appropriate aerodrome standards.

11.3.5 Communication equipment

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11.3.5.1 At a controlled aerodrome, a vehicle used by work parties carrying out aerodrome works on the movement area should be equipped with a radio for two-way communications with the aerodrome air traffic control unit.

11.3.5.2 For the purpose of communication with the air traffic control unit, each vehicle used for carrying out aerodrome works on the movement area should be given a call sign.

11.3.5.3 Any vehicle or plant that is not:
   a) marked or lit in accordance with section 11.1.4 above; or
   b) if applicable, equipped with a two-way radio, may only be used in carrying out aerodrome works if it is:
      1) used under the direct supervision of another vehicle that is equipped with a two-way radio set and which is responsible for escorting the vehicle or plant without radio when carrying out aerodrome works; or
      2) used only within the limits of appropriately marked and lit work areas.

11.3.5.4 The drivers of vehicles equipped with a radio for two-way communications with the aerodrome air traffic control unit shall be properly trained and be responsible for checking that their radio sets are switched on and serviceable at all times when working on the movement area.

   Note - The training requirements for airside vehicle drivers are contained in ICAO Airport Service Manual Part 8 – DOC 9137.

11.3.6 Works near aircraft movement areas

11.3.6.1 The aerodrome operator shall refer to chapters 6 and 7 of this Manual, ICAO Airport Services Manual Part 6 to determine the extent of work allowed near aircraft movement areas.

11.3.6.2 Works on or near aircraft movement areas or runway strips should be carried out as quickly as practicable to minimise any potential risks arising out of changes associated with the works in progress.

11.3.6.3 Where works are to be undertaken in the vicinity of navigational or landing aids located within the runway strips, considerations should be taken to ensure that neither the works nor vehicles or plant associated with the works may affect the performance of the aids.
11.3.7 Completion of aerodrome works
11.3.7.1 On the completion of aerodrome works and restoration of normal safety standards to the movement area, the aerodrome operator should cancel any AIP Supplement or NOTAM issued to advice of those works.

11.3.7.2 Attention is drawn to the requirements for an aerodrome operator to inspect his aerodrome, as circumstances require, to ensure aviation safety during and immediately after any period of construction or repair of an aerodrome facility or equipment that is critical to the safety of aircraft operations, and at any other time when there are conditions at the aerodrome that could affect aviation safety.

11.4.0 Aerodrome accident/incident reporting and investigation
11.4.1 Aerodrome occurrence reporting
11.4.1.1 This section prescribes the requirements for reporting the occurrence or detection of defects, failures or malfunctions at an aerodrome, its components or equipment, which could jeopardize the safe operation of the aerodrome or cause it to become a danger to persons or property.

11.4.1.2 The objectives of the Aerodrome Occurrence Report is as follows:
   a) To ensure that knowledge of these occurrences is disseminated so that other persons and organizations may learn from them.
   b) To enable an assessment to be made by those concerned (whether internal or external to the aerodrome operator) of the safety implications of each occurrence, both in itself and in relation to previous similar occurrences, so that they may take or initiate any necessary action.

11.4.2 Reportable occurrences and reporting procedures
11.4.2.1 An aerodrome operator shall notify the Authority of any accident, serious incident, fatal or serious injury occurring at his aerodrome – in accordance with aerodrome operator’s standard operating procedures or as soon as practicable – and provide a detailed occurrence report thereafter.
CHAPTER 12 - AERODROME OPERATOR ORGANIZATIONS AND DOCUMENTATION MANAGEMENT

12.1.0 Introduction

12.1.1 Aerodrome operator organization

Aerodrome organisation management and operational structure

12.1.1.1 An effective management structure is essential for the operation of aerodromes. Duties and responsibilities of managers and senior executives must be clearly defined in writing, and chains of command systematically established.

12.1.1.2 The number and nature of the appointments at an aerodrome will vary with the size and complexity of the aerodrome and organization. An excess of managers can lead to fragmentation of responsibility and control, and to as much difficulty and inefficiency as too few. In general, the appointment of deputies for managerial posts should be kept to a minimum and particular care should be taken in defining their functions and responsibilities. The aerodrome operator shall ensure that the management organization is adequate and properly matched to the operating environment and commitments.

12.1.1.3 It is important that the operational management has proper status in the organisation and that it is in suitably experienced and competent hands. The positions held by key operations and maintenance personnel shall be listed in the Aerodrome Manual.

12.1.1.4 Where maintenance activities or aircraft ground handling services are performed by external contractors or agencies and not directly by the aerodrome operator, a senior post should be established to coordinate arrangements and to provide continuous liaison with the maintenance contractors or handling agencies. It is the
responsibility of the aerodrome operator to ensure that his contractors and/or agencies are competent to perform their duties having regard to their experience, equipment, organization, staffing, training and other arrangements.

12.1.1.5 Attention is drawn to the requirement for aerodrome operators to ensure proper and efficient maintenance of their aerodrome facilities and equipment. In addition, as part of the aerodrome organisation, the aerodrome operator shall, in respect of his aerodrome, make provisions for;

a) appropriate air traffic services to ensure the safety of aircraft in the airspace associated with the aerodrome; and

b) aeronautical information services, meteorological services and provision of security and other services related to safety.

12.1.2 Aerodrome operational staff and competency

12.1.2.1 An aerodrome operator shall employ an adequate number of qualified and skilled personnel to perform all critical activities for the operation and maintenance of the aerodrome.

12.1.2.2 An aerodrome operator shall ensure that all persons performing duties or providing services at his aerodrome are trained in accordance with the standards for training aerodrome personnel set out in his Aerodrome Manual.

12.1.2.3 The Authority or any competent authority requires the competency of specific personnel to be certified in accordance with the regulations, the aerodrome operator shall, employ only persons possessing such certification.

12.1.2.4 In addition, an aerodrome operator shall implement programmes to upgrade the competency of the personnel referred to in subparagraph 12.1.2.1. above.

12.1.2.5 Aerodrome operational staff here refers to staff engaged in the day to day operation of the aerodrome whose duties have a bearing on aircraft safety. They include apron control staff, rescue and firefighting personnel, bird control staff, airfield lighting and aircraft pavement maintenance personnel, aircraft movement area inspection staff, etc., who in the course of their duties are concerned with ensuring that the aerodrome is safe for use by aircraft, or are required to have access to the aerodrome manoeuvring areas or apron.
12.1.2.6 For the purpose of certification and aerodrome safety management system, an aerodrome operator shall be required to satisfy the Authority that he has an adequate number of operational staff for the proposed aerodrome operations. This requirement will not be assessed against a set formula, as there will clearly be a wide variation according to particular circumstances.

12.1.2.7 Arrangements for the supervision of operational staff must be sensibly related to the size of the organization and the nature of the operation, and must be in the hands of persons having the experience and qualities necessary to ensure that the maintenance are of high professional standards. The duties and responsibilities of these supervisory personnel and their supporting staff should be well-defined.

12.1.2.8 All operational personnel shall be properly trained to perform their duties in an efficient and effective manner. Apart from initial training, refresher training should also be provided at regular intervals to ensure that a high standard is maintained. Training provisions including any competency test required of staff should be detailed in the Aerodrome Manual. A record of all such training and tests shall be kept up to date.

12.1.3 Aerodrome operations library

12.1.3.1 An aerodrome operator should maintain an adequate library of maps, charts, guidance material, operations manuals and other documents needed for reference, planning and the effective operation of the aerodrome. The library should be kept in an orderly fashion and responsibility for its maintenance clearly defined.

12.1.3.2 Arrangements should be made for the amendment of manuals, documents and guidance material, and for bringing the amendments to the notice of staff concerned. A record of the amendments should be kept and a system derived to ensure the effective promulgation of information to staff concerned.

12.1.3.3 The minimum list of the documents and publications that must be kept and made available for access by staff is shown in Appendix F of this Manual of Aerodrome Standards.

12.1.4 Instruction to aerodrome operational staff
12.1.4.1 The Aerodrome Manual shall include a systematic procedure for bringing urgent or temporary information to the notice of aerodrome operations and maintenance staff.

12.2.0 Documents and record management
12.2.1 Forms, documents and records
12.2.1.1 Forms – An aerodrome operator may need to provide various official forms and records for use by the operational staff. Unless the use of such forms is self-explanatory, instructions for their completion should be included in the Aerodrome Manual. Copies and records of the safety related forms such as forms for the inspection of runway, taxiway, apron, equipment, marking, lighting etc., the recording of bird strike occurrence and reporting of accidents and incidents should be made available to all relevant staff who need to use them.

12.2.1.2 Safety Records – An aerodrome operator should maintain a quality control system to ensure a systematic means of safekeeping safety records that would enable effective preservation of these records and allow ease of retrieval. A list of the minimum documentation, publications and safety records to be kept together with the minimum period required for record preservation is shown in Appendix G of this Manual of Aerodrome Standards.

CHAPTER 13 - SUPPLEMENTS TO THE STANDARDS

13.1.0 Introduction
13.1.1 Supplementary standards issued in this manual in accordance with article 87 of the Chicago Convention which requires a contracting state to take action to ensure the safety, regularity and efficiency of air navigation. Supplementary standards, if not included in this manual may take the form of directive subject to regulation 38 (1) and (2) or Advisory Circular, but has the same force and effect of the parent regulation creating the Manual of Aerodrome Standards.
13.2.0 Time for Submission of proposed amendment to the Aerodrome Manual.

13.2.1 The Guyana Civil Aviation (Aerodrome) Regulation 57 requires the aerodrome operator to submit to the Authority, their proposed amendment to the Aerodrome Manual for approval.

13.2.2 An “amendment” to the Aerodrome Manual is a significant change in the method of compliance to Guyana Civil Aviation (Aerodrome) Regulations 2007 by an airport operator.

13.2.3 Supplementary to regulation 57, the aerodrome operator must submit the proposed amendments to the Aerodrome Manual at least 30 days before the proposed effective date.

13.2.4 A shorter time period may be allowed under circumstances beyond the control of the airport operator.

Examples of what constitutes an amendment:
- Wildlife Hazard Management Plan developed
- Change in RFFS Category
- Change in frequency/responsibility of safety inspections
- Change in responsibility of basic emergency medical care
- Significant change in physical facilities, such as a new runway or runway extension.
- Changes resulting from an Annual emergency plan review.

13.2.5 A “revision” to the Aerodrome Manual (e.g. Names/titles of key personnel or telephone numbers) is an updating of information to maintain currency which is not a change in method of compliance and does not require the Authority’s approval. Revisions are submitted as needed to maintain currency of the Aerodrome Manual and should have a date of issue.

Examples of what constitutes a revision:
- Updating names of key personnel

13.2.6 Subject to regulation 37(1) an operator will be required to establish a training program for the following:-
- Wildlife Hazard Management Plan;
- Runway incursion;
- Airside vehicle operations;
- Safety Management; and
- Any other as the Authority may require.
CHAPTER 14 - PARTICULARS TO BE INCLUDED IN AN AERODROME MANUAL FOR AERODROMES IN CATEGORY A

14.1.0 PART I: GENERAL
14.1.1 General information, including the following -
   a) purpose and scope of the aerodrome manual;
   b) the legal requirement for an certificate and an aerodrome manual as prescribed in the national regulations;
   c) conditions for use of the aerodrome - a statement to indicate that the aerodrome shall at all times, when it is available for the take-off and landing of aircraft, be so available to all persons on equal terms and conditions;
   d) the available aeronautical information system and procedures for its promulgation;
   e) the system for recording aircraft movements; and
   f) obligations of the operator.

14.2.0 PART 2: PARTICULARS OF THE AERODROME SITE
14.2.1 General information, including the following –
   a) a plan of the aerodrome showing the main aerodrome facilities for the operation of the aerodrome including, particularly, the location of each wind direction indicator;
   b) a plan of the aerodrome showing the aerodrome boundaries;
   c) a plan showing the distance of the aerodrome from the nearest city, town or other populous area, and the location of any aerodrome facilities and equipment outside the boundaries of the aerodrome; and
   d) particulars of the land title of the aerodrome site. If the boundaries of the aerodrome are not defined in the land title documents particulars of the land title to, or interest in, the property on which the aerodrome is located and a plan showing the boundaries and position of the aerodrome.
14.3.0 PART 3: PARTICULARS OF THE AERODROME REQUIRED TO BE REPORTED TO THE AERONAUTICAL INFORMATION SERVICE 1.

14.3.1 General Information -
   a) the name of the aerodrome;
   b) the location of the aerodrome;
   c) the geographical coordinates of the aerodrome reference point determined in terms of the World Geodetic System - 1984 reference datum;
   d) the aerodrome elevation and geoid undulation;
   e) the elevation of each threshold and geoid undulation, the elevation of each runway end and any significant high and low points along the runway, and the highest elevation of the touchdown zone of a precision approach runway;
   f) the aerodrome reference temperature;
   g) details of the aerodrome beacon; and
   h) the name of the operator and the address, telephone and facsimile numbers at which the operator may be contacted at all times.

14.3.2 Aerodrome dimensions and related information General information, including the following –
   a) runway - true bearing, designation number, length, width, displaced threshold location, slope, surface type, type of runway and, for a precision approach runway, the existence of an obstacle free zone;
   b) length, width and surface type of strip, runway end safety areas, stopways;
   c) length, width and surface type of taxiways;
   d) apron surface type and aircraft stands;
   e) clearway length and ground profile;
   f) visual aids for approach procedures, viz. Approach lighting type and visual approach slope indicator system (PAPI/APAPI and T-VASIS/AT-VASIS); marking and lighting of runways, taxiways, and aprons; other visual guidance and control aids on taxiways (including runway holding positions, intermediate holding positions and stop bars) and aprons, location and type of visual docking guidance system; availability of standby power for lighting;
g) the location and radio frequency of VOR aerodrome checkpoints;

h) the location and designation of standard taxi routes;

i) the geographical coordinates of each threshold;

j) the geographical coordinates of appropriate taxiway centre line points;

k) the geographical coordinates of each aircraft stand;

l) the geographical coordinates and the top elevation of significant obstacles in the approach and take-off area, in the circling area and in the vicinity of the aerodrome. (This information may best be shown in the form of charts such as those required for the preparation of aeronautical information publications, as specified in Annexes 4 and 15 to the Convention);

m) pavement surface type and bearing strength using the Aircraft Classification Number - Pavement Classification Number method;

n) one or more pre-flight altimeter check locations established on an apron and their elevation;

o) declared distances: take-off run available, take-off distances available, accelerate-stop distance available, landing distance available;

p) disabled aircraft removal plan: the telephone/telex/ facsimile number and e-mail address of the aerodrome coordinator for the removal of a disabled aircraft on or adjacent to the movement area, information on the capability to remove a disabled aircraft, expressed in terms of the largest type of aircraft which the aerodrome is equipped to remove; and

q) rescue and fire-fighting; the level of protection provided, expressed in terms of the category of the rescue and firefighting services, which should be in accordance with the longest aircraft normally using the aerodrome and the type and amounts of extinguishing agents normally available at the aerodrome. Note: - the accuracy of the information in Part 3 is critical to aircraft safety. Information requiring engineering survey and assessment should be gathered or verified by qualified technical persons.
14.4.0 PART 4: PARTICULARS OF THE AERODROME OPERATING PROCEDURES AND SAFETY MEASURES 1.

14.4.1 Aerodrome reporting Particulars of the procedures for reporting any changes to the aerodrome information set out in the Aeronautical Information Publication and Aeronautical Information Circular and procedures for requesting the issue of NOTAMs, including the following –

a) arrangements for reporting any changes to the Authority and recording the reporting of changes during and outside the normal hours of aerodrome operations;

b) the names and roles of persons responsible for notifying the changes, and their telephone numbers during and outside the normal hours of aerodrome operations; and

c) the address and telephone and facsimile numbers, as provided by the Authority, of the place where changes are to be reported to the Authority.

14.4.2 Access to the aerodrome movement area Particulars of the procedures that have been developed and are to be followed in coordination with the agency responsible for preventing unlawful interference in civil aviation at the aerodrome and for preventing unauthorized entry of persons, vehicles, equipment, animals or other things into the movement area, including the following –

a) the role of the operator, the aircraft operator, aerodrome fixed-base operator, the aerodrome security entity, the Authority and other government departments, as applicable; and

b) the personnel responsible for controlling access to the aerodrome, and the telephone numbers for contacting them during and after working hours.

14.4.3 Aerodrome emergency plan Particulars of the aerodrome emergency plan, including the following-

a) plans for dealing with emergencies occurring at the aerodrome or in its vicinity, including the malfunction of aircraft in flight; structural fires; sabotage, including bomb threats (aircraft or structure); unlawful seizure of aircraft; and incidents on the aerodrome covering “during the emergency” and “after the emergency” considerations;

b) details of test and aerodrome facilities and equipment to be used in emergencies, including the frequency of those tests;
c) details of exercises to test emergency plans, including the frequency of those exercises;
d) a list of organizations, agencies and persons of authority, both on-and/off-aerodrome, for site roles; their telephone and facsimile numbers, e-mail addresses and the radio frequencies of their offices;
e) the establishment of an aerodrome emergency committee to organize training and other preparations for dealing with emergencies; and
f) the appointment of an on-scene commander for the overall emergency operation.

14.4.4 Rescue and fire-fighting

Particulars of the facilities, equipment, personnel and procedures for meeting the rescue and fire-fighting requirements, including the names and roles of the persons responsible for dealing with the rescue and fire-fighting services at the aerodrome.

14.4.5 Inspection of the aerodrome movement area and obstacle limitation surfaces by the operator

Particulars of the procedures for the inspection of the aerodrome movement area and obstacle limitation surfaces, including the following –

a) arrangements for carrying out inspections, including runway friction and water-depth measurements on runways and taxiways, during and outside the normal hours of aerodrome operations;
b) arrangements and means of communicating with air traffic control during an inspection;
c) arrangements for keeping an inspection logbook, and the location of the logbook;
d) details of inspection intervals and times;
e) inspection checklist;
f) arrangements for reporting the results of inspections and for taking prompt follow-up actions to ensure correction of unsafe conditions; and
g) the names and roles of persons responsible for carrying out inspections, and their telephone numbers during and after working hours.

14.4.6 Visual aids and aerodrome electrical systems

Particulars of the procedures for the inspection and maintenance of aeronautical
lights (including obstacle lighting), signs, markers and aerodrome electrical systems, including the following -

a) arrangements for carrying out inspections during and outside the normal hours of aerodrome operation, and the checklist for such inspections;

b) arrangements for recording the result of inspections and for taking follow-up action to correct deficiencies;

c) arrangements for carrying out routine maintenance and emergency maintenance;

d) arrangements for secondary power supplies and, if applicable, the particulars of any other method of dealing with partial or total system failure; and

e) personnel responsible for the inspection and maintenance of the lighting, and the telephone numbers for contacting those persons during and after working hours.

14.4.7 Maintenance of the movement area

Particulars of the facilities and procedures for the maintenance of the movement area, including arrangements for –

a) maintaining the paved areas;

b) maintaining the unpaved runways and taxiways;

c) maintaining the runway and taxiway strips; and

d) the maintenance of aerodrome drainage.

14.4.8 Aerodrome works - safety

Particulars of the procedures for planning and carrying out construction and maintenance work safely (including work that may have to be carried out at short notice) on or in the vicinity of the movement area which may extend above an obstacle limitation surface, including the following –

a) arrangements for communicating with air traffic control during the progress of such work;

b) the names, telephone numbers and roles of the persons and organizations responsible for planning and carrying out the work, and arrangements for contacting those persons and organizations at all times;

c) the names and telephone numbers, during and after working hours, of the aerodrome fixed-base operators, ground handling agents and aircraft operators who are to be notified of the work;

d) a distribution list for work plans, if required.
14.4.9 Apron management Particulars of the apron management procedures, including the following –
   a) arrangements between air traffic control and the apron management unit;
   b) arrangements for allocating aircraft parking positions;
   c) arrangements for initiating engine start and ensuring clearance of aircraft push-back;
   d) marshalling service; and
   e) leader (van) service.

14.4.10 Apron safety management Procedures to ensure apron safety, including –
   a) protection from jet blasts;
   b) enforcement of safety precautions during aircraft refuelling operations;
   c) apron sweeping;
   d) apron cleaning;
   e) arrangements for reporting incidents and accidents on an apron; and
   f) arrangements for auditing the safety compliance of all personnel working on the apron.

14.4.11 Airside vehicle control Particulars of the procedure for the control of surface vehicles operating on or in the vicinity of the movement area, including the following –
   a) details of the applicable traffic rules (including speed limits and the means of enforcing the rules);
   b) the method of issuing driving permits for operating vehicles in the movement area.

14.4.12 Birds and wildlife hazard management Particulars of the procedures to deal with the danger posed to aircraft operations by the presence of birds or mammals in the aerodrome flight pattern or movement area, including the following –
   a) arrangements for assessing birds and wildlife hazards;
   b) arrangements for implementing birds and wildlife control programmes; and
   c) the names and roles of the persons responsible for dealing with birds and wildlife hazards, and their telephone numbers during and after working hours.

14.4.13 Obstacle control Particulars setting out the procedures for –
a) monitoring the obstacle limitation surfaces and type A chart for obstacles in the take-off surface;
b) controlling obstacles within the authority of the operator;
c) monitoring the height of buildings or structures within the boundaries of the obstacle limitation surfaces;
d) controlling new developments in the vicinity of aerodromes; and
e) notifying the Authority of the nature and location of obstacles and subsequent addition of removal of obstacles for action as necessary, including amendment of the Aeronautical Information Services publications.

14.4.14 Removal of disabled aircraft Particulars of the procedures for removing a disabled aircraft on or adjacent to the movement area, including the following –
a) the roles of the operator and the holder of the aircraft operator certificate.
b) arrangements for notifying the aircraft operator.
c) arrangements for liaising with the air traffic control unit;
d) arrangements for obtaining equipment and personnel to remove the disabled aircraft; and
e) role and telephone numbers of personnel responsible for arranging for the action as necessary, including amendment of the AIS publications.

14.4.15 Handling of hazardous materials (1) Particulars of the procedures for the safe handling and storage of hazardous materials on the aerodrome, including the following –
a) arrangements for special areas of the aerodrome to be set up for the storage of inflammable liquids (including aviation fuels) and any other hazardous materials; and
b) the method to be followed for the delivery storage, dispensing and handling of hazardous materials.
c) For the purposes of this paragraph “hazardous materials” include inflammable liquids and solids, corrosive liquids, compressed gases and magnetized or radioactive materials.

14.4.16 Low visibility operations Particulars of procedures to be introduced for low-visibility operations, including the measurement and reporting of runway visual range as and when required, and the
personnel, their telephone numbers, responsible for measuring the Runway Visual Range.

14.4.17 Protection of sites for radar and navigational aids Particulars of the procedures for the protection of sites for radar and radio navigational aids located on the aerodrome to ensure that their performance will not be degraded, including the following:

a) arrangements for the control of activities in the vicinity of radar and navigational aids installations;
b) arrangements for ground maintenance in the vicinity of these installations; and
c) arrangements for the supply and installation of signs warning of hazardous microwave radiation.

Note 1. In writing the procedures for each category, clear and precise information should be included on - -

(i) when, or in what circumstances, an operating procedure is to be activated; -
(ii) how an operating procedure is to be activated; -
(iii) actions to be taken; -
(iv) the equipment necessary for carrying out the actions, and access to such equipment.

Note 2. If any of the procedures specified above are not relevant or applicable, reasons should be given.

14.5.0 PART 5: AERODROME ADMINISTRATION AND SAFETY MANAGEMENT SYSTEM 1.

14.5.1 Aerodrome administration Particulars of the aerodrome administration, including the following

a) an aerodrome organizational chart showing the names and positions of key personnel, including their responsibilities;
b) the name, position and telephone number of the person who has overall responsibility for aerodrome safety; and
c) airport committees.

14.5.2 Safety Management System Particulars of the safety management system established for ensuring compliance with all safety requirements and achieving continuous improvement in safety performance, the essential features being –

a) the safety policy, in so far as applicable, on the safety management process and its relation to the operational and maintenance process;
b) the structure or organization of the Safety Management System, including staffing and the assignment of individual and group responsibilities for safety issues;

c) Safety Management System strategy and planning, such as setting safety performance target, allocating priorities for implementing safety initiative and providing a framework for controlling the risks to as low a level as is reasonably practicable keeping always in view the requirements of the prescribed standards and recommended practice, and regulations;

d) Safety Management System implementation, including facilities, methods and procedures for the effective communication of safety messages and the enforcement of safety requirements;

e) a system for the implementation of, and action on, critical safety areas which require a higher level of safety management integrity (safety measures programme);

f) measures for safety promotion and accident prevention and a system for risk control involving analysis and handling of accidents, incidents, complaints, defects, faults, discrepancies and failures, and continuing safety monitoring.

g) the internal safety audit and review system detailing the systems and programmes for quality control of safety;

h) the system for documenting all safety-related aerodrome facilities as well as airport operational and maintenance records, including information on the design and construction of aircraft payments and aerodrome lighting. The system should enable easy retrieval of records including charts;

i) personnel training and competency, including the review and evaluation of the adequacy of training provided to personnel on safety-related duties and of the certification system for testing their competency; and

j) the incorporation and enforcement of safety-related clauses in the contract for construction work at the aerodrome.

APPENDIX 1.
COLOURS FOR AERONAUTICAL GROUND LIGHTS, MARKINGS, SIGNS AND PANELS

1. General

Introductory Note.—The following specifications define the chromaticity limits of colours to be used for aeronautical ground lights, markings, signs and panels. The specifications are in accord with the 1983 specifications of the International Commission on Illumination (CIE).

It is not possible to establish specifications for colours such that there is no possibility of confusion. For reasonably certain recognition, it is important that the eye illumination be well above the threshold of perception, that the colour not be greatly modified by selective atmospheric attenuations and that the observer’s colour vision be adequate. There is also a risk of confusion of colour at an extremely high level of eye illumination such as may be obtained from a high intensity source at very close range. Experience indicates that satisfactory recognition can be achieved if due attention is given to these factors.

The chromaticities are expressed in terms of the standard observer and coordinate system adopted by the International Commission on Illumination (CIE) at its Eighth Session at Cambridge, England, in 1931.*

2. Colours for aeronautical ground lights

2.1 Chromaticities

2.1.1 The chromaticities of aeronautical ground lights shall be within the following boundaries:

CIE Equations (see Figure A1-1):

a) Red
   Purple boundary $y = 0.980 - x$
   Yellow boundary $y = 0.335$

b) Yellow
   Red boundary $y = 0.382$
   White boundary $y = 0.790 - 0.667x$
   Green boundary $y = x - 0.120$

c) Green
   Yellow boundary $x = 0.360 - 0.080y$
   White boundary $x = 0.650y$
   Blue boundary $y = 0.390 - 0.171x$
d) Blue

Green boundary \( y = 0.805x + 0.065 \)
White boundary \( y = 0.400 - x \)
Purple boundary \( x = 0.600y + 0.133 \)

e) White

1) Incandescent

Yellow boundary \( x = 0.500 \)
Blue boundary \( x = 0.285 \)
Green boundary \( y = 0.440 \)

and \( y = 0.150 + 0.640x \)

Purple boundary \( y = 0.050 + 0.750x \)

and \( y = 0.382 \)

2) LED

Yellow boundary \( x = 0.440 \)
Blue boundary \( x = 0.320 \)
Green boundary \( y = 0.150 + 0.643x \)
Purple boundary \( y = 0.050 + 0.757x \)

f) Variable white

Yellow boundary \( x = 0.255 + 0.750y \)

and \( x = 1.185 - 1.500 y \)

Blue boundary \( x = 0.285 \)

Green boundary \( y = 0.440 \)

and \( y = 0.150 + 0.640x \)

Purple boundary \( y = 0.050 + 0.750x \)

and \( y = 0.382 \)

Note. — Guidance on chromaticity changes resulting from the effect of temperature on filtering elements is given in the Aerodrome Design Manual (Doc 9157), Part 4.

2.1.2 Recommendation. — Where dimming is not required, or where observers with defective colour vision must be able to determine the colour of the light, green signals should be within the following boundaries:

Yellow boundary \( y = 0.726 - 0.726x \)
White boundary \( x = 0.650y \)
Blue boundary \( y = 0.390 - 0.171x \)

2.1.3 Recommendation. — Where increased certainty of recognition is more important than maximum visual range, green signals should be within the following boundaries:
2.2 Discrimination between lights

2.2.1 **Recommendation.**— If there is a requirement to discriminate yellow and white from each other, they should be displayed in close proximity of time or space as, for example, by being flashed successively from the same beacon.

2.2.2 **Recommendation.**— If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centre line lights, the y coordinates of the yellow light should not exceed a value of 0.40.

*Note.* — The limits of white have been based on the assumption that they will be used in situations in which the characteristics (colour temperature) of the light source will be substantially constant.

2.2.3 **Recommendation.**— The colour variable white is intended to be used only for lights that are to be varied in intensity, e.g. to avoid dazzling. If this colour is to be discriminated from yellow, the lights should be so designed and operated that:

a) the x coordinate of the yellow is at least 0.050 greater than the x coordinate of the white; and

b) the disposition of the lights will be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

2.2.4 The colour of aeronautical ground lights shall be verified as being within the boundaries specified in Figure A1-1 by measurement at five points within the area limited by the innermost isocandela curve (isocandela diagrams in Appendix 2 refer), with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the colour measurements shall be taken at the centre and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the colour measurements shall be taken at the centre and the limits of the diagonals (corners). In addition, the colour of the light shall be checked at the outermost isocandela curve to ensure that there is no colour shift that might cause signal confusion to the pilot.
Note 1.— For the outermost isocandela curve, a measurement of colour coordinates should be made and recorded for review and judgement of acceptability by the appropriate authority.

Note 2.— Certain light units may have application so that they may be viewed and used by pilots from directions beyond that of the outermost isocandela curve (e.g. stop bar lights at significantly wide runway-holding positions). In such instances, the appropriate authority should assess the actual application and if necessary require a check of colour shift at angular ranges beyond the outermost curve.

2.2.5 In the case of visual approach slope indicators and other light units having a colour transition sector, the colour shall be measured at points in accordance with 2.2.4, except that the colour areas shall be treated separately and no point shall be within 0.5 degrees of the transition sector.

3. **Colours for markings, signs and panels**

   Note 1.— The specifications of surface colours given below apply only to freshly coloured surfaces. Colours used for markings, signs and panels usually change with time and therefore require renewal.


   Note 3.— The specifications recommended in 3.4 for transilluminated panels are interim in nature and are based on the CIE specifications for transilluminated signs. It is intended that these specifications will be reviewed and updated as and when CIE develops specifications for transilluminated panels.

3.1 The chromaticities and luminance factors of ordinary colours, colours of retroreflective materials and colours of transilluminated (internally illuminated) signs and panels shall be determined under the following standard conditions:

   a) angle of illumination: 45°;
   b) direction of view: perpendicular to surface; and
   c) illuminant: CIE standard illuminant D65.

3.2 **Recommendation.**— The chromaticity and luminance factors of ordinary colours for markings and externally illuminated signs and
panels should be within the following boundaries when determined under standard conditions. CIE Equations (see Figure A12):

a) Red

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>$y = 0.345 - 0.051x$</td>
</tr>
<tr>
<td>White</td>
<td>$y = 0.910 - x$</td>
</tr>
<tr>
<td>Orange</td>
<td>$y = 0.314 + 0.047x$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.07 \text{ (mnm)}$</td>
</tr>
</tbody>
</table>

b) Orange

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>$y = 0.285 + 0.100x$</td>
</tr>
<tr>
<td>White</td>
<td>$y = 0.940 - x$</td>
</tr>
<tr>
<td>Yellow</td>
<td>$y = 0.250 + 0.220x$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.20 \text{ (mnm)}$</td>
</tr>
</tbody>
</table>

c) Yellow

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>$y = 0.108 + 0.707x$</td>
</tr>
<tr>
<td>White</td>
<td>$y = 0.910 - x$</td>
</tr>
<tr>
<td>Green</td>
<td>$y = 1.35x - 0.093$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.45 \text{ (mnm)}$</td>
</tr>
</tbody>
</table>

d) White

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>$y = 0.010 + x$</td>
</tr>
<tr>
<td>Blue</td>
<td>$y = 0.610 - x$</td>
</tr>
<tr>
<td>Green</td>
<td>$y = 0.030 + x$</td>
</tr>
<tr>
<td>Yellow</td>
<td>$y = 0.710 - x$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.75 \text{ (mnm)}$</td>
</tr>
</tbody>
</table>

e) Black

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>$y = x - 0.030$</td>
</tr>
<tr>
<td>Blue</td>
<td>$y = 0.570 - x$</td>
</tr>
<tr>
<td>Green</td>
<td>$y = 0.050 + x$</td>
</tr>
<tr>
<td>Yellow</td>
<td>$y = 0.740 - x$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.03 \text{ (max)}$</td>
</tr>
</tbody>
</table>

f) Yellowish green

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>$y = 1.317x + 0.4$</td>
</tr>
<tr>
<td>White</td>
<td>$y = 0.910 - x$</td>
</tr>
<tr>
<td>Yellow</td>
<td>$y = 0.867x + 0.4$</td>
</tr>
</tbody>
</table>

g) Green

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>$x = 0.313$</td>
</tr>
<tr>
<td>White</td>
<td>$y = 0.243 + 0.670x$</td>
</tr>
<tr>
<td>Blue</td>
<td>$y = 0.493 - 0.524x$</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>$\beta = 0.10 \text{ (mnm)}$</td>
</tr>
</tbody>
</table>
Note. — The small separation between surface red and surface orange is not sufficient to ensure the distinction of these colours when seen separately.

3.3.0 Recommendation. — The chromaticity and luminance factors of colours of retroreflective materials for markings, signs and panels should be within the following boundaries when determined under standard conditions. CIE Equations (see Figure A13):

a) Red

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>( y = 0.345 - 0.051x )</td>
</tr>
<tr>
<td>White</td>
<td>( y = 0.910 - x )</td>
</tr>
<tr>
<td>Orange</td>
<td>( y = 0.314 + 0.047x )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.03 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>

b) Orange

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>( y = 0.265 + 0.205x )</td>
</tr>
<tr>
<td>White</td>
<td>( y = 0.910 - x )</td>
</tr>
<tr>
<td>Yellow</td>
<td>( y = 0.207 + 0.390x )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.14 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>

c) Yellow

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>( y = 0.160 + 0.540x )</td>
</tr>
<tr>
<td>White</td>
<td>( y = 0.910 - x )</td>
</tr>
<tr>
<td>Green</td>
<td>( y = 1.35x - 0.093 )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.16 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>

d) White

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>( y = x )</td>
</tr>
<tr>
<td>Blue</td>
<td>( y = 0.610 - x )</td>
</tr>
<tr>
<td>Green</td>
<td>( y = 0.040 + x )</td>
</tr>
<tr>
<td>Yellow</td>
<td>( y = 0.710 - x )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.27 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>

e) Blue

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>( y = 0.118 + 0.675x )</td>
</tr>
<tr>
<td>White</td>
<td>( y = 0.370 - x )</td>
</tr>
<tr>
<td>Purple</td>
<td>( y = 1.65x - 0.187 )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.01 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>

f) Green

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>( y = 0.711 - 1.22x )</td>
</tr>
<tr>
<td>White</td>
<td>( y = 0.243 + 0.670x )</td>
</tr>
<tr>
<td>Blue</td>
<td>( y = 0.405 - 0.243x )</td>
</tr>
<tr>
<td>Luminance factor</td>
<td>( \beta = 0.03 \text{ (mmn)} )</td>
</tr>
</tbody>
</table>
3.4 **Recommendation.**— The chromaticity and luminance factors of colours for luminescent or transilluminated (internally illuminated) signs and panels should be within the following boundaries when determined under standard conditions. CIE Equations (see Figure A1-4):

a) Red

Purple boundary \[ y = 0.345 - 0.051x \]
White boundary \[ y = 0.910 - x \]
Orange boundary \[ y = 0.314 + 0.047x \]
Luminance factor \[ \beta = 0.07 \text{ (mnm)} \]
(day condition)
Relative luminance to white (night condition) 5% (mnm)

b) Yellow

Orange boundary \[ y = 0.108 + 0.707x \]
White boundary \[ y = 0.910 - x \]
Green boundary \[ y = 1.35x - 0.093 \]
Luminance factor \[ \beta = 0.45 \text{ (mnm)} \]
(day condition)
Relative luminance to white (night condition) 30% (mnm)

30% (mnm)

30% (mnm)

30% (mnm)

30% (mnm)

30% (mnm)

30% (mnm)

30% (mnm)

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30% (mnm)

30% (mnm)
e) Green

Yellow boundary: $x = 0.313$
White boundary: $y = 0.243 + 0.670x$
Blue boundary: $y = 0.493 - 0.524x$
Luminance factor: $\beta = 0.10$ minimum (day conditions)
Relative luminance: 5% (minimum) to white (night condition) 30% (maximum)
Figure A1.2. Ordinary colours for markings and externally illuminated signs and panels.
Figure A1-3  Colours of retro-reflective materials for markings, signs and panels
Figure A1–4. Colours of transilluminated (internally illuminated) signs and panels
APPENDIX 2.
AERONAUTICAL GROUND LIGHT CHARACTERISTICS

Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

<table>
<thead>
<tr>
<th></th>
<th>7.0</th>
<th>11.5</th>
<th>16.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>5.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

2. Toe-in 2 degrees

3. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

   distance from threshold   vertical main beam coverage
   threshold to 115 m         0.5° — 10.5°
   116 m to 215 m            1° — 11°
   216 m and beyond          1.5° — 11.5° (as illustrated above)

4. See collective notes for Figures A2-1 to A2-11.

Figure A2-2. Isocandela diagram for approach side row light (red light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>5.5</th>
<th>7.5</th>
<th>9.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>4.5</td>
<td>6.0</td>
<td>8.5</td>
<td></td>
</tr>
</tbody>
</table>

2. Toe-in 3.5 degrees

3. See collective notes for Figures A2-1 to A2-11.

Figure A2-3. Isocandela diagram for threshold light (green light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

<table>
<thead>
<tr>
<th></th>
<th>7.0</th>
<th>11.5</th>
<th>16.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>5.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

2. Toe-in 2 degrees

3. See collective notes for Figures A2-1 to A2-11.

Figure A2-4. Isocandela diagram for threshold wing bar light (green light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

2. Toe-in 4 degrees

3. See collective notes for Figures A2-1 to A2-11

Figure A2-5. Isocandela diagram for touchdown zone light (white light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

<table>
<thead>
<tr>
<th>a</th>
<th>5.0</th>
<th>7.0</th>
<th>8.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>3.5</td>
<td>6.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

2. For red light, multiply values by 0.15.

3. For yellow light, multiply values by 0.40.

4. See collective notes for Figures A2-1 to A2-11.

Figure A2-6. Isocandela diagram for runway centre line light with 30 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)
Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

2. For red light, multiply values by 0.15.

3. For yellow light, multiply values by 0.40.

4. See collective notes for Figures A2-1 to A2-11.

Figure A2-7. Isocandela diagram for runway centre line light with 15 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light).
Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

2. See collective notes for Figures A2-1 to A2-11.

Figure A2-8: Isocandela diagram for runway end light (red light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

2. Toe-in 3.5 degrees

3. For red light, multiply values by 0.15.

4. For yellow light, multiply values by 0.40.

5. See collective notes for Figures A2-1 to A2-11.

Figure A2-9. Isocandela diagram for runway edge light where width of runway is 45 m (white light)
Notes:

1. Curves calculated on formula \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

2. Toe-in 4.5 degrees

3. For red light, multiply values by 0.15.

4. For yellow light, multiply values by 0.40.

5. See collective notes for Figures A2.1 to A2.11.

Figure A2.10 Incandela diagram for runway edge light where width of runway is 60 m (white light)
Collective notes to Figures A2-1 to A2-11

1. The ellipses in each figure are symmetrical about the common vertical and horizontal axes.

2. Figures A2-1 to A2-10 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. 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:
5. The beam coverage 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. Those 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) and stop bar lights in straight sections intended for use 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) and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m.
Notes:

1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.
2. See collective notes for Figures A2-12 to A2-21.

Figure A2-14. Isocandela diagram for taxiway centre line (7.5 m spacing) and stop bar lights in curved sections intended for use in runway visual range conditions of less than a value of 350 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) and stop bar lights in straight sections intended for use in runway visual range conditions of 350 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) and stop bar lights in curved sections intended for use in runway visual range conditions of 350 m or greater.
Curve | a | b | c | d | e  
--- | --- | --- | --- | --- | ---  
Intensity (cdl) | 8 | 20 | 100 | 450 | 1,800  

Notes:

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.

2. See collective notes for Figures A2-12 to A2-21.

Figure A2-17. Iso-candle diagram for high-intensity taxiway centre line (15 m spacing) and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required and where large offsets can occur.
Figure A2.18. Iso-candela diagram for high-intensity taxiway centre line (15 m spacing) and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required.
Figure A2-19. Isocandela diagram for high-intensity taxiway centre line (7.5 m spacing) and stop bar lights in curved sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required.
Figure A2-20. Isocandela diagram for high-intensity runway guard lights, Configuration B

Figure A2-21. Grid points to be used for calculation of average intensity of taxiway centre line and stop bar lights
Collective notes to Figures A2-12 to A2-21

1. The intensities specified in Figures A2-12 to A2-20 are in green and yellow light for taxiway centre line lights, yellow light for runway guard lights and red light for stop bar lights.

2. Figures A2-12 to A2-20 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-21 and using the intensity values measured at all grid points located within and on the perimeter of the rectangle representing the main beam. The average value is the arithmetic average of the light intensities measured at all considered grid points.

3. No deviations are acceptable in the main beam or in the innermost beam, as applicable, when the lighting fixture is properly aimed.

4. Horizontal angles are measured with respect to the vertical plane through the taxiway centre line except on curves where they are measured with respect to the tangent to the curve.

5. Vertical angles are measured from the longitudinal slope of the taxiway surface.

6. The importance of adequate maintenance cannot be over-emphasized. The intensity, either average where applicable or as specified on the corresponding luminance curves, should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.

7. The light unit shall be installed so that the main beam or the innermost beam, as applicable, is aligned within one-half degree of the specified requirement.

Figure A2-22. Light intensity distribution of T-VASIS and AT-VASIS
Note 1.— Those curves are for minimum intensities in red light.

Note 2.— The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.

Note 3.— The intensity values shown in brackets are for APAPI.

Figure A2-23. Light intensity distribution of PAPI and APAPI
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
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 A2-25. Isocandela diagram for each light in high-intensity runway guard lights, Configuration A.
APPENDIX 3.

MANDATORY INSTRUCTION MARKINGS AND INFORMATION MARKINGS

Note 1. — See Chapter 5, Sections 5.3.16 and 5.2.17 for specifications on the application, location and characteristics of mandatory instruction markings and information markings.

Note 2. — This appendix details the form and proportions of the letters, numbers and symbols of mandatory instruction markings and information markings on a 20 cm grid.
YZ12
3456
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.

<table>
<thead>
<tr>
<th>Runway code number</th>
<th>Minimum character height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mandatory instruction sign</td>
</tr>
<tr>
<td>1 or 2</td>
<td>300 mm</td>
</tr>
<tr>
<td>3 or 4</td>
<td>400 mm</td>
</tr>
</tbody>
</table>

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
     - 200 mm 32 mm
     - 300 mm 48 mm
     - 400 mm 64 mm

3. Stroke width for single letter shall be as follows:

   - Legend height
     - 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 the 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, 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.

10. The face height of signs shall be as follows:

<table>
<thead>
<tr>
<th>Legend height</th>
<th>Face height (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mm</td>
<td>400 mm</td>
</tr>
<tr>
<td>300 mm</td>
<td>600 mm</td>
</tr>
<tr>
<td>400 mm</td>
<td>800 mm</td>
</tr>
</tbody>
</table>

11. The face width of signs shall be determined using Figure A4-3 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 the Aerodrome Design Manual (Doc 9157), Part 4.*

12. 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. The colours of signs shall be in accordance with the appropriate specifications in Appendix 1.
Note 1. — The average luminance of a sign is calculated by establishing grid points on a sign face showing typical inscriptions and a background of the appropriate colour (red for mandatory instruction signs and yellow for direction and destination signs) as follows:

a) Starting at the top left corner of the sign face, establish a reference grid point at 7.5 cm from the left edge and the top of the sign face.

b) Create a grid of 15 cm spacing horizontally and vertically from the reference grid point. Grid points within 7.5 cm of the edge of the sign face shall be excluded.

c) Where the last point in a row/column of grid points is located between 22.5 cm and 15 cm from the edge of the sign face (but not inclusive), an additional point shall be added 7.5 cm from this point.

d) Where a grid point falls on the boundary of a character and the background, the grid point shall be slightly shifted to be completely outside the character.

Note 2. — Additional grid points may be required to ensure that each character includes at least five evenly spaced grid points.

Note 3. — Where one unit includes two types of signs, a separate grid shall be established for each type.

Figure A4-1. Grid points for calculating average luminance of a sign
Figure A4-2. Forms of characters
Runway vacated sign

Note.— Existing NO ENTRY signs not conforming to these dimensions are to be replaced not later than 1 January 2012.

NO ENTRY sign
Note 1.—The arrow stroke width, diameter of the dot, and both width and length of the dash shall be proportioned to the character stroke widths.

Note 2.—The dimensions of the arrow shall remain constant for a particular sign size, regardless of orientation.

Figure A4-2.

Figure A4-3. Sign dimensions
## APPENDIX 5

### a) Letter to letter code number

<table>
<thead>
<tr>
<th>Preceding Letter</th>
<th>Following Letter</th>
<th>Code number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B, D, E, F,</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>M, N, P, R, U</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A, J, T, V,</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>V, W, V</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>H, I, K, L</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>G, O, S, X, Z</td>
<td>3</td>
</tr>
</tbody>
</table>

### b) Numerical to numerical code number

<table>
<thead>
<tr>
<th>Preceding Numerical</th>
<th>Following Number</th>
<th>Code number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5, 6</td>
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<tr>
<td></td>
<td>8, 9</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
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<td></td>
<td>3</td>
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<td>2</td>
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<td>5</td>
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<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

### d) Width of letter

<table>
<thead>
<tr>
<th>Letter</th>
<th>Width (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>255</td>
</tr>
<tr>
<td>B</td>
<td>255</td>
</tr>
<tr>
<td>C</td>
<td>255</td>
</tr>
<tr>
<td>D</td>
<td>255</td>
</tr>
<tr>
<td>E</td>
<td>255</td>
</tr>
<tr>
<td>F</td>
<td>255</td>
</tr>
<tr>
<td>G</td>
<td>255</td>
</tr>
<tr>
<td>H</td>
<td>255</td>
</tr>
<tr>
<td>I</td>
<td>49</td>
</tr>
<tr>
<td>J</td>
<td>255</td>
</tr>
<tr>
<td>K</td>
<td>255</td>
</tr>
<tr>
<td>L</td>
<td>255</td>
</tr>
<tr>
<td>M</td>
<td>255</td>
</tr>
<tr>
<td>N</td>
<td>255</td>
</tr>
<tr>
<td>O</td>
<td>255</td>
</tr>
<tr>
<td>P</td>
<td>255</td>
</tr>
<tr>
<td>Q</td>
<td>255</td>
</tr>
<tr>
<td>R</td>
<td>255</td>
</tr>
<tr>
<td>S</td>
<td>255</td>
</tr>
<tr>
<td>T</td>
<td>255</td>
</tr>
<tr>
<td>U</td>
<td>255</td>
</tr>
<tr>
<td>V</td>
<td>255</td>
</tr>
<tr>
<td>W</td>
<td>255</td>
</tr>
<tr>
<td>X</td>
<td>255</td>
</tr>
<tr>
<td>Y</td>
<td>255</td>
</tr>
<tr>
<td>Z</td>
<td>255</td>
</tr>
</tbody>
</table>

### e) Numerical height

<table>
<thead>
<tr>
<th>Letter</th>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>9</td>
<td>32</td>
</tr>
</tbody>
</table>

### INSTRUCTIONS

1. To determine the proper SPACE between letters or numerals, obtain the code number from table a or b and enter table c for that code number to the desired letter or numerical height.
2. The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.75 of the height of the characters used except that when an arrow is located with a single character such as A, the space may be reduced to not less than one quarter of the height of the character in order to provide a good visual balance.
3. Where the numeral follows a letter or vice versa use Code 1.
4. Where a higher, dot, dot, diagonal strike follows a character or vice versa use Code 1.
### Table A5-1. Latitude and longitude

<table>
<thead>
<tr>
<th>Latitude and longitude</th>
<th>Accuracy Data type</th>
<th>Integrity Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome reference point</td>
<td>30 m surveyed/calculated</td>
<td>Routine</td>
</tr>
<tr>
<td>Navaids located at the aerodrome</td>
<td>3 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Obstacles in Area 3</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Obstacles in Area 2 (the part within the aerodrome boundary)</td>
<td>5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Runway thresholds</td>
<td>1 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Runway end (flight path alignment point)</td>
<td>1 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Runway centre line points</td>
<td>1 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Runway-holding position</td>
<td>0.5 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Taxiway centre line/parking guidance line points</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Taxiway intersection marking line</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Exit guidance line</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Apron boundaries (polygon)</td>
<td>1 m surveyed</td>
<td>Routine</td>
</tr>
<tr>
<td>Aircraft stand points/INS checkpoints</td>
<td>0.5 m surveyed</td>
<td>Routine</td>
</tr>
</tbody>
</table>

Note 1.— See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Note 2.— Implementation of Annex 15, provisions 10.1.4 and 10.1.6, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data.

### Table A5-2. Elevation/altitude/height

<table>
<thead>
<tr>
<th>Elevation/altitude/height</th>
<th>Accuracy Data type</th>
<th>Integrity Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome elevation</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>WGS-84 geoid undulation at aerodrome elevation position</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>---------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Runway threshold, non-precision approaches</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>WGS-84 geoid undulation at runway threshold, non-precision approaches</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Runway threshold, precision approaches</td>
<td>0.25 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>WGS-84 geoid undulation at runway threshold, precision approaches</td>
<td>0.25 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Runway centre line points</td>
<td>0.25 m surveyed</td>
<td>Critical</td>
</tr>
<tr>
<td>Taxiway centre line/parking guidance line points</td>
<td>1 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Obstacles in Area 2 (the part within the aerodrome boundary)</td>
<td>3 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Obstacles in Area 3</td>
<td>0.5 m surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Distance measuring equipment/precision (DME/P)</td>
<td>3 m surveyed</td>
<td>Essential</td>
</tr>
</tbody>
</table>

Note 1.— See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Note 2.— Implementation of Annex 15, provisions 10.1.4 and 10.1.6, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate advance planning for the collection and processing of such data.

**Table A5-3. Declination and magnetic variation**

<table>
<thead>
<tr>
<th>Declination/variation</th>
<th>Accuracy Data type</th>
<th>Integrity Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome magnetic variation</td>
<td>1 degree surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>ILS localizer antenna magnetic variation</td>
<td>1 degree surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>MLS azimuth antenna magnetic variation</td>
<td>1 degree surveyed</td>
<td>Essential</td>
</tr>
</tbody>
</table>

Table A5-4. Bearing

<table>
<thead>
<tr>
<th>Bearing</th>
<th>Accuracy Data type</th>
<th>Integrity Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILS localizer alignment</td>
<td>1/100 degree surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>MLS zero azimuth alignment</td>
<td>1/100 degree surveyed</td>
<td>Essential</td>
</tr>
<tr>
<td>Runway bearing (True)</td>
<td>1/100 degree surveyed</td>
<td>Essential</td>
</tr>
</tbody>
</table>

Table A5-5. Length/distance/dimension

<table>
<thead>
<tr>
<th>Length/ distance/dimension</th>
<th>Accuracy Data type</th>
<th>Integrity Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runway length</td>
<td>1 m surveyed</td>
<td>Critical</td>
</tr>
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<td>Runway width</td>
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APPENDIX 6.

LOCATION OF LIGHTS ON OBSTACLES

Note — High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level. If medium-intensity lighting is used, marking will also be required.

Figure A6-1. Medium-intensity flashing-white obstacle lighting system, Type A
Figure A6-2. Medium-intensity flashing-red obstacle lighting system, Type B

Note.—For night-time use only.
Note: For night-time use only.

Figure A6.3. Medium-intensity fixed-red obstacle lighting system, Type C
Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level. If medium intensity lighting is used, marking will also be required.

Figure A6-4. Median-intensity dual obstacle lighting system, Type A/Type B
Note.—High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level.
If medium-intensity lighting is used, marking will also be required.

Figure A6-5. Medium-intensity dual obstacle lighting system, Type A/Type C
Figure A6-6. High-intensity flashing-white obstacle lighting system, Type A
Figure A6-7. High-medium-intensity dual obstacle lighting system. Type A/Type B
Figure A6-8. High–medium-intensity dual obstacle lighting system, Type A/Type C
APPENDIX 7.

FRAMEWORK FOR SAFETY MANAGEMENT SYSTEMS (SMS)

This appendix specifies the framework for the implementation and maintenance of a safety management system (SMS) by a certified aerodrome. An SMS is a management system for the management of safety by an organization. The framework includes four components and twelve elements representing the minimum requirements for SMS implementation. The implementation of the framework shall be commensurate with the size of the organization and the complexity of the services provided. This appendix also includes a brief description of each element of the framework.

1. Safety policy and objectives
   1.1 Management commitment and responsibility
   1.2 Safety accountabilities
   1.3 Appointment of key safety personnel
   1.4 Coordination of emergency response planning
   1.5 SMS documentation

2. Safety risk management
   2.1 Hazard identification
   2.2 Safety risk assessment and mitigation

3. Safety assurance
   3.1 Safety performance monitoring and measurement
   3.2 The management of change
   3.3 Continuous improvement of the SMS

4. Safety promotion
   4.1 Training and education
   4.2 Safety communication

1. Safety policy and objectives
   1.1 Management commitment and responsibility
   The certified aerodrome shall define the organization’s safety policy which shall be in accordance with international and national requirements, and which shall be signed by the accountable executive of the organization. The safety policy shall
reflect organizational commitments regarding safety; shall include a clear statement about the provision of the necessary resources for the implementation of the safety policy; and shall be communicated, with visible endorsement, throughout the organization. The safety policy shall include the safety reporting procedures; shall clearly indicate which types of operational behaviours are unacceptable; and shall include the conditions under which disciplinary action would not apply. The safety policy shall be periodically reviewed to ensure it remains relevant and appropriate to the organization.

1.2 Safety accountabilities
The certified aerodrome shall identify the accountable executive who, irrespective of other functions, shall have ultimate responsibility and accountability, on behalf of the certified aerodrome, for the implementation and maintenance of the SMS. The certified aerodrome shall also identify the accountabilities of all members of management, irrespective of other functions, as well as of employees, with respect to the safety performance of the SMS. Safety responsibilities, accountabilities and authorities shall be documented and communicated throughout the organization, and shall include a definition of the levels of management with authority to make decisions regarding safety risk tolerability.

1.3 Appointment of key safety personnel
The certified aerodrome shall identify a safety manager to be the responsible individual and focal point for the implementation and maintenance of an effective SMS.

1.4 Coordination of emergency response planning
The certified aerodrome shall ensure that an emergency response plan that provides for the orderly and efficient transition from normal to emergency operations and the return to normal operations is properly coordinated with the emergency response plans of those organizations it must interface with during the provision of its services.

1.5 SMS documentation
The certified aerodrome shall develop an SMS implementation plan, endorsed by senior management of the organization that defines the organization’s approach to the management of safety in a manner that meets the organization’s safety objectives. The organization shall develop and maintain SMS documentation describing the safety policy and objectives, the SMS requirements, the SMS processes and procedures, the accountabilities, responsibilities and authorities for processes and procedures, and the SMS outputs. Also as part of the SMS documentation, the certified aerodrome shall develop and maintain a safety management system manual (SMSM), to communicate its approach to the management of safety throughout the organization.

2. Safety risk management
   2.1 Hazard identification
   The certified aerodrome shall develop and maintain a formal process that ensures that hazards in operations are identified. Hazard identification shall be based on a combination of reactive, proactive and predictive methods of safety data collection.

   2.2 Safety risk assessment and mitigation
   The certified aerodrome shall develop and maintain a formal process that ensures analysis, assessment and control of the safety risks in aerodrome operations.

3. Safety assurance
   3.1 Safety performance monitoring and measurement
   The certified aerodrome shall develop and maintain the means to verify the safety performance of the organization and to validate the effectiveness of safety risk controls. The safety performance of the organization shall be verified in reference to the safety performance indicators and safety performance targets of the SMS.

   3.2 The management of change
   The certified aerodrome shall develop and maintain a formal process to identify changes within the organization which may affect established processes and services; to describe the
arrangements to ensure safety performance before implementing changes; and to eliminate or modify safety risk controls that are no longer needed or effective due to changes in the operational environment.

3.3 Continuous improvement of the SMS
The certified aerodrome shall develop and maintain a formal process to identify the causes of substandard performance of the SMS, determine the implications of substandard performance of the SMS in operations, and eliminate or mitigate such causes.

4. Safety promotion
4.1 Training and education
The certified aerodrome shall develop and maintain a safety training programme that ensures that personnel are trained and competent to perform the SMS duties. The scope of the safety training shall be appropriate to each individual’s involvement in the SMS.

4.2 Safety communication
The certified aerodrome shall develop and maintain formal means for safety communication that ensures that all personnel are fully aware of the SMS, conveys safety-critical information, and explains why particular safety actions are taken and why safety procedures are introduced or changed.

APPENDIX 8.
# LIST OF RELATED REFERENCE DOCUMENTS

<table>
<thead>
<tr>
<th>No.</th>
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<tr>
<td>1</td>
<td>ICAO Annex 14 Vol. I</td>
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</table>
| 2   | ICAO Aerodrome Design Manual (Doc 9157)  
Part 1 – Runways  
Part 2 – Taxiways, Aprons and Holding Bays  
Part 3 – Pavements  
Part 4 – Visuals Aids  
Part 5 – Electrical Systems  
Part 6 – Frangibility |
| 3   | ICAO Airport Planning Manual (Doc 9184)  
Part 1 – Master Planning  
Part 2 – Land Use and Environment Control  
Part 3 – Guidelines for Consultant/Construction Services |
| 4   | ICAO Airport Services Manual (Doc 9137)  
Part 1 – Rescue and Fire Fighting  
Part 2 – Pavement Surface Conditions  
Part 3 – Bird Control and Reduction  
Part 4 – Fog Dispersal  
Part 5 – Removal of Disabled Aircraft  
Part 6 – Control of Obstacles  
Part 7 – Airport Emergency Planning  
Part 8 – Airport Operational Services  
Part 9 – Airport Maintenance Practices |
| 5   | ICAO Manual on ICAO Bird Strike Information System (Doc 9332) |
| 6   | ICAO Manual of Surface Movement Guidance and Control Systems (Doc 9476) |
ATTACHMENT A.

APPLICATION OF STANDARDS / REQUIREMENTS TO AERODROMES

1 General

1.0 Introduction
This Appendix provides guidance to aerodrome operators on the application of standards / requirements contained in the Manual of Aerodrome Standards.

1.1 Legislative background and applicability
1.1.1 The provisions of the Guyana Civil Aviation (Aerodromes) Regulations 2016, stipulates that the Authority may grant an Aerodrome Certificate and licence to an applicant if satisfied that the applicant’s aerodrome facilities, equipment and services comply with the requirements prescribed by the Authority.
1.1.2 These requirements are set out in the ‘Manual of Aerodrome Standards’ as requirements and are applicable to all operators of licensed or certified aerodromes in Guyana subject to any conditions as may be specified in the license or certificate.

1.2 Standards/Requirements
1.2.1 The Standards/Requirements in the context of the Manual of Aerodromes Standards are defined as follows:

a) **Standard/Requirements:** Any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which aerodrome operators shall conform. In the event of non-compliance with any standard, notification and justification (through appropriate risk assessment and aeronautical studies) to the Authority is compulsory.

b) **In the Manual of Aerodrome Standards the standards are identified by the words ‘must’ or ‘shall’. Unless otherwise exempted by the Authority, they shall be complied with at all times.**
Figures, appendices and tables associated with these standards form part of the main document and have the same status as the primary text. The Manual of Aerodrome Standards may also require standards from other documents to be followed. In such cases, the referred standards become part of the Manual.

1.3 Changes to aerodrome standards / requirements and their effects on existing aerodromes

1.3.1 Standards/Requirements are subject to change from time to time. In general, existing aerodrome facilities may not need to be immediately modified in accordance with new standards/requirements that arise, unless advance notice has been given for the aerodrome operator to comply. The Authority will determine and promulgate an appropriate time frame, depending on the critical nature of the requirement and other aerodrome operational considerations, for such revisions in standards/requirements to be applicable, so that they can be complied with by the aerodrome operators concerned.

1.3.2 Pursuant to paragraph 1.3.1 above, in the interim and unless otherwise directed by the Authority, an aerodrome operator’s existing facility that does not meet the new standards / requirements specified in the Manual must continue to comply with the standards / requirements that were applicable to it under the conditions of the issuance of its Aerodrome certificate.

1.3.3 At a certified aerodrome, an existing aerodrome facility that does not comply with the Manual of Aerodrome Standards must be identified and recorded in the respective Aerodrome Manual. It must include the date or period when that facility was first introduced or last upgraded and an indication from the aerodrome operator of a plan or timescale to bring the facility in compliance with the Manual. As part of the site safety audits conducted by the Authority, evidence to demonstrate efforts to implement the above mentioned plan or timescale may be required.

1.3.4 Other than existing aerodrome facilities and equipment that are allowed to continue to be in use, or exemptions granted to the aerodrome operator for specific cases of consideration, an aerodrome operator is expected to comply with the standards /requirements contained in the Manual of Aerodrome Standards when introducing a new aerodrome facility or equipment, or when
carrying out replacement or improvement works on an existing facility or equipment, unless the replacement or improvement works is limited to those of very minor nature.

1.4 Aeronautical studies
1.4.1 Where an aerodrome operator is not able to comply with any standard /requirements stipulated in the Manual, an aeronautical study may be conducted to assess the impact of deviations from the standards / requirements. The purpose of such studies is to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation.

1.4.2 An aeronautical study is most frequently undertaken during the planning of a new airport or new airport facility, or during the certification of an existing aerodrome. It may also be carried out when aerodrome standards / requirements cannot be met as a result of development.

1.4.3 An aeronautical study is a study of an aeronautical problem carried out by an aerodrome operator to identify possible solutions and select a solution that is acceptable without degrading safety. The Authority will review these studies on a case-by-case basis and determine their acceptability.

1.4.4 Technical analysis will provide justification for a deviation on the grounds that an equivalent level of safety can be attained by other means. It is generally applicable on situations where the cost of correcting a problem that violates a standard is excessive but where the unsafe effects of the problem can be overcome by some procedural or other means, which offer both practical and reasonable solutions.

1.4.5 In conducting a technical analysis, an aerodrome operator should draw upon their practical experience and specialized knowledge. The aerodrome operator may also consult other specialists in relevant areas. When considering alternative procedures in the deviation approval process, it is essential to bear in mind the safety objective of the aerodrome certification regulations and the applicable standards / requirements so that the intent of the regulations is not circumvented.

1.4.6 In some instances, the only reasonable means of providing an equivalent level of safety is to adopt suitable procedures and to
require, as a condition of certification, that cautionary advice be published in the appropriate AIS publications.

1.4.7 The determination to require caution will be primarily dependent on two considerations:
(i) a pilot’s need to be made aware of potentially hazardous conditions; and
(ii) the responsibility of the aerodrome operator to notify for publication deviations from standards / requirements that would otherwise be assumed under the certificate status.

1.5 Exemptions from aerodrome standards / requirements

1.5.1 When an aerodrome is not able to comply with any standard or recommended practice specified in the Manual of Aerodrome Standards the aerodrome operator may apply for exemptions from the relevant standard or / requirements. Applications must be supported, in writing, by cogent reasons including any aeronautical study conducted and their associated results, and where appropriate, an indication of when compliance with the current standards and/or can be expected.

1.5.2 The Authority may, after taking into account all safety-related aspects and operating circumstances, exempt, by notice (exemption notice or gazette notice as may be determined) in writing, an aerodrome operator from any provision of the aerodrome regulations, including compliance with any standard or / requirements prescribed in the Manual of Aerodrome Standards.

1.5.3 Any exemption granted by the Authority shall be subject to such conditions or procedures as may be specified in the relevant Aerodrome licence as being necessary in the interest of safety.

1.5.4 When an aerodrome does not comply with any standard specified in the Manual of Aerodrome Standards, the Authority may determine, after taking into consideration such aeronautical or other studies deemed fit, any condition or procedure necessary to ensure that the aerodrome attains a level of safety equivalent to that established by the standard or / requirements. In such cases, the aerodrome operator shall ensure that his aerodrome complies with any condition or procedure determined by the Authority.

1.5.5 As required by regulations, any deviation of an aerodrome from any standard shall be set out in an endorsement to the relevant Aerodrome licence.
1.5.6 Exemptions granted to an aerodrome operator must also be recorded in the Aerodrome Manual. The Aerodrome Manual must contain details of the exemption, reason that the exemption was requested for, any resultant limitations, conditions or procedures imposed, and other related safety information.

1.5.7 An exemption granted in respect of an existing facility shall continue to apply until its expiry date.

1.6 Conflict with other standards / requirements
1.6.1 Compliance with the standards / requirements specified in the Manual of Aerodrome Standards does not absolve an aerodrome operator from obligations in respect of requirements prescribed by other government or statutory authorities. Where another statutory requirement conflicts with the provisions of the Manual, the matter must be referred to the Authority for resolution.

1.7 Provisions for future larger aeroplanes
1.7.1 Nothing in the Manual of Aerodrome Standards is intended to inhibit the planning or provision of aerodrome facilities for larger aeroplanes that may be accommodated by the aerodrome at a later date. Appropriate additional safeguards may be taken into account to cater for more demanding aircraft that may be introduced at a later date. These relate mainly to minimum clearance requirements and guidance is given in ICAO Aerodrome Design Manual Parts 1 and 2. However, where movement area facilities are built for future larger aeroplanes, the aerodrome operator must liaise with the Authority to determine the interim notification of aeroplane reference code and maintenance arrangements.

1.7.2 It is the prerogative of aerodrome operators to select the appropriate aeroplane and aeroplane characteristics for master planning of their aerodromes. The Manual of Aerodrome Standards has included ICAO Code F specifications for aerodrome facilities intended for aeroplanes larger than B747 wide body jets.

ATTACHMENT B.

GUIDANCE MATERIAL SUPPLEMENTARY TO ANNEX 14, VOLUME I
1. **Number, siting and orientation of runways**

   **Siting and orientation of runways**

1.1 Many factors should be taken into account in the determination of the siting and orientation of runways. Without attempting to provide an exhaustive list of these factors nor an analysis of their effects, it appears useful to indicate those which most frequently require study. These factors may be classified under four headings:

1.1.1 *Type of operation.* Attention should be paid in particular to whether the aerodrome is to be used in all meteorological conditions or only in visual meteorological conditions, and whether it is intended for use by day and night, or only by day.

1.1.2 *Climatological conditions.* A study of the wind distribution should be made to determine the usability factor. In this regard, the following comments should be taken into account:

   a) Wind statistics used for the calculation of the usability factor are normally available in ranges of speed and direction, and the accuracy of the results obtained depends, to a large extent, on the assumed distribution of observations within these ranges. In the absence of any sure information as to the true distribution, it is usual to assume a uniform distribution since, in relation to the most favourable runway orientations; this generally results in a slightly conservative usability factor.

   b) The maximum mean crosswind components given in Chapter 3, 3.1.3, refer to normal circumstances. There are some factors which may require that a reduction of those maximum values be taken into account at a particular aerodrome. These include:

   1) the wide variations which may exist, in handling characteristics and maximum permissible crosswind components, among diverse types of aeroplanes (including future types) within each of the three groups given in 3.1.3;

   2) prevalence and nature of gusts;

   3) prevalence and nature of turbulence;

   4) the availability of a secondary runway;

   5) the width of runways;
6) the runway surface conditions — water, snow and ice on the runway materially reduce the allowable crosswind component; and

7) the strength of the wind associated with the limiting crosswind component. A study should also be made of the occurrence of poor visibility and/or low cloud base. Account should be taken of their frequency as well as the accompanying wind direction and speed.

1.1.3 Topography of the aerodrome site, its approaches, and surroundings, particularly:
   a) compliance with the obstacle limitation surfaces;
   b) current and future land use. The orientation and layout should be selected so as to protect as far as possible the particularly sensitive areas such as residential, school and hospital zones from the discomfort caused by aircraft noise. Detailed information on this topic is provided in the Airport Planning Manual (Doc 9184), Part 2, and in Guidance on the Balanced Approach to Aircraft Noise Management (Doc 9829);
   c) current and future runway lengths to be provided;
   d) construction costs; and
   e) possibility of installing suitable non-visual and visual aids for approach-to-land.

1.1.4 Air traffic in the vicinity of the aerodrome, particularly:
   a) proximity of other aerodromes or ATS routes;
   b) traffic density; and
   c) air traffic control and missed approach procedures.

Number of runways in each direction

1.2 The number of runways to be provided in each direction depends on the number of aircraft movements to be catered to.

2. Clearways and stopways

2.1 The decision to provide a stopway and/or a clearway as an alternative to an increased length of runway will depend on the physical characteristics of the area beyond the runway end, and on the operating performance requirements of the prospective aeroplanes. The runway, stopway and clearway lengths to be provided are determined by the aeroplane take-off performance, but a check should also be made of the landing distance required by
the aeroplanes using the runway to ensure that adequate runway length is provided for landing. The length of a clearway, however, cannot exceed half the length of take-off run available.

2.2 The aeroplane performance operating limitations require a length which is enough to ensure that the aeroplane can, after starting a take-off, either be brought safely to a stop or complete the take-off safely. For the purpose of discussion it is supposed that the runway, stopway and clearway lengths provided at the aerodrome are only just adequate for the aeroplane requiring the longest take-off and accelerate-stop distances, taking into account its take-off mass, runway characteristics and ambient atmospheric conditions. Under these circumstances there is, for each take-off, a speed, called the decision speed; below this speed, the take-off must be abandoned if an engine fails, while above it the take-off must be completed. A very long take-off run and take-off distance would be required to complete a take-off when an engine fails before the decision speed is reached, because of the insufficient speed and the reduced power available. There would be no difficulty in stopping in the remaining accelerate-stop distance available provided action is taken immediately. In these circumstances the correct course of action would be to abandon the take-off.

2.3 On the other hand, if an engine fails after the decision speed is reached, the aeroplane will have sufficient speed and power available to complete the take-off safely in the remaining take-off distance available. However, because of the high speed, there would be difficulty in stopping the aeroplane in the remaining accelerate-stop distance available.

2.4 The decision speed is not a fixed speed for any aeroplane, but can be selected by the pilot within limits to suit the accelerate-stop and take-off distance available, aeroplane take-off mass, runway characteristics and ambient atmospheric conditions at the aerodrome. Normally, a higher decision speed is selected as the accelerate-stop distance available increases.

2.5 A variety of combinations of accelerate-stop distances required and take-off distances required can be obtained to accommodate a particular aeroplane, taking into account the aeroplane take-off mass, runway characteristics, and ambient atmospheric conditions. Each combination requires its particular length of take-off run.
2.6 The most familiar case is where the decision speed is such that the take-off distance required is equal to the accelerate-stop distance required; this value is known as the balanced field length. Where stopway and clearway are not provided, these distances are both equal to the runway length. However, if landing distance is for the moment ignored, runway is not essential for the whole of the balanced field length, as the take-off run required is, of course, less than the balanced field length. The balanced field length can, therefore, be provided by a runway supplemented by an equal length of clearway and stopway, instead of wholly as a runway. If the runway is used for take-off in both directions, an equal length of clearway and stopway has to be provided at each runway end. The saving in runway length is, therefore, bought at the cost of a greater overall length.

2.7 In case economic considerations preclude the provision of stopway and, as a result, only runway and clearway are to be provided, the runway length (neglecting landing requirements) should be equal to the accelerate-stop distance required or the take-off run required, whichever is the greater. The take-off distance available will be the length of the runway plus the length of clearway.

2.8 The minimum runway length and the maximum stopway or clearway length to be provided may be determined as follows, from the data in the aeroplane flight manual for the aeroplane considered to be critical from the viewpoint of runway length requirements:

a) if a stopway is economically possible, the lengths to be provided are those for the balanced field length. The runway length is the take-off run required or the landing distance required, whichever is the greater. If the accelerate-stop distance required is greater than the runway length so determined, the excess may be provided as stopway, usually at each end of the runway. In addition, a clearway of the same length as the stopway must also be provided;

b) if a stopway is not to be provided, the runway length is the landing distance required, or if it is greater, the accelerate-stop distance required, which corresponds to the lowest practical value of the decision speed. The excess of the take-off distance required over the runway length may be provided as clearway, usually at each end of the runway.
2.9 In addition to the above consideration, the concept of clearways in certain circumstances can be applied to a situation where the take-off distance required for all engines operating exceeds that required for the engine failure case.

2.10 The economy of a stopway can be entirely lost if, after each usage, it must be regraded and compacted. Therefore, it should be designed to withstand at least a certain number of loadings of the aeroplane which the stopway is intended to serve without inducing structural damage to the aeroplane.

3. Calculating declared distances

3.1 The declared distances to be calculated for each runway direction comprise: the take-off run available (TORA), take-off distance available (TODA), accelerate-stop distance available (ASDA), and landing distance available (LDA).

3.2 Where a runway is not provided with a stopway or clearway and the threshold is located at the extremity of the runway, the four declared distances should normally be equal to the length of the runway, as shown in Figure A-1 (A).

3.3 Where a runway is provided with a clearway (CWY), then the TODA will include the length of clearway, as shown in Figure A-1 (B).

3.4 Where a runway is provided with a stopway (SWY), then the ASDA will include the length of stopway, as shown in Figure A-1 (C).

3.5 Where a runway has a displaced threshold, then the LDA will be reduced by the distance the threshold is displaced, as shown in Figure A-1 (D). A displaced threshold affects only the LDA for approaches made to that threshold; all declared distances for operations in the reciprocal direction are unaffected.

3.6 Figures A-1 (B) through A-1 (D) illustrate a runway provided with a clearway or a stopway or having a displaced threshold. Where more than one of these features exist, then more than one of the declared distances will be modified — but the modification will follow the same principle illustrated. An example showing a situation where all these features exist is shown in Figure A-1 (E).

3.7 A suggested format for providing information on declared distances is given in Figure A-1 (F). If a runway direction cannot be used for take-off or landing, or both, because it is operationally forbidden,
then this should be declared and the words “not usable” or the abbreviation “NU” entered.

4. **Slopes on a runway**

4.1 **Distance between slope changes**

The following example illustrates how the distance between slope changes is to be determined (see Figure A-2):

D for a runway where the code number is 3 should be at least:

\[ 15 \,000 \, (|x - y| + |y - z|) \, \text{m} \]

- \(|x - y|\) being the absolute numerical value of \(x - y\)
- \(|y - z|\) being the absolute numerical value of \(y - z\)

Assuming \(x = +0.01\)
Assuming \(y = -0.005\)
Assuming \(z = +0.005\)

then \(|x - y| = 0.015\)
then \(|y - z| = 0.01\)

To comply with the specifications, D should be not less than:

- that is, \(15 \,000 \, (0.015 + 0.01)\, \text{m}\),
- that is, \(15 \,000 \, \times 0.025 = 375\, \text{m}\)

4.2 **Consideration of longitudinal and transverse slopes**

When a runway is planned that will combine the extreme values for the slopes and changes in slope permitted under Chapter 3, 3.1.13 to 3.1.19, a study should be made to ensure that the resulting surface profile will not hamper the operation of aeroplanes.
Figure B-1: Illustration of declared distances
4.3 Radio altimeter operating area:
In order to accommodate aeroplanes making auto-coupled approaches and automatic landings (irrespective of weather conditions) it is desirable that slope changes be avoided or kept to a minimum, on a rectangular area at least 300 m long before the threshold of a precision approach runway. The area should be symmetrical about the extended centre line, 120 m wide. When special circumstances so warrant, the width may be reduced to no less than 60 m if an aeronautical study indicates that such reduction would not affect the safety of operations of aircraft. This is desirable because these aeroplanes are equipped with a radio altimeter for final height and flare guidance, and when the aeroplane is above the terrain immediately prior to the threshold, the radio altimeter will begin to provide information to the automatic pilot for auto-flare. Where slope changes cannot be avoided, the rate of change between two consecutive slopes should not exceed 2 per cent per 30 m.

5. Runway surface evenness
5.1 In adopting tolerances for runway surface irregularities, the following standard of construction is achievable for short distances of 3 m and conforms to good engineering practice: Except across the crown of a camber or across drainage channels, the finished surface of the wearing course is to be of such regularity that, when tested with a 3 m straight-edge placed anywhere in any direction on the surface, there is no deviation greater than 3 mm between the bottom of the straight-edge and the surface of the pavement anywhere along the straight-edge.
5.2 Caution should also be exercised when inserting runway lights or drainage grilles in runway surfaces to ensure that adequate smoothness of the surface is maintained.

5.3 The operation of aircraft and differential settlement of surface foundations will eventually lead to increases in surface irregularities. Small deviations in the above tolerances will not seriously hamper aircraft operations. In general, isolated irregularities of the order of 2.5 cm to 3 cm over a 45 m distance are tolerable. Although maximum acceptable deviations vary with the type and speed of an aircraft, the limits of acceptable surface irregularities can be estimated to a reasonable extent. The following table describes maximum and temporarily acceptable limits. If the maximum limits are exceeded, corrective action should be undertaken as soon as reasonably practicable to improve the ride quality. If the temporarily acceptable limits are exceeded, the portions of the runway that exhibit such roughness should have corrective measures taken immediately if aircraft operations are to be continued.

<table>
<thead>
<tr>
<th>Surface irregularity</th>
<th>Minimum acceptable length of irregularities (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Maximum surface irregularity height (or depth) (cm)</td>
<td>3</td>
</tr>
<tr>
<td>Temporary acceptable surface irregularities height (or depth) (cm)</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Note that “surface irregularity” is defined herein to mean isolated surface elevation deviations that do not lie along a uniform slope through any given section of a runway. For the purposes of this concern, a “section of a runway” is defined herein to mean a segment of a runway throughout which a continuing general uphill, downhill or flat slope is prevalent. The length of this section is generally between 30 and 60 metres, and can be
greater, depending on the longitudinal profile and the condition of the pavement.

5.4 Figure A-3 illustrates a comparison of the surface roughness criteria with those developed by the United States Federal Aviation Administration.

5.5 Deformation of the runway with time may also increase the possibility of the formation of water pools. Pools as shallow as approximately 3 mm in depth, particularly if they are located where they are likely to be encountered at high speed by landing aeroplanes, can induce aquaplaning, which can then be sustained on a wet runway by a much shallower depth of water. Improved guidance regarding the significant length and depth of pools relative to aquaplaning is the subject of further research. It is, of course, especially necessary to prevent pools from forming whenever there is a possibility that they might become frozen.

6. **Assessing the surface friction characteristics when affected by contaminants**

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 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 Annex 15, Appendix 2, “SNOWTAM format” as well as in PANS-ATM, Chapter 12, 12.3, “ATC phraseologies”.

![Figure B-3. Comparison of roughness criteria](image)

6.4 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 decelero-meter type of devices and the other types is that when using the Decelero-meter 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.

6.5 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

6.6 The 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.

7. Determination of surface friction characteristics for construction and maintenance purposes
Note.—The guidance in this section involves the functional measurement of friction-related aspects related to runway construction and maintenance. Excluded from this section is the operational, as opposed to functional, measurement of friction for contaminated runways. However, the devices used for functional measurement could also be used for operational measurement, but in the latter case, the figures given in Airport Services Manual (Doc 9137), Part 2, Table 3-1 are not relevant.

7.1 The surface friction characteristics of a paved runway should be:
   a) assessed to verify the surface friction characteristics of new or resurfaced paved runways (Chapter 3, 3.1.25); and
   b) assessed periodically in order to determine the slipperiness of paved runways (Chapter 10, 10.2.4).

7.2 The condition of a runway pavement is generally assessed under dry conditions using a self-wetting continuous friction measuring device. Evaluation tests of runway surface friction characteristics are made on clean surfaces of the runway when first constructed or after resurfacing.

7.3 Friction tests of existing surface conditions are taken periodically in order to avoid falling below the minimum friction level specified by the State. When the friction of any portion of a runway is found to be below this value, then such information is promulgated in a NOTAM specifying which portion of the runway is below the minimum friction level and its location on the runway. A corrective maintenance action must be initiated without delay. Friction measurements are taken at time intervals that will ensure the identification of runways in need of maintenance or of special surface treatment before their condition becomes serious. The time intervals and mean frequency of measurements depend on factors such as: aircraft type and frequency of usage, climatic conditions, pavement type, and pavement service and maintenance requirements.

7.4 Friction measurements of existing, new or resurfaced runways are made with a continuous friction measuring device provided with a smooth tread tire. The device should use self-wetting features to allow measurements of the surface friction characteristics to be made at a water depth of 1 mm.

7.5 When it is suspected that the surface friction characteristics of a runway may be reduced because of poor drainage, owing to
inadequate slopes or depressions, then an additional measurement is made, but this time under natural conditions representative of a local rain. This measurement differs from the previous one in that water depths in the poorly cleared areas are normally greater in a local rain condition. The measurement results are thus more apt to identify problem areas having low friction values that could induce aquaplaning than the previous test. If circumstances do not permit measurements to be conducted during natural conditions representative of a rain, then this condition may be simulated. (See section 8.)

7.6 When conducting friction tests using a self-wetting continuous friction measuring device, it is important to note that, unlike compacted snow and ice conditions, in which there is very limited variation of the friction coefficient with speed, a wet runway produces a drop in friction with an increase in speed. However, as the speed increases, the rate at which the friction is reduced becomes less. Among the factors affecting the friction coefficient between the tire and the runway surface, texture is particularly important. If the runway has a good macro-texture allowing the water to escape beneath the tire, then the friction value will be less affected by speed. Conversely, a low macro-texture surface will produce a larger drop in friction with increase in speed.

7.7 Annex 14, Volume I, requires States to specify a minimum friction level below which corrective maintenance action should be taken. As criteria for surface friction characteristics of new or resurfaced runway surfaces and its maintenance planning, the State can establish a maintenance planning level below which appropriate corrective maintenance action should be initiated to improve the friction. The Airport Services Manual (Doc 9137), Part 2, provides guidance on establishing maintenance planning and minimum friction levels for runway surfaces in use.

8. Drainage characteristics of the movement area and adjacent areas

8.1 General

8.1.1 Rapid drainage of surface water is a primary safety consideration in the design, construction and maintenance of the movement area and adjacent areas. The objective is to minimize water depth on the surface by draining water off the runway in the shortest path
possible and particularly out of the area of the wheel path. There are two distinct drainage processes taking place:

a) natural drainage of the surface water from the top of the pavement surface until it reaches the final recipient such as rivers or other water bodies; and

b) dynamic drainage of the surface water trapped under a moving tire until it reaches outside the tire-to-ground contact area.

8.1.2 Both processes can be controlled through:

a) design;

b) construction; and

c) maintenance.

of the pavements in order to prevent accumulation of water on the pavement surface.

8.2 Design of pavement

8.2.1 Surface drainage is a basic requirement and serves to minimize water depth on the surface. The objective is to drain water off the runway in the shortest path. Adequate surface drainage is provided primarily by an appropriately sloped surface (in both the longitudinal and transverse directions). The resulting combined longitudinal and transverse slope is the path for the drainage runoff. This path can be shortened by adding transverse grooves.

8.2.2 Dynamic drainage is achieved through built-in texture in the pavement surface. The rolling tire builds up water pressure and squeezes the water out the escape channels provided by the texture. The dynamic drainage of the tire-to-ground contact area may be improved by adding transverse grooves provided that they are subject to rigorous maintenance.

8.3 Construction of pavement

8.3.1 Through construction, the drainage characteristics of the surface are built into the pavement. These surface characteristics are:

a) slopes;

b) texture:

1) microtexture;

2) macrotexture;

8.3.2 Slopes for the various parts of the movement area and adjacent parts are described in Chapter 3 and figures are given as per cent. Further
8.3.3 Texture in the literature is described as microtexture or macrotexture. These terms are understood differently in various parts of the aviation industry.

8.3.4 Microtexture is the texture of the individual stones and is hardly detectable by the eye. Microtexture is considered a primary component in skid resistance at slow speeds. On a wet surface at higher speeds a water film may prevent direct contact between the surface asperities and the tire due to insufficient drainage from the tire-to-ground contact area.

8.3.5 Microtexture is a built-in quality of the pavement surface. By specifying crushed material that will withstand polishing microtexture, drainage of thin waterfilms are ensured for a longer period of time. Resistance against polishing is expressed in terms of the Polished Stone Values (PSV) which is in principle a value obtained from a friction measurement in accordance with international standards. These standards define the PSV minima that will enable a material with a good microtexture to be selected.

8.3.6 A major problem with microtexture is that it can change within short time periods without being easily detected. A typical example of this is the accumulation of rubber deposits in the touchdown area which will largely mask microtexture without necessarily reducing macrotexture.

8.3.7 Macrotexture is the texture among the individual stones. This scale of texture may be judged approximately by the eye. Macrotexture is primarily created by the size of aggregate used or by surface treatment of the pavement and is the major factor influencing drainage capacity at high speeds. Materials shall be selected so as to achieve good macrotexture.

8.3.8 The primary purpose of grooving a runway surface is to enhance surface drainage. Natural drainage can be slowed down by surface texture, but grooving can speed up the drainage by providing a shorter drainage path and increasing the drainage rate.

8.3.9 For measurement of macrotexture, simple methods such as the “sand and grease patch” methods described in the Airport Services Manual (Doc 9137), Part 2 were developed. These methods were used for the early research on which current airworthiness requirements are based, which refer to a classification categorizing
macrotexture from A to E. This classification was developed, using sand or grease patch measuring techniques, and issued in 1971 by the Engineering Sciences Data Unit (ESDU). *Runway classification based on texture information from ESDU 71026: Classification Texture depths (mm)*

<table>
<thead>
<tr>
<th>Texture Class</th>
<th>Depth Range (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.10 – 0.14</td>
</tr>
<tr>
<td>B</td>
<td>0.15 – 0.24</td>
</tr>
<tr>
<td>C</td>
<td>0.25 – 0.50</td>
</tr>
<tr>
<td>D</td>
<td>0.51 – 1.00</td>
</tr>
<tr>
<td>E</td>
<td>1.01 – 2.54</td>
</tr>
</tbody>
</table>

8.3.10 Using this classification, the threshold value between microtexture and macrotexture is 0.1 mm mean texture depth (MTD). Related to this scale, the normal wet runway aircraft performance is based upon texture giving drainage and friction qualities midway between classification B and C (0.25 mm). Improved drainage through better texture might qualify for a better aircraft performance class. However such credit must be in accordance with aeroplane manufacturers’ documentation and agreed by the State. Presently credit is given to grooved or porous friction course runways following design, construction and maintenance criteria acceptable to the State. The harmonized certification standards of some States refer to texture giving drainage and friction qualities midway between classification D and E (1.0 mm).

8.3.11 For construction, design and maintenance, States use various international standards. Currently *ISO 13473-1: Characterization of pavement texture by use of surface profiles — Part 1: Determination of Mean Profile Depth* links the volumetric measuring technique with non-contact profile measuring techniques giving comparable texture values. These standards describe the threshold value between microtexture and macrotexture as 0.5 mm. The volumetric method has a validity range from 0.25 to 5 mm MTD. The profilometry method has a validity range from 0 to 5 mm mean profile depth (MPD). The values of MPD and MTD differ due to the finite size of the glass spheres used in the volumetric technique and because the MPD is derived from a two-dimensional profile rather than a three dimensional surface. Therefore a transformation equation must be established for the measuring equipment used to relate MPD to MTD.
8.3.12 The ESDU scale groups runway surfaces based on macrotexture from A through E, where E represents the surface with best dynamic drainage capacity. The ESDU scale thus reflects the dynamic drainage characteristics of the pavement. Grooving any of these surfaces enhances the dynamic drainage capacity. The resulting drainage capacity of the surface is thus a function of the texture (A through E) and grooving. The contribution from grooving is a function of the size of the grooves and the spacing between the grooves. Aerodromes exposed to heavy or torrential rainfall must ensure that the pavement and adjacent areas have drainage capability to withstand these rainfalls or put limitations on the use of the pavements under such extreme situations. These airports should seek to have the maximum allowable slopes and the use of aggregates providing good drainage characteristics. They should also consider grooved pavements in the E classification to ensure that safety is not impaired.

8.4 Maintenance of drainage characteristics of pavement

8.4.1 Macrotexture does not change within a short timespan but accumulation of rubber can fill up the texture and as such reduce the drainage capacity, which can result in impaired safety. Furthermore the runway structure may change over time and give unevenness which results in ponding after rainfall. Guidance on rubber removal and unevenness can be found in the Airport Services Manual (Doc 9137), Part 2. Guidance on methods for improving surface texture can be found in the Aerodrome Design Manual (Doc 9157), Part 3.

8.4.2 When groovings are used, the condition of the grooves should be regularly inspected to ensure that no deterioration has occurred and that the grooves are in good condition. Guidance on maintenance of pavements is available in the Airport Services Manual (Doc 9137), Part 2 — Pavement Surface Conditions and Part 9 — Airport Maintenance Practices and the Aerodrome Design Manual (Doc 9157), Part 2.

8.4.3 The pavement may be shot blasted in order to enhance the pavement macrotexture.

9. Strips

9.1 Shoulders
9.1.1 The shoulder of a runway or stopway should be prepared or constructed so as to minimize any hazard to an aeroplane running off the runway or stopway. Some guidance is given in the following paragraphs on certain special problems which may arise, and on the further question of measures to avoid the ingestion of loose stones or other objects by turbine engines.

9.1.2 In some cases, the bearing strength of the natural ground in the strip may be sufficient, without special preparation, to meet the requirements for shoulders. Where special preparation is necessary, the method used will depend on local soil conditions and the mass of the aeroplanes the runway is intended to serve. Soil tests will help in determining the best method of improvement (e.g. drainage, stabilization, surfacing, light paving).

9.1.3 Attention should also be paid when designing shoulders to prevent the ingestion of stones or other objects by turbine engines. Similar considerations apply here to those which are discussed for the margins of taxiways in the Aerodrome Design Manual (Doc 9157), Part 2, both as to the special measures which may be necessary and as to the distance over which such special measures, if required, should be taken.

9.1.4 Where shoulders have been treated specially, either to provide the required bearing strength or to prevent the presence of stones or debris, difficulties may arise because of a lack of visual contrast between the runway surface and that of the adjacent strip. This difficulty can be overcome either by providing a good visual contrast in the surfacing of the runway or strip, or by providing a runway side stripe marking.

9.2 Objects on strips
Within the general area of the strip adjacent to the runway, measures should be taken to prevent an aeroplane’s wheel, when sinking into the ground, from striking a hard vertical face. Special problems may arise for runway light fittings or other objects mounted in the strip or at the intersection with a taxiway or another runway. In the case of construction, such as chamfering from the top of the construction to not less than 30 cm below the strip surface level. Other objects, the functions of which do not require them to be at surface level, should be buried to a depth of not less than 30 cm.
9.3 Grading of a strip for precision approach runways
Chapter 3, 3.4.8, recommends that the portion of a strip of an instrument runway within at least 75 m from the centre line should be graded where the code number is 3 or 4. For a precision approach runway, it may be desirable to adopt a greater width where the code number is 3 or 4. Figure A-4 shows the shape and dimensions of a wider strip that may be considered for such a runway. This strip has been designed using information on aircraft running off runways. The portion to be graded extends to a distance of 105 m from the centre line, except that the distance is gradually reduced to 75 m from the centre line at both ends of the strip, for a length of 150 m from the runway end.

![Diagram of graded portion of a strip including a precision approach runway where the code number is 3 or 4]

Figure B-4. Graded portion of a strip including a precision approach runway where the code number is 3 or 4

10. Runway end safety areas
10.1 Where a runway end safety area is provided in accordance with Chapter 3, consideration should be given to providing an area long enough to contain overruns and undershoots resulting from a reasonably probable combination of adverse operational factors. On a precision approach runway, the ILS localizer is normally the first upstanding obstacle, and the runway end safety area should extend up to this facility. In other circumstances, the first upstanding obstacle may be a road, a railroad or other constructed or natural
feature. The provision of a runway end safety area should take such obstacles into consideration.

10.2 Where provision of a runway end safety area would be particularly prohibitive to implement, consideration would have to be given to reducing some of the declared distances of the runway for the provision of a runway end safety area and installation of an arresting system.

10.3 Research programmes, as well as evaluation of actual aircraft overruns into arresting systems, have demonstrated that the performance of some arresting systems can be predictable and effective in arresting aircraft overruns.

10.4 Demonstrated performance of an arresting system can be achieved by a validated design method, which can predict the performance of the system. The design and performance should be based on the type of aircraft anticipated to use the associated runway that imposes the greatest demand upon the arresting system.

10.5 The design of an arresting system must consider multiple aircraft parameters, including but not limited to, allowable aircraft gear loads, gear configuration, tire contact pressure, aircraft centre of gravity and aircraft speed. Accommodating undershoots must also be addressed. Additionally, the design must allow the safe operation of fully loaded rescue and fire fighting vehicles, including their ingress and egress.

10.6 The information relating to the provision of a runway end safety area and the presence of an arresting system should be published in the AIP.

10.7 Additional information is contained in the *Aerodrome Design Manual* (Doc 9157), Part 1.
11. Location of threshold
11.1 General
11.1.1 The threshold is normally located at the extremity of a runway, if there are no obstacles penetrating above the approach surface. In some cases, however, due to local conditions it may be desirable to displace the threshold permanently (see below). When studying the location of a threshold, consideration should also be given to the height of the ILS reference datum and/or MLS approach reference datum and the determination of the obstacle clearance limits. (Specifications concerning the height of the ILS reference datum and MLS approach reference datum are given in Annex 10, Volume I.)

11.1.2 In determining that no obstacles penetrate above the approach surface, account should be taken of mobile objects (vehicles on roads, trains, etc.) at least within that portion of the approach area within 1 200 m longitudinally from the threshold and of an overall width of not less than 150 m.
11.2 Displaced threshold

11.2.1 If an object extends above the approach surface and the object cannot be removed, consideration should be given to displacing the threshold permanently.

11.2.2 To meet the obstacle limitation objectives of Chapter 4, the threshold should ideally be displaced down the runway for the distance necessary to provide that the approach surface is cleared of obstacles.

11.2.3 However, displacement of the threshold from the runway extremity will inevitably cause reduction of the landing distance available, and this may be of greater operational significance than penetration of the approach surface by marked and lighted obstacles. A decision to displace the threshold, and the extent of such displacement, should therefore have regard to an optimum balance between the considerations of clear approach surfaces and adequate landing distance. In deciding this question, account will need to be taken of the types of aeroplanes which the runway is intended to serve, the limiting visibility and cloud base conditions under which the runway will be used, the position of the obstacles in relation to the threshold and extended centre line and, in the case of a precision approach runway, the significance of the obstacles to the determination of the obstacle clearance limit.

11.2.4 Notwithstanding the consideration of landing distance available, the selected position for the threshold should not be such that the obstacle free surface to the threshold is steeper than 3.3 per cent where the code number is 4 or steeper than 5 per cent where the code number is 3.

11.2.5 In the event of a threshold being located according to the criteria for obstacle free surfaces in the preceding paragraph, the obstacle marking requirements of Chapter 6 should continue to be met in relation to the displaced threshold.

11.2.6 Depending on the length of the displacement, the RVR at the threshold could differ from that at the beginning of the runway for take-offs. The use of red runway edge lights with photometric intensities lower than the nominal value of 10 000 cd for white lights increases that phenomenon. The impact of a displaced threshold on take-off minima should be assessed by the appropriate authority.

11.2.7 Provisions in Annex 14, Volume I, regarding marking and lighting of displaced thresholds and some operational recommendations can
be found in 5.2.4.9, 5.2.4.10, 5.3.5.5, 5.3.8.1, 5.3.9.7, 5.3.10.3, 5.3.10.7 and 5.3.12.6.

12. **Approach lighting systems**
    12.1 **Types and characteristics**
    12.1.1 The specifications in this volume provide for the basic characteristics for simple and precision approach lighting systems. For certain aspects of these systems, some latitude is permitted, for example, in the spacing between centre line lights and crossbars. The approach lighting patterns that have been generally adopted are shown in Figures A-7 and A-8. A diagram of the inner 300 m of the precision approach category II and III lighting system is shown in Figure 5-14.

    12.1.2 The approach lighting configuration is to be provided irrespective of the location of the threshold, i.e. whether the threshold is at the extremity of the runway or displaced from the runway extremity. In both cases, the approach lighting system should extend up to the threshold. However, in the case of a displaced threshold, inset lights are used from the runway extremity up to the threshold to obtain the specified configuration. These inset lights are designed to satisfy the structural requirements specified in Chapter 5, 5.3.1.9, and the photometric requirements specified in Appendix 2, Figure A2-1 or A2-2.

    12.1.3 Flight path envelopes to be used in designing the lighting are shown in Figure A6.
Figure B-5. Flight path envelop to be used for lighting design for category I, II and III operations
12.2 Installation tolerances

Horizontal

12.2.1 The dimensional tolerances are shown in Figure A-8.
12.2.2 The centre line of an approach lighting system should be as coincident as possible with the extended centre line of the runway with a maximum tolerance of ±15°.

12.2.3 The longitudinal spacing of the centre line lights should be such that one light (or group of lights) is located in the centre of each crossbar, and the intervening centre line lights are spaced as evenly as practicable between two crossbars or a crossbar and a threshold.

12.2.4 The crossbars and barrettes should be at right angles to the centre line of the approach lighting system with a tolerance of ±30°, if the pattern in Figure A-8 (A) is adopted or ± 2°, if Figure A-8 (B) is adopted.

12.2.5 When a crossbar has to be displaced from its standard position, any adjacent crossbar should, where possible, be displaced by appropriate amounts in order to reduce the differences in the crossbar spacing.

12.2.6 When a crossbar in the system shown in Figure A-8 (A) is displaced from its standard position, its overall length should be adjusted so that it remains one-twentieth of the actual distance of the crossbar from the point of origin. It is not necessary, however, to adjust the standard 2.7 m spacing between the crossbar lights, but the crossbars should be kept symmetrical about the centre line of the approach lighting.

**Vertical**

12.2.7 The ideal arrangement is to mount all the approach lights in the horizontal plane passing through the threshold (see Figure A-9), and this should be the general aim as far as local conditions permit. However, buildings, trees, etc., should not obscure the lights from the view of a pilot who is assumed to be 1° below the electronic glide path in the vicinity of the outer marker.

12.2.8 Within a stopway or clearway, and within 150 m of the end of a runway, the lights should be mounted as near to the ground as local conditions permit in order to minimize risk of damage to aeroplanes in the event of an overrun or undershoot. Beyond the stopway and clearway, it is not so necessary for the lights to be mounted close to the ground, and therefore undulations in the ground contours can be compensated for by mounting the lights on poles of appropriate height.

12.2.9 It is desirable that the lights be mounted so that, as far as possible, no object within a distance of 60 m on each side of the centre line...
protrudes through the plane of the approach lighting system. Where a tall object exists within 60 m of the centre line and within 1350 m from the threshold for a precision approach lighting system, or 900 m for a simple approach lighting system, it may be advisable to install the lights so that the plane of the outer half of the pattern clears the top of the object.

12.2.10 In order to avoid giving a misleading impression of the plane of the ground, the lights should not be mounted below a gradient of 1 in 66 downwards from the threshold to a point 300 m out, and below a gradient of 1 in 40 beyond the 300 m point. For a precision approach category II and III lighting system, more stringent criteria may be necessary, e.g. negative slopes not permitted within 450 m of the threshold.

12.2.11 Centre line. The gradients of the centre line in any section (including a stopway or clearway) should be as small as practicable, and the changes in gradients should be as few and small as can be arranged and should not exceed 1 in 60. Experience has shown that as one proceeds outwards from the runway, rising gradients in any section of up to 1 in 66, and falling gradients of down to 1 in 40, are acceptable.

12.2.12 Crossbars. The crossbar lights should be so arranged as to lie on a straight line passing through the associated centre line lights, and wherever possible this line should be horizontal. It is permissible, however, to mount the lights on a transverse gradient not more than 1 in 80, if this enables crossbar lights within a stopway or clearway to be mounted nearer to the ground on sites where there is a cross-fall.

12.3 Clearance of obstacles

12.3.1 An area, hereinafter referred to as the light plane, has been established for obstacle clearance purposes, and all lights of the system are in this plane. This plane is rectangular in shape and symmetrically located about the approach lighting system’s centre line. It starts at the threshold and extends 60 m beyond the approach end of the system, and is 120 m wide.

12.3.2 No objects are permitted to exist within the boundaries of the light plane which are higher than the light plane except as designated herein. All roads and highways are considered as obstacles extending 4.8 m above the crown of the road, except aerodrome
service roads where all vehicular traffic is under control of the aerodrome authorities and coordinated with the aerodrome traffic control tower. Railroads, regardless of the amount of traffic, are considered as obstacles extending 5.4 m above the top of the rails.

12.3.3 It is recognized that some components of electronic landing aids systems, such as reflectors, antennas, monitors, etc., must be installed above the light plane. Every effort should be made to relocate such components outside the boundaries of the light plane. In the case of reflectors and monitors, this can be done in many instances.

12.3.4 Where an ILS localizer is installed within the light plane boundaries, it is recognized that the localizer, or screen if used, must extend above the light plane. In such cases the height of these structures should be held to a minimum and they should be located as far from the threshold as possible. In general the rule regarding permissible heights is 15 cm for each 30 m the structure is located from the threshold. As an example, if the localizer is located 300 m from the threshold, the screen will be permitted to extend above the plane of the approach lighting system by $10 \times 15 = 150$ cm maximum, but preferably should be kept as low as possible consistent with proper operation of the ILS.

12.3.5 In locating an MLS azimuth antenna the guidance contained in Annex 10, Volume I, Attachment G, should be followed. This material, which also provides guidance on collocating an MLS azimuth antenna with an ILS localizer antenna, suggests that the MLS azimuth antenna may be sited within the light plane boundaries where it is not possible or practical to locate it beyond the outer end of the approach lighting for the opposite direction of approach. If the MLS azimuth antenna is located on the extended centre line of the runway, it should be as far as possible from the closest light position to the MLS azimuth antenna in the direction of the runway end. Furthermore, the MLS azimuth antenna phase centre should be at least 0.3 m above the light centre of the light position closest to the MLS azimuth antenna in the direction of the runway end. (This could be relaxed to 0.15 m if the site is otherwise free of significant multipath problems.) Compliance with this requirement, which is intended to ensure that the MLS signal quality is not affected by the approach lighting system, could result in the partial obstruction of the lighting system by the MLS azimuth
antenna. To ensure that the resulting obstruction does not degrade visual guidance beyond an acceptable level, the MLS azimuth antenna should not be located closer to the runway end than 300 m and the preferred location is 25 m beyond the 300 m crossbar (this would place the antenna 5 m behind the light position 330 m from the runway end). Where an MLS azimuth antenna is so located, a central part of the 300 m crossbar of the approach lighting system would alone be partially obstructed. Nevertheless, it is important to ensure that the unobstructed lights of the crossbar remain serviceable all the time.

12.3.6 Objects existing within the boundaries of the light plane, requiring the light plane to be raised in order to meet the criteria contained herein, should be removed, lowered or relocated where this can be accomplished more economically than raising the light plane.

12.3.7 In some instances objects may exist which cannot be removed, lowered or relocated economically. These objects may be located so close to the threshold that they cannot be cleared by the 2 per cent slope. Where such conditions exist and no alternative is possible, the 2 per cent slope may be exceeded or a “stair step” resorted to in order to keep the approach lights above the objects. Such “step” or increased gradients should be resorted to only when it is impracticable to follow standard slope criteria, and they should be held to the absolute minimum. Under this criterion no negative slope is permitted in the outermost portion of the system.
12.4 Consideration of the effects of reduced lengths

12.4.1 The need for an adequate approach lighting system to support precision approaches where the pilot is required to acquire visual references prior to landing cannot be stressed too strongly. The safety and regularity of such operations is dependent on this visual acquisition. The height above runway threshold at which the pilot decides there are sufficient visual cues to continue the precision approach and land will vary, depending on the type of approach being conducted and other factors such as meteorological conditions, ground and airborne equipment, etc. The required length of approach lighting system which will support all the variations of such approaches is 900 m, and this shall always be provided whenever possible.

12.4.2 However, there are some runway locations where it is impossible to provide the 900 m length of approach lighting system to support precision approaches.

12.4.3 In such cases, every effort should be made to provide as much approach lighting system as possible. The appropriate authority may impose restrictions on operations to runways equipped with reduced lengths of lighting. There are many factors which determine at what height the pilot must have decided to continue
the approach to land or execute a missed approach. It must be understood that the pilot does not make an instantaneous judgement upon reaching a specified height. The actual decision to continue the approach and landing sequence is an accumulative process which is only concluded at the specified height. Unless lights are available prior to reaching the decision point, the visual assessment process is impaired and the likelihood of missed approaches will increase substantially. There are many operational considerations which must be taken into account by the appropriate authorities in deciding if any restrictions are necessary to any precision approach and these are detailed in Annex 6.

13. Priority of installation of visual approach slope indicator systems

13.1 It has been found impracticable to develop guidance material that will permit a completely objective analysis to be made of which runway on an aerodrome should receive first priority for the installation of a visual approach slope indicator system. However, factors that must be considered when making such a decision are:

a) frequency of use;
b) seriousness of the hazard;
c) presence of other visual and non-visual aids;
d) type of aeroplanes using the runway; and
e) frequency and type of adverse weather conditions under which the runway will be used.

13.2 With respect to the seriousness of the hazard, the order given in the application specifications for a visual approach slope indicator system, 5.3.5.1 b) to e) of Chapter 5, may be used as a general guide. These may be summarized as:

a) inadequate visual guidance because of:
   1) approaches over water or featureless terrain, or absence of sufficient extraneous light in the approach area by night;
   2) deceptive surrounding terrain;

b) serious hazard in approach;
c) serious hazard if aeroplanes undershoot or overrun; and
d) unusual turbulence.
13.3 The presence of other visual or non-visual aids is a very important factor. Runways equipped with ILS or MLS would generally receive the lowest priority for a visual approach slope indicator system installation. It must be remembered, though, that visual approach slope indicator systems are visual approach aids in their own right and can supplement electronic aids. When serious hazards exist and/or a substantial number of aeroplanes not equipped for ILS or MLS use a runway, priority might be given to installing a visual approach slope indicator on this runway.

13.4 Priority should be given to runways used by turbojet aeroplanes.

14. **Lighting of unserviceable areas**

   Where a temporarily unserviceable area exists, it may be marked with fixed-red lights. These lights should mark the most potentially dangerous extremities of the area. A minimum of four such lights should be used, except where the area is triangular in shape where a minimum of three lights may be employed. The number of lights should be increased when the area is large or of unusual configuration. At least one light should be installed for each 7.5 m of peripheral distance of the area. If the lights are directional, they should be orientated so that as far as possible their beams are aligned in the direction from which aircraft or vehicles will approach. Where aircraft or vehicles will normally approach from several directions, consideration should be given to adding extra lights or using omnidirectional lights to show the area from these directions. Unserviceable area lights should be frangible. Their height should be sufficiently low to preserve clearance for propellers and for engine pods of jet aircraft.

15. **Rapid exit taxiway indicator lights**

15.1 Rapid exit taxiway indicator lights (RETLs) comprise a set of yellow unidirectional lights installed in the runway adjacent to the centre line. The lights are positioned in a 3-2-1 sequence at 100 m intervals prior to the point of tangency of the rapid exit taxiway centre line. They are intended to give an indication to pilots of the location of the next available rapid exit taxiway.
15.2 In low visibility conditions, RETILs provide useful situational awareness cues while allowing the pilot to concentrate on keeping the aircraft on the runway centre line.

15.3 Following a landing, runway occupancy time has a significant effect on achievable runway capacity. RETILs allow pilots to maintain a good roll-out speed until it is necessary to decelerate to an appropriate speed for the turn into a rapid exit turn-off. A roll-out speed of 60 knots until the first RETIL (three-light barrette) is reached is seen as the optimum.

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 the *Aerodrome Design Manual* (Doc 9157), Part 4.

17. **Signal area**
   A 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.

18. **Rescue and firefighting services**
18.1 **Administration**
18.1.1 The rescue and firefighting service at an aerodrome should be under the administrative control of the aerodrome management, which should also be responsible for ensuring that the service provided is organized, equipped, staffed, trained and operated in such a manner as to fulfil its proper functions.
18.1.2 In drawing up the detailed plan for the conduct of search and rescue operations in accordance with 4.2.1 of Annex 12, the aerodrome management should coordinate its plans with the relevant rescue coordination centres to ensure that the respective limits of their responsibilities for an aircraft accident within the vicinity of an aerodrome are clearly delineated.
18.1.3 Coordination between the rescue and firefighting service at an aerodrome and public protective agencies, such as local fire brigade, police force, coast guard and hospitals, should be achieved by prior agreement for assistance in dealing with an aircraft accident.
18.1.4 A grid map of the aerodrome and its immediate vicinity should be provided for the use of the aerodrome services concerned. Information concerning topography, access roads and location of water supplies should be indicated. This map should be
conspicuously posted in the control tower and fire station, and available on the rescue and firefighting vehicles and such other supporting vehicles required to respond to an aircraft accident or incident. Copies should also be distributed to public protective agencies as desirable.

18.1.5 Coordinated instructions should be drawn up detailing the responsibilities of all concerned and the action to be taken in dealing with emergencies. The appropriate authority should ensure that such instructions are promulgated and observed.

18.2 Training
The training curriculum should include initial and recurrent instruction in at least the following areas:

a) airport familiarization;
b) aircraft familiarization;
c) rescue and firefighting personnel safety;
d) emergency communications systems on the aerodrome, including aircraft fire-related alarms;
e) use of the fire hoses, nozzles, turrets and other appliances required for compliance with Chapter 9, 9.2;
f) application of the types of extinguishing agents required for compliance with Chapter 9, 9.2;
g) emergency aircraft evacuation assistance;
h) firefighting operations;
i) adaptation and use of structural rescue and firefighting equipment for aircraft rescue and firefighting;
j) dangerous goods;
k) familiarization with firefighters’ duties under the aerodrome emergency plan; and
l) protective clothing and respiratory protection.

18.3 Level of protection to be provided
18.3.1 In accordance with Chapter 9, 9.2, aerodromes should be categorized for rescue and firefighting purposes and the level of protection provided should be appropriate to the aerodrome category.

18.3.2 However, Chapter 9, 9.2.3, permits a lower level of protection to be provided for a limited period 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. It is important to note that the concession included in 9.2.3 is applicable only where there is a wide range of difference between the dimensions of the aeroplanes included in reaching 700 movements.

18.4 Rescue equipment for difficult environments
18.4.1 Suitable rescue equipment and services should be available at an aerodrome where the area to be covered by the service includes water, swampy areas or other difficult environment that cannot be fully served by conventional wheeled vehicles. This is particularly important where a significant portion of approach/departure operations takes place over these areas.

18.4.2 The rescue equipment should be carried on boats or other vehicles such as helicopters and amphibious or air cushion vehicles, capable of operating in the area concerned. The vehicles should be so located that they can be brought into action quickly to respond to the areas covered by the service.

18.4.3 At an aerodrome bordering the water, the boats or other vehicles should preferably be located on the aerodrome, and convenient launching or docking sites provided. If these vehicles are located off the aerodrome, they should preferably be under the control of the aerodrome rescue and firefighting service or, if this is not practicable, under the control of another competent public or private organization working in close coordination with the aerodrome rescue and firefighting service (such as police, military services, harbour patrol or coast guard).

18.4.4 Boats or other vehicles should have as high a speed as practicable so as to reach an accident site in minimum time. To reduce the possibility of injury during rescue operations, water jet-driven boats are preferred to water propeller-driven boats unless the propellers of the latter boats are ducted. Should the water areas to be covered by the service be frozen for a significant period of the year, the equipment should be selected accordingly. Vehicles used in this service should be equipped with life rafts and life preservers related to the requirements of the larger aircraft normally using the aerodrome, with two-way radio communication, and with floodlights for night operations. If aircraft operations during
periods of low visibility are expected, it may be necessary to provide guidance for the responding emergency vehicles.

18.4.5 The personnel designated to operate the equipment should be adequately trained and drilled for rescue services in the appropriate environment.

18.5 Facilities

18.5.1 The provision of special telephone, two-way radio communication and general alarm systems for the rescue and firefighting service is desirable to ensure the dependable transmission of essential emergency and routine information. Consistent with the individual requirements of each aerodrome, these facilities serve the following purposes:

a) direct communication between the activating authority and the aerodrome fire station in order to ensure the prompt alerting and dispatch of rescue and fire fighting vehicles and personnel in the event of an aircraft accident or incident;

b) direct communication between the rescue and firefighting service and the flight crew of an aircraft in emergency;

c) emergency signals to ensure the immediate summoning of designated personnel not on standby duty;

d) as necessary, summoning essential related services on or off the aerodrome; and

e) maintaining communication by means of two-way radio with the rescue and firefighting vehicles in attendance at an aircraft accident or incident.

18.5.2 The availability of ambulance and medical facilities for the removal and after-care of casualties arising from an aircraft accident should receive the careful consideration of the appropriate authority and should form part of the overall emergency plan established to deal with such emergencies.

19. Operators of vehicles

19.1 The authorities responsible for the operation of vehicles on the movement area should ensure that the operators are properly qualified. This may include, as appropriate to the driver’s function, knowledge of:

a) the geography of the aerodrome;

b) aerodrome signs, markings and lights;
c) radiotelephone operating procedures;
d) terms and phrases used in aerodrome control including the ICAO spelling alphabet;
e) rules of air traffic services as they relate to ground operations;
f) airport rules and procedures; and
g) specialist functions as required, for example, in rescue and firefighting.

19.2 The operator should be able to demonstrate competency, as appropriate, in:

a) the operation or use of vehicle transmit/receive equipment;
b) understanding and complying with air traffic control and local procedures;
c) vehicle navigation on the aerodrome; and
d) special skills required for the particular function.

In addition, as required for any specialist function, the operator should be the holder of a State driver’s licence, a State radio operator’s licence or other licences.

19.3 The above should be applied as is appropriate to the function to be performed by the operator, and it is not necessary that all operators be trained to the same level, for example, operators whose functions are restricted to the apron.

19.4 If special procedures apply for operations in low visibility conditions, it is desirable to verify an operator’s knowledge of the procedures through periodic checks.

ATTACHMENT C.

OBSTACLE LIMITATION SURFACES
SCHEDULE 2
FORM 1

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<th>File Ref. No:</th>
<th>License No.</th>
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<tr>
<th>1. Name of Aerodrome</th>
<th>2. Name &amp; Address of License Holder</th>
<th>3. Position</th>
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4. Aerodrome Reference Code:

5. Conditions

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<tr>
<th>Period of Validity of License</th>
<th>Signature of authorized Officer</th>
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__________________________  _______________________
Director General            Date
Guyana Civil Aviation Authority
### GUYANA CIVIL AVIATION AUTHORITY

**AERODROME CERTIFICATE**  
(International Use)

<table>
<thead>
<tr>
<th>1. Name of Aerodrome</th>
<th>2. Name &amp; Address of Aerodrome Operator</th>
<th>3. Position</th>
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<th>4. Authority</th>
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<th>5. Special Procedures and conditions</th>
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<th>6. The validity of this certificate is:</th>
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<th>7. This Aerodrome Certificate was issued on:</th>
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**SIGNATURE: ………………………….**  
Director of Civil Aviation (ag).

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**Conditions of Aerodrome Certificate**

1. This aerodrome is certified for international use and shall at all time, when it is available for take-off or landing of aircraft, be so available to all persons on equal terms and conditions.

2. The holder of this certificate shall:-  
   (a) Give to the Authority not less than ten (10) days’ notice in writing of any intended change in the appointment or duties of the Executive or the Head of Operation;  
   (b) At the request of any interested person, furnish the information concerning the terms and condition of the certificate;
(e) Notify the Authority of the time during which the aerodrome shall be available for take-off and landing of aircraft engaged on flights for the purpose of public transport of passengers;

(d) Make no change in physical characteristic of the aerodrome, including the erection of new installations and alterations to the existing installations, without the prior approval of the Authority.

(e) Inform the Authority, by the quickest available means, of any degradation in the facilities specified in the aerodrome manual or any material change in the surface of the landing area, manoeuvring area, the apron or in the obstructions characteristics of the approach;

(f) Ensure that no aircraft shall take-off or land at the aerodrome unless the medical and firefighting facilities specified in the aerodrome manual are properly maintained and ready for immediate turn out whenever the aerodrome is available for operation.

3. The holder of this certificate shall maintain the system of visual lighting aids to the standards that exist at the time of grant of this certificate. All such lighting aids required for safe take-off and landing of aircraft at night shall remain in operation at all times that they may be so required, provided that minor temporary unserviceability that does not affect the safety of operations shall not preclude the take-off or landing of aircraft.

4. Subject to conditions 1 above, nothing in this certificate shall be taken to confer on any person the right to use the aerodrome without the consent of the Aerodrome Operator or the Authority.

5. The holder of the certificate shall comply with the requirements of Part 12 of Schedule 6 of the Civil Aviation (Air Navigation) Regulations and the Airport Manual approved by the Authority and any other instructions issued by the Authority from time to time.

6. The holder of the certificate shall have in operation an effective Safety Management System as described in the Airport Manual and GCAA will have access to reports / inspections to ensure the implementation of the Safety Management System.

7. The expressions used in this certificate shall have the same respective meaning as in Part 12 of Schedule 6 of the Civil Aviation (Air Navigation) Regulations and the Airport Certification Manual.

Made this day of November, 2016

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Hon. David Patterson, MP
Minister of Public Infrastructure