Republic of the Philippines
Department of Transportation
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES
Office of the Director General

MEMORANDUM CIRCULAR NO.: 011-17

TO : **ALL CONCERNED**

FROM : **ACTING DIRECTOR GENERAL**

SUBJECT : **AMENDMENT TO PHILIPPINE MANUAL OF STANDARDS FOR AERODROMES INCORPORATING AMENDMENT 11A AND 11B TO ICAO ANNEX 14 VOLUME I**

REFERENCE:

1. Philippine Civil Aviation Regulations- Aerodromes
2. Philippine Manual of Standards - Aerodromes
3. ICAO Annex 14 Volume I
4. ICAO Annex 14; Amendment 11
5. Regulations Amendment Procedures
6. Board Resolution No. 2012-054 dated 28 September 2012

Pursuant to the powers vested in me under the Republic Act 9497, otherwise known as the Civil Aviation Authority Act of 2008 and in accordance with the Board Resolution No.: 2012-054 dated 28 September 2012, I hereby approve the incorporation of ICAO Annex 14 Volume I Amendment No. 11A and 11B to the Philippine Manual of Standards for Aerodromes.

ORIGINAL REGULATION:

MANUAL OF STANDARDS FOR AERODROMES

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Chapter 1. Introduction

Section 1.1 General

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Section 1.4: Definition of Terms

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Integrity The degree of assurance that an aeronautical data and its value has not been lost or altered since the data origination or authorised amendment.

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

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Safety management system A systematic approach to managing safety including the necessary organisational structure, accountabilities, policies and procedures.

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CHAPTER 3: APPLYING FOR AN AERODROME CERTIFICATE

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3.1.2.3 As part of the certification process, CAAP staff or other authorized persons may carry out audits, surveys, inspections, checks or tests of any aspect of the aerodrome or require substantiation of any information provided by the applicant. However, it should be clearly understood that the CAAP inspection or testing procedures may use a sampling process. CAAP activity does not absolve the applicant from the responsibility to provide accurate information.

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CHAPTER 5. AERODROME INFORMATION FOR AIP

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5.1.3.8 Pavement strength.

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5.1.3.8 (c) Information on pavement type for ACN-PCN determination, sub grade strength category, maximum tire pressure category and evaluation method must be reported using the following codes:

(iii) maximum allowable tire pressure category

Maximum allowable tire pressure category:	**Code**
High: no pressure limit	W
Medium: pressure limited to 1.50 MPa	X
Low: pressure limited to 1.00 MPa	Y
Very low: pressure limited to 0.50 MPa	Z

(iv) evaluation method

Evaluation method:	**Code**
Technical evaluation: representing a specific study of the pavement characteristics and application of pavement behaviour technology.	T
Using aircraft experience: representing knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use.	U

(d)Examples of pavement strength reporting

Example 1: If the bearing strength of a rigid pavement, built on a medium strength subgrade, has been assessed by technical evaluation to be PCN 80 and there is no tire pressure limitation, then the reported information would be: PCN 80/R/B/W/T

Example 2: If the bearing strength of a flexible pavement, built on a high strength subgrade, has been assessed by 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, built on a medium strength subgrade, has been assessed by technical evaluation to be PCN 40 and the tire pressure is to be limited to 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 B747-400 all up mass limitation of 390,000 kg, then the reported information would include the following note:

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

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CHAPTER 6: Aerodrome physical characteristics

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Section 6.2 Runways

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6.2.9 Runway Surface

6.2.9.1 The surface of a runway shall be constructed without irregularities that would result in the loss of frictional characteristics or otherwise adversely affect the take-off or landing of an aircraft.

Note: The finish on the surface of a runway should be such that, when tested with a 3 metre straight-edge placed anywhere on the surface, there is no deviation greater than 3 mm between the lower edge of the straight-edge and the surface of the runway pavement anywhere along the straight-edge.

6.2.9.2 The surface of a paved runway must have an average surface texture depth of not less than 1mm over the full runway width and runway length.

Note: A runway surface meeting the ICAO minimum design objective for new surface specified in Annex 14, Volume 1, derived using a continuous friction measuring device, is acceptable.

- *This normally requires some form of special surface treatment.*
- *Guidance on methods used to measure surface texture is given in the ICAO Airport Services Manual, Part 2.*

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6.2.11 Runway shoulders

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6.2.16 Strength of runway shoulders

6.2.16.1 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 ICAO Aerodrome Design Manual, Part 1.

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6.2.4 Runway turn pads

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6.2.4.8 The surface of a runway turn pad shall not have surface irregularities that may cause damage to an aircraft, and shall provide good friction characteristics when the surface is wet.

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Section 6.3 Runway strips

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6.3.9 Objects on runway strips

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6.3.9.2 All fixed objects permitted on the runway strip must be of low mass and frangibly mounted.

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6.3.9.1 A runway strip must be clear of fixed objects other than frangible visual aids provided for the guidance of aircraft or vehicles:

(a) within 77.5 m of the center line of a precision approach category I, II or III runway, whose code number is 4 and the code letter is F; or

(b) within 60 m of the center line of a precision approach category I, II or III runway, whose code number is 3 or 4; or

(c) within 45 m of the center line of a precision approach category I runway, whose code number is 1 or 2.

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6.3.8.3 The portion of a strip at the end of a runway must be prepared to resist blast erosion, in order to protect a landing aeroplane from the danger of an exposed pavement edge.

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6.4.1 Runway End Safety Area (RESA)

6.4.1.1. A RESA shall be provided at the end of a runway strip unless the runway's code number is 1 or 2 and it is not an instrument runway.

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6.4.1.3 The minimum length of the RESA must be 90 m where the associated runway is suitable for aircraft with a code number 3 or 4 and is used by air transport jet aero planes. In other cases, the minimum RESA length must be 60 m

Note: Additional length of RESA may be provided, especially at international aerodromes, in accordance with the following ICAO recommendations:

1. 240 m if the runway's code number is 3 or 4; or

2. 120 m if the runway's code number is 1 or 2.

6.4.1.4 The width of a RESA must not be less than twice the width of the associated runway.

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Section 6.6: Stopway

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6.6.3 Surface of stopway

6.6.3.1 A stopway with a bituminous seal or asphalt surface must have frictional characteristics equal at least to those of the associated runway.

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Section 6.7: Taxiways

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8.4.2.4 Where it has been determined necessary by the Director General to denote the proximity of a runway holding position, an enhanced taxiway marking shall be installed. When provided under a determination by the DG, enhanced taxiway centre line markings are to be installed at all taxiway/runway intersections for a particular aerodrome and may form part of runway incursion prevention measures.

8.4.2.5 An enhanced taxiway centre line marking shall extend from the runway holding position marking for 45 metres (including at least 3 dashed lines) in the direction away from the runway, or to the next runway holding position marking if within the 45 m distance.

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9.9.20 Runway touchdown zone lights

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Section 9.12 Taxiway lighting

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9.12.1 Provision of taxiway centreline lights

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9.12.11 Characteristics of taxiway centreline lights

9.12.11.1 Taxiway centreline lights are to be inset fixed lights showing green on:

(a) a taxiway other than an exit taxiway; and

(b) a runway forming part of a taxi-route.

9.12.11.2 Taxiway centreline lights on exit taxiways, including rapid exit taxiways, must be inset fixed lights:

(a) showing green and yellow alternately, from the point where they begin to the perimeter of the ILS or MLS critical area or the lower edge of the inner transitional surface, whichever is further from the runway; and

(b) showing green from that point onwards;

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9.12.23 Stop bars

Note 1: As stop bars require direct ATC control, an aerodrome operator needs to consult with ATC before planning for their introduction.

9.12.23.1 A stop bar must 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, unless operational procedures at the aerodrome restrict the number of aircraft on the manoeuvring area to one at a time when runway visual range conditions are less 350 m.

9.12.23.2 A stop bar must 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 between values of 350 m and 550 m, unless operational procedures at the aerodrome restrict the number of aircraft on the manoeuvring area to one at a time when runway visual range conditions are less 550 m and appropriate aids and procedures are available to assist in preventing inadvertent incursions by aircraft and vehicles onto the runway.

Note : As stop bars require direct ATC control either manually or automatically, an aerodrome operator needs to consult with ATC before planning for their introduction

9.12.24 Location of stop bars

9.12.24.1 A stop bar must be provided at every runway holding position serving a runway and:

(a) be located across the taxiway on, or not more than 0.3 m before, the point at which it is intended that traffic approaching the runway stop;

(b) consist of inset lights spaced 3 m apart across the taxiway;

(c) be disposed symmetrically about, and at right angles to, the taxiway centreline.

9.12.24.2 Where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft, a pair of elevated lights, with the same characteristics as the stop bar lights, must be provided abeam the stop bar, located at a distance of at least 3 m from the taxiway edge sufficient to overcome the visibility problem.

9.12.25 Characteristics of Stop Bars

9.12.25.1 A stop bar must be unidirectional and show red in the direction of approach to the stop bar.

9.12.25.4 The lighting circuit must be designed so that:

(a) stop bars located across entrance taxiways are selectively switchable;

(b) stop bars located across taxiways used as exit taxiways only are switchable selectively or in groups;

(c) when a stop bar is illuminated, any taxiway centreline lights immediately beyond the stop bar are to be extinguished for a distance of at least 90 m; and

(d) stop bars shall have interlock with the taxiway centreline lights so that when the centreline lights beyond the stop bar are illuminated the stop bar lights are extinguished and vice versa.

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9.12.16 Provision of runway guard lights

Note: Runway guard lights are sometimes referred to as 'wig wags'. The effectiveness of this lighting system in preventing runway incursions has been successfully proven in a number of countries and this lighting has been adopted by ICAO as a standard. Provision of runway guard lights will bring aerodrome lighting in line with international practices.

9.12.16.1 Runway guard lights Configuration A must be provided at each runway/taxiway intersection when the runway is intended for use in:

(a) runway visual range conditions less than a value of 550m where a stop bar is not installed; and

(b) runway visual range conditions of values between 550m and 1200m where the traffic is heavy.

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9.12.17 Pattern and location of runway guard lights

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9.12.17.2 Configuration A is the configuration to be installed in all cases, except that Configuration B, or both Configuration A and B, must be used where enhanced conspicuity of the taxiway/runway intersection is needed, for example;

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9.12.17.5 Configuration B shall not be co-located with a stop bar installation.

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Section 8.10: Obstacle Markings

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9.3.1.2 In general, an object in the following situations would require to be provided with obstacle lighting unless CAAP, after an aeronautical study, assesses it as being shielded by another lit object or that it is of no operational significance:

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(v) a vehicle or other mobile objects, excluding aircraft, on the movement area, except aircraft service equipment and vehicles used only on aprons;

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(i) If the object extends above the take-off climb surface within 3000 m of the inner edge of the take-off climb surface;

(ii) if the object extends above the approach or transitional surface within 3000 m of the inner edge of the approach surface;

(iii) if the object extends above the applicable inner, conical or outer horizontal surfaces;

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7.1.5 Objects outside the OLS

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7.1.5.2 Any object that extends to a height of 150 m or more above local ground level must be regarded as an obstacle unless it is assessed by CAAP to be otherwise.

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7.1.6.3 Marking and lighting of obstacles

(a) CAAP may direct that obstacles be marked and or lit and may impose operational restrictions on the aerodrome as a result of an obstacle.

(b) If directed by CAAP, lighting and/or marking of obstacles, including terrain, must be carried out in accordance with the standards set out in Chapter 8 and Chapter 9.

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9.3.2 Types of obstacle lighting and usage

9.3.2.1 Three types of lights are used for lighting obstacles. These are low intensity, medium intensity and high intensity lights, or a combination of such lights.

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9.3.3.8 The number and arrangement of lights at each level to be marked is to be such that the obstacle is indicated from every angle of azimuth. Where a light is shielded in any direction by an adjacent object, the light so shielded may be omitted but additional lights may be required in such a way so as to retain the general definition of the obstacle.

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8.10.4 Marking of Vehicles

8.10.4.1 A vehicle used regularly on the manoeuvring area by day should be painted a single conspicuous colour, preferably yellow or orange. Where so painted, it does not require additional marking.

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8.10.4.3 Flags must be not less than 0.9 m square and consist of an orange and white chequered pattern, each square of which must have sides not less than 0.3 m. Where orange merges with the background, another colour that contrasts with the background must be used.

8.10.2.3 Obstacles with unbroken surfaces more than 4.5 m by 4.5 m size, must be painted in a chequered pattern of lighter and darker squares or rectangles, with sides no less than 1.5 m and no more than 3 m long, as shown in Figure 8.10-1. The corners of the obstacle must be painted in the darker colour.

8.10.2.4 Obstacles more than 1.5 m size in one direction and less than 4.5 m in the other, or any lattice obstacle greater than 1.5 m in size in both directions, must be marked with alternating contrasting bands of colour, with the ends painted in the darker colour, as shown in Figure 8.10-2. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.

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8.10.2.6 Masts, poles and towers must be marked in contrasting bands with the darker colour at the top, as shown in Figure 8.10-3. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.

8.10.2.5 Obstacles with any dimension less than 1.5 m, except for masts, poles and towers described in Paragraph 8.10.2.6, must be painted in a solid contrasting color.

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9.3.3.1 One or more obstacle lights are to be located as close as practicable to the top of the object. The top lights are to be arranged so as to at least indicate the points or edges of the object highest above the obstacle limitation surface.

9.3.3.2 In the case of a chimney or other structure of like function, the top lights are to be placed sufficiently below the top (nominally 1.5 m to 3 m) so as to minimise contamination by smoke, etc.

9.3.3.3 In the case of a tower or antenna structure to be provided with high intensity obstacle lights, and the structure has an appurtenance such as a rod or antenna extending greater than 12 m above the structure, and it is not practicable to locate the high intensity obstacle light on top of the appurtenance, the high intensity obstacle light is to be located at the highest practicable point and, if practicable, have a medium intensity obstacle light (flashing white) mounted on the top.

9.3.3.4 In the case of an extensive object or a group of closely spaced objects, top lights are to be displayed at least on the points or edges highest in relation to the obstacle limitation surfaces, so as to indicate the general definition and extent of the objects. If two or more edges are at the same height, the edge nearest the runway threshold is to be lit. Where low intensity lights are used, they are to be spaced at longitudinal intervals not exceeding 45 m. Where medium intensity lights are used, they are to be spaced at longitudinal intervals not exceeding 900 m, and at least three are to be displayed on one side of the extensive obstacle to indicate a line of lights.

9.3.3.5 When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the object, additional obstacle lights are to be placed on the highest part of the object.

9.3.8.4 High intensity obstacle lights located on an object other than a tower supporting overhead wires or cables are to flash simultaneously at a rate between 40-60 flashes per minute.

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9.3.8.6 To minimize environmental impact, unless otherwise directed by DGCA, the installation setting angles for high intensity obstacle lights are to be:

Height of light unit above terrain	**Angle of the peak of the beam above the horizontal**
greater than 151 m AGL	0°
122 m to 151 m AGL	1°
92 m to 122 m AGL	2°
less than 92 m AGL	3°

Table 9.3-2

9.3.2.2 Low intensity obstacle lights are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m.

Note: A group of trees or buildings is regarded as an extensive object.

9.3.2.3 Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights, where:

(a) the object is an extensive one;

(b) the top of the object is 45 m or more above the surrounding ground; or

(c) CAAP determines that early warning to pilots of the presence of the object is desirable

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9.3.2.5 High intensity obstacle lights are flashing white lights used on obstacles that are in excess of 150 m in height. As high intensity obstacle lights have a significant environmental impact on people and animals, it is necessary to consult with interested parties about their use. High intensity obstacle lights may also be used during the day, in lieu of obstacle markings, on obstacles that are in excess of 150 m in height, or are difficult to be seen from the air because of their skeletal nature, such as towers with overhead wires and cables spanning across roads, valleys or waterways.

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9.3.3.7 Where high intensity obstacle lights are used on an object other than a tower supporting overhead wires or cables, the spacing between the lights is not to exceed 105 m.

Where the high intensity obstacle lights are used on a tower supporting wires or cables, they are to be located on three levels:

(a) at the top of the tower;

(b) at the lowest level of the catenary of the wires or cables; and

(c) at approximately midway between the two levels.

Note: In some cases this may require the bottom and middle lights to be located off the tower.

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9.3.8.5 High intensity obstacle lights located on a tower supporting overhead wires or cables are to flash sequentially; first the middle light, second the top light, and last the bottom light. Cycle frequency is to be 40 - 60 per minute and the intervals between flashes of lights are to approximate the following ratios:

Flash interval between:	**Ratio of cycle time**
middle and top light	1/13
top and bottom light	2/13
bottom and middle light	10/13

Table 9.3-1

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9.3.8.6 To minimise environmental impact, unless otherwise directed by DGCA, the installation setting angles for high intensity obstacle lights are to be:

Height of light unit above terrain	**Angle of the peak of the beam above the horizontal**
greater than 151 m AGL	0°
122 m to 151 m AGL	1°
92 m to 122 m AGL	2°
less than 92 m AGL	3°

Table 9.3-2

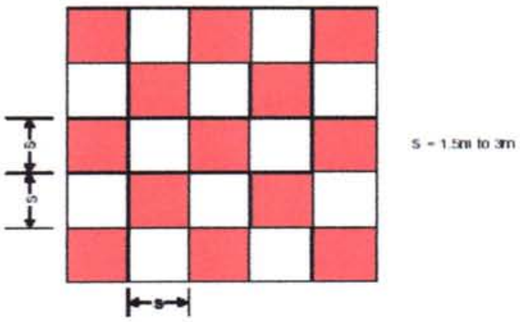

Figure 8.10-1: Marking of square face obstacle

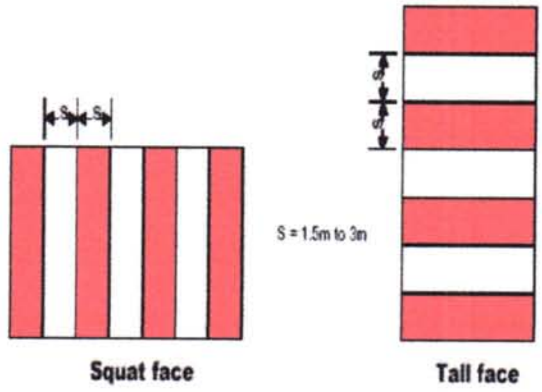

Figure 8.10-2: Marking of squat or tall face objects

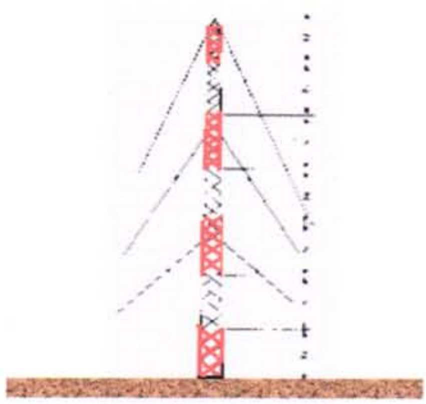

Figure 8.10-3: Marking of mast, pole and tower

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Section 10.7: Aerodrome Emergency Planning

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10.7.1.4 A full scale emergency exercise must be carried out at least once every two years, commensurate with the size and scale of operations at the airport, unless the emergency plan was activated for a major emergency within the two-year period. A partial exercise is to be conducted in the intervening year.

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10.7.1.9 The plan shall include the ready availability and co-ordination of appropriate specialist agencies who are 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 those areas.

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14.1.4 Where an aerodrome is located close to water or 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.

CHAPTER 14 - Rescue and fire fighting service.

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Section 14.3 Extinguishing agents

14.3.1 Both principal and complementary agents shall be provided at an aerodrome unless otherwise directed by the Director General.

Note: Descriptions of the agents may be found in ICAO Airport Services Manual Part 1

14.3.2 The principal extinguishing agent may be a foam meeting minimum performance category level A or B, or a combination.

Note: Information about the properties of fire fighting foam performance level may be found in ICAO Airport Services Manual Part 1.

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14.3.4 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 in accordance with 14.2.1 and 14.2.2 and table 14-2, except that these amounts may be modified as follows:

a) for aerodrome categories 1 and 2 up to 100% of the water may be replaced by complementary agent; and

b) for aerodrome categories 3 to 10 when a foam meeting performance level A is used, up to 30% of the water may be replaced by complementary agent.

For the purpose of agent substitution, the following equivalents shall be used:

a) 1kg complementary agent is equivalent to 1 litre of water for production of a foam meeting performance level A; and

b) 1kg complementary agent is equivalent to 0.66 litre of water for production of a foam meeting performance level B.

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14.3.5 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. The amount of foam concentrate provided on a vehicle should be sufficient to produce at least two loads of foam solution.

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Table 14-2 Minimum usable amounts of extinguishant for RFFS

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14.3.5 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. The amount of foam concentrate provided on a vehicle should be sufficient to produce at least two loads of foam solution.

Section 14.4 Response time

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14.4.2 The operational objective of the RFFS is to achieve a response time, to any point of each operational runway, not exceeding 3 minutes from the initial call.

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Section 14.9: Personnel

14.9.1 During flight operations, sufficient trained personnel should be detailed and be readily available to ride the rescue and fire fighting vehicles and to operate the equipment at maximum capacity. These trained personnel should be deployed in such a way that ensures the minimum response times can be achieved and that continuous agent application at the appropriate rate can be fully maintained. Consideration should be given to for personnel to use hand lines, ladders and other equipment normally associated with aircraft rescue and fire fighting operations.

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14.9.3 In determining the number of personnel required to provide for aircraft rescue, consideration should be given to the types of aircraft using the aerodrome.

10.16 Maintenance around navigational aids

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10.15.2.3 Certified international aerodromes with runways serving code 4 jet aeroplanes conducting international air transport operations are required to use an ICAO accepted continuous friction measuring device with self-wetting features to measure the friction level of the runway.

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10.10.11.2 The longitudinal slope of the temporary ramp described in paragraph 10.10.11.1, measured with reference to the existing runway surface or previous overlay course, must 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.

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Section 6.4 Runway end safety area

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Section 9.2: Colours for Aeronautical Ground Lights

9.2.1 General

9.2.1.1 The following specifications define the chromaticity limits of colours to be used for aerodrome lighting.

9.2.1.2 The chromaticity is expressed in terms of the standard observer and coordination system adopted by the International Commission on Illumination (CIE).

Section 9.2: Colors for Aeronautical Ground Lights

9.2.2 Chromaticity

9.2.2.1 The chromaticity of aerodrome lights must be within the following boundaries:

CIE Equation (see Figure 9.2-1)

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

Yellow boundary $x = 0.500$

Blue boundary $x = 0.285$

Green boundary $y = 0.440$

and $y = 0.150 + 0.640x$

Purple boundary $y = 0.050 + 0.750x$

and $y = 0.382$

f) Variable white

Yellow boundary $x = 0.255 + 0.750y$

and $x = 1.185 - 1.500y$

Blue boundary $x = 0.285$

Green boundary $y = 0.440$

and $y = 0.150 + 0.640x$

Purple boundary $y = 0.050 + 0.750x$

and $y = 0.382$

...

Figure 9.13-3: Isocandela Diagram for Taxiway Centerline Lights, and Stop Bar Lights, on Taxiway intended for use in conjunction with a Precision Approach Category III Runway — for use on straight sections of taxiway where large offsets can occur. Also for Runway Guard Lights Configuration B.

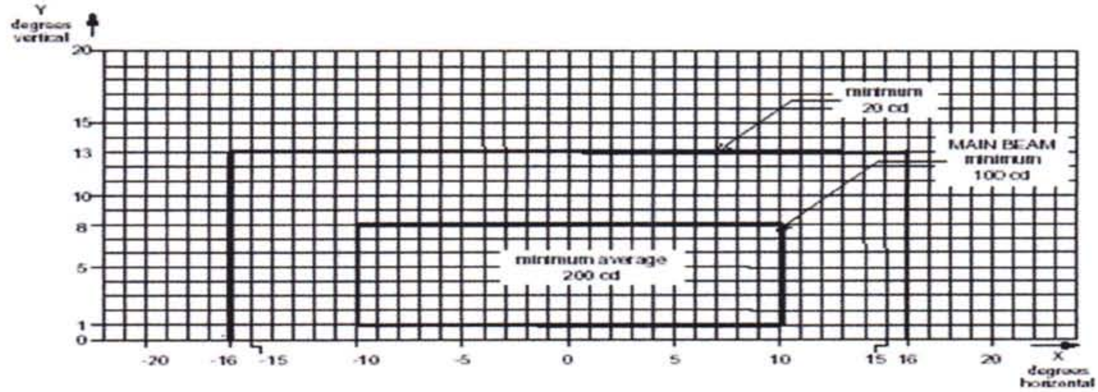


Figure 9.13-4: Isocandela Diagram for Taxiway Centerline Lights, and Stop Bar Lights, for Taxiways intended for use in conjunction with a Precision Approach Category III Runway – for use on straight sections of taxiway where large offsets do not occur

Notes:

1.These beam coverages are suitable for a normal displacement of the cockpit from the centerline of up to 3m.

2. See collective notes at Paragraph 9.13.1 for these isocandella diagrams.

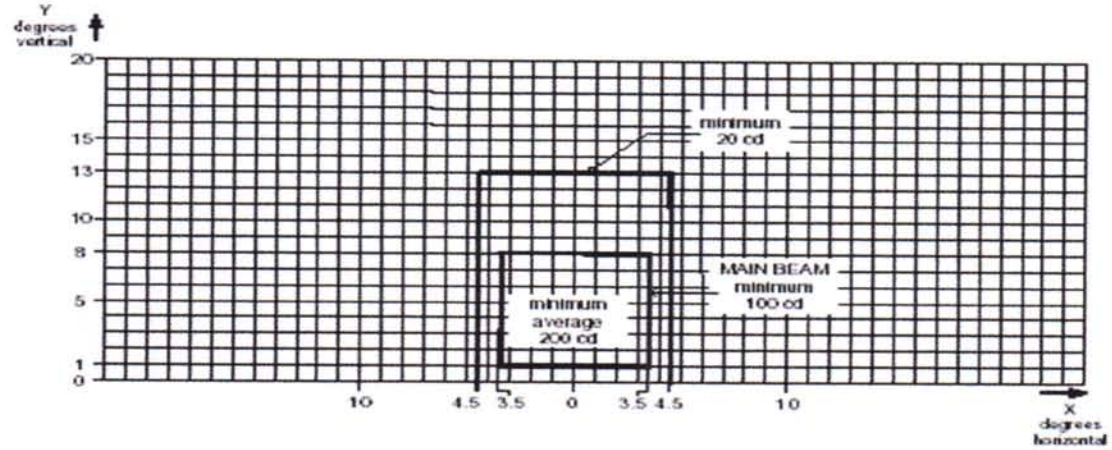


Figure 9.13-5: Isocandela Diagram for Taxiway Centerline Lights, and Stop Bar Lights, for Taxiways intended for use in conjunction with a Precision Approach Category III Runway — for use on curved sections of taxiway

Notes: 1. Lights on curves to have light beam toed-in 15.75^0 with respect to the tangent of the curve.

2. See collective notes at Paragraph 9.13.1 for these isocandela diagrams.

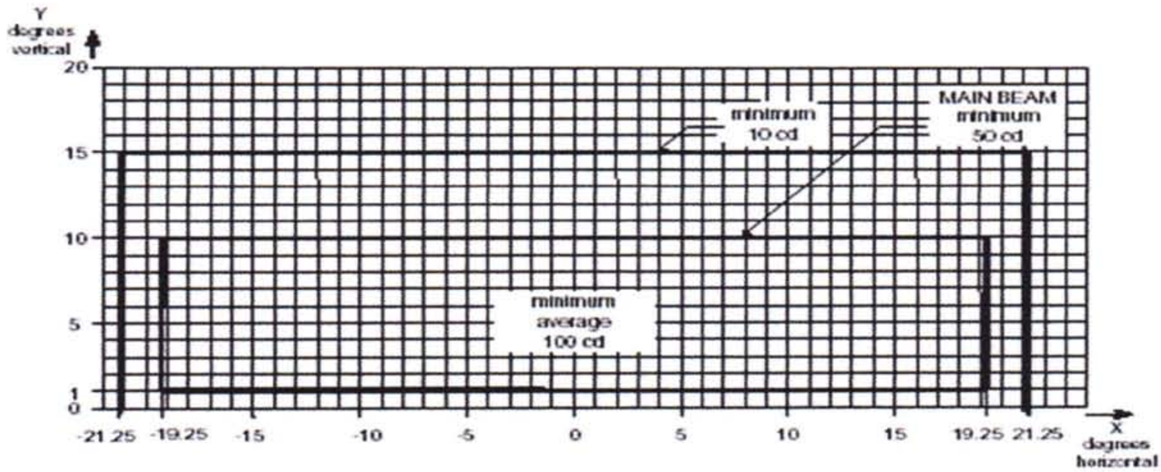


Figure 9.13-1: Isocandela diagram for Taxiway Centerline Lights, and Stop Bar Lights on Straight Sections of Taxiways intended for use in conjunction with a Non-Precision or Precision Approach Category I or II Runway

Notes: 1. The intensity values have taken into account high background luminance, and possibility of deterioration of light output resulting from dust and local contamination.

2. Where omnidirectional lights are used they must comply with the vertical beam spread.

3. See the collective notes at paragraph 9.13.1 for these isocandella diagrams.

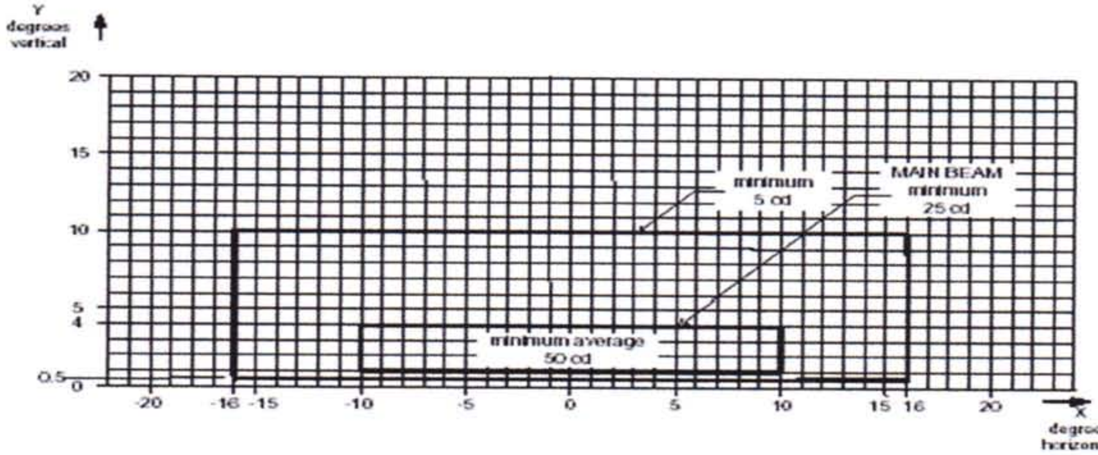


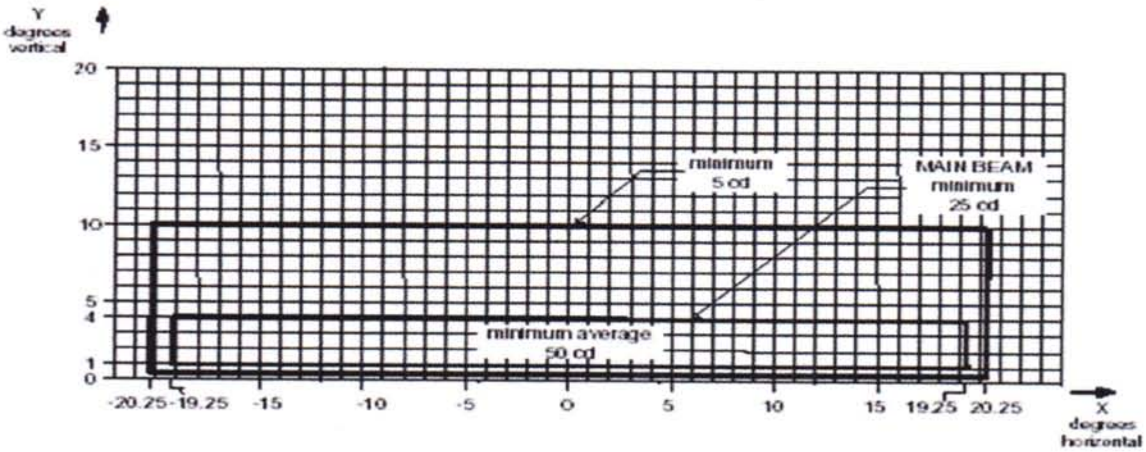
Figure 9.13-2: Isocandela Diagram for Taxiway Centerline Lights, and Stop Bar Lights on Curved Sections of Taxiways intended for use in conjunction with a Non-Precision or Precision Approach Category I or II Runway

Notes: 1. The intensity values have taken into account high background luminance, and possibility of deterioration of light output resulting from dust and local contamination.

2. Light on curves to have light beam toed-in 15.75° with respect to the tangent of the curve.

3. These beam coverages allow for displacement of the cockpit from the centerline up to distance of the order of 12 m as could occur at the end of curves.

4. See collective notes at Paragraph 9.13.1 for these isocandela diagrams.



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10.1.5 Framework for Aerodrome Safety Management System

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No provisions on FRAMEWORK FOR THE STATE SAFETY PROGRAMME (SSP)

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Section 1.4: Definition of terms

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

(a) Non-precision approach runway. An instrument runway served by visual aids and a radio aid providing at least directional guidance adequate for a straight-in approach with a published minimum descent altitude, also known as landing minima for a particular radio aid or a combination of radio aids.

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

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

a. 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 175 m.

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

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

Note : 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.

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

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AMENDED REGULATION:

MANUAL OF STANDARDS FOR AERODROMES

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Chapter 1. Introduction

Section 1.1 General

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Section 1.4: Definition of Terms

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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.

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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.

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Integrity (aeronautical data). The degree of assurance that an aeronautical data and its value has not been lost or 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.

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Runway end safety area (RESA). An area symmetrical about the extended runway centerline and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

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

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CHAPTER 3: Applying for an aerodrome certificate

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3.1.2.3 As part of the certification process, CAAP 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.— 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 contains the safety management provisions applicable to certified aerodromes. Guidance on an aerodrome 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).*

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CHAPTER 5. AERODROME INFORMATION FOR AIP

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5.1.2 Aeronautical Data Accuracy and Integrity Requirements

5.1.2.1 Determination and reporting of aerodrome-related aeronautical data shall be in accordance with the accuracy and integrity requirements set forth in MOS Appendix 5, Table 5.1-1 to 5.1-5, while taking into account the established quality system procedures. Accuracy requirements for aeronautical data are based upon a 95% confidence level and in that respect, three types of positional data shall be identified: surveyed points (e.g. runway threshold), calculated points (mathematical calculations from the known surveyed points of points in space, fixes) and declared points (e.g. flight information region boundary points).

Note: - Specifications governing the quality system are given in CAR-ANS Part 15, Chapter 3.

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

Note.— Aerodrome mapping databases related provisions are contained in CAR-ANS Part 15, Chapter 11.

5.1.2.3 Where made available in accordance with 5.1.2.2, 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.

5.1.2.4 Where made available in accordance with 5.1.2.2, aerodrome mapping data shall comply with the accuracy and integrity requirements in MOS Appendix 5.

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

5.1.2.5 The integrity of aeronautical data shall be maintained throughout the data process from survey/origin to the next intended user. Based on the applicable integrity classifications, 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.

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CHAPTER 5. AERODROME INFORMATION FOR AIP

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5.1.4.10 Pavement strength.

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(d) Information on pavement type for ACN-PCN determination, sub grade strength category, maximum tire pressure category and evaluation method must be reported using the following codes:

(iii) maximum allowable tire pressure category

Maximum allowable tire pressure category:	**Code**
Unlimited: no pressure limit	W
High: pressure limited to 1.75 MPa	X
Medium: pressure limited to 1.25 MPa	Y
Low: pressure limited to 0.50 MPa	Z

(iv) evaluation method

Evaluation method:	**Code**
Technical evaluation: representing a specific study of the pavement characteristics and	T

application of pavement behaviour technology.	
Using aircraft experience: representing knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use.	U

(e) The following examples illustrate how pavement strength data are reported under the ACN-PCN method:

Example 1.— If the bearing strength of a rigid pavement, resting on a medium strength subgrade, has been assessed by technical evaluation to be PCN 80 and there is no tire pressure limitation, then the reported information would be:
PCN 80 / R / B / W / T

Example 2.— : If the bearing strength of a flexible pavement, built on a high strength subgrade, has been assessed by using aircraft experience to be PCN 50 and the maximum tire pressure allowable is 1.25 MPa, then the reported information would be: PCN 50 / F / A / Y / U

Note.— Composite construction

Example 3.— If the bearing strength of a flexible pavement, built on a medium strength subgrade, has been assessed by technical evaluation to be PCN 40 and the tire pressure is to be limited to 0.80 MPa, then the reported information would be: PCN 40 / F / B / 0.80 MPa /T

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

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

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CHAPTER 5. AERODROME INFORMATION FOR AIP

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5.1.5 Condition of the movement area and related facilities

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

Note.— Nature, format and conditions of the information to be provided are specified in CAR-ANS Part 15 and MOS-ATS.

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

a) construction or maintenance work;

b) rough or broken surfaces on a runway, a taxiway or an apron;

c) water on a runway, a taxiway or an apron;

d) other contaminants on a runway, taxiway or apron;

e) other temporary hazards, including parked aircraft;

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

g) 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 1, Attachment C provides guidance on the description of runway surface conditions. Additional guidance is included in the Airport Services Manual *(Doc 9137), Part 2. Procedures for monitoring and reporting the conditions of the movement area are included in the PANS-Aerodromes (Doc 9981).*

Note: - 2. The Aeroplane Performance Manual (doc 10064) provides guidance on aircraft performance calculation requirements regarding description of runway surface conditions in MOS 5.1.5.2 c) and d).

Note: - 3. Origin and evolution of data, assessment process and the procedures are prescribed in the PANS-Aerodromes (Doc 9981). These procedures are intended to fulfill the requirements to achieve the desired level of safety for aeroplane operations prescribed by Annex 6 and Annex 8 and to provide the information fulfilling the syntax requirements for dissemination specified in CAR-ANS Part 15 and MOS ATS.

5.1.5.3 To facilitate compliance with 5.1.5.1 and 5.1.5.2, inspections of the movement area shall be carried out each day;

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

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

Note: - 1. Procedures on carrying out daily inspections of the movement area are given in the PANS-Aerodromes (Doc 9981). Further guidance are available in the Airport Services Manual (Doc 9137), Part 8, in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and in the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830).

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

5.1.5.4 Personnel assessing and reporting runway surface conditions required in 5.1.5.2 and 5.1.7.1 shall be trained and competent to meet criteria set by CAAP.

Note.— Guidance on criteria is included in the Airport Services Manual *(Doc 9137), Part 8, Chapter 7.*

5.1.7 Runway surface condition(s) for use in the runway condition report

Introductory Note: - The philosophy of the runway condition report is that the aerodrome operator assesses the runway surface conditions whenever water is present on an operational runway. From this assessment, a runway condition code (RWYCC) and a description of the runway surface are reported which can be used by the flight crew for aeroplane performance calculations. This report, based on the type, depth and coverage of contaminants, is the best assessment of the runway surface condition by the aerodrome operator; however, all other pertinent information may be taken into consideration. The PANS-Aerodromes (Doc 9981) contains procedures on the use of the runway condition report and assignment of the RWYCC in accordance with the runway condition assessment matrix (RCAM). See also MOS Attachment A Section 3.

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

DRY
STANDING WATER
WET

Note:- 1. The runway surface conditions are those conditions for which, by means of the methods described in the PANS-Aerodromes (Doc 9981), the flight crew can derive appropriate aeroplane performance.

Note:- 2. The conditions, either single or in combination with other observations, are criteria for which the effect on aeroplane performance is sufficiently deterministic to allow assignment of a specific runway condition code.

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

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

Note: - 2. See MOS 5.1.5.2 and 5.2.6 concerning the provision of information to, and coordination between appropriate authorities.

5.1.8 Runway Friction Level

5.1.8.1 Notification shall be given to relevant aerodrome users when the friction level of a paved runway or portion thereof is less than the minimum friction level specified in MOS 6.2.9.1 to 6.2.9.4.

Note: - 1. Guidance on determining and expressing the minimum friction level is provided in the ICAO Circular 329 – Assessment, Measurement and Reporting of Runway Surface Conditions.

Note: - 2. Procedures on conducting a runway surface friction characteristics evaluation programme is provided in the PANS-Aerodromes (Doc 9981). See also MOS Attachment A Section 20.

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

CHAPTER 6: Aerodrome physical characteristics

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Section 6.2 Runways

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6.2.10 Runway Surface

6.2.10.1 The surface of a runway shall be constructed without irregularities that would impair the runway surface friction characteristics or otherwise adversely affect the take-off or landing of an aeroplane.

Note 1: The finish on the surface of a runway should be such that, when tested with a 3 meter straight-edge placed anywhere on the surface, there is no deviation greater than 3 mm between the lower edge of the straight-edge and the surface of the runway pavement anywhere along the straight-edge.

Note 2.— 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 3— Guidance on design tolerances and other information is given in MOS Attachment A, Section 4. Additional guidance is included in the Aerodrome Design Manual *(Doc 9157), Part 3.*

6.2.10.2 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by CAAP and where practicable shall be evaluated to determine that the surface friction characteristics achieve the design objectives.

Note: - Guidance on surface friction characteristics of a new or resurfaced runway is given in MOS Attachment A, Section 20. Additional guidance is included in the Airport Services Manual, Part 2.

6.2.10.5 Measurements of the surface friction characteristics of a new or resurfaced paved runway shall be made with a continuous friction measuring device using self-wetting features.

Note: - Guidance on surface friction characteristics of new runway surfaces is given in MOS Attachment A Section 20. Additional guidance is included in the Airport Services Manual (Doc 9137), Part 2.

6.2.10.3 The surface of a paved runway must have an average surface texture depth of not less than 1mm over the full runway width and runway length.

Note: - 1. A runway surface, meeting the ICAO minimum design objective for new surface specified in MOS Attachment A Section 20, derived using a continuous friction measuring device, is acceptable.

- *This normally requires some form of special surface treatment.*
- *Guidance on methods used to measure surface texture is given in the ICAO Airport Services Manual, Part 2.*

Note: - 2. Macrotexture and microtexture are taken into consideration in order to provide the required surface friction characteristics. Guidance on surface design is given in MOS Attachment A, Section 2.3.

Note: .- 3 Guidance on methods used to measure surface texture is given in the Airport Services Manual *(Doc 9137), Part 2.*

Note : - 4 Guidance on design and methods for improving surface texture is given in the Aerodrome Design Manual *(Doc 9157), Part 3.*

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6.2.10.6 When the surface is grooved or scored, the grooves or scorings shall be either perpendicular to the runway center line or parallel to non-perpendicular transverse joints, where applicable.

Note.— Guidance on methods for improving the runway surface texture is given in the Aerodrome Design Manual *(Doc 9157), Part 3.*

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6.2.12 Runway shoulders

Note: - Guidance on characteristics and treatment of runway shoulders is given in MOS 6.2.17.2 to 6.2.17.5, and in the Aerodrome Design Manual (Doc 9157), Part 1.

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6.2.17 Strength of runway shoulders

6.2.17.1 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 ICAO Aerodrome Design Manual (Doc 9157), Part 1.

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6.2.5 Runway turn pads

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6.2.5.9 The surface of a runway turn pad shall not have surface irregularities that may cause damage to an aeroplane using the turn pad.

6.2.5.10 The surface of a runway turn pad shall be so constructed or resurfaced as to provide surface friction characteristics at least equal to that of the adjoining runway.

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Section 6.3 Runway strips

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6.3.9 Objects on runway strips

Note: - MOS 11.1.1.1 for information regarding siting of equipment and installations on runway strips.

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6.3.9.3 All fixed objects permitted on the runway strip must be of low mass and frangibly mounted. An object situated on a runway strip which may endanger aeroplanes shall be regarded as an obstacle and shall, as far as practicable, be removed.

Note: - 1 Consideration will have to be given to the location and design of drains on a runway strip to prevent damage to an aeroplane accidentally running off a runway. Suitably designed drain covers may be required. For further guidance, see the Aerodrome Design Manual (Doc 9157), Part 1.

Note: -2 Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure does not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1.

Note: - 3 Particular attention needs to be given to the design and maintenance of an open-air storm water conveyance in order to prevent wildlife attraction, notably birds. If needed, it can be covered by a net. Guidance on Wildlife Control and Reduction can be found in the Airport Services Manual (Doc 9137), Part 3.

6.3.9.1 No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes and which must be sited on the runway strip, and satisfying the relevant frangibility requirement in (MOS 8 and 9), shall be permitted on a runway strip:

(a) within 77.5 m of the centerline of a precision approach category I, II or III runway, whose code number is 4 and the code letter is F; or

(b) within 60 m of the centerline of a precision approach category I, II or III runway, whose code number is 3 or 4; or

(c) within 45 m of the centerline of a precision approach category I runway, whose code number is 1 or 2.

6.3.9.2 No mobile object shall be permitted on a runway strip while the runway is in use for takeoff or landing.

6.3.8.3 The portion of a strip to at least 30 m before a threshold must be prepared against blast erosion in order to protect a landing aeroplane from the danger of an exposed edge.

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

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

Section 6.4 Runway End Safety Area

6.4.1 Runway End Safety Area (RESA)

6.4.1.1. A runway end safety area shall be provided at each end of a runway strip where:

(a) the code number is 3 or 4; and

(b) the code number is 1 or 2 for instrument runway.

Note.— Guidance on runway end safety areas is given in MOS Attachment A, Section 1

6.4.1.2. A runway end safety area shall be provided at each end of a runway strip where the code number is 1 or 2 and the runway is a non-instrument one.

6.4.1.3 A runway end safety area shall extend from the end of a runway strip to a distance of at least 90 m where:

(a) the code number is 3 or 4; and
(b) 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 CAAP.

Note. — Guidance on arresting systems is given in MOS Attachment A Section 1.

6.4.1.4 A runway end safety area shall, as far as practicable, extend from the end of a runway strip to a distance of at least:

(a) 240 m where the code number is 3 or 4; or a reduced length when an arresting system is installed;

(b) 120 m where the code number is 1 or 2 and the runway is an instrument one; or a reduced length when an arresting system is installed; and

(c) 30 m where the code number is 1 or 2 and the runway is a non-instrument one. The RESA standard shall apply to all runways including an existing runway when it is reduced or extended in length.

6.4.1.5 The width of a RESA must not be less than twice the width of the associated runway.

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Section 6.6: Stopway

Note: - The inclusion of detailed specifications for stopways in this section is not intended to imply that a stopway has to be provided. MOS Attachment A, Section 17, provides information on the use of stopways.

6.6.3 Surface of stopway

6.6.3.1 The surface of a paved stopway shall be so constructed or resurfaced as to provide surface friction characteristics at or above those of the associated runway.

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6.6.3.2 The friction characteristics of an unpaved stopway should not be substantially less than that of the runway with which the stop way is associated.

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Section 6.7: Taxiways

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6.7.8 Surface of taxiways

6.7.8.1 The surface of a taxiway shall not have irregularities that cause damage to aeroplane structures.

6.7.8.2 The surface of a paved taxiway shall be so constructed or resurfaced as to provide suitable surface friction characteristics.

Note.–Suitable surface friction characteristics are those surface properties required on taxiways that assure safe operation of aeroplanes.

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Section 8.4: Taxiway Markings

8.4.2 Taxiway centerline marking

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8.4.2.4 Where it has been determined necessary by CAAP to denote the proximity of a runway holding position, an enhanced taxiway marking shall be installed. When provided, enhanced taxiway center line markings are to be installed at each taxiway/runway intersections and may form part of runway incursion prevention measures.

8.4.2.5 Where provided:

(a) An enhanced taxiway centerline marking shall extend from the runway-holding position Pattern A marking defined in Figure 8.4-2, to a distance of up to 47m in the direction of travel away from the runway. See-Figure 8.4-3(a).

(b) If the enhanced taxiway centerline marking intersects another runway-holding position marking, such as for a precision approach category II or III runway, that is located within 47m of the first runway-holding position marking, the enhanced taxiway center line marking shall be interrupted 0.9m prior to and after the intersected runway-holding position marking. The enhanced taxiway center line marking shall continue beyond the intersected runway-holding position marking for at least 3 dashed line segments or 47m from start to finish, whichever is greater. See Figure 8.4-3(b).

(c) If the enhanced taxiway centerline marking continues through a taxiway/taxiway intersection that is located within 47m of the runway-holding position marking, the enhanced taxiway centerline marking shall be interrupted 1.5m prior to and after the point where the intersected taxiway centerline crosses the enhanced taxiway centerline. The enhanced taxiway centerline marking shall continue beyond the taxiway/taxiway intersection for at least 3 dashed line segments or 47m from start to finish, whichever is greater. See Figure 8.4-3(c).

(d) Where two taxiway center lines converge at or before the runway-holding position marking, the inner dashed line shall not be less than 3m in length. See Figure 8.4-3(d).

(e) Where there are two opposing runway-holding position markings and the distance between the markings is less than 94m, the enhanced taxiway center line markings shall extend over this entire distance. The enhanced taxiway center line markings shall not extend beyond either runway-holding position marking. See Figure 8.4-3(e).

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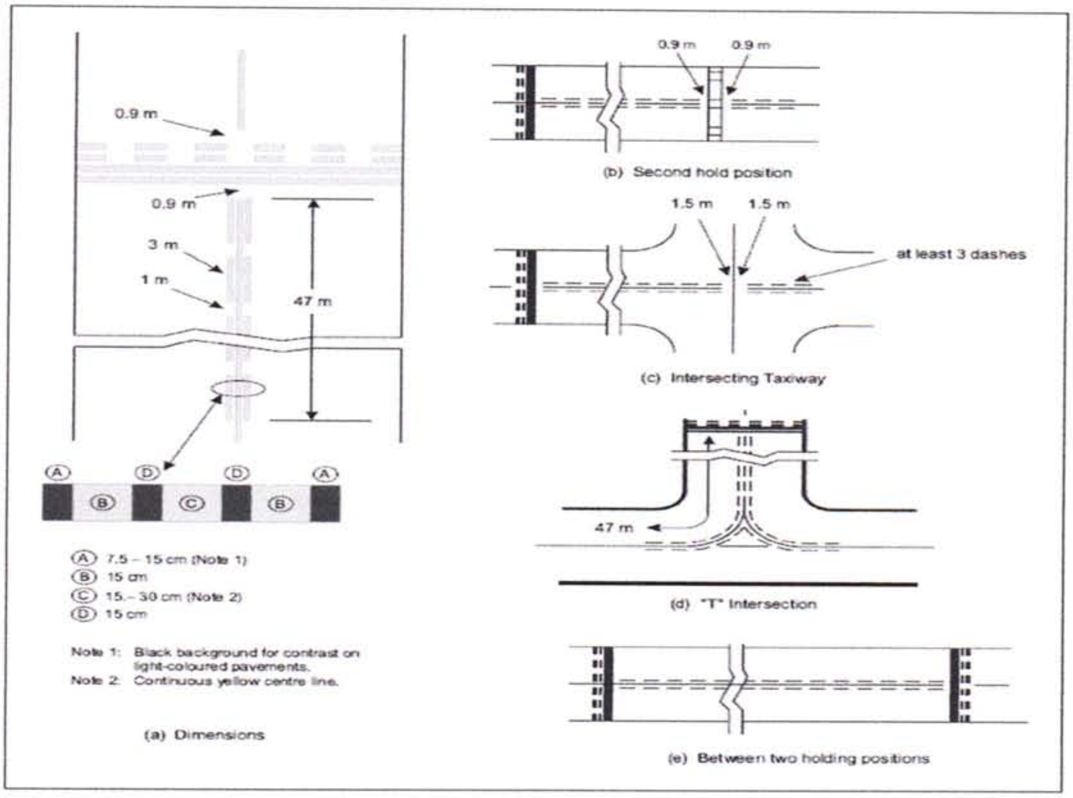

Figure 5-7. Enhanced Taxiway Centre Line Marking

9.9.21 Simple Touchdown Zone Lights

Note.— The purpose of Simple Touchdown Zone Lights is to provide pilots with enhanced situational awareness in all visibility conditions and to help enable pilots to decide whether to commence a go around if the aircraft has not landed by a certain point on the runway. It is essential that pilots operating at aerodromes with Simple Touchdown Zone Lights be familiar with the purpose of these lights.

9.9.21.1 Except MOS 9.9.20, at an aerodrome where the approach angle is greater than 3.5^0 and/or the Landing Distance Available combined with other factors increases the risk of an overrun, Simple Touchdown Zone Lights shall be provided.

9.9.21.2 Simple Touchdown Zone Lights shall be a pair of lights located on each side of the runway centerline 0.3 meters 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 9.9-3)

9.9.21.3 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.

9.9.21.4 Simple Touchdown Zone Lights shall be fixed unidirectional lights showing variable white, aligned so as to be visible to the pilot of a landing aeroplane in the direction of approach to the runway.

9.9.21.5 Simple Touchdown Zone Lights shall be in accordance with the specifications in MOS Figure 9.10-10.

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.

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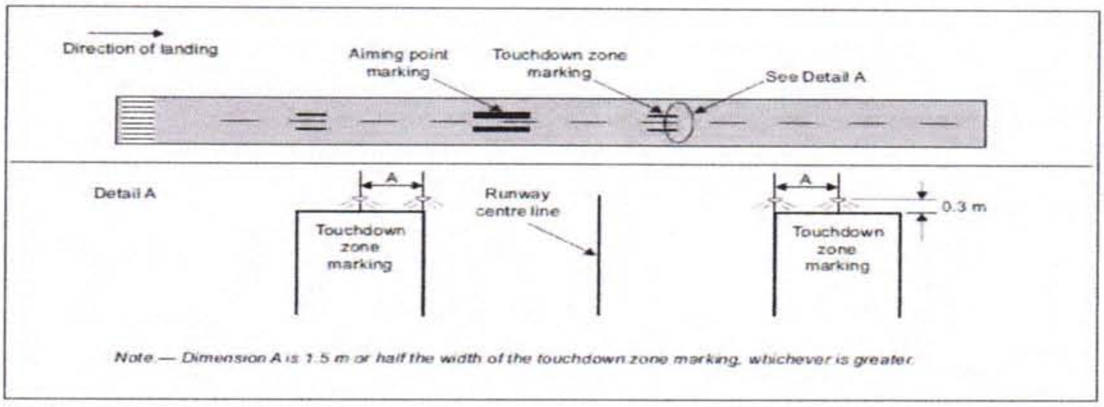

Figure 9.9-1. Simple touchdown zone lighting

Section 9.12 Taxiway lighting

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9.12.1 Provision of taxiway centerline lights

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9.12.11 Characteristics of taxiway centerline lights

9.12.11.1 Except as provided for in MOS 9.12.11.3 taxiway centerline lights are to be inset fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or in the vicinity of the taxiway on:

(a) a taxiway other than an exit taxiway; and

(b) a runway forming part of a standard taxi-route.

9.12.11.2 Taxiway centerline lights on exit taxiways, including rapid exit taxiways, must be inset fixed lights(See Figure 9.12-1):

(a) showing green and yellow alternately, from the point where they begin to the perimeter of the ILS or MLS critical area or the lower edge of the inner transitional surface, whichever is farther from the runway;

(b) showing green from that point onwards; and

(c) The first light in the exit center line shall always show green and the light nearest to the perimeter shall always show yellow.

9.12.11.3 Where it is necessary to denote the proximity to a runway, taxiway center line lights shall be fixed lights showing alternating green and yellow from the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farthest from the runway, to the runway and continue alternating green and yellow until:

a) their end point near the runway center line; or

b) in the case of the taxiway center line lights crossing the runway, to the opposite perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farthest from the runway.

Note 1.— Care is necessary to limit the light distribution of green lights on or near a runway so as to avoid possible confusion with threshold lights.

Note 2.— The provisions of MOS 9.12.11.3 *can form part of effective runway incursion prevention measures.*

...

9.12.23 Stop bars

Note 1: A stop bar is intended to be controlled either manually or automatically by air traffic services.

Note 2.— Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures.

9.12.23.1 A stop bar must 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, unless:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of traffic onto the runway; or

b) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:

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

(ii) vehicles on the manoeuvring area to the essential minimum.

9.12.23.2 A stop bar must 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 between values of 350 m and 550 m, unless:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions by aircraft and vehicles onto the runway; and

b) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:

(i) aircraft on the maneuvering area to one at a time; and

(ii) vehicles on the maneuvering area to the essential minimum. Where there is more than one stop bar associated with a taxiway/runway intersection, only one shall be illuminated at any given time.

...

9.12.23.5 A stop bar must be provided at an intermediate holding position to supplement markings with lights and to provide traffic control by visual means.

9.12.24 Location of stop bars

9.12.24.1 A stop bar must be provided at every runway holding position serving a runway and:

(a) be located across the taxiway on, or not more than 0.3 m before, the point at which it is intended that traffic approaching the runway stop;

(b) consist of inset lights spaced at uniform intervals of no more than 3 m apart across the taxiway;

(c) be disposed symmetrically about, and at right angles to, the taxiway centerline.

9.12.24.2 Where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft, a pair of elevated lights, with the same characteristics as the stop bar lights, must be provided abeam the stop bar, located at a distance of at least 3 m from the taxiway edge sufficient to overcome the visibility problem.

9.12.25 Characteristics of Stop Bars

9.12.25.1 A stop bar must be unidirectional and show red in the direction of approach to the intersection or runway holding position.

Note - Where necessary to enhance conspicuity of an existing stop bar, extra lights are installed uniformly.

9.12.25.2 Stop bars installed at a runway-holding position shall be unidirectional and shall show red in the direction of approach to the runway.

9.12.25.3 Where the additional lights specified in MOS 9.12.24.2 are provided, these lights shall have the same characteristics as the lights in the stop bar, but shall be visible to approaching aircraft up to the stop bar position.

9.12.25.4 The intensity and beam spread of the stop bar lights must be in accordance with the applicable specifications in MOS 9.13, Figure 9.13-1 to Figure 9.13-5.

...

9.12.25.7 Where stop bars are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications of MOS 9.13, Figure 9.13-8, Figure 9.13-9 or Figure 9.13-10.

Note.— High-intensity stop bars shall only be used in case of an absolute necessity and following a specific study.

9.12.25.8 Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications of MOS 9.13, Figure 9.13-9 or Figure 9.13-10.

...

9.12.25.6 The lighting circuit must be designed so that:

(a) stop bars located across entrance taxiways are selectively switchable;

(b) stop bars located across taxiways used as exit taxiways only are switchable selectively or in groups;

(c) when a stop bar is illuminated, any taxiway centerline lights immediately beyond the stop bar are to be extinguished for a distance of at least 90 m; and

(d) stop bars are interlocked with the taxiway centerline lights so that when the centerline lights beyond the stop bar are illuminated the stop bar lights are 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.

...

9.12.16 Provision of runway guard lights

Note 1: Runway guard lights are sometimes referred to as 'wig wags'. The effectiveness of this lighting system in preventing runway incursions has been successfully proven in a number of countries and this lighting system has been adopted by ICAO as a standard. Provision of runway guard lights will bring aerodrome lighting in line with international practices.

Note. 2— 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 a runway. There are two standard configurations of runway guard lights as illustrated in MOS Figure 9.12-2.

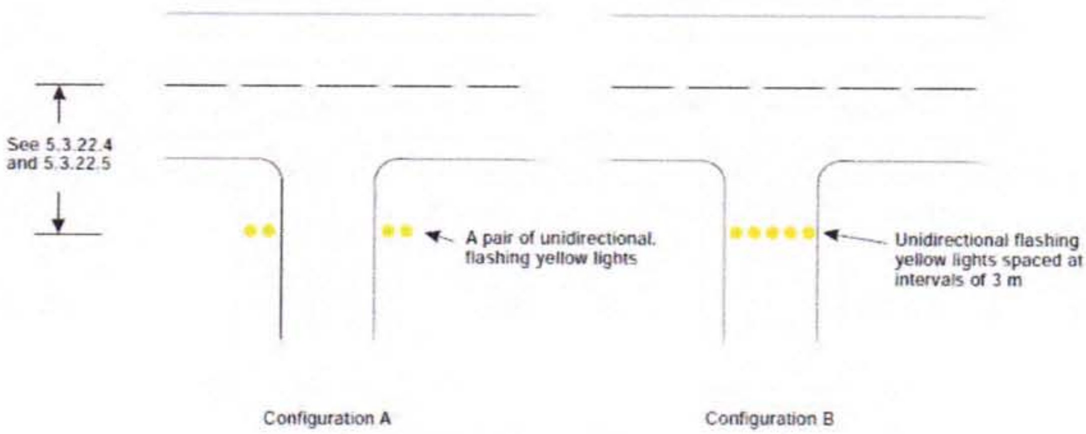


Figure 5-28. Runway guard lights

New Figure 9.12- 3 ***Runway guard lights***

9.12.16.1 Runway guard lights Configuration A must be provided at each runway/taxiway intersection when the runway is intended for use in:

(a) runway visual range conditions less than a value of 550m where a stop bar is not installed; and

(b) runway visual range conditions of values between 550m and 1200m where the traffic is heavy.

...

9.12.17 Pattern and location of runway guard lights

...

9.12.17.2 As part of runway incursion prevention measures, runway guard lights, Configuration A or B, shall be provided at each taxiway/runway intersection where runway incursion hot spots have been identified, and used under all weather conditions during day and night.

...

9.12.17.5 Configuration B shall not be co-located with a stop bar installation.

...

9.12.26 No-entry bar

Note 1.— A no-entry bar is intended to be controlled manually by air traffic services.

Note 2.— Runway incursions may take place in all visibility or weather conditions. The provision of no entry bars at taxiway/runway intersections and their use at night and in all visibility conditions can form part of effective runway incursion prevention measures.

9.12.26.1 A no-entry bar shall be provided across a taxiway which is intended to be used as an exit only taxiway to assist in preventing inadvertent access of traffic to that taxiway.

9.12.26.2 A no-entry bar shall be located across the taxiway at the end of an exit only taxiway where it is desired to prevent traffic from entering the taxiway in the wrong direction.

9.12.26.3 A no-entry bar shall consist of unidirectional lights spaced at uniform intervals of no more than 3 m showing red in the intended direction(s) of approach to the runway.

Note.- Where necessary to enhance conspicuity, extra lights are installed uniformly.

9.12.26.4 A pair of elevated lights shall be added to each end of the no-entry bar where the in-pavement no entry bar lights might be obscured from a pilot's view, for example, by rain, or where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft.

9.12.26.5 The intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications in MOS 9.13 Figure 9.13-1 through Figure 9.13-5 as appropriate.

9.12.26.6 Where no-entry bars are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications of MOS 9.13 Figure 9.13-6, Figure 9.13-7 or Figure 9.13-8.

Note.— High-intensity no-entry bars are typically only used in case of an absolute necessity and following a specific study.

9.12.26.7 Where a wide beam fixture is required, the intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications of Section 9.13 Figure 9.13-6 or Figure 9.13-8.

9.12.26.8 The lighting circuit shall be designed so that:

a) no-entry bars are switchable selectively or in groups;

b) when a no-entry bar is illuminated, any taxiway centre line lights installed beyond the no-entry bar, when viewed towards the runway, shall be extinguished for a distance of at least 90 m; and

c) when a no-entry bar is illuminated, any stop bar installed between the no-entry bar and the runway shall be extinguished.

...

Section 8.10: Obstacle Markings

8.10.1.1 The marking 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.

...

8.10.2.1 Objects within the lateral boundaries of the obstacle limitation surfaces

(a) 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.

(b) 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.

(c) All obstacles within the distance specified in Table 6.4-5,Table 6.4-5(E) or Table 6.4-5(F), from the center line of a taxiway, an apron taxiway or aircraft stand taxilane shall be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.

(d) A fixed obstacle that extends above a take-off climb surface within 3000 m of the inner edge of the take-off climb surface shall be marked and, if the runway is used at night, lighted, except that:

(i) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;

(ii) 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;

(iii) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(iv) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

(e) 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:
(i) 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

(ii) the object is lighted by high-intensity obstacle lights by day.

(f) 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:

(i) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;

(ii) 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;

(iii) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(iv) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

(g) A fixed obstacle that extends above a horizontal surface shall be marked and, if the aerodrome is used at night, lighted, except that:

(i) such marking and lighting may be omitted when:

- *the obstacle is shielded by another fixed obstacle; or*
- *for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or*
- *an aeronautical study shows the obstacle not to be of operational significance*

(ii) 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;

(iii) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(iv) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

(h) A fixed object that extends above an obstacle protection surface shall be marked and, if the runway is used at night, lighted.

Note – See MOS 9.8.2 for information on the obstacle protection surface.

(i) 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. — In certain circumstances, objects that do not project above any of the surfaces enumerated in MOS 7.3 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.

(j) 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 indicated that the wires or cables could constitute a hazard to aircraft.

8.10.2.2 Objects outside the lateral boundaries of the obstacle limitation surfaces

(a) Obstacles in accordance with MOS 7.1.5.2 shall be marked and lighted, except that the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day.

(b) 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).

(c) 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.

8.10.3 Marking and/or lighting of objects

8.10.3.1 General

(a) The presence of objects which must be lighted, as specified in MOS 8.10.2.7, shall be indicated by low-, medium- or high-intensity lights, or a combination of such lights.

(b) The types of obstacle lights are the following:

(i) Low-intensity - Types A, B, C and D;
(ii) Medium-intensity -Types A, B and C; and
(iii) High-intensity - Type A and B.

Note: For guidance on the specifications of the types of obstacle lights is given in MOS Appendix 6,Table 6-3 .

(c) 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.

...

8.10.3.3 Mobile objects

(a) All mobile objects to be marked shall be colored or display flags.

(b) When mobile objects are marked by color, a single conspicuous color, preferably red or yellowish green for emergency vehicles and yellow for service vehicles shall be used. Where so painted, it does not require additional marking.

(c) 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.

(d) 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 colors 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 colors merge with the background.

(e) Low intensity obstacle lights, Type C, shall be displayed on vehicles and other mobile objects excluding aircraft.

Note – See PCARs, Part 8 for lights to be displayed by aircraft.

(f) 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.

(g) Low intensity obstacle lights, type D, shall be displayed on follow-me vehicles.

(h) 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 MOS Appendix 6, Table 6.1-1, Table 6.1-2 and Table 6.1-3. 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.

8.10.3.4 Fixed objects

Note .— The fixed objects of wind turbines are addressed separately in MOS 8.10.3.5 (Wind Turbines) and the fixed objects of overhead wires, cables, etc. and supporting towers are addressed separately in MOS 8.10.3.6 (Overhead wires, Cables and supporting Towers)

(a) All fixed objects to be marked shall, whenever practicable, be colored, 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 color need to be otherwise marked.

(b) Objects with unbroken surfaces more than 4.5 m by 4.5 m size, must be painted in a chequered pattern of lighter and darker squares or rectangles, with sides no less than 1.5 m and no more than 3 m long, as shown in Figure 8.10-1 (a). The corners of the obstacle must be painted in the darker color. Orange and white or alternatively red and white shall be used, except where such colors merge with the background.

(c) Objects more than 1.5 m size in one direction and less than 4.5 m in the other, or any lattice object greater than 1.5 m in size in both directions, must be marked with alternating contrasting bands of color, with the ends painted in the darker color, as shown in Figure 8.10-2. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.

...

8.10.2.5 Masts, poles and towers must be marked in contrasting bands with the darker colour at the top, as shown in Figure 8.10-2. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.

Note –MOS Appendix 6 Table 6-1 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 color.

8.10.3.4 Fixed objects

...

(d) An object shall be colored in a single conspicuous color if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red shall be used, except where such colors merge with the background.

Note – Against some backgrounds it may be found necessary to use a different color from orange or red to obtain sufficient contrast.

(e) 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 a group 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.

(f) Flags used to mark fixed objects shall not be less than 0.6 m on each side and shall be orange in color or a combination of two triangular sections, one orange and the other white, or one red and the other white, except that where such colors merge with the background, other conspicuous colors shall be used.

(g) 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 1000 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.

(h) A marker shall be of one color. When installed, white and red, or white and orange markers shall be displayed alternately. The color selected shall contrast with the background against which it will be seen.

...

9.3.3.1 In the case of an object to be lighted, one or more low-, medium- or high-intensity obstacle lights are to be located as close as practicable to the top of the object. The top lights are to be arranged so as to at least indicate the points or edges of the object highest above the obstacle limitation surface.

Note – Recommendations on how a combination of low-, medium-, and/or high-intensity lights on obstacles should be displayed are given in MOS Appendix 6, Table 6-2 & Table 6-3.

9.3.3.2 Recommendations on how a combination of low-, medium-, and/or high-intensity lights on obstacles should be displayed are given in MOS Appendix 6, Table 6-2 & Table 6-3. In the case of a chimney or other structure of like function, the top lights are to be placed sufficiently below the top (nominally 1.5 m to 3 m) as shown in Fig. 8.10-2, so as to minimize contamination by smoke, etc.

9.3.3.3 In the case of a tower or antenna structure to be provided with high intensity obstacle lights by day, and the structure has an appurtenance such as a rod or antenna extending greater than 12 m above the structure, and it is not practicable to locate the high intensity obstacle light on top of the appurtenance, the high intensity obstacle light is to be located at the highest practicable point and, if practicable, have a medium intensity obstacle light, Type A (flashing white) mounted on the top.

9.3.3.4 In case of an extensive object or a group of closely spaced objects to be lighted that are:

(a)penetrating a horizontal 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 obstacle limitation surface, 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.

...

9.3.3.6 When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the object, additional obstacle lights are to be placed on the highest part of the object.

9.3.3.5 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.

(b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

...

9.3.8.4 High intensity obstacle lights Type A, Medium-intensity obstacle lights, Types A and B, located on an object other than a tower supporting overhead wires or cables are to flash simultaneously at a rate between 40-60 flashes per minute.

8.10.3.6 – (I)
To minimize environmental impact, unless otherwise directed by CAAP, the installation setting angles for high intensity obstacle lights are to be:

Height of light unit above terrain (AGL)		**Angle of the peak of the beam above the horizontal**
Greater than	Not exceeding	
151 m		0°
122 m	151 m	1°
92 m	122 m	2°
	92 m	3°

Table 8.10-3 Installation setting angles for high intensity obstacle lights

8.10.3.4 Fixed objects

(i) 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 should be composed of high intensity obstacle lights, Type A or medium intensity obstacle lights, Type A, as appropriate, for daytime and twilight use and medium-intensity obstacle light, Type B or C, for night-time use.

...

9.3.2.2 Lighting of objects with a height less than 45m above ground level

(a) Low intensity obstacle lights Type A or B are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m.

Note: A group of trees or buildings is regarded as an extensive object.

(b) 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.

(c) Low-intensity obstacle lights, Type B, shall be used either alone or in combination with medium-intensity obstacle lights, Type B, in accordance with MOS 9.3.2.2(d)

(d) 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.

9.3.2.3 Lighting of objects with a height 45 m to a height less than 150 m above ground level

(a) 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.

(b) 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.

(c) 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.

(d) When the top of the obstacle is more than 45 m above the level of the surrounding ground or the elevation of the tops of nearby buildings (when the obstacle is surrounded by buildings), the top light, Type C are to be medium intensity lights. Additional low intensity lights are to be provided at lower levels to indicate the full height of the structure. These additional lights are to be spaced as equally as possible, between the top lights and ground level or the level of tops of nearby buildings, as appropriate. The spacing between the lights is not to exceed 52 m.

(e) 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 MOS 9.3.3.1 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.

(f) There are three types of medium intensity obstacle lights:

(i) TYPE A, Flashing white light. Likely to be unsuitable for use in environmentally sensitive locations, and near built-up areas. May be used in lieu of obstacle markings during the day to indicate temporary obstacles in the vicinity of an aerodrome, for example construction cranes, etc. and are not to be used in other applications without specific CAAP agreement

(ii) TYPE B, Flashing red light, also known as a hazard beacon, is suitable for all applications, and is extensively used to mark terrain obstacles such as high ground.

(iii) TYPE C, Steady red light, which may be used where there is opposition to the use of a flashing red light, for example in environmentally sensitive locations.

9.3.2.4 Lighting of objects with a height 150 m or more above ground level

(a) 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.

(b) 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 MOS 9.3.3.1 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.

(c) 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, or impact on people and animals, 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.

(d) 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.

(e) 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.

(f) 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.

8.10.3.5 Wind turbines

(a) A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note: - 1. Additional lighting or markings may be provided where in the opinion of CAAP such lighting or markings are deemed necessary.

Note: - 2 Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

Note: - 3 In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

(b)-The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines shall be painted white, unless otherwise indicated by an aeronautical study.

(c) When lighting is deemed necessary, medium intensity obstacle lights shall be used. In the case of a wind farm, i.e. group of two or more wind turbines it shall be regarded as an extensive object and the lights shall be installed:

(i). to identify the perimeter of the wind farm;

(ii) respecting the maximum spacing, in accordance with MOS 9.3.3.4 between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

(iii) so that, where flashing lights are used, they flash simultaneously; and

(iv) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.

(v) at locations prescribed in a), b) and d), respecting the following criteria:

...

(d) The obstacle lights shall be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

(e) Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation shall be in accordance with MOS 8.10.3.5(c)(v) or as determined by an aeronautical study.

8.10.3.6 Overhead wires, cables, etc. and supporting towers

Marking

(a) The wires, cables, etc. to be marked must be equipped with markers; the supporting tower should be colored.

Marking by colors

(b)The supporting towers of overhead wires, cables, etc. that require marking shall be marked in accordance with MOS 8.10.3.4 (a) to (e), 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

(c) 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 100 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.

(d) A marker displayed on an overhead wire, cable, etc. must be spherical and have a diameter of not less than 60 cm.

(e) 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:

(i) 30 m where the marker diameter is 60 cm progressively increasing with the diameter of the marker to

(ii) 35 m where the marker diameter is 80 cm and further progressively increasing to a maximum of

(iii) 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.

(f) A marker shall be of one color. When installed, white and red, or white and orange markers shall be displayed alternately. The color selected shall contrast with the background against which it will be seen.

(g) 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

(h).High intensity obstacle lights, Type B, shall be used to indicate the presence of the tower supporting overhead wires, cables, etc. where:

i) an aeronautical study indicates such light to be essential for the recognition of the presence of wires, cables, etc.; or

ii) it has not been found practicable to install marker on the wires, cables, etc.

(i) Where high intensity obstacle lights, Type B, are used on an object other than a tower supporting overhead wires or cables, the spacing between the lights is not to exceed 105 m. Where the high intensity obstacle lights are used on a tower supporting wires or cables, they are to be located on three levels:

(i) at the top of the tower;
(ii) at the lowest level of the catenary of the wires or cables; and
(iii) at approximately midway between the two levels.

Note: In some cases this may require the bottom and middle lights to be located off the tower.

(j) High intensity obstacle lights, Type B, located on a tower supporting overhead wires or cables are to flash sequentially; first the middle light, second the top light, and last the bottom light. Cycle frequency is to be 40 - 60 per minute and the intervals between flashes of lights are to approximate the following ratios:

Flash interval between:	**Ratio of cycle time**
middle and top light	1/13
top and bottom light	2/13
bottom and middle light	10/13

Table 8.10-2 Flash interval between Ratio of cycle time

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.

(k) 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 should be provided. This system shall be composed of high-intensity obstacle lights, Type B, 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. Where medium-intensity lights are used they shall be installed at the same level as the high-intensity obstacle light Type B.

(l)To minimize environmental impact, unless otherwise directed by CAAP, the installation setting angles for high intensity obstacle lights are to be:

Height of light unit above terrain (AGL)		Angle of the peak of the beam above the horizontal
Greater than	Not exceeding	
151 m		0°
122 m	151 m	1°
92 m	122 m	2°
	92 m	3°

Table 8.10-3: Installation setting angles for high intensity obstacle lights

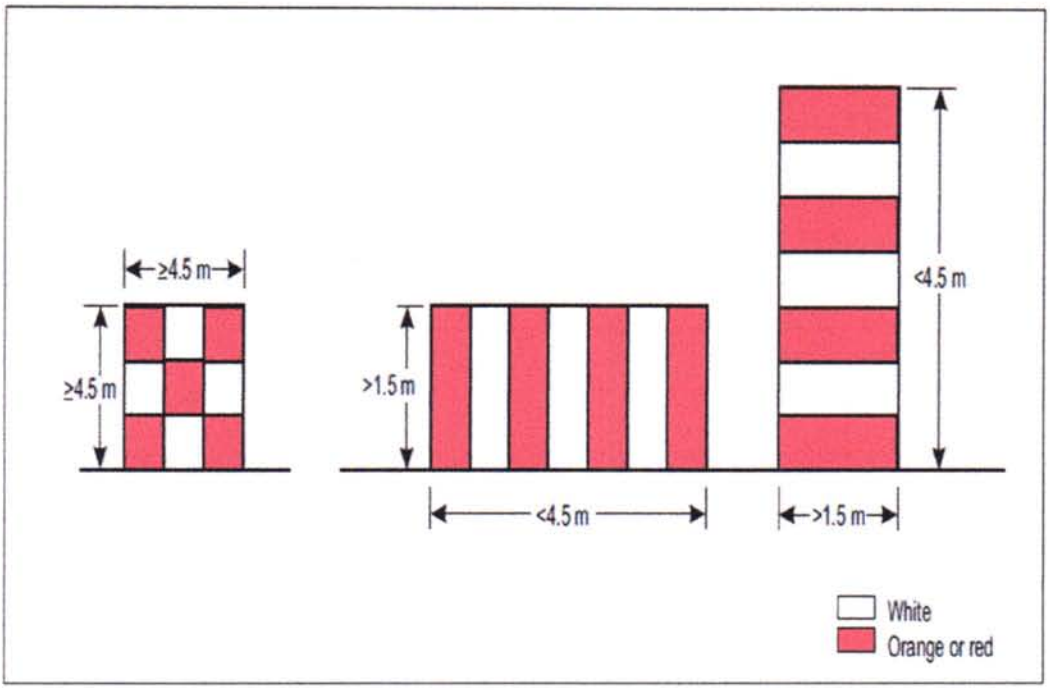
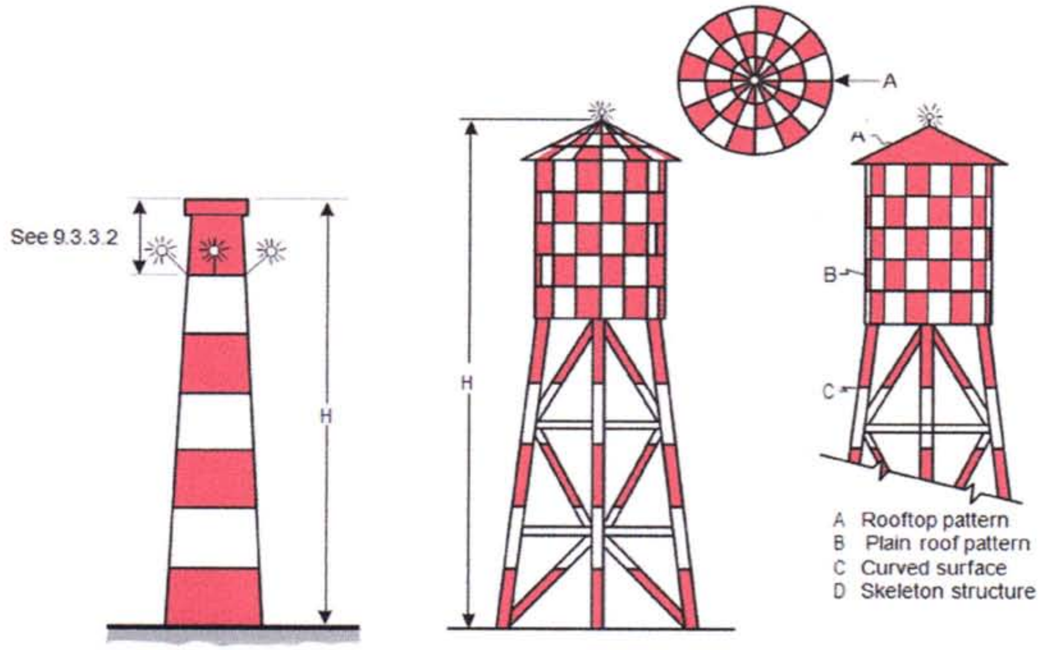
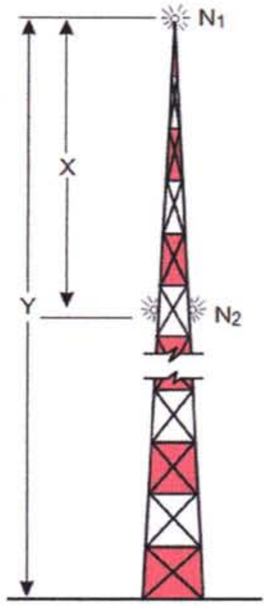


Figure 8.10-1: Basic marking patterns



Note.— H is less than 45 m for the examples shown above.
For greater heights intermediate lights must be added as shown below.



Light spacing (X) in accordance with Appendix 6.2

Number of levels of lights = N = $\frac{Y \text{ (meters)}}{X \text{ (meters)}}$

Figure 8.10-2: Marking and lighting of tall structures

Figure 8.10-1 Basic marking patterns

Longest dimension Greater than	Not exceeding	Band width
1.5 m	*210 m*	*1/7 of longest dimension*
210 m	*270 m*	*1/9 " " "*
270 m	*330 m*	*1/11 " " "*
330 m	*390 m*	*1/13 " " "*
390 m	*450 m*	*1/15 " " "*
450 m	*510 m*	*1/17 " " "*
510 m	*570 m*	*1/19 " " "*
570 m	*630 m*	*1/21 " " "*

Note.— Table 8.10-1 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 color.

Section 10.7: Aerodrome Emergency Planning

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10.7.1.2 The AEP-shall contain procedures for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness. The currency and adequacy of the AEP must be reviewed at least once every twelve (12) months.

Note.— The AEP includes all participating agencies and associated equipment.

10.7.1.3 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

(c) 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, Part 7.

Emergencies in difficult environments

10.7.1. 10 The plan shall include the ready availability and co-ordination 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.

10.7.1.11 At those aerodromes located close to water and/or swampy areas, or difficult terrain, the aerodrome emergency plan shall include the establishment, testing and assessment at regular intervals of a predetermined response for the specialist rescue services.

10.7.1.12 An assessment of the approach and departure areas within 1,000 m of the runway threshold shall be carried out to determine the options available for intervention.

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.

...

CHAPTER 14 - Rescue and fire fighting service.

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Section 14.3: Extinguishing agents

14.3.1 Both principal and complementary agents shall be provided at an aerodrome.

Note: Descriptions of the agents may be found in ICAO Airport Services Manual Part 1.

14.3.2 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 should preferably meet a performance level B or C foam.

Note.— Information on the required physical properties and fire extinguishing performance criteria needed for a foam to achieve an acceptable performance level A, B or C rating is given in the Airport Services Manual (Doc 9137), Part 1.

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14.3.4 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 in accordance with 14.2.1 and 14.2.2 and table 14-2, except for aerodrome categories 1 and 2, up to 100 % of the water may be replaced by complementary agent.

For the purpose of agent substitution, 1kg complementary agent is equivalent to 1 liter 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 3.75L/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.

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14.3.7 Reserved

14.3.8 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.

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14.3.5 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. The amount of foam concentrate provided on a vehicle shall be sufficient to produce at least two loads of foam solution.

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14.3.9 When a combination of different performance level foams are provided at an aerodrome, the total amount of water to be provided for foam production shall be calculated for each foam type and the distribution of these quantities shall be documented for each vehicle and applied to the overall rescue and fire fighting requirement.

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Table 14-2 Minimum usable amounts of extinguishant for RFFS

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14.3.10 Reserve supply of foam

(a) A reserve supply of foam concentrate, equivalent to 200 per cent of the quantities identified in Table 14-2, shall be maintained on the aerodrome for vehicle replenishment purposes.

Note.— Foam concentrate carried on fire vehicles in excess of the quantity identified in Table 14-2 can contribute to the reserve.

(b) Complementary agent, equivalent to 100 per cent of the quantity identified in Table 9-2, 14-2 shall be maintained on the aerodrome for vehicle replenishment purposes. Sufficient propellant gas shall be included to utilize this reserve complementary agent.

(c) Category 1 and 2 aerodromes that have replaced up to 100 per cent of the water with complementary agent shall hold a reserve supply of complementary agent of 200 per cent.

(d) Where a major delay in the replenishment of the supplies is anticipated, the amount of reserve supply in 14.3.10(a), 14.3.10 (b) and 14.3.10 (c) shall be increased as determined by a risk assessment.

Note.— See ICAO Doc 9137, Airport Services Manual, Part 1 for guidance on the conduct of a risk analysis to determine the quantities of reserve extinguishing agents.

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Section 14.4 Response time

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14.4.2 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.

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Section 14.9: Personnel

14.9.1 During flight operations, sufficient trained and competent personnel shall be designated to be readily available to ride the rescue and fire fighting vehicles and to operate the equipment at maximum capacity. These personnel shall be deployed in a way that ensures the minimum response times can be achieved and that continuous agent application at the appropriate rate(s) can be fully maintained. Consideration shall also be given to for personnel to use hand lines, ladders and other rescue and firefighting equipment normally associated with aircraft rescue and firefighting operations.

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14.9.3 In determining the number of personnel required to provide for aircraft rescue, consideration shall be given to the types of aircraft using the aerodrome. 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.

Note: - 2. Refer to AC-139-RFFS-002 for guidance on RFFS Task Resource Analysis (TRA).

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11.1.1 Siting of equipment and installations on operational area

Note 1.— Requirements for obstacle limitation surfaces are specified in –MOS 7.1.3

Note 2.— The design of light fixtures and their supporting structures, light units of visual approach slope indicators, signs, and markers, is specified in MOS 9.1, 9.8, 8.6 and, 8.2 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.

11.1.1.1 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 MOS Table 6.7-5 Taxiway minimum separation distances, if it would endanger an aircraft; or

b) on a clearway if it would endanger an aircraft in the air.

11.1.1.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located:

a) on that portion of a runway strip within:

(i) 75 m of the runway center line where the code number is 3 or 4; or

(ii) 45 m of the runway center 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 MOS Table 6.4-5 Taxiway minimum separation distances; or

c) on a clearway and which would endanger an aircraft in the air; shall be frangible and mounted as low as possible.

11.1.1.3 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on the non-graded portion of a runway strip shall be regarded as an obstacle and shall be frangible and mounted as low as possible.

Note. — Guidance on the siting of navigation aids is contained in the Aerodrome Design Manual (Doc 9157), Part 6.

11.1.1.4 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation shall be located within 240 m from the end of the strip and within:

a) 60 m of the extended center line where the code number is 3 or 4; or

b) 45 m of the extended center line where the code number is 1 or 2; of a precision approach runway category I, II or III.

11.1.1.5 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on or near a strip of a precision approach runway category I, II or III and which:

a) is situated on that portion of the strip within 77.5 m of the runway center 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:

(i) 60 m of the extended runway center line where the code number is 3 or 4; or

(ii) 45 m of the extended runway center line where the code number is 1 or 2; or

c) penetrates the inner approach surface, the inner transitional surface or the balked landing surface; shall be frangible and mounted as low as possible.

Note.— See MOS 9.1.11.13 for the protection date for existing elevated approach lights.

11.1.1.6 Any equipment or installation required for air navigation or for aircraft safety purposes which is an obstacle of operational significance in accordance with MOS 7.4.2.7,7.4.2.5, 7.4.2.8 or 7.4.1.1 and 7.4.1.2 shall be frangible and mounted as low as possible.

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10.15 Aerodrome Maintenance

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10.15.1 Maintenance Programme

10.15.1.1 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 and electrical systems and buildings

10.15.1.2 The design and application of the maintenance programme should observe Human Factors principles.

Note.— Guidance material on Human Factors principles can be found in the Human Factors Training Manual (Doc 9683) and in the Airport Services Manual (Doc 9137), Part 8.

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10.15.2 Pavements

10.15.2.1 The surfaces of all movement areas including pavements, (runways, taxiways, aprons and adjacent areas) shall be inspected and their conditions monitored regularly as part of the aerodrome preventative and corrective maintenance programme with the objective of avoiding and eliminating any loose objects/debris that might cause damage to an aeroplane or impair the operation of aircraft systems.

Note 1.— See MOS 5.1.5.1 & 12.1.4.1 for inspections of movement areas.

Note: - 2. Procedures on carrying out daily inspections of the movement area and control of FOD are given in the 8, PANS-Aerodromes (Doc 9981), the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830).

Note.— See MOS Attachment A, Section 4.

10.15.2.3 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 CAAP.

Note: - ICAO Digest Circ. 329 - Assessment, Measurement and Reporting of Runway Surface Conditions contains further information on this subject, on improving surface friction characteristics of runways.

Note: - The Airport Services Manual (Doc 9137), Part 2, contains further information on this subject, on improving surface friction characteristics of runways.

10.15.2.4 Runway surface friction characteristics for maintenance purpose shall be periodically measured with a continuous friction measuring device using self-wetting features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface friction characteristics of the runway.

Note: - 1. Guidance on evaluating the runway surface friction characteristics provided in Circ. 329 – Assessment, Measurement and Reporting of Runway Surface Conditions.

Note 2 - The objective of MOS 10.15.4.4, 10.15.2.3, 10.15.2.7 (c) and 10.15.2.8 is to ensure that the surface friction characteristics for the entire runway remain at or above a minimum friction level specified by CAAP.=

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10.15.2.7 Corrective maintenance action shall be taken to prevent the runway surface friction characteristics for either the entire runway or a portion thereof from falling below a minimum friction level specified by CAAP.

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

10.15.2.8 The runway surface shall be visually assessed, as necessary, under natural or simulated rain conditions for ponding or poor drainage and where required, corrective maintenance action taken. When a taxiway is used by turbine-engine 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.

10.15.3 Removal of contaminants

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

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10.10.11 Runway Pavement Overlay

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.

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10.10.11.2 The longitudinal slope of the temporary ramp described in paragraph 10.10.11.1, measured with reference to the existing runway surface or previous overlay course, must 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.

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10.10.11.6 The overlay shall be constructed and maintained above the minimum friction level specified in MOS Table 10.15-1.

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9.1.15 Maintenance performance of aerodrome lighting (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.- 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.

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ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

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20. 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 MOS Table 10.15-1 are not relevant.

20.1 The surface friction characteristics of a paved runway shall be:

a) assessed to verify the surface friction characteristics of new or resurfaced paved runways (MOS 6.2.10.5); and

b) assessed periodically in order to determine the slipperiness of paved runways (MOS 10.15.2.4);

20.2 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.

20.3 Friction tests of existing surface conditions are taken periodically in order to avoid falling below the minimum friction specified by CAAP. 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.

20.4 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 enable allow measurements of the surface friction characteristics to be made at a water depth of 1 mm.

20.5 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 test 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 MOS Attachment A, Section 2.)

20.6 When conducting friction tests using a self wetting continuous friction measuring device, 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 macrotexture allowing the water to escape beneath the tire, then the friction value will be less affected by speed. Conversely, a low macrotexture surface will produce a larger drop in friction with increase in speed.

20.7 CAAP shall specify a minimum friction level below which corrective maintenance action shall be taken. As criteria for surface friction characteristics of new or resurfaced runway surfaces and its maintenance planning, CAAP shall establish a maintenance planning level below which appropriate corrective maintenance action shall 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.

ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

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2. Drainage characteristics of the movement area and adjacent areas

Note: Guidance material for Drainage characteristics is provided under MOS Attachment A Section 2

2.1 General

2.1.1 Rapid drainage of surface water is a primary safety consideration in the design, construction and maintenance of 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.

2.1.2 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.

2.2 Design of pavement

2.2.1 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.

2.2.2 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.

2.3 Construction of pavement

2.3.1 Through construction, the drainage characteristics of the surface are built into the pavement. These surface characteristics are:

a) slopes;
b) texture:

  i) microtexture;
  ii) macrotexture;

2.3.2 Slopes for the various parts of the movement area and adjacent parts are described in MOS 6 and figures are given as per cent. Further guidance is given in Aerodrome Design Manual (Doc 9157), Part 1, Chapter 5.

2.3.3 Texture in the literature is described as microtexture or macrotexture. These terms are understood differently in various part of the aviation industry.

2.3.4 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.

2.3.5 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.

2.3.6 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.

2.3.7 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.

2.3.8 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.

2.3.9 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 upon, 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)*
A	0.10 – 0.14
B	0.15 – 0.24
C	0.25 – 0.50
D	0.51 – 1.00
E	1.01 – 2.54

2.3.10 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).

2.3.11 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.

2.3.12 The ESDU scale groups runway surfaces based on macro texture 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.

2.4 Maintenance of drainage characteristics of pavement

2.4.1 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 uneveness which results in ponding after rainfall. Guidance on rubber removal and uneveness can be found in Airport Services Manual (Doc 9137), Part 2. Guidance on methods for improving surface texture can be found in Aerodrome Design Manual (Doc 9157), Part 3.

2.4.2 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 Doc 9137, Airport Services Manual, Part 2 — Pavement Surface Conditions and Part 9 — Airport Maintenance Practices and Doc 9157, Part 2.

2.4.3 The pavement may be shot blasted in order to enhance the pavement macrotexture.

ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

1. Runway end safety area

1.1.Where a runway end safety area is provided in accordance with MOS 6.4, consideration shall 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 shall 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 shall take such obstacles into consideration.

1.2 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.

1.3. 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.

1.4. 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.

1.5. 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 center 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.

1.6. The information relating to the provision of a runway end safety area and the presence of an arresting system shall be published in the AIP.

1.7. Additional information is contained in the Aerodrome Design Manual (Doc 9157), Part 1.

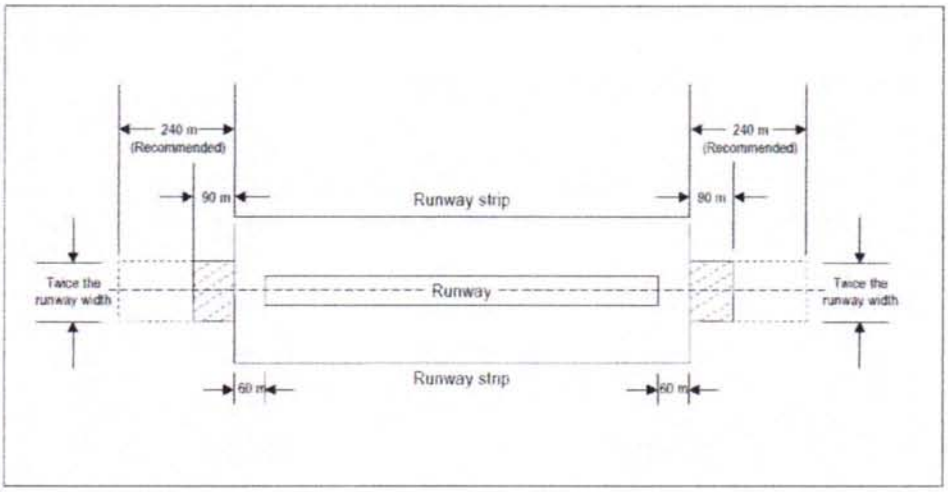

Figure A-1 Runway end safety area for a runway where the doe number is 3 or 4

Section 9.2: Colours for Aeronautical Ground Lights

9.2.1 General

Introductory Note: - The following specifications define the chromaticity limits of colors to be used for aeronautical ground lights, markings, signs and panels. The specifications are in accord with the 1983 specifications of the International Commission on Illumination (CIE), except for the color orange in Figure 9.2-1.

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.**

The chromaticities for solid state lighting (e.g. LED) are based upon the boundaries given in the standard S 004/E-2001 of the International Commission on Illumination (CIE), except for the blue boundary of white.

9.2.1.2 The chromaticity is expressed in terms of the standard observer and coordination system adopted by the International Commission on Illumination (CIE).

Section 9.2: Colors for Aeronautical Ground Lights

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9.2.2 Chromaticities for lights having filament-type light sources

9.2.2.1 The chromaticity of aerodrome lights must be within the following boundaries:

CIE Equation (see Figure 9.2-1)

a) Red
Purple boundary $y = 0.980 - x$
Yellow boundary $y = 0.335$, except for visual approach slope indicator systems;
Yellow boundary $y = 0.320$, for visual approach slope indicator systems.

Note.-See 9.8.4.6 (c)

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
i) 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 $y = 0.382$

f) Variable white
Yellow boundary $x = 0.255 + 0.750y$
and $x = 1.185 - 1.500y$

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.

Figure 9.13-3: Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in conjunction with a Precision Approach Category III Runway where large offsets can occur and for low-intensity runway guard lights, Configuration B.

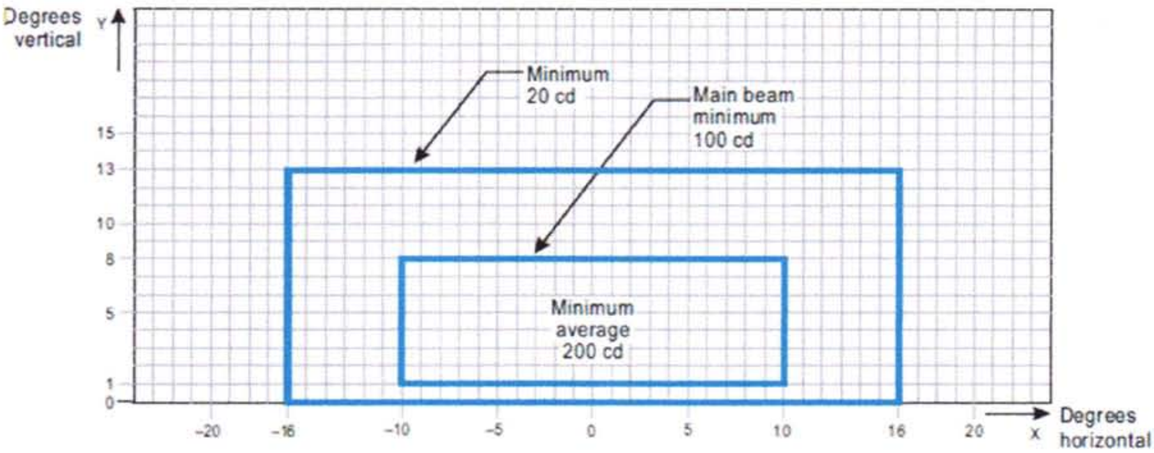


Figure 9.13-4: Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in conjunction with a Precision Approach Category III Runway.

Notes:

1. These beam coverages are suitable for a normal displacement of the cockpit from the centerline of approximately 3m.

2. See collective notes at MOS 9.13.1 for these isocandella diagrams.

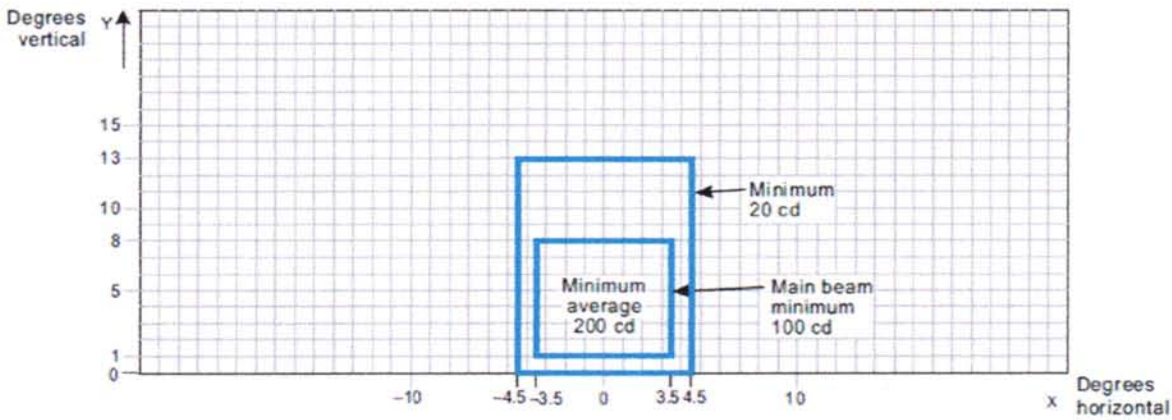


Figure 9.13-5: Isocandela diagram for taxiway centre line (7.5 m spacing), no- entry bar and stop bar lights in curved sections intended for use in-conjunction with a Precision Approach Category III Runway.

Notes: 1. Lights on curves to have light beam toed-in 15.75^0 with respect to the tangent of the curve.

2. See collective notes at MOS 9.13.1 for these isocandela diagrams.

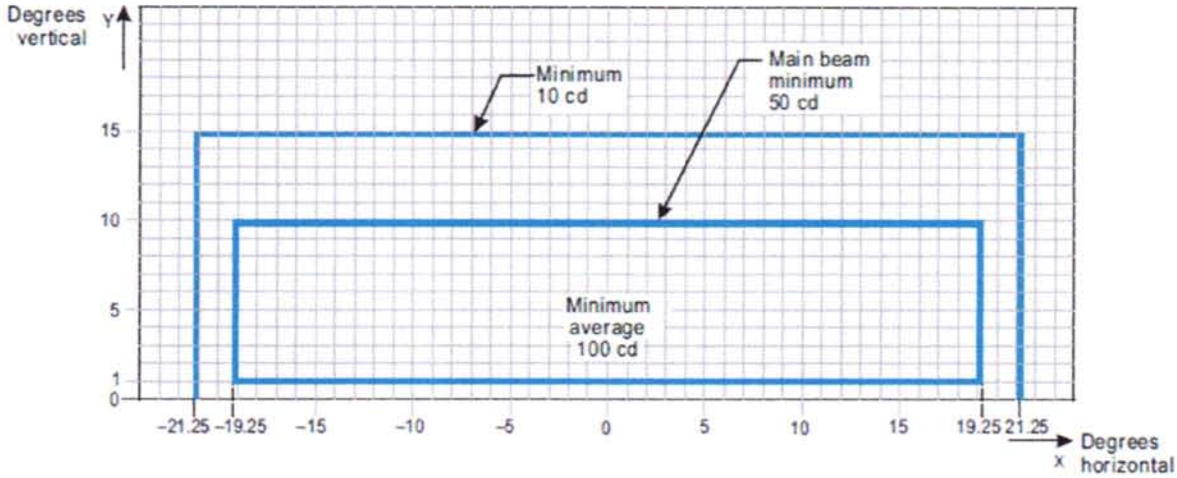


Figure 9.13-1: Isocandela diagram for taxiway centre line (30 m, 60 m spacing), no-entry bar and stop bar lights in straight sections of Taxiways intended for use in conjunction with a Non-Precision or Precision Approach Category I or II Runway

Note: - 1. At locations where high background luminance is usual and where deterioration of light output resulting from dust and local contamination is a significant factor, the cd values should be multiplied by 2.5

Note: - 2. Where omnidirectional lights are used they must comply with the vertical beam spread.

Note: - 3. See the collective notes at MOS 9.13.1 for these isocandela diagrams.

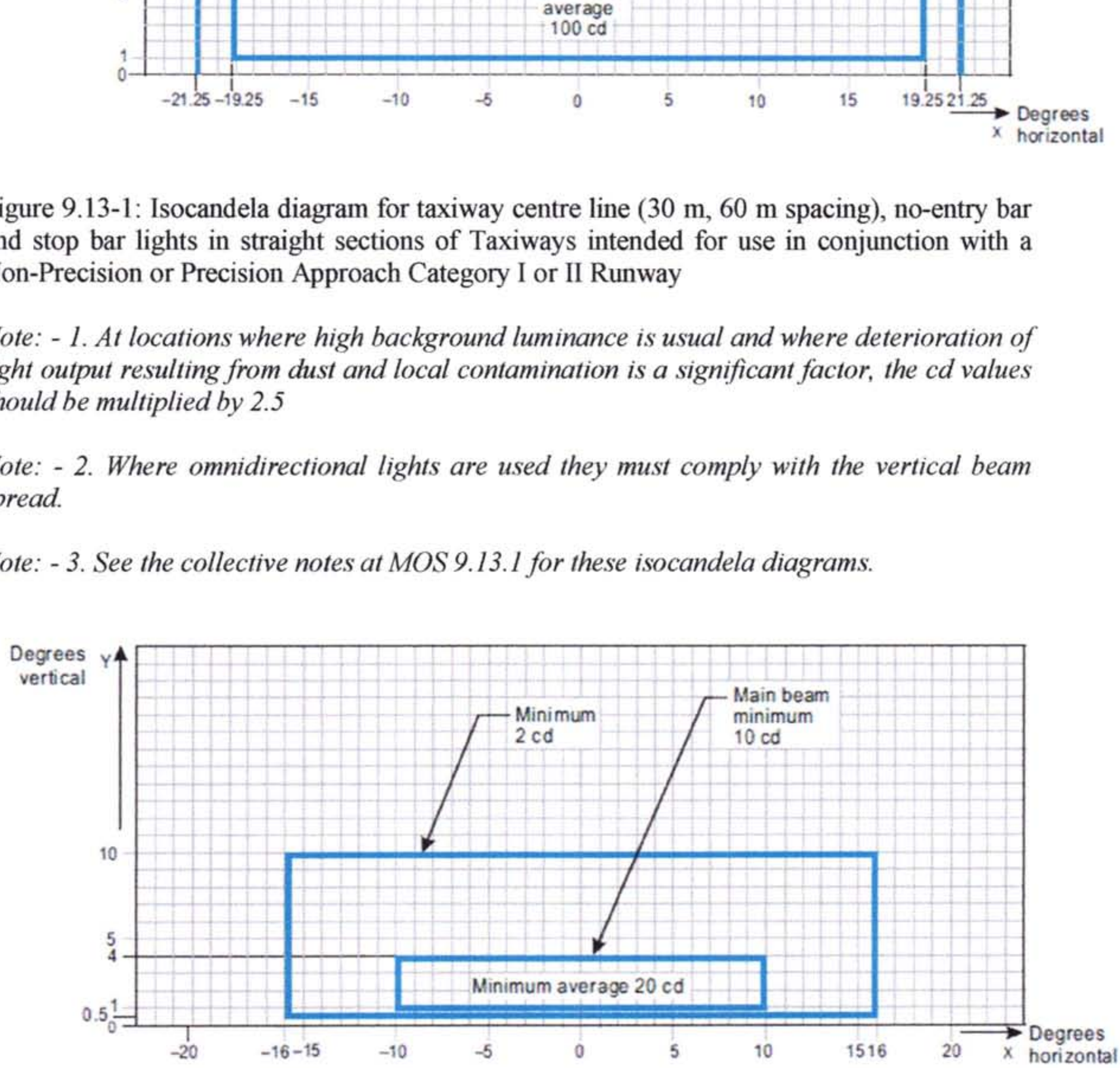


Figure 9.13-2: Isocandela Diagram for Taxiway Centerline Lights, and Stop Bar Lights on Curved Sections of Taxiways intended for use in conjunction with a Non-Precision or Precision Approach Category I or II Runway.

Notes:

1. *Lights on curves to have light beam toed-in 15.75° 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 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 centerline up to distance of the order of 12 m as could occur at the end of curves.*
4. *See collective notes at MOS 9.13.1 for these isocandela diagrams.*

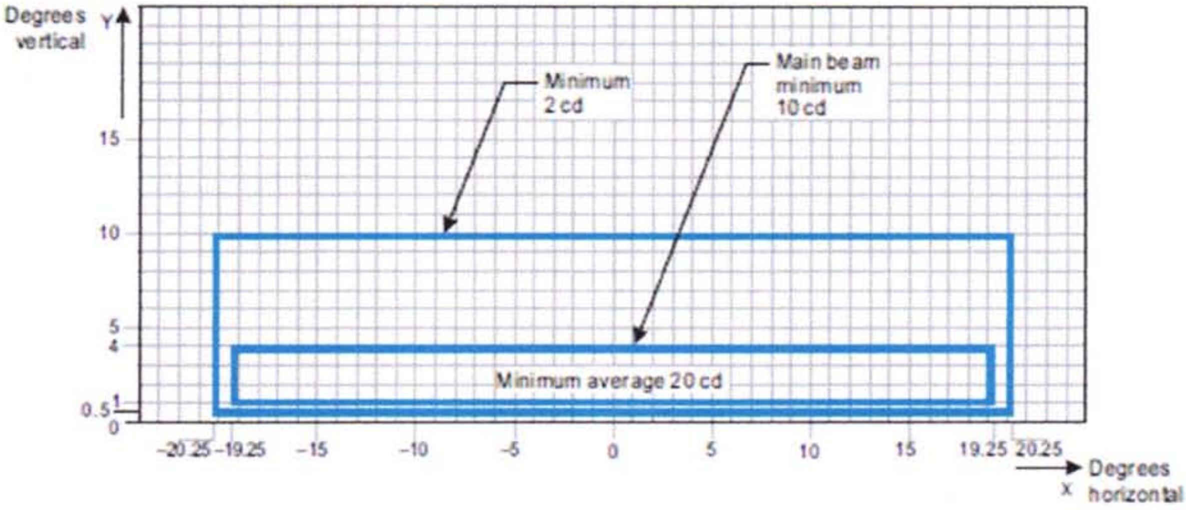
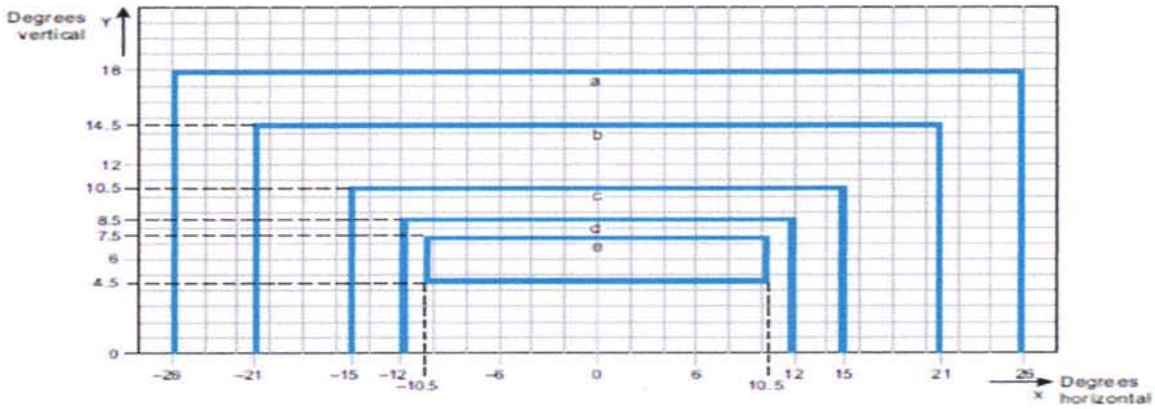


Figure 9.13-6 ÷ Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required and where large offsets can occur.

Notes:

1. *These beam coverages allow for displacement of the cockpit from the centerline up to distances of the order of 12 m and are intended for use before and after curves.*
2. *See collective notes at MOS 9.13.1 for these isocandela diagrams.*

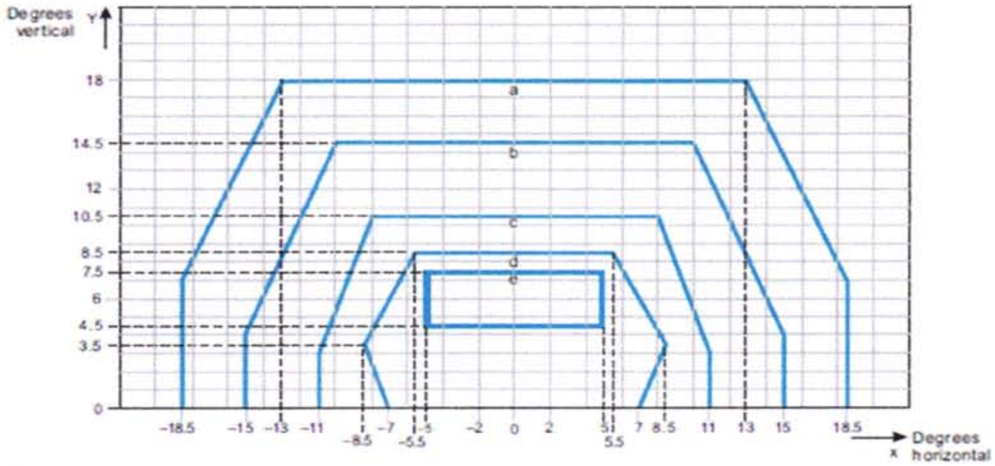


Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1 800

Figure 9.13-7: Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required.

Notes:

1. *These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.*
2. *See collective notes at MOS 9.13.1 for these isocandela diagrams.*

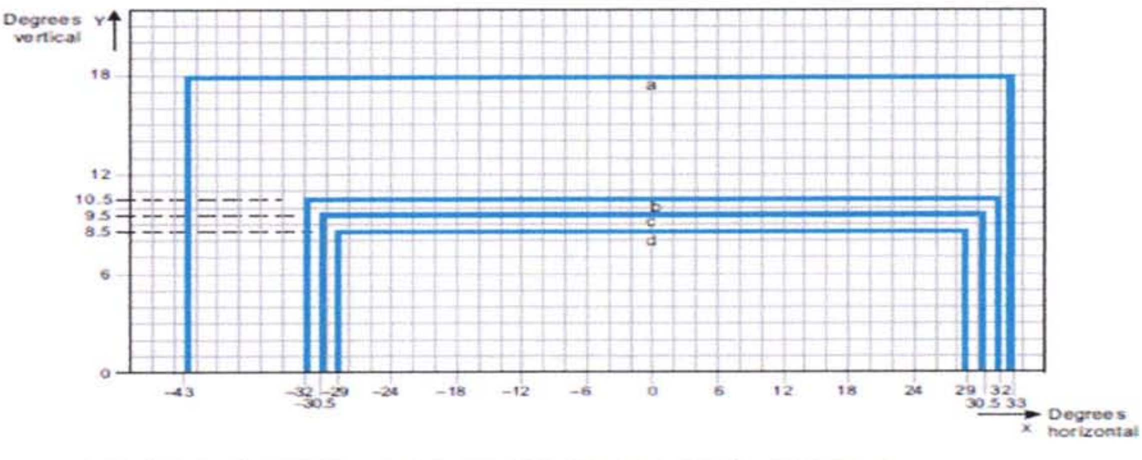


Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1 800

Figure 9.13-8 : Isocandela diagram for high-intensity taxiway center line (7.5 m spacing), no-entry bar and stop bar lights in curved sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required.

Notes:

1. *Lights on curves to be toed-in 17 degrees with respect to the tangent of the curve.*
2. *See collective notes at MOS 9.13.1 for these isocandela diagrams.*



Curve	a	b	c	d
Intensity (cd)	8	100	200	400

Appendix 5:Aeronautical data accuracy and integrity requirements

Table A5.1-1. Latitude and longitude

Latitude and longitude	Accuracy Data type	Integrity Classification
Aerodrome reference point .....30 m	surveyed/calculated	routine
Navaids located at the aerodrome .... 3 m	surveyed	essential
Obstacles in Area 3 .... 0.5	surveyed	essential
Obstacles in Area 2 (the part within the aerodrome boundary) .... 5 m	surveyed	essential
Runway thresholds .... 1 m	surveyed	critical
Runway end (flight path alignment point) .... 1 m	surveyed	critical
Runway centre line points .... 1 m	surveyed	critical
Runway-holding position .... 0.5 m	surveyed	critical
Taxiway centre line/parking guidance line points .... 0.5 m	surveyed	essential
Intermediate holding position marking line .... 0.5 m	surveyed	essential
Exit guidance line .... 0.5 m	surveyed	essential

Apron boundaries (polygon) ..... 1 m	surveyed	routine
Aircraft stand points/INS checkpoint............................... 0.5 m	surveyed	routine

Note: - 1. See CAR-ANS Part 15, Appendix 15G, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Note: - 2. Implementation of CAR-ANS Part 15, provisions 15.10.1.4 and 15.10.1.8, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate planning for the collection and processing of such data.

Table A5-2. Elevation/Altitude/Height

Elevation/altitude/height	Accuracy Data type	Integrity Classification
Aerodrome elevation .... 0.5 m	surveyed	essential
WGS-84 geoid undulation at aerodrome elevation position ..0.5 m	surveyed	essential
Runway threshold, non-precision approaches .... 0.5 m	surveyed	essential
WGS-84 geoid undulation at runway threshold, non-precision approaches.............0.5 m	surveyed	essential
Runway threshold, precision approaches .... 0.25 m	surveyed	critical
WGS-84 geoid undulation at runway threshold, precision approaches .... 0.25 m	surveyed	critical

Runway centre line points ..... 0.25 m	surveyed	critical
Taxiway centre line/parking guidance line points .... 1 m	surveyed	essential
Obstacles in Area 2 (the part within the aerodrome boundary) ....3 m	surveyed	essential
Obstacles in Area 3 .... 0.5 m	surveyed	essential
Distance measuring equipment/ precision (DME/P) .... 3 m	surveyed	essential

Note: - 1. See CAR-ANS Part 15, Appendix 15G for graphical illustrations of obstacle data collection surfaces and criteria to identify obstacles in the defined areas.

Note: - 2 Implementing of CAR-ANS Part 15, provisions 15.10.1.4 & 15.10.1.8, concerning the availability, as of 12 November 2015, of obstacle data according to Area 2 and Area 3 specifications would be facilitated by appropriate planning for the collection and processing of such data.

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Section 1.4: Definition of terms

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

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

(b) **Precision approach runway, category I**. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) not lower than 60 m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550 m.

(c) **Precision approach runway, category II.** A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m.

(d) **Precision approach runway, category III**. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B to and along the surface of the runway; and a - 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 175 m.

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

c — intended for operations with no decision height (DH) and no runway visual range limitations.

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

Note 2.— Refer to PCAR, Part 8 for instrument approach operation types.

...

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

Note.— Visual meteorological conditions (VMC) are described in PCARs Part 8.

— END —

EFFECTIVITY CLAUSE:

Fifteen (15) days after publication in a requisite single newspaper of general circulation or the Official Gazette and a copy filed with the U.P. Law Center - Office of the National Administrative Register, this Memorandum Circular shall take effect and supersede any orders and/or memoranda in conflict herewith.

So ordered. Signed this 09 day of MAY 2017, CAAP, Pasay City.

CAPTAIN JIM C. SYDIONGCO